"Do we have to use a wiki, Miss?"
How Web 2.0 technologies can support students as inquiry learners in a secondary school

Lynette Ann Hay
BADipED, MAppScTL

A thesis submitted to Charles Sturt University for the degree of Doctor of Philosophy

March 2017
# Table of Contents

Table of Contents ........................................................................................................... i
List of Figures ................................................................................................................... vi
List of Tables ...................................................................................................................... viii
List of Case in Points ......................................................................................................... ix
Certificate of Authorship ................................................................................................. x
Acknowledgements .......................................................................................................... xi
Abstract ............................................................................................................................ xiii

Chapter 1  Introduction ................................................................................................. 1
  1.1 Purpose of the study .............................................................................................. 4
  1.2 Significance of the research ................................................................................ 5
  1.3 Outline of contents .............................................................................................. 6

Chapter 2  Literature review ......................................................................................... 9
  2.1 Background to the study ...................................................................................... 9
    2.1.1 School libraries and student learning .......................................................... 9
    2.1.2 Guided inquiry as an instructional framework for school libraries .......... 14
    2.1.3 School libraries, technology and Web 2.0 .................................................. 16
  2.2 Student learning through inquiry .......................................................................... 20
    2.2.1 Questioning is central to an inquiry-based approach ................................. 22
    2.2.2 Authentic learning as a central tenet of inquiry ......................................... 27
    2.2.3 Inquiry involves cycles of reflection and assessment ............................... 30
  2.3 Students’ approaches to learning .......................................................................... 34
    2.3.1 How learning styles influence students’ approach to learning ................. 35
    2.3.2 Students’ information behaviour as inquiry learners ............................... 41
  2.4 How Web 2.0 technologies can support teaching and learning ......................... 60
4.3 Data analysis ........................................................................................................... 129
  4.3.1 Quantitative analysis ......................................................................................... 132
  4.3.2 Qualitative analysis ......................................................................................... 134
4.4 Trustworthiness of the research .............................................................................. 138
  4.4.1 Credibility ........................................................................................................ 139
  4.4.2 Dependability ................................................................................................... 140
  4.4.3 Confirmability .................................................................................................. 140
  4.4.4 Transferability .................................................................................................. 141
  4.4.5 Reflexivity ........................................................................................................ 141
4.5 Summary .................................................................................................................. 142

Chapter 5  Findings ........................................................................................................ 143
  5.1 Students’ approaches to study .............................................................................. 144
    5.1.1 Background information about researching assignments ............................ 144
    5.1.2 Learning styles .............................................................................................. 153
  5.2 Students’ approaches to technology use ................................................................. 156
    5.2.1 Criteria determining technology use ............................................................... 156
    5.2.2 Mental models of technology ........................................................................ 173
    5.2.3 Technology informants .................................................................................. 183
    5.2.4 Students’ personal technology toolkit ............................................................. 185
  5.3 Functionality of Web 2.0 technologies ................................................................. 193
    5.3.1 Information collection and repository functions ............................................. 199
    5.3.2 Communication functions ............................................................................. 210
    5.3.3 Project management function ....................................................................... 215
    5.3.4 Data collection and analysis functions ............................................................ 224
    5.3.5 Knowledge construction functions .................................................................. 229
    5.3.6 Publishing functions ..................................................................................... 237
Chapter 5

5.3.7 Self-reflection functions ................................................................. 240
5.3.8 Summary of functionality of Web 2.0 technologies ......................... 244
5.4 Impact of approaches to learning on student use of Web 2.0 technologies ... 244
5.5 Learning teams, instructional intervention and Web 2.0 .......................... 249
  5.5.1 The nature of learning teams to support inquiry .............................. 249
  5.5.2 Types of instructional intervention using Web 2.0 technologies .......... 255
  5.5.3 Summary of learning teams, instructional intervention and Web 2.0 .... 263
5.6 Participants’ views on technology use in the future to support inquiry ....... 264
  5.6.1 Students’ views on technology use in the future ............................. 264
  5.6.2 Teacher and TL views on technology use in the future .................... 273
  5.6.3 Summary of participants’ views on future technology use ................. 278
5.7 Summary ............................................................................................. 279

Chapter 6 Discussion and conclusion ......................................................... 283
6.1 Using Web 2.0 technologies to support inquiry learning ....................... 284
  6.1.1 Technology functionality matrix .................................................... 285
  6.1.2 Project management and Web 2.0 for inquiry ............................... 298
  6.1.3 Summary of how Web 2.0 technologies support inquiry ................. 311
6.2 Learning styles and Web 2.0 technologies .......................................... 312
  6.2.1 Summary of learning styles and Web 2.0 technologies ................... 316
6.3 Instruction and engagement in the blended classroom ............................ 316
  6.3.1 Instructional intervention using Web 2.0 technologies .................... 318
  6.3.2 Learning teams in the blended classroom ...................................... 325
  6.3.3 Summary of instruction and engagement in the blended classroom ...... 333
6.4 Personal construction and students' technology use ............................. 334
  6.4.1 Process of personal construction and students’ technology use .......... 334
  6.4.2 A theory of personal construction of technology use ....................... 337
6.4.3 Implications of the PCTU Theory ........................................................................ 355
6.5 Limitations of the study ......................................................................................... 363
6.6 Conclusion ............................................................................................................. 366
References .................................................................................................................. 372
Appendices ................................................................................................................. 402
Appendix A Ethics in Human Research Committee (EHRC) Approval letter, 
participants information sheets and consent forms ..................................................... 403
Appendix B Online student questionnaire design .......................................................... 414
Appendix C Example of field notes/memoing ............................................................... 427
Appendix D Teacher and TL interview question schedules .......................................... 434
Appendix E Student interview question schedule ....................................................... 440
Appendix F Daily schedule of data collection period ................................................... 443
Appendix G Examples of ‘working profile’ for students based on demographic data. 448
Appendix H Coding and scoring schedule for ASSIST data from student questionnaire 
................................................................................................................................. 451
Appendix I Types of codes with examples .................................................................... 457
Appendix J Final version of the coding schedule ......................................................... 461
Appendix K Example of memo writing as an analytic technique ................................. 477
List of Figures

Figure 2.1 Entwistle’s three approaches to studying .......................................................... 39
Figure 4.1 PIP progress report 1 .......................................................................................... 114
Figure 4.2 PIP progress report 2 .......................................................................................... 115
Figure 4.3 PIP progress report 3 .......................................................................................... 116
Figure 4.4 The participant-observer continuum .................................................................. 121
Figure 5.1 Results of students’ ASSIST scores ................................................................. 155
Figure 5.2 Schedule of wiki page creation, edits and comments ........................................... 201
Figure 5.3 Example of student use of blog for recording and storing documentation .. 205
Figure 5.4 Class Delicious account (globstud) created by the TL................................. 207
Figure 5.5 Screenshot of a student’s Delicious account ..................................................... 209
Figure 5.6 Evidence of communication between teacher and TL with a student on their wiki .......................................................................................................................... 213
Figure 5.7 Communication between TL and student on a wiki......................................... 214
Figure 5.8 Example of a web calender widget in a wiki ...................................................... 220
Figure 5.9 SurveyMonkey online questionnaire used by Student01 .................................. 225
Figure 5.10 SurveyMonkey online questionnaire used by Student09 ............................... 226
Figure 5.11 Use of wiki page for data compilation by Student06 .................................... 228
Figure 5.12 Outline of Student01 PIP topic on frontpage of wiki ..................................... 231
Figure 5.13 Initial changes (Revision No. 1) made to content on Student01 wiki frontpage  .......................................................................................................................... 233
Figure 5.14 Changes made to content (Revision No. 13) on Student01 wiki frontpage  .......................................................................................................................... 234
Figure 5.15 Changes made to content (Revision No. 21) on Student01 wiki frontpage  .......................................................................................................................... 235
Figure 5.16 Use of wiki as publishing tool by Student02 ...................................................... 238
Figure 5.17 Student02 using wiki page to publish progress reports .......................... 239
Figure 5.18 Student08 using a blog post to publish progress reports ......................... 240
Figure 5.19 Screenshot of Student04’s ‘Journal’ page in her wiki ............................. 241
Figure 5.20 Screenshot of Student10’s use of Comments feature in the wiki for self-reflection .............................................................................................................. 242
Figure 5.21 Instructional intervention between TL and Student05 on the wiki ............ 262
Figure 6.1 Project management process and process groups ................................. 300
Figure 6.2 Project management process interaction and percentage of time each group is active throughout project life cycle ......................................................................... 303
Figure 6.3 Applying a project management lens to Kuhlthau’s (2004) ISP model throughout a project’s life cycle ......................................................................................... 305
Figure 6.4 Dimensions of the blended classroom as a socially constructed domain ... 339
Figure 6.5 Dimensions of the personally constructed domain of a student ............. 342
Figure 6.6 Technology evaluation as a process of personal construction ................. 346
Figure 6.7 The social and personal constructs of a blended classroom ................... 352
List of Tables

Table 4.1 Types of, and frequency of, data collection for each type of participant ..... 130
Table 5.1 Comparison between in class and out of class estimates of time ............... 145
Table 5.2 Problems/frustrations with assignments identified by students................. 147
Table 5.3 Types of TL help sought by students.................................................... 149
Table 5.4 Types of teacher help sought by students.............................................. 150
Table 5.5 Students’ use of Web 2.0 technologies before PIP unit.......................... 151
Table 5.6 Technologies used by each student to complete their PIP....................... 157
Table 5.7 Types of tools and functions in students’ personal technology toolkit....... 188
Table 5.8 Seven broad functions of Web 2.0 tools supporting the inquiry process ..... 195
Table 5.9 Summary of students’ predominant learning style and types of technologies used for their PIP ............................................................... 245
Table 6.1 Summary of types of tools and breadth of functionality evident in the study ........................................................................................................ 285
Table 6.2 Technology functionality matrix ............................................................... 287
Table 6.3 Comparative table of Kelly’s PCT corollaries and Hay’s Technology Evaluation principles ................................................................. 347
List of Case in Points

CIP 5.1 Criteria determining technology use ................................................................. 164
CIP 5.2 Developing your personal technology toolkit ...................................................... 190
CIP 5.3 Technology infrastructure issues at school ......................................................... 271
Certificate of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma at Charles Sturt University or any other educational institution, except where due acknowledgement is made in the thesis. Any contribution made to the research by colleagues with whom I have worked at Charles Sturt University or elsewhere during my candidature is fully acknowledged.

I agree that this thesis be accessible for the purpose of study and research in accordance with the normal conditions established by the Executive Director, Division of Library Services, Charles Sturt University or nominee, for the care, loan and reproduction of theses.

Date: 23 March 2017
Acknowledgements

I would like to dedicate this PhD thesis to my parents, Kevin John Andrew Hay and June Elizabeth Hay, whose commitment ensured I received a quality education in my primary, secondary and post-compulsory school years. This contributed significantly to my qualifications and capacity to move from working as a school teacher and teacher librarian into academic life as a lecturer in the mid-1990s. While my mother is no longer with us (may she rest in peace), I am grateful that my father is still alive to see the submission of this thesis as the culmination of my formal educational journey as both a learner and as a member of the academy.

The realisation of this doctoral work has only been possible as a result of the hard work of a number of people, to whom I am eternally grateful. I’d like to thank Dr Kirsty Williamson, the Principal Supervisor who started this PhD journey with me from the outset and worked tirelessly in supporting me through the proposal and confirmation phase, the data collection and analysis phase, and a significant part of the writing up phase, of my doctoral thesis. Great appreciation to my two associate supervisors, Dr Ross Todd and Dr Joy McGregor, for hanging in there with me for all these years, particularly Dr Todd’s guidance with the data analysis and conceptual development components of my research, and Dr McGregor’s contribution throughout the entire doctoral experience as a sounding board, and writing and editorial advisor. Special recognition to Dr Barney Dalgarno for taking over as my Principal Supervisor in 2014 and working with me solidly to get me ‘over the line’. Also special mention to Dr Bob Pymm for being my critical friend for the past two years, I greatly appreciate your support. And finally, the two men in my life who have lived this PhD journey more than others. Firstly, my wonderful husband, Glen Borm, who has been my biggest supporter during this doctoral experience – you are my rock – thank you ‘Big Dog’. Also my gorgeous Golden Retriever dog, Sampson, who has been my furry research assistant and personal trainer throughout my PhD, thanks ‘Little Dog’.
In addition, I received financial support from my previous employer, CSU, to complete my PhD in the following ways:

- Received Faculty of Education Resource Funding for travel to Sydney to conduct field observations and interviews for my PhD research, and to undertake research writing retreats in Melbourne with Dr Kirsty Williamson and at Rutgers University with Dr Ross Todd.

- Granted study leave as part of CSU’s Special Studies Program (SSP).

- Supported by the Staff Higher Degrees Workload Support Scheme of the Centre for Research and Graduate Training (CRGT) to provide time in my workload for research, including work on my PhD.

Finally, I would like to thank the School of Information Studies and Faculty of Education for their support of my PhD throughout the years of my candidature while working as a CSU lecturer.
Abstract

The study explored the use of Web 2.0 technologies by students in a secondary school inquiry learning setting. In particular, it aimed to examine how Web 2.0 technologies can be used to support students' completion of an inquiry project, and the different types of instructional intervention that a teacher librarian and class teacher can provide in the context of this kind of learning task. It also explored how student learning styles may impact on students' levels of use of Web 2.0 technologies when undertaking inquiry on a topic of personal interest, and how student, teacher, and teacher librarian experiences with Web 2.0 technologies might influence their views on using these in the future to support learning.

The study adopted ethnography as the overarching methodological approach and used a mixed methods approach to the collection of qualitative and quantitative data. Constructivist learning theory was used as an interpretivist lens for exploring the participants’ inquiry and technology experiences in the study, with Personal Construct Theory, Social Construction Theory and Zone of Proximal Development used in interpreting the qualitative data. Entwistle’s Approaches and Study Skills Inventory for Students (ASSIST) was used to explore students’ approaches to learning and technology use.

The findings and conclusions presented in the thesis contribute to research and professional practice in eight ways. The study identified seven broad functions that Web 2.0 technologies can provide students, teachers and TLs while undertaking inquiry projects, and presents a Technology Functionality Matrix as a scaffold to identify the features and functionality of the Web 2.0 tools to assist those interested in trialling one or more of the Web 2.0 tools examined in this thesis. The study also identified a set of seven criteria for determining technology use which students apply when critically evaluating technologies that are available to them to support their learning. The study also identified three mental models of technologies – vagueness, technicality and enrichment – which can influence the way individual’s approach the use of technologies.
The concept of a student’s personal technology toolkit was identified as a key element impacting on a student’s approach to technology use. This toolkit represents those technologies that students have adopted as their preferred or default suite of tools and techniques to meet their learning and personal needs. It was found when students are given a choice to use technologies to support their learning, they will draw upon their own personal suite of tools and techniques to complete learning tasks, unless they are exposed to other tools or techniques that could help them complete a task more efficiently, effectively or creatively than they would achieve with their existing toolkit. The study also concluded that students’ lack of project management knowledge, processes and skills is an inhibiting factor affecting their progress throughout the inquiry experience. As a result, the study has developed a project management framework that combines an information process model with project management processes to highlight those aspects of the student inquiry experience where project management scaffolding could assist with students’ planning and management of project tasks, and has shown how Web 2.0 technologies can be used to support students’ project management/inquiry process.

The concept of a student’s individual learning team was also identified. The study showed how students (by Year 10) have the capacity to independently construct and maintain their own learning team that draws upon a mix of teachers, TLs, classmates, family, friends, and outside experts, based on five types of expertise the student perceives they bring to the inquiry experience. In addition, the study has identified the potential of Web 2.0 technologies as a platform for teachers and teacher librarians to support eight different types of instructional intervention when supporting students undertaking inquiry.

The most significant contribution the study makes to the fields of library and information sciences and education research is a new theory called the Personal Construction of Technology Use (PCTU) Theory. This theory provides an explanation of how students’ experiences with Web 2.0 technologies influence their views on using these technologies to support learning. The domains, dimensions, processes and principles of the PCTU Theory provides a set of propositions for further empirical investigation within each, or across the fields, of information behaviour and use, teaching and learning, technology use
and adoption, and constructivist learning theory. It also provides educators with a model that articulates one way of interpreting students’ information, technology and inquiry learning experiences in a blended classroom environment.
Chapter 1 Introduction

Simply capitalizing on new technology … is not enough. The new models must use these tools and services to engage students on a deeper level.

(Johnson, Adams, & Haywood, 2011, p. 5)

The quotation above provides a pertinent introduction to the research reported in this thesis, which explores how Web 2.0 technologies can be used to support individual student learning during an inquiry project. The report, published in the United States as a result of collaboration of a number of educational organisations, raises a range of relevant issues. For example, there is growing adoption and acceptance of cloud-based and browser-based applications in schools, which are “designed for many different tasks and hosted in the cloud” (Johnson, Adams, & Haywood, 2011, p. 10). The present study focuses on such applications, and it is important that educators gain an understanding of how these technologies are contributing to a shift beyond what we have traditionally known as schooling.

This edition of the NMC K-12 Horizon Report (Johnson, Adams, & Haywood, 2011) also highlighted the demand for personalised learning, which is “not adequately supported by current technology and practices” (p. 5). The availability of new technologies, enabling greater “learner choice and control”, means that “one-size-fits-all teaching methods are neither effective nor acceptable for today’s diverse students” (p. 5). The present research is particularly pertinent to this point. A key goal has been to examine not only how students use Web 2.0 technologies in their learning, but also how personalisation and customisation of teaching approaches has worked as each student has interacted on an individual basis with the teacher and teacher librarian (TL). Therefore, students’ use of Web 2.0 technologies and teacher/TL instructional interventions using Web 2.0 spaces, and how these may be influenced within the context of a blended classroom, are important aspects of the study presented in this thesis.

The research reported has a strong focus on the school library’s role in student learning. Todd (2006a) has argued that the ‘real business’ of TLs is a role focusing on instructional intervention that moves beyond information seeking to support students “transform[ing]
found information into personal knowledge” (para 1). Kuhlthau and Todd (2007) presented this ‘learning intervention’ role of the TL within a guided inquiry framework, which is defined as “carefully planned, closely supervised, targeted intervention of an instructional team of school librarians and teachers to guide students through curriculum-based inquiry units that build deep knowledge and deep understanding of a curriculum topic, and gradually lead towards independent learning” (para 2). Dimensions of information use have been important in terms of: (a) the physical and cognitive dimensions of students incorporating found information into their existing knowledge base (Wilson, 2000), (b) the impact of the affective dimension on students’ information use and recommended zones of intervention as defined by Kuhlthau (1993), and (c) the interactions of these three dimensions within a knowledge construction process such as that examined by Todd (2006a). The nature of instructional interventions afforded by Web 2.0 technologies in supporting students’ information use and knowledge construction as described here are only now being realised in practice, and being investigated by researchers. Therefore, the present study contributes to the examination of how teaching and learning can be personalised and customised in this new era of digital opportunities.

A guided inquiry approach, as espoused by Kuhlthau and colleagues (Kuhlthau, & Todd, 2007; Kuhlthau, Caspari, & Maniotes, 2007; Kuhlthau, Maniotes, & Caspari, 2012), requires individual students to explore topics of their own choice as part of the inquiry learning process, which in turn places demands on the teacher and TL to assist students in developing a focus for their projects. Some interventions may be planned based on scaffolds that have been developed and used by both researchers and practitioners in the past, while other interventions may be more adhoc and provided on a just-in-time basis. It is these incidental and customised interventions within Web 2.0 learning spaces that we need to capture, analyse, document and share with others. Web 2.0 technologies have the capacity to ‘capture’ and ‘timestamp’ the learning experiences of students and the instructional support of teachers and TLs as they occur. One of the outcomes of the present study is to demonstrate how this can be done to support student/teacher reflection, and support evidence-based practice in schools.
Furthermore, within the context of collaborative practice, the relationships that develop and exist between each student and the teacher and TL as a teaching team can vary and require significant negotiation on the part of each party. Up until recently, the way teachers and TLs think about collaborative practice has been primarily focused on the relationships that have developed and occur within a face-to-face mode; however, with the integration of Web 2.0 technologies in the curriculum, we need to learn more about the collaborative relationships and instructional support of students that teachers and TLs can provide within the online spaces used in a blended classroom environment. This again is within the purview of the research investigation.

Learning styles of students also have relevance, particularly how these may contribute to or affect students’ approach to learning and use of Web 2.0 technologies. The basic premise behind learning styles is that individual students prefer to learn in their own way. There is a significant body of research that focuses on the concept of ‘learning styles’ influencing students’ approaches to learning, with the majority examining students’ preferred learning styles within the higher education context. For example, see foundational studies such as Marton and Säljö (1976), Biggs (1979), Entwistle, Hanley and Hounsel (1979), Entwistle (1981), Entwistle and Ramsden (1983), and Tait, Entwistle and McCune (1998), to name a few. In terms of students’ information use, research by Ford and colleagues (Ford, Wood, & Walsh, 1994; Ford, Miller, & Moss, 2003) has shown a relationship between students’ approaches to completing information search tasks and their preferred approaches to study. Within the context of school libraries, Heinström and colleagues (Heinström, 2006a, 2006b; Heinström & Todd 2006) have explored the influence of study approach on a range of features of students’ information seeking behaviour student experience while completing guided inquiry projects, and more recently Heinström and Sormunen (2013, 2016) have examined secondary school students’ approaches to study while using wikis to support learning tasks. Thus, research on learning styles was seen as relevant to the present study, and consequently an adaptation of Entwistle and Tait’s (1997) *Approaches and Study Skills Inventory for Students* (ASSIST) measure was used to examine the relationships (if any) of student learning styles and their use of Web 2.0 technologies.
The intentions of students, teachers and TLs to use Web 2.0 technologies in the future, based on their experience with testing and trialling new technologies in the classroom, is also of relevance to the research in this thesis. Research shows that access issues are not the only factor affecting the choices individuals make regarding technology use (Selwyn, 2006; Hargittai, 2007; Witt, Massman, & Jackson, 2011). Technology readiness is also important, where once students learn “the basics” of using a technology, they need to apply these skills within a number of learning contexts to prepare them for future opportunities when they can use the technology again. Christensen and Knezek (2014) refers to this as developing the capacity to “select the appropriate tool for the job/assignment that is required of them” which is an outcome of one becoming technology literate (p. 831-832). Therefore, factors influencing students’ technology use and their capacity to develop technology literacy knowledge and skills while using Web 2.0 technologies for inquiry are also important within the context of the study of this thesis.

1.1 Purpose of the study

The purpose of this study was to explore the use of Web 2.0 technologies by students in an inquiry learning setting. In particular, it aimed to examine how Web 2.0 technologies can be used to support students’ completion of project-based assignments, and how student learning styles may impact on students’ levels of use of Web 2.0 technologies to complete such a project. It was also designed to examine the different types of instructional intervention that a TL and teacher provide using Web 2.0 technologies, and the timing of these interventions within and beyond school hours, i.e., when students are studying from home. The researcher also intended to explore the nature of ‘online dynamics’ generated between student, teacher and TL as a learning team within the Web 2.0 learning spaces created to support student projects, and how their experiences using these technologies might influence their use of these in the future to support learning. Thus, the key research question for this study was: How can Web 2.0 technologies be used to support student learning through a guided inquiry process?

The following set of focus questions was developed to guide the exploration of the main research question:
(1) How can Web 2.0 technologies be used to support students’ in the process of completing a project-based assignment?

(2) How do learning styles affect students’ use of Web 2.0 technologies while they are in the process of completing a project-based assignment?

(3) What types of instructional intervention within a guided inquiry framework can be provided by the teacher librarian and class teacher when students are using Web 2.0 technologies as learning environments?

(4) What kind of ‘online dynamics’ among students, teachers and teacher librarians exist in Web 2.0 learning environments, and how does this influence students’ learning?

(5) How do teacher, teacher librarian and student experiences with Web 2.0 technologies influence their views on using these in the future to support students’ learning?

1.2 Significance of the research

By addressing the research questions, identified above, the study has the potential to contribute to the fields of education, library and information science, and digital technology, and is therefore significant in a number of ways. Firstly, it illustrates those features and functions of Web 2.0 technologies that are particularly useful in supporting inquiry-based learning experiences of students, and the implementation of a guided inquiry approach in schools, particularly with regard to the customisation and personalisation of teaching methods by both teachers and TLs. Findings are based on empirical evidence of how students, teachers and TLs can work within a blended classroom environment using a guided inquiry approach.

Secondly, it demonstrates the potential role of school libraries and the TL in supporting student inquiry using Web 2.0 technologies, particularly in terms of the instructional role of the TL in helping students as they are working on inquiry projects, while at school and at home. It highlights the knowledge and skills TLs can bring to the inquiry experience
in terms of their information, learning and technology expertise, and how this expertise may be utilised and valued by students and teachers.

Thirdly, it examines student learning styles and how these may influence or affect students’ use of Web 2.0 technologies to support their learning, the study has the potential to contribute to the growing body of learning style research conducted in the library and information science discipline and school education context, and of greater significance, the school librarianship field.

Fourthly, it provides an understanding of students’ approaches to technology use in general, and how this influences the ways students’ use Web 2.0 technologies in the blended classroom. Technologies are not just tools to support learning in schools – they become the learning environment. Students’ engagement with this learning environment is personal; it is not one-size fits all. Therefore, by illustrating how individual students make their own decisions about the nature and scope of, and use of technologies to support their learning, the study can inform teachers and TLs of those factors that are potential enablers or inhibitors of student’s technology use, or the inquiry learning experience.

Finally, the study is also significant to the information and education professions’ understanding of the potential ways Web 2.0 technologies can be used to create online learning spaces for student groups and individuals, as well as the understanding the nature and dynamics of a blended classroom environment.

1.3 Outline of contents

The thesis consists of six chapters. This first chapter has briefly introduced the background to the study reported in this thesis. It has placed the research within the context of school librarianship and the educational role of the teacher librarian as an information, technology and learning specialist, as well as the educational contexts of integrating technologies into the curriculum and designing blended classrooms. It has also situated the student experience as central to these contexts, and the implications of this for individual students’ development as inquiry learners and technology users. In
addition, it has outlined the significance of the research, including implications for research, professional practice and learning theory.

Chapter 2 presents a more detailed background to the study which examines research into school libraries and student learning, and how school libraries have evolved in supporting the information, technology and learning needs of students in the past two decades. This section also explores how the field of school librarianship in Australia was situated within the broader international context of the field as this evolution occurred. This is followed by a review of the literature across four key areas that have informed the context and design of the study. These include student learning through inquiry; students’ approaches to learning, including learning styles and students’ information behaviour; the use of Web 2.0 technologies to support teaching and learning; and the teacher librarian as instructional partner in guided inquiry.

Chapter 3 discusses the theoretical framework and methodology employed by the study. It presents three constructivist theories – Personal Construct Theory (Kelly, 1963), Social Construction Theory (Berger & Luckmann, 1967), and Vygotsky’s (1978) Zone of Proximal Development – as the basis for developing the interpretivist lens which the researcher used to examine the research context of the study. This is followed by an explanation of ethnography as the overarching methodological approach used by the study, and the mixed methods employed to explore the participants’ inquiry and technology experiences in the study.

Chapter 4 details the research context including a description of the research site, participants, and inquiry-based unit. This is followed by the procedures undertaken to gain ethics approval and access to the research site and participants, and the techniques employed to support the mixed methods ethnographic study, including data collection and data analysis. The chapter concludes with discussion about the factors contributing to the trustworthiness of the study.

Chapter 5 presents the findings of the study under six major areas, with findings regarding students’ approaches to study (including learning styles) and students’ approaches to technology use (in general). This is followed by participants’ use of Web
2.0 technologies to support the inquiry experience, and the impact of learning styles on students’ use of Web 2.0 technologies. Findings on the nature of learning teams and instructional intervention using Web 2.0 for inquiry are then presented, followed by the ways participants’ Web 2.0-based inquiry experience shaped their views of technology use in the future.

In the final chapter, Chapter 6, the first three sections discuss findings of the study in relation to the first four focus questions. These are discussed in relation to the literature, with implications for professional practice and further research presented at the end of each section. A fourth section proposes a new theory, Personal Construction of Technology Use Theory, followed by discussions on the theory’s implications for professional practice and future research which contribute to answering the final focus question. The chapter concludes with a section discussing the limitations of the study, followed by the final section, the Conclusion, of the thesis.
Chapter 2 Literature review

If our assignments are not real-world problems, helping students to ask authentic questions, find the best sources, winnow out unnecessary information, compile information in a coherent and creative format, and share it with a global audience, then we are failing to empower them.

(Foote, 2010, “The Heart of the Matter”, para 5)

This chapter presents the background to this study in terms of the contexts of schooling, school libraries and emergence of new technologies within which the topic under investigation was identified by the researcher. This includes the contribution of school libraries in supporting student learning, the introduction of guided inquiry as an instructional framework for school libraries, and how school libraries were responding to the emergence of Web 2.0 technologies to support student learning. This is followed by a review of the research literature across the areas of inquiry learning; students’ approaches to learning, including learning styles and students’ information behaviour; the use of Web 2.0 technologies to support teaching and learning, and the teacher librarian as instructional partner in guided inquiry.

2.1 Background to the study

The topic of investigation presented in this thesis was born as a result of the researcher’s interest in the emergence of Web 2.0 technologies and their potential impact on the way teachers teach and students learn, and how this may influence the changes in the contribution of the school library and TL to student learning. The following section presents the context within which this study was developed and the research questions devised.

2.1.1 School libraries and student learning

A substantial body of scientifically based research from North America has shown a positive relationship between school libraries and student achievement (Lance & Loertscher, 2001; Haycock, 2003; Lance & Russell, 2004; Klinger, 2006; Small &
Snyder, 2010). Even with this body of evidence, the likes of Oberg (2001), Todd (2001), Loertscher and Todd (2003) and Haycock (2003) have argued that with the increased emphasis on accountability within education systems, the continued demonstration of school library impacts on student learning outcomes is imperative for school librarianship worldwide.

The Australian Council of Education Research review of the literature regarding the impact of school libraries on student learning by Lonsdale (2003) concluded studies over the past two decades showed that:

- A strong library program can lead to higher student achievement regardless of the socioeconomic background of the students.
- A school library program can have a significant impact on student achievement when classroom teachers and TLs collaborate on the planning of instructional units, resource selection and collection quality, and teachers’ professional development.
- A strong computer network connecting the school library’s resources to classrooms and laboratories has an impact on student achievement.
- School libraries can make “a positive difference to students’ self-esteem, confidence, independence and sense of responsibility in regards to their own learning”. (p. 1)

Over two decades of empirical studies (from 1993 onwards) across 26 states and provinces in North America citing the measurable impact school libraries and TLs have on student achievement have been presented in four editions of the international advocacy document School Libraries Work! (Scholastic Library Publishing, 2004, 2006, 2008, 2015). Findings from the impact studies show a direct correlation between student achievement and school library programs led by school library professionals whose dual teaching and library training qualifies them to teach information literacy, promote reading and facilitate literary learning, assist teachers and students to locate and critically evaluate information and synthesise their findings into new knowledge, effectively use technology to support teachers and students’ information seeking and knowledge construction, organise and maintain an up to date and relevant collection, provide
equitable intellectual and physical access to resources, and maintain a supportive and nurturing information environment to increase student satisfaction and learning achievement (Haycock, 1999, 2003, 2011; Woolls, 2004; Scholastic Library Publishing, 2008, 2015). These findings highlight the important role of the TL – as information, technology and learning specialist – as part of the instructional fabric of a school’s teaching and learning environment.

Throughout the world, the need for evidence-based practice in education has been highlighted as a priority. This emerged as a movement in school librarianship in the early 2000s by Todd and others (Todd, 2001; Loertscher & Todd, 2003; Todd, 2006b, 2007a). TLs in Australia began to acknowledge the need to adopt evidence-based methods to highlight that the work they do in schools actually does make a difference. By the mid-2000s, some Australian studies on the impact of school libraries on student learning emerged. The Student Learning through Australian School Libraries project conducted in 2004 (Hay, 2005; 2006) replicated the 2003 United States study, Student Learning through Ohio School Libraries, by the Center for International Scholarship in School Libraries (CISSL) at Rutgers, the State University of New Jersey (Todd, Kuhlthau, & OELMA, 2004). The Australian study surveyed just over 6,700 Australian Year 5 to 12 students from 46 metropolitan and regional public schools, concluding that as the information and technology worlds of the 21st century becomes increasingly complex, students have an increasing dependence on, and demand for, a school library that provides students with access to state of the art technologies, resources, services and teaching to support their learning when in school and at home (Hay, 2006a, 2006b, 2006c).

Some Australian TLs also adapted the data collection instruments from the Student Learning through School Libraries projects to conduct school-based impact studies, such as Twomey (2007) and Harkness (2008). Results of the Twomey study regarding the importance students placed on the school library’s provision of quality technology infrastructure and ICT instructional support reflected those by Hay (2006b). Students wanted greater access to technology within the school and saw the school library as a flexible learning space where they could gain access to ICTs as well as gain assistance with using these, particularly when completing school assignments and inquiry projects.
With a greater number of schools and homes gaining access to the Internet and World Wide Web during this time, the potential ‘reach’ of the school library’s resources, services, and instructional support into the homes and lives of students during out-of-school hours was increasing, and some TLs were just exploring what this might involve with the emergence of Web 2.0 (which is explored in the next section).

Other Australian studies on school library impact included research on the implementation of a guided inquiry approach in supporting student research projects, including the application of the evidence-based practice toolkit, known as the School Library Impact Measure (SLIM) survey toolkit, developed by Kuhlthau and colleagues (Todd, Kuhlthau, & Heinström, 2005b; Kuhlthau, Caspari, & Maniotes, 2007). These Australian studies featured the work of TL practitioners such as Fitzgerald (2007, 2011), Scheffers (2008; Scheffers, Bruce, & Nix, 2006), Drury and Martin (2009), Maitland-Smith, Twitchett, and Davey (2009), and Sheerman (2011a; Sheerman, Little, & Breward, 2011). However, the focus of these were principally based on the TL’s face-to-face instructional role in the school library and in classrooms, as opposed to online instructional intervention. The results of these studies are examined further in Section 2.5 on the TL’s role as instructional partner in guided inquiry.

The action research and evidence-based practice initiatives of Scheffers regarding the impact of collaborative partnerships between the TL and teachers and the effective integration of information and communication technologies (ICTs) in supporting literacy teaching and learning (Scheffers, 2004; Scheffers & Bohman, 2003), along with La Marca’s (2003, 2004) research on the role of the TL in creating a reading environment to support student learning, and Kurvink and Turnbull’s (2007) action research project on the development and impact of an adolescent reading program spanning five years, all provide evidence of the role and impact of the school library and TL in supporting a reading culture and literary learning in Australian schools. The focus of these studies, however, was again on student outcomes and the instructional role of the TL within face-to-face learning contexts.

Research has also been conducted on how TLs can use action research to build evidence of impact on student learning (Harada & Yoshina, 1997; Todd, 1997; Harada 2004,
2005a, 2005b; Gordon 2006, 2008, 2009a; and Ballard, March, & Sand, 2009, to name a few), which also informed the publication of ‘how-to’ manuals and journal articles for TL practitioners such as the likes of Klobas (1997), Farmer (2003), Howard and Eckhardt (2005a, 2005b), Loertscher (2006), and Callison (2007). While these studies and guides have been seen as critical in helping build evidence for the profession, a study in the United States by Kaplan (2010) examined how information about school library impact studies was disseminated to decisions makers and evaluated the effectiveness of the dissemination processes employed. The study concluded that the information about impact studies from 1993 to 2005 was not effectively disseminated to decision makers and had little effect on decisions and legislation related to the support of school library media programs and personnel within states. Kaplan argued the need for “systematic disseminating of information about these state school library impact studies to important decision makers”, with professional library associations being “more proactive about the dissemination of the information”, and the importance of individual school library practitioners taking on “some of this responsibility” to facilitate greater and more effective dissemination (p. 61). That said, these needed to be positioned within those educational and technological shifts that were emerging in the teaching and learning landscape and the changing nature of curricula priorities that were particularly of interest to decision makers. Ultimately Web 2.0 technologies and developing students’ capacity as digital learners became one of those shifts that was becoming of increasing interest to education authorities, state and district administrators, school principals and the community as part of 21st century schooling. At the time data was being collected for the research presented in this thesis, none of these impact studies focused specifically on student learning in the Web 2.0 learning environment.

While the majority of these impact studies have occurred in North America, in the 2000s an increasing number of evidence-based practice programs and action research projects on the impact of building information literacy programs in Australian schools were being published in journals, highlighting the growing interest within the TL community to contribute to building an evidence base on the impact of TLs and library programs in Australian schools (such as Schutz, 2000; Miller & Janovsky, 2002; Ryan & Hudson, 2003, 2005; and Heard, Lynch, & Haren, 2008). However, the information literacy
programs evaluated did not include the integration of technologies as a fundamental component of their design.

It was within this context of school library impact studies and evidence-based practice initiatives nationally and internationally, particularly those TLs wishing to implement a guided inquiry approach to support student learning in their school, and documenting evidence of resultant impact, that the study presented in this thesis was conceived in 2007.

2.1.2 Guided inquiry as an instructional framework for school libraries

The concept of guided inquiry was first introduced in Australia in 2007 by Todd (2007b), where a guided inquiry framework was presented based on the Center for International Scholarship in School Libraries (CISSL) document, *School Library Impact Measure - S*L*I*M: A toolkit and handbook for tracking and assessing student learning outcomes of Guided Inquiry through the school library* (Todd, Kuhlthau, & Heinström, 2005b). At the time of formulating the proposal for this PhD research, only two TLs in Australia had published their experiences and findings at conferences (Fitzgerald, 2007; Scheffers, 2007) and in journals (Fitzgerald, 2007). Fitzgerald (2007) presented her guided inquiry experience as a case study which contained a description of the unit of work under investigation, some brief findings along with quotes from students about their experience, and some reflective comments and advice about what changes/revisions she would make before conducting further guided inquiry units of work. By mid-2007, the first full publication on *Guided Inquiry* by Kuhlthau, Caspari and Maniotes was released which provided TL practitioners and researchers with a comprehensive guide on how this process could support both inquiry learning and information literacy education.

By February 2009, the Australian Library and Information Association (ALIA) and Australian School Library Association (ASLA) released a policy in support of guided inquiry as an instructional approach in its *Statement on guided inquiry and the curriculum* (2009), endorsing this approach to teaching and learning because it “helps students to construct meaning, think creatively and solve problems”, enabling learners
to “develop higher-order thinking through guidance at critical points in the learning process”.

In 2001 Kuhlthau argued for the need for substantial school reform to address the demands of the “information age”. Nearly a decade later, Gordon (2010) claimed that a “culture of inquiry is emerging from research-based information literacy instruction that takes place in school libraries” (p. 73); however “research is needed to understand how inquiry and action research-based information literacy instruction in school libraries can influence school culture” (p. 75). The work of TL practitioners in Australia such as Fitzgerald (2007, 2011), Scheffers (2008), Kurvink and Turnbull (2009), and Sheerman (2011a), as well as the work of school library media practitioners and researchers in North America such as Schmidt and colleagues (Schmidt, Smyth, & Kowalski, 2008; Schmidt, Kowalski, & Nevins, 2010), and Kuhlthau and Todd (Todd, 2006a; Kim & Todd, 2008; Kuhlthau & Maniotes, 2010), are now contributing to building research evidence of the TL as a teacher of guided inquiry. More recently, Kuhlthau, Maniotes and Caspari (2012) released their Guided Inquiry Design framework, which presented an inquiry model of the eight phase of Open, Immerse, Explore, Identify, Gather, Create, Share and Evaluate. These were designed to provide greater inquiry-based scaffolding to the seven stages of Kuhlthau’s ISP (2004). Within the context, of the present study, this later model is referred to only in the discussion and conclusions presented in Chapter 6 of this thesis, given that the data collection phase of the research was conducted before the publication of this new model.

Therefore, within this Australian and international context presented above, it was the intention of the researcher of this thesis to contribute to this movement of ‘building evidence’, by exploring the nature and role of the TL as a teacher of inquiry when Web 2.0 technologies were being used to support students’ inquiry experience. Given a guided inquiry approach encouraged a collaborative partnership between teachers and the TL, the researcher also planned to examine the nature of relationships between student, teacher and TL, and the nature of instructional intervention afforded by Web 2.0 technologies in supporting students’ information use and knowledge construction, thus contributing to building empirical research evidence regarding the TL’s involvement in teaching a guided inquiry approach in schools.
2.1.3 School libraries, technology and Web 2.0

By the mid-2000s, with an increasing number of students in Australia with Internet access at home, 24/7 access to a range of quality online resources and services through the school library had become essential if school libraries were to remain central to students’ informational and technological worlds (Hay, 2006a). While the development of digital library collections with remote access to a school’s intranet, along with quality online databases and pre-selected, authoritative digital resources provide a good starting point, Church (2005) argued that teachers and TLs needed to find new ways of “connecting” with their students, in that they “have to meet them on the Web and provide library service and instruction online, at the point of need” (para 4).

While teachers and TLs can work with students during school hours to critically evaluate information and develop the skills and understandings required to detect misinformation from pertinent and authentic information, school libraries also needed to find ways of supporting students’ information behaviour and knowledge construction when they were completing learning tasks out of normal class time, including when they were at home. Based on the findings of a previous study conducted by the researcher of this thesis, Hay (2006a) recommended a range of online information services and information literacy scaffolds that school libraries could provide to support students when ‘connected’ at home, based on a range of exemplars of online service provision by school libraries in Australia and North America at the time (Horton, 2006; Milbury, 2006; Scotch Library Web Team, 2006; Valenza, 2006).

In addition, the body of research exploring the nature and development of school library websites and virtual libraries (Clyde, 2001; 2003), information skills instruction using Internet resources (Eisenberg & Berkowitz, 2000; Johnson, 2003; Herring, 2004) and instructional websites (Herring, 2005) provided TLs with insights into the development of and nature of responsive online school library service. However, this research had not extended beyond what had become known as the ‘Web 1.0’ online environment (O’Reilly, 2005), or ‘Library 1.0’ environment (Maness, 2006) where users were primarily passive consumers of online content. Few studies were exploring how school libraries could harness the potential of Web 2.0 technologies to provide online services or instructional support for students and teachers.
The Oxford English Dictionary (OUP, 2017) defines Web 2.0 as the “second stage of development of the Internet, characterised especially by the change from static web pages to dynamic or user-generated content and the growth of social media”. Examples of Web 2.0 include social networking sites and social media sites (e.g., Facebook, Twitter), blogs, wikis, folksonomies and social bookmarking sites (where users collect and share websites and links and tag these with keywords, e.g. Delicious, Diigo), audio and video sharing sites (e.g., podcasts, YouTube), hosted services for sharing photos (e.g. Flickr), collaborative platforms (e.g., Wikipedia, Google Docs, Edmodo), and mashup applications (e.g. GoogleMaps, SongDNA) that draw upon a number of sources including user-generated data. O’Reilly (2005) refers to the Web 2.0 era as “the architecture of participation” where “users add value” (p. 3).

By the mid-2000s little research had been conducted on school libraries’ use of Web 2.0 technologies to support student learning, with the exception of an initial study of school library blogs by Clyde (2005b). This was in direct contrast to the increasing number of articles published in the professional literature of school librarianship encouraging TLs to ‘embrace’ the potential of Web 2.0 technologies, or be left behind (Bradley, 2007; Harris, 2006; Hargardon, 2007; Hauser, 2007; O’Connell, 2006; Valenza, 2007; Wall 2006). Hall and Davison (2007) made a similar conclusion in their review of the literature on the use of blogging in library and science education, arguing that “enthusiastic claims for blogging in educational settings are founded on a research base that is currently limited: little empirical work lies behind them” (p. 164), with “findings” based on anecdotal evidence, “such as stories of practice, rather than data derived from well-executed research” (p. 169).

The following quote by Harris (2006) illustrates the tone of much of the professional literature at the time that the study presented in this thesis was designed:

Blogs and the whole gamut of interactive, Web-based tools are redefining how we connect with people and content on the Internet… Web 2.0 [is] a truly revolutionary concept in which pervasive interactivity, where multitudes of users online actively exchange or contribute content, will transform the very nature of knowledge and information… These tools will necessarily redefine the learning landscape as we know it. And school libraries – if they are to remain relevant – must undergo transformation as well. (p. 51)
At the same time, a number of ‘how-to’ type publications were published outlining the richness Web 2.0 technologies could bring to the classroom (Richardson, 2006; Warlick, 2007; Crane, 2008; November, 2008), with some authors arguing the potential of Web 2.0 in leveraging educational reform for 21st century schools (Solomon & Schrum, 2007; Schrum & Levin, 2009). At this time, a number of publications began to emerge that specifically targeted school librarianship by consultants, practitioners and academics on the potential applications of Web 2.0 technologies, including Godwin and Parker (2008), Fontichiaro (2009), Berger and Trexler (2010), Harris (2011) and Herring (2011). However, these only presented the application of a range of Web 2.0 technologies in practice. They were not based on empirical evidence of the impact on student learning.

In defining ‘School Library 2.0’, Naslund and Giustini (2008) provided a range of examples of how to use blogging, social networking and other Web 2.0 tools to engage learners in learning how to learn in digital contexts, predicting that the “future of School Library 2.0 will see social software applied to digital learning spaces in pedagogically innovative ways… [bringing] rich media together in an experimental but collaborative platform… where students can work with peers and interact globally” (p. 65). In the professional literature, school library consultants and practitioners recommended the use of blogs to promote school library programs and resources and support literature and literacy programs in schools (Berger, 2005; Achterman, 2006; McPherson, 2006a). The use of wikis were recommended as collaborative web spaces to support student learning in groups and to publish content online (Achterman, 2006; McPherson, 2006b). They argued that podcasting could help motivate students as learners, as well as provide students with another format for publishing project reports (Lamb & Johnson, 2007a, 2007b; Hauser, 2007). Furthermore, social bookmarking services could provide students and teachers with opportunities for collaborative information discovery through the provision of a Web 2.0 space where individuals could contribute to their group’s collection of bookmarks of web resources, no matter what browser or computer they were using (Alexander, 2006). Again, these claims were not based on empirical research.

Increased participation in terms of communication, collaboration and publication of content is central to the Web 2.0 ethos (sometimes referred to as the ‘participatory Web’,
or ‘read/write Web’). In the mid-2000s, Lackie (2006) believed that it was “opening up even more opportunities for us [librarians] to better engage our library users, essentially making communication and online work easier and more productive” (p. 9). This belief was supported by Harris (2006) who viewed the school library’s use of Web 2.0 technologies as an “opportunity for library professionals to engage in some exciting activities that will enable our institutions to remain effective in the midst of fast-moving technological change” (p. 52).

Clyde (2005b) explored the purpose and uses of fifteen school library blogs and concluded the existence of “a gap between the potential of weblogs for school libraries, as outlined in the professional literature of education and librarianship, and the reality of school library blogging” (p. 45), with the primary uses of blogs being to provide library news and updates, and to provide links to web resources. In exploring the educational benefits of blogging, Clyde (2005a) also referred to the results of a case study in a high school that demonstrated how blogs were supporting literacy development through storytelling, claiming this enhanced student motivation in writing, and encouraged students to communicate with each other and seek feedback from their class members about their writing. These studies were the beginning of empirical evidence reporting the impact of Web 2.0 technology of school libraries and the work of TLs.

Thus, it was within this context of school libraries starting to explore the ways Web 2.0 technologies could be used to support student learning, and the instructional role the TL could play in supporting both teachers and students’ use of Web 2.0 technologies (with very little empirical research to inform teaching practice), that this study was conceived. The primary aim was to document what inquiry learning “looks like” within a Web 2.0 environment. For example, how do students make sense of the Web 2.0 world while undertaking an inquiry project? How does the teacher and TL make sense of the Web 2.0 world when designing and implementing an inquiry-based unit that integrates these tools? What can we learn about students’ predominant approaches to inquiry learning and Web 2.0 technologies? What can we learn about the types of instructional intervention that teachers and TLs can provide in Web 2.0 learning spaces? In the late
2000s, these were questions that we did not have answers to and consequently they formed the basis of this PhD study in an attempt to shed some light on these questions.

The following four sections in this chapter present a review of those bodies of research that inform the nature of this study. It summarises what we already know about student learning through inquiry; students’ approaches to learning, including learning styles and students’ information behaviour; the use of Web 2.0 technologies to support student learning; and the role of TL as instructional partner in guided inquiry.

2.2 Student learning through inquiry

Underpinning inquiry-based learning is the philosophy of John Dewey who believed that education begins with the curiosity of the learner. Dewey (1910) referred to curiosity as the “desire for fullness of experience”, where the “curious mind is constantly alert and exploring, seeking material for thought.” (p. 30-31). He argued the challenge for a teacher was “to protect the spirit of inquiry” in students by transforming their “natural capacities of inference into habits of critical examination and inquiry” (p. 29). This means that students’ curiosity and interest are at the heart of inquiry where they are actively engaged in questioning, critical thinking, and problem solving, where they ‘make meaning’ out of inquiry-based experiences. Therefore, the role of the teacher is one of partner in the learning process, working with students to develop independence in discovering meaning about the topic under investigation (Dewey, 1897). In other words, inquiry as a learning process is not an independent and unguided process. Students require instruction to develop capacity as inquirers of their world.

Jean Piaget’s (1950) work on cognitive development also informs our understanding of student learning through inquiry. He claimed that children learn through questioning, challenging and reworking prior understanding through active engagement (which complements the philosophy of Dewey). His work on the operational development of intelligence, particularly with regard to adolescence, furthers our understanding of the nature of inquiry learners in their mid-teens, which is of particular relevance to the study presented in this thesis. Piaget and colleague, Barbel Inhelder (1958) identified what they referred to as a “general tendency of adolescents to construct theories and make use
of the ideologies that surround them” (p. 336). In other words, adolescents are able to analyse their own thinking and construct theories. Piaget and Inhelder argued that by mid-adolescence, the majority of young people are developing their own personal views of the world around them which manifest themselves in the form of political or social theories where they try to explain how they see and could “reform the world”, while others’ interests and values may be influenced by literary or aesthetic theories about life, or embrace religious or philosophical views of the world (p. 340). They argue by this age, young people build these theories or ‘ideals’ as their way of trying to adapt to society, i.e., preparing them for adult life. Furthermore, an adolescent’s theory construction “shows both that he has become capable of reflective thinking and that his thought makes it possible for him to escape the concrete present toward the realm of the abstract and the possible” (p. 342). Thus, within the context of inquiry learning, students of this age can be provided with opportunities to test and trial their personal views and beliefs when investigating authentic issues, or problems about the world around them, or when using technologies to support their inquiry. This in turn results in further learning, or knowledge construction. This also relates to the theories of personal construction by George Kelly (1963), and social construction by Berger and Luckmann (1967), which are examined in detail in Chapter 3 of this thesis.

Inquiry as a learning process broadly involves learning experiences which “begin with a question followed by investigating solutions, creating new knowledge as information is gathered and understood, discussing discoveries and experiences, and reflecting on new-found knowledge” (Savery, 2006, p. 16). In other words, students seek to answer questions by constructing evidence-based arguments based on a process of investigation (Hmelo-Silver, Duncan, & Chinn, 2007). A number of approaches to ‘inquiry as process’ exist, however, based on the discipline within which inquiry may occur. For example, inquiry learning draws upon the practices of scientific inquiry where scientists “frame hypotheses that build from theories and previous research; design investigations that allow them to use tools and technologies to gather, analyze, and interpret data; and create explanations of the phenomena” (Krajcik & Blumenfeld, 2006, p. 323). Inquiry from the perspective of historians involves a cyclical process that begins with asking questions to gain an understanding of the past; historical resources (both primary and secondary) are located and analysed for aspects or incidents of the past; further questions
are identified and explored to document “historical evidence”; credible and worthwhile inferences and claims about the past are constructed to help answer a question; and often these “historical interpretations” identify further questions to explore (Lee, 2005).

Within the context of mathematical inquiry, cycles of inquiry are used to seek answers to questions, or solve problems. For example, a cycle may involve the refining of a problem where an initial investigation of a topic identifies new questions to explore, generating further investigations as a new cycle of inquiry. Students need to provide evidence to support their claims and seek feedback from mathematics peers and mentors, which may lead to “a refinement of the question, theories to explain outcomes, or discussion of ways to explore the relationships generated, with the cycle ending when student are satisfied that the results of their investigation sufficiently resolve or explain the problem” (Makar, 2007, para 8). Thus, the similarities between these different types of inquiry include the goal of constructing evidence-based arguments about real world issues and authentic problems, and a process that involves questioning, investigating, constructing, reporting and reflecting, drawing upon knowledge, skills and views of the discipline, throughout the inquiry experience.

The challenge for students as inquiry learners is to apply ‘what they know and learn’ about inquiry across a number of disciplines. Tapping into students’ curiosity and interest in the world in which they live is central to maintaining that ‘spirit of inquiry’ which Dewey (1910) believed was fundamental to effective schooling. These characteristics of inquiry learners are often referred to as dispositions or ‘habits of mind’.

2.2.1 Questioning is central to an inquiry-based approach

Cultural anthropologist and scholar of new media, Michael Wesch (2008) argues that questions are the basis for lifelong learning:

Good questions are the driving force of critical and creative thinking and therefore one of the best indicators of significant learning. Good questions are those that force students to challenge their taken-for-granted assumptions and see their own underlying biases. Oftentimes the answer to a good question is irrelevant – the question is an insight in itself. The only answer to the best questions is another good question. And so the best
The ability to question is central to an inquiry-based approach to learning. Harada and Yoshina’s (2004b) observation of students’ inquiry experiences led them to conclude that inquiry learning “provokes deeper thinking and investigation and greater student motivation to learn” (p. 22). Their year-long study of a group of Year 5 students and their teachers working on inquiry-based units also found that questioning underpins the inquiry learning experience, where the design of a unit is based on an ‘essential’ or ‘big’ question from which students develop their own specific question or questions on which to base on their own research projects (Harada & Yoshina, 2004a, p. 2). As they found information on their topics, the students were further encouraged by their teachers to question the ideas they found “to generate more questions that provoke deeper levels of understanding” (p. 2). The teachers worked as facilitators, guiding students to chart their own course of inquiry. The researchers observed the students gaining confidence in developing their own answers to questions, and concluded “students realize the legitimacy of what they want to know” (p. 2). This process encouraged the students to become partners in negotiating the curriculum with their teachers as they begin to develop independence as inquiry learners.

Likewise, Behrenbruch’s (2012) study of Year 10 students’ inquiry experiences found that students’ identified skill development over specific content as being the most valuable learning they encountered while completing inquiry tasks. These skills included asking good questions and being able to question ideas and opinions they were exposed to as an inquirer. The students were able to not just list the skills they had developed, they were able to “explain their importance and applications; that alertness to wider possibilities required for master thinking dispositions” (p. 68). In the inquiry classrooms Behrenbruch observed that big conceptual ideas and student questions drove knowledge and skills development, as opposed to structured state-based curriculum units, and the teachers found their students asking more complex questions “that motivated them to learn” (p. 11). Inquiry as a vehicle for highly motivating students was also found in the teacher research conducted by Wilhelm and his colleagues (Wilhelm, 2007; Wilhelm, Wilhelm, & Boas, 2009).
Results of a study on authentic assessment versus standardised test scores by Newmann, Bryk and Nagaoka (2001) also found that authentic assessments in inquiry supported questions of primary and secondary students that were of personal value and interest to them, which in turn provided the motivation for students to persevere with inquiry projects that were “hard work”, compared to completing assignments that had no personal meaning to the students (p. 30). In addition, the knowledge and skills developed as a result of completing inquiry tasks resulted in increased scores for these students in standardised tests in reading, writing and mathematics. Research on the role questioning plays in inquiry by Wilhelm and Wilhelm (2010) identified four key characteristics of successful essential questions. They need to be ‘engaging’ to pique students’ interest; they need to be ‘enduring’ in that they lead to understanding that has value in and relevance to the real world; they need to be ‘at the heart of the discipline’ by contributing to knowledge in the field or solving problems within the subject areas; and they need to be ‘in need of uncovery’, which involves “a background of foundational principles, rich concepts, procedures, and theoretical understandings that require unpacking, and that lead to knowing the story behind the story about how and why this knowledge was created in the way that it was, why it works as it does” (p. 42). Conversely, they identify three characteristics of what an essential question is not, i.e., essential questions cannot be answered through information retrieval; they cannot be understood quickly within a single lesson, or in some cases, an instructional unit; and they cannot be easily agreed upon (they need to encourage contention).

For students to be able to ask ‘big’ or ‘deep’ questions, however, they must be able to successfully draw on their prior knowledge, or build new background knowledge to generate this level of questioning. This is supported by Marzano (2004), whose meta-analysis of studies on the influence of background knowledge on student learning concluded that “what students already know about the content is one of the strongest indicators of how well they will learn new information relative to the content” (p. 1). Fisher, Frey and Lapp (2012) recommend teachers use questioning as one way of “activating background knowledge” (p. 30). However, they caution that teachers need to go beyond questioning of factual knowledge (which is based on remembering). Teachers need to plan questions that require students to apply, analyse and evaluate ideas in order to build background knowledge. In addition, students can build background
knowledge via wide reading, direct experiences such as field trips, guest speakers or personal interviews, and virtual experiences using virtual museum and gallery websites or 3D virtual worlds.

While Kuhlthau’s (1991; 1993; 2004) research on her information search process (ISP) focused on students’ experience with selecting a topic in the early stages of completing an open-ended style project (as opposed to the derivation of a specific question or questions for investigation), a key finding of her work was identifying the third and fourth stages as the most critical in terms of student success as learners. The third stage of prefocus exploration was identified as the most difficult stage in the process for many students. This is when students are exploring information about a general topic to “extend personal understanding and to form a focus… or a personal point of view [where] … Information encountered rarely fits smoothly with previously held constructs, and information from different sources commonly seems inconsistent and incompatible” (2004, p. 47). As they encounter a range of views from the information found, their constructs of the topic change. Furthermore, the affective dimension of students’ experience during this stage involves confusion, doubt and uncertainty while they identify several possible focuses of a particular topic. In this stage some students can feel so threatened that they may be inclined to abandon their search altogether. In other words, finding a specific focus for a topic is the hardest part of the information seeking process for students when completing inquiry projects.

Furthermore, the fourth stage of focus formulation was identified as the turning point of a students’ ISP, where the selected topic becomes more personalised as students construct their own views and insights to “form a focused perspective of the topic” to investigate as their project (p. 48). Kuhlthau also concluded that students who do not form a focus during this stage experience difficulties throughout the remainder of their project as they attempt to write up findings and present conclusions. While this research did not examine students’ construction of a topic expressed as a specific question, it does highlight the difficulties faced by students as they build background knowledge to inform the selection of a topic, in determining a specific focus on which to base their inquiry, and the affective dimensions influencing students’ experience during this time.
Kuhlthau’s latter work on the Guided Inquiry framework with colleagues Caspari and Maniotes, however, does acknowledge questioning as central to inquiry unit design (Kuhlthau, Caspari, & Maniotes, 2007). They argue the provision of open-ended topics “provide opportunities for students to generate questions that are important and interesting to them” (p. 134). They compare open-ended questions of their Guided Inquiry framework to the essential questions of Wiggins and McTighe’s (1998) Understanding by Design process, both of which are designed to encourage inquiry as an investigation for deep understanding, as opposed to finding facts to answer questions. That said, few studies have investigated the nature of, or process involved in, students’ developing their own good or authentic questions. Gordon’s (1999) study of sixty five Year 10 students as authentic researchers did include explicit instruction in the process of forming a research question, with 93% of students in agreeance that forming a research question was helpful in completing their authentic research task. An assumption underpinning the design of the inquiry unit in Gordon’s study was that if students could articulate their topic as a “researchable question” in a written proposal, this would help students develop a rationale and methodology for proceeding with the investigation of their authentic inquiry task. Many students found, however, that they needed to modify their research question as they learned more about their topic, with a number of students realising they needed to complete far more background reading to inform the development of their research question.

Likewise, Fitzgerald’s (2007) study of 120 Year 7 students found students were not used to choosing their own inquiry question, with some having great difficulty with it. She concluded this was in part due to the very broad nature of the inquiry unit and the age of the students, where they could select historical fiction from any period in history. Fitzgerald recommended that future inquiry units for students of this age (12 years) needed “boundaries put around their field of inquiry… [because researching] any topic in history was very difficult to narrow” (p. 34), and they need “intensive guidance and modelling of questions that will be manageable for them very early on” in the inquiry process (p. 35). This supports Kuhlthau’s (2004) findings regarding the prefocus exploration and focus formulation stages as critical points of intervention in the information search process. Students need to invest considerable time in building background knowledge before committing to a topic focus, and they require scaffolding
and instructional support throughout these stages, particularly when they are trying to articulate this as a specific research question or questions as evidenced in the Gordon (1999) and Fitzgerald studies (2007, 2011).

Tallman’s (1998) I-Search study of a class of Year 9 students while completing a personal interest project found the use of questioning techniques encouraged higher-order thinking and assisted students in applying information effectively to their research question. Narrowing down topics to a specific focus was identified by the researcher as one of the most difficult tasks within the inquiry unit, even though the teacher and TL used a set of conferencing questions to assist students during the topic selection stage of the I-Search process. This questioning was employed to help motivate students about potential topics of personal interest, help them determine what they already knew about their topic, and what their next steps would be in the I-Search process. Similar to Gordon (1999) and Kuhlthau’s (2004) findings, the success of students’ inquiry experience were influenced by their ability to formulate a focus, however, the Gordon and Tallman studies highlight the important contribution “researchable questions” can make to strengthening the focus of students’ topics and the resultant direction this can provide students through the writing up and presentation stages of an inquiry project.

Therefore, the above studies show that the ability to question is central to inquiry learning, in terms of developing students’ capacity to question as inquirers, and teachers’ capability in initially devising an essential question on which an inquiry unit is based, and then designing instructional interventions to work with students to build background knowledge to inform the development of their own big or researchable questions, as well as scaffold students’ transition from topic exploration to focus formulation.

2.2.2 Authentic learning as a central tenet of inquiry

Inquiry encourages students to explore the world and to make sense of their own world. They are encouraged to examine how what happens out there in the world involves them or impacts them. Students as inquiry learners, learn by doing. John Dewey (1907) referred to this as “the instinct of making – the constructive impulse [where]… the child's impulse to do finds expression first in play, in movement, gesture, and make-
believe, becomes more definite, and seeks outlet in shaping materials into tangible forms and permanent embodiment… Children simply like to do things, and watch to see what will happen” (p. 59-60). Thus, inquiry learning is based on the premise that students are natural inquirers who have a personal stake in what they are learning.

Knodt’s (2008) work with inquiry to support the teaching of science reflects the above “instinct” posited by Dewey. Observation of students in her studies demonstrated ways in which inquiry provided students with an opportunity to “engage their natural impulse to ask about and explore their world”, which in turn helped them develop critical and creative thinking skills and dispositions (p. 3). Throughout this process, students were also encouraged to share their new ideas or challenges to their thinking with their teachers and other adults, such as their parents or other adults involved in the inquiry. She refers to these inquiry experiences as cultivating innovative and industrious thinking in students, where student confidence increases along with their motivation and interest in pursuing new inquiry challenges that reflect “real world thinking” (p. 5). From this we can conclude that the learning experiences students encounter through inquiry are authentic in terms of purpose, skill development, and audience.

In addition, students as inquirers learn through the hands on application of ideas, process and strategies. For example, as outlined in Section 2.2.1, students learn how to think and do through the application of strategies that help them develop as inquirers. This empowers students when faced with future inquiry tasks. For example, 38% of the Year 10 students in Gordon’s (1999) study stated the best part of completing the inquiry project was the skills and understandings they learned to prepare them for the International Baccalaureate (IB) Extended Essay task they were expected to complete as part of their Year 11 studies in the following year. Other strategies identified by students as helpful for future project work included research methods (data collection and analysis), using library resources and systems, project organisation, and time management, which are all relevant to functioning effectively “in the real world”. Therefore, when students learning by doing, they can develop the capacity to apply this new learning to future learning tasks, i.e., they are learning to learn.
Furthermore, inquiry learning provides students with opportunities to share their new learning with audiences other than just the teacher or assessor of their project work. Students often complete part of their inquiry during out-of-school hours, such as at home, which results in family members becoming part of a student’s inquiry experience. Sometimes it is as a result of students’ interest in and engagement with a project that they wish to continue their inquiry after school (Knott, 2008), especially when a student’s inquiry is of a very personal nature that relates to their own life or family such as career, health, hobby or relationship topics (Tallman, 1998). For others this is the result of limited amount of class time available for inquiry such as the experience of students in Gordon’s (1999) study who concluded the amount of time given to inquiry during school hours was not sufficient. Or fitting in an inquiry unit can be affected by the logistics of the school year; for example, a school holiday period intersected the I-Search unit in Tallman’s (1998) study, which left some students working on their projects without access to teacher support, thus defaulting the support to others in their life. Therefore, students’ authentic learning experiences can be shaped by people other than the teaching team, particularly when opportunities to complete inquiry projects in school time is limited.

Some inquiry units also encourage students to seek feedback from a wider audience about their ideas, whether at the information gathering or knowledge construction phase, or as part of the presentation and assessment phases. Maina (2004) and Renzulli, Gentry and Reis (2004) argue that authentic learning tasks need to target a real world problem with students’ investigations involving people from the broader community or wider world, because this motivates students as they develop a personal and/or emotional stake in the problem. For example, Hill and Smith’s (1998) study of Year 10/11 design and technology students found that authentic learning experiences which encouraged students to connect with community experts about their project designs, helped students invent and modify these to successfully address real world needs, and helped them consider the impact of human, societal and environmental factors on their designs.

This reflects Lave and Wenger’s (1991) situated learning theory, where they argue that students need to be enculturated into the discipline they wish to enter in the world of work, whether that be a scientist, mathematician, historian or other specialisation. This
type of authentic inquiry experience assists students in gaining a sense of what it is like when they position themselves within a particular discipline or context. Thus, authentic inquiry tasks can extend the student experience beyond ‘learning by doing’ to ‘learning by being’, where the results of their constructive impulse or “the instinct of making”, as defined by Dewey (1907), is tested within a disciplinary context providing real world feedback and real world experience.

2.2.3 Inquiry involves cycles of reflection and assessment

Reflection underpins inquiry learning. Students need to be given opportunities to reflect on what they have done as part of the learning experience. Fogarty (1994) defines metacognition as “knowing what you know and what you don’t know” (p. viii). Students need to learn how to assess their own work, to think about their thinking, and become “more aware of one’s own thought processes” (Burke, 2009, p. 107). In other words, they need to develop a sense of awareness as an inquirer. They need to “learn ways to self-reflect regularly so they can become adept at monitoring, assessing, and improving their own performances and their own thinking” (p. 108). Reflection is an active learning process where students are encouraged to connect new ideas, understandings and skills with their prior knowledge (Piaget, 1950). As well as making connections, reflection allows students to recognise the gaps that exist in their understanding of an issue or topic, or development of a skill or technique.

Learning journals, learning logs or portfolios provide students with a platform for undertaking reflection and evaluating their learning throughout the inquiry experience in a cyclical way, as opposed to a single reflective activity at the end of the experience. Gordon’s (2009b) research on the reflective practice of students using the ISP led her to conclude that journals are powerful “instruments of reflection” that offer snapshots of cognitive, affective, and behavioural indicators “that signal students’ needs that might otherwise be lost in the instructional process” (p. 29). Furthermore, Burke (2009) argues that feedback provided as a result of this reflective practice “generates motivation for continued learning” (p. 45). It is, therefore, important for feedback loops to be built into inquiry unit design. Kuhlthau, Caspari and Maniotes (2007) also identify portfolios as an important method for monitoring and evaluating student progress and performance.
throughout an inquiry unit. They have found that capturing moments in a student’s learning journey can be used as points for self-reflection, “heighten[ing] students’ awareness of their own learning and progress”, which leads to deeper learning (p. 123). Gordon (2009b) argues such reflective scaffolds or tools become “instruments of mediated communication” where they “capture interactions between students, or between learners and teachers” (p. 29), thus capturing documented evidence of the nature and number of instructional interventions throughout a student’s inquiry experience.

The set of three reflection sheets from the *School Library Impact Measure (SLIM) survey toolkit* developed by Kuhlthau and colleagues (Todd, Kuhlthau, & Heinström, 2005b) support the implementation of an inquiry cycle of reflection, evaluation and intervention. These have been used in a number of studies to encourage students to reflect on what they are doing, thinking and feeling while undertaking inquiry projects. They were developed as part of the *Impact of School Libraries on Student Learning* project (Todd, Kuhlthau, & Heinström, 2005a; Todd, 2006a) where these reflection sheets were tested and refined in ten New Jersey schools with seventeen classes of Years 6-12 students across a number of discipline areas. The teacher and TL participants in this study found the reflection sheets useful tools for monitoring students’ progress at the initial, mid-point and end of the inquiry unit. The researchers, however, concluded that the most effective evaluation of students’ inquiry experience needs to include a combination of measures such as the SLIM reflection sheets along with portfolios and conferencing to help students reflect on their work and make connections between existing and new knowledge throughout the inquiry process. This is also reinforced in the work of Kuhlthau, Maniotes and Caspari (2012) on Guided Inquiry Design.

Fitzgerald (2007) found the SLIM reflection sheets useful in supporting Year 7 students’ completion of an historical inquiry unit, particularly in terms of the information these provided to diagnose individual students’ needs and help the teachers and TL tailor direct interventions accordingly. They also found them useful in documenting evidence of students’ level of interest in their topic, and tracking student development toward deeper knowledge of their topic in their reflections across the initial, mid and end points of the project. McLean’s (2011) study of three Year 5-6 classes’ guided inquiry unit on
endangered animals resulted in similar conclusions of the TL and teachers with regard to the value of the reflection sheets in monitoring and diagnosing students’ needs throughout their inquiry experience. In a later study of older students completing a Year 11 inquiry unit, Fitzgerald and colleagues (2011) also found the reflection sheets demonstrated students’ metacognitive development regarding information processes and a sustained interest in their inquiry questions. She concluded the reflections sheets were “central to student inquiry proceeding, providing a feedback mechanism between teachers, teacher librarians and students” (p. 31). A similar study conducted by Maitland-Smith, Twitchett and Davey (2009) with students in two Year 10 International Studies classes completing an inquiry unit on global governance found student reflections demonstrated “a growing confidence and steady increase in students’ assessment of their knowledge of the topic over the course of the unit” (p. 12). The teachers also found that students’ interest in their topics were also sustained throughout the unit based on the instructional support the teacher and TL provided individual students at the point of need, with students expressing greater self-awareness in their reflections including “knowledge of their personal strengths and weaknesses as learners” (p. 12).

In addition, a study by Sheerman (2011a) on the inquiry experience of a Year 10 Commerce class using the SLIM reflection sheets, analysis of students’ sentences either as statements, explanations or conclusions, showed that it was possible to track the development in students’ knowledge of their topics. She found as the inquiry unit progressed, students articulated what they had learned about their topics as explanations and conclusions rather than statements (which were evidence of knowledge construction). Students received regular feedback about their learning through a number of scaffolds devised by the teacher and TL. They also received feedback from other students through peer review process, where the “praise and advice they gave each other was genuine and practical” (p. 32). Student reflections demonstrated an increase in their interest of their topic throughout the unit, which illustrated they had taken ownership of their work, and students also felt they were capable of developing questions to help lead them to additional information to help inform their understanding of their topic.
Conversely, Kim’s (2010) analyses of students’ statements, explanations and conclusions collected via SLIM reflection sheets in her study of three classes of English Language Learners’ (ELLs) (aged between 14-19 years) completing guided inquiry projects, found that regardless of students’ ELL level and the type of inquiry task completed, while their topical knowledge progressively increased during the project, the ELL students rarely reported synthesised knowledge beyond facts or explanations. With regard to maintaining student interest in their projects, however, the ELL students’ reflections demonstrated greater interest in their topic as they progressed, with substantial increases of interest displayed in the latter part of the inquiry project when they had developed a personal understanding of their topic based on the information they had collected for the project. Kim’s research also identified a range of intervention strategies teachers and TLs can use to support the development of ELL students’ metacognitive capabilities, based on the use of SLIM reflection sheets for inquiry projects.

Findings from the above studies thus support Burke’s (2009) conclusion that feedback generates motivation for students’ to continue with their learning, which in turn fuels the momentum of students’ inquiry experience, and encourages metacognition – enabling them to be self-regulatory – which further builds their capacity as reflective thinkers and independent inquirers.
2.3 Students’ approaches to learning

Students as individuals approach learning in different ways. Students have preferences with regard to the way they remember, perform, understand and learn (Messick, 1976). For example, some students prefer to receive information or instruction through visual means, while others prefer auditory, read/write or kinesthetic modalities to learn from information, as espoused by Fleming and Mills (1992). Kolb (1976) identified the four learning styles of diverging, assimilating, converging and accommodation which he believed enabled the design of learning experiences to be orientated according to a person’s preferred learning style. Marton and Säljö (1997) identified the differences between those students who employ a deep approach versus a surface approach to learning. These approaches are often referred to as ‘learning styles’, and those who subscribe to these notions of learning argue that teachers need to be aware of students’ preferred approaches to learning to customise the learning environment and their instructional methods to maximise students’ opportunities to learn.

Similarly, students’ information behaviour underpins the way they learn. Given that inquiry-based learning requires students to immerse themselves in ideas from a range of information sources, teachers and TLs need to understand how students find and use information to support their development as effective and efficient information users and independent inquirers. Furthermore, within our increasingly digitally driven information world, it is important for educators to understand how students use technologies to support their information and learning needs. In addition, we need to understand the ways that students construct knowledge using found information and available technologies, to design quality inquiry units and provide the necessary instructional scaffolds to support students’ inquiry experiences. Students’ preferred ways of working with information and technology while undertaking inquiry projects are also based on their own constructs or mental models of how information and technologies help them learn. The following sections examine what we know from the research literature about students’ approaches to learning in terms of learning styles, information behaviour, and knowledge construction.
2.3.1 How learning styles influence students’ approach to learning

Numerous scales, models and tests have been developed by educational theorists to define the different ways that students prefer to receive information, or approach learning tasks (Cassidy, 2004). Some examples are as auditory or visual learners such as Gardner’s multiple intelligences (1983); or processing information critically or reflectively as articulated under Bloom’s cognitive domain (Bloom, Krathwohl, & Masia, 1956; Anderson, Krathwohl, & Bloom, 2001); or one processing the affective needs of oneself and others, now commonly referred to as one’s emotional intelligence (Salovey & Mayer, 1990; Goleman, 1995), just to name a few. There is, however, a body of research that focuses on the concept of ‘learning styles’ influencing students’ approaches to learning.

The basic premise behind learning styles is that individual students prefer to learn in their own way. The term ‘learning styles’ is often used to define the broad area of research that addresses a range of learning theories, models and measures of “learning style”, “cognitive style”, “learning strategies”, “learning approach”, and “learning preferences” (Cassidy, 2004, p. 421). Before the 1980s, ‘cognitive styles’ was the term commonly used to define individual differences in peoples’ ways of organising and processing information and experiences. Messick (1976) concluded that these styles “represent consistencies in the manner or form of cognition, as distinct from the content of cognition or the level of skill displayed in cognitive performance... [which] are conceptualized as stable attitudes, preferences, or habitual strategies determining a person’s typical modes of perceiving, remembering, thinking, and problem solving” (p. 5). Messick also articulated how cognitive styles differ from intellectual abilities, with the concept of ability implying “the measurement of capacities in terms of maximal performance” with an emphasis on level of accomplishment, in comparison to the concept of style which implies “the measurement of characteristic modes of operation in terms of typical performance, with the emphasis on process” (p. 7-8).

Hartley (1998) built on this earlier work of Messick and associates by defining the difference between styles and strategies, with learning styles being “the ways in which individuals characteristically approach different learning tasks”, whereas learning strategies are those “strategies [that] students adopt when studying” (p. 149). Biggs’s
(1993) definition of ‘approach to studying’ is similar to Hartley’s definition of learning style, in that it is a “way of describing how a student relates to a task, which immediately implicates what the task is, how it is presented, whether it is assessed, and so on” (p. 10). Based on his evaluation of a large number of common learning style models and instruments, Cassidy concluded, “There is general acceptance that the manner in which individuals choose to or are inclined to approach a learning situation has an impact on performance and achievement of learning outcomes” (p. 420). Therefore, educators and researchers who support this notion of learning argue that teachers need to be cognisant of the range of ways their students prefer to learn, and adopt teaching approaches or create learning environments that are compatible with these styles. While there are an extensive range of learning style theories, models and measures published in the research literature, only those based specifically on deep and surface approaches to learning will be examined here in detail due to their relevance to this thesis.

The early research of Marton and Säljö (1976) examining the ways students perceived a specific reading task and how they learned from it, established differences between students’ intentions when approaching a learning task. Students’ approaches were identified as being either deep or surface. A deep learner’s intention was to understand meaning by relating ideas and using evidence to support their learning. On the other hand, a surface learner simply tried to identify those bits of information which they thought needed to be learned for the purpose of completing the task.

This informed the exploratory study of Entwistle, Hanley and Hounsell (1979) who developed an instrument for assessing learning style which focused on the level of engagement or depth of processing that a student applied during learning. Using factor analysis, they identified three broad behavioural groupings of students, with the first factor group linking a deep approach and comprehension learning with intrinsic motivation; the second factor grouping indicated connections between surface approach, operation learning, and both fear of failure and extrinsic motivation; and the third grouping which brought together organised study methods, positive attitudes, and achievement motivation. Their research discovered that deep and surface approaches were apparent across differing tasks, suggesting that these approaches had been developed in students as relatively consistent study habits. These findings informed the
work Entwistle completed with Ramsden (1983) where they developed the *Approaches to Studying Inventory* (ASI) instrument based on interviews about students’ everyday study habits which identified the influence of assessment procedures on students’ learning and studying behaviour. They referred to these approaches as ‘study orientations’, and in addition to deep and surface approaches to learning, a third category – strategic approach – was identified as a predominant approach for some learners. This category was used to define those learners whose intention was to achieve the highest possible grades by using organised study methods and effective time management, drawing in part upon the earlier findings which related to the third factor grouping (above).

Independently, Biggs’ (1979) study which tried to link study strategies and the motives of students to learn, also using factor analysis, identified three common approaches to learning which he referred to as surface, deep, and achieving. These broadly reflected the three approaches identified by Entwistle and colleagues; however, the emphasis was slightly different. Biggs’ instruments were originally derived from information processing theories of cognitive psychology, and later he refined them to “measure the extent to which individuals typically endorse common approaches to learning tasks”, resulting in the development of the *Learning Process Questionnaire* (LPQ) to be used for secondary school students, and the *Study Process Questionnaire* (SPQ) to be used for higher education (p. 2). Based on further testing of the SPQ, Biggs also concluded that some students could adopt different approaches to studying based on the context. He, therefore, referred to this [which] phenomenon as a “predisposition to this or that learning approach is the individual student's way of achieving balance in the [education] system as perceived by the student” (1993, p. 10). In comparison, Entwistle, McCune and Walker (2001) concluded that the intentions to learn in deep or surface ways are mutually exclusive; however, they did find that “a combination of deep and strategic approaches is commonly found in successful students” (p. 108). Findings of the Speth, Namuth and Lee (2007) study of 446 undergraduate agriculture students support this combination of deep and strategic approaches with several students receiving equal scores on these scales. This research team concluded that, “it is highly adaptive for students who prefer to take a Deep Approach to also be alert to assessment demands” (p. 113).
The approaches to studying instrument has been developed, revised and expanded by Entwistle and colleagues across a number of studies (see for example, Entwistle, 1981, 2000, 2007; Tait, Entwistle, & McCune, 1998; Entwistle & Peterson, 2004; Entwistle, McCune, & Scheja, 2006). The Revised Approaches to Studying Inventory (RASI) (Tait and Entwistle, 1996) was further developed into the Approaches and Study Skills Inventory for Students (ASSIST) by Tait, Entwistle and McCune (1998), which has been the most widely used version of the instrument to date. The central idea behind the ASSIST tool is to identify those students whose approach to learning and studying is either a deep approach, where students actively seek personal understanding when studying, compared to those students who employ a surface approach to learning where they try to reproduce material they encounter in their studies as the principal approach to learning, as well as identifying those students with a predominantly strategic approach, where students are primarily motivated by attaining the highest possible grade. The motivational and strategic aspects of these three approaches to learning are summarised in Figure 2.1.

Entwistle and Tait’s research (1990) found that students who adopt deep approaches to learning were more attracted to subjects they found intellectually challenging and assessment that allowed them to express their own ideas. In contrast, students who employ surface approaches preferred subjects where teachers provided an explicit link between the content taught and “fact-based assessment procedures”. In other words, they were not attracted to subjects where students were encouraged to develop and demonstrate personal understanding as part of the assessment. It was also found that students preferred subjects and teaching approaches that were similar to their own approaches; for example, “students who felt well prepared in independent studying were more likely to adopt strategic approaches, with those reporting a lack of prior knowledge being more likely to adopt surface approaches” (Entwistle & Peterson, 2004, p. 419).

Furthermore, students whose focus is mainly on achievement typically take on a strategic approach, where they manage to organise their time and structure the learning experience to complete tasks efficiently and effectively (Tait, Entwistle, & McCune, 1998). In addition, research of study approaches by Vermetten, Vermunt and Lodewijks (2002) introduced students to learning tasks that challenged students (what they refer to
Figure 2.1 Entwistle’s three approaches to studying

<table>
<thead>
<tr>
<th>Deep Approach</th>
<th>Transforming by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention – to understand ideas for yourself</td>
<td></td>
</tr>
<tr>
<td>Relating ideas to previous knowledge and experience</td>
<td></td>
</tr>
<tr>
<td>Looking for patterns and underlying principles</td>
<td></td>
</tr>
<tr>
<td>Checking evidence and relating it to conclusions</td>
<td></td>
</tr>
<tr>
<td>Examining logic and argument cautiously and critically</td>
<td></td>
</tr>
<tr>
<td>Becoming actively interested in the course content</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surface Approach</th>
<th>Reproducing by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention – to cope with course requirements</td>
<td></td>
</tr>
<tr>
<td>Studying without reflecting on either purpose or strategy</td>
<td></td>
</tr>
<tr>
<td>Treating the course as unrelated bits of knowledge</td>
<td></td>
</tr>
<tr>
<td>Memorising facts and procedures routinely</td>
<td></td>
</tr>
<tr>
<td>Finding difficulty in making sense of new ideas presented</td>
<td></td>
</tr>
<tr>
<td>Feeling undue pressure and worry about work</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strategic Approach</th>
<th>Organising by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention – to achieve the highest possible grades</td>
<td></td>
</tr>
<tr>
<td>Putting consistent effort into studying</td>
<td></td>
</tr>
<tr>
<td>Finding the right conditions and materials for studying</td>
<td></td>
</tr>
<tr>
<td>Managing time and effort effectively</td>
<td></td>
</tr>
<tr>
<td>Being alert to assessment requirements and criteria</td>
<td></td>
</tr>
<tr>
<td>Gearing work to the perceived preferences of lecturers</td>
<td></td>
</tr>
</tbody>
</table>

Note. The defining characteristics of the ASSIST tool’s three approaches to studying, including the learning intentions, strategies and motivations of students (Entwistle, 2005, p. 19)

as tasks that produce ‘friction’) and were designed to scaffold deep learning. Their study found that this type of intervention did have some effect on students’ learning; however, those students who were already strategic (in self-regulating their learning) tended to avoid using the scaffolds provided.

The approaches to study inventory has also been used across a range of disciplines, including the information sciences, featured particularly in the research of Ford (see for example, Ford, 1985; Ellis, Ford, & Wood 1992; Wood, Ford, Miller, Sobczyk & Duffin, 1996; and Ford, Miller, & Moss, 2003) and Heinström (see for example, 2000, 2005,
In addition, an adapted version of the ASSIST tool was devised for school age students by Heinström (2006b; Heinström & Todd, 2006), which informed the research design of the study presented in this thesis.

In terms of students’ information use, research has shown a relationship between students’ approaches to completing information search tasks and their preferred approaches to study. For example, a student’s fear of failure and poor time management skills can influence their information retrieval behaviour (Ford, Miller, & Moss, 2003). Also, students employing a deep approach often search widely for information and use a variety of materials to inform their learning (Ford, 1986). This is in comparison to surface learners whose approach to study is based on the reproduction of information, and their information seeking is characterised by minimal effort.

In the early 2000s, Ford, Wilson, Foster, Ellis and Spink (2002) predicted that “the notion of cognitive style is likely to form an important building block” in the development of information behaviour models (p. 734). They argued a better understanding of students’ learning styles and approaches to learning could assist in “improved information systems, quality of response by human information intermediaries, and/or helping end users enhance their own information seeking skills” (p. 734). This prediction also encouraged the researcher of this thesis to explore how students’ learning styles might influence their use of Web 20 technologies.

Within the context of school libraries, Heinström and Todd (Heinström, 2006a, 2006b; Heinström & Todd 2006) employed an adapted version of the ASSIST tool to explore the influence of study approach on a range of features of students’ information seeking behaviour as part of a larger qualitative study examining student experience in completing guided inquiry projects. One key finding from this project was that students’ tendencies to experience different feelings and difficulties while searching and processing information were dependent on their study approaches. Heinström and Todd (2006) also found that students who were motivated to learn more about a topic tended to apply a deep approach to information seeking and use, which was also distinguished by reflection and analysis. These findings further encouraged the researcher of this
thesis to include the ASSIST measure to expand on the above results, given (a) the use of Web 2.0 technologies would be an added dimension to previous research that has investigated the relationship between students’ approaches to study while undertaking a guided inquiry experience; and (b) any Web 2.0 experiences, preferences or behaviours could have important implications for the design and implementation of instructional interventions, either planned or ad hoc, by TLs and teachers.

2.3.2 Students’ information behaviour as inquiry learners

Wilson (1999) defines information behaviour as the “activities a person may engage in when identifying his or her own needs for information, searching for such information in any way, and using or transferring that information” (p. 249). While a lot of research has focused on human information-seeking behaviour, and individual’s approaches to information search and retrieval using information systems (Wilson, 1981; Ellis 1989; Dervin, 1992; Kuhlthau, 1988, 1991; Foster, 2005), less research has explored people’s information use. In the strictest sense, information use implies that found information has been incorporated into an individual’s existing knowledge base (Spink & Cole, 2001). Information use goes beyond the search, access, retrieval and organisation of information sources to that of mental information processing or “being informed [which] denotes a change in what we know” as posited by Buckland (1991, p. 39), and the construction of knowledge (Bartlett & Toms, 2005; Todd, 2005). The following section presents a review of the literature concerning students’ information behaviour as inquiry learners in three key areas that are particularly pertinent to the focus of the present study. These include students’ information experience as process, students’ online seeking behaviour, and information use and knowledge construction.

2.3.2.1 Students’ information experience as process

Students’ conceptions of the information experience while undertaking inquiry and what the process of independent research entails can vary greatly. Asselin, Kymes and Lam (2007) argue that students’ views of “doing research” do not necessarily reflect the information process and inquiry learning models that are commonly integrated into the curriculum, such as the Big Six (Eisenberg & Berkowitz, 1990, 2000), the Information Skills Process (New South Wales Department of Education & Training, 2007) and The
It was Kuhlthau’s (1983, 1993) research on secondary school students’ information behaviour while undertaking assignments that was responsible for identifying students’ information experience as a process of information actions entailing physical, affective, and cognitive dimensions. Her Information Search Process (ISP) model was the first instructional model that was developed empirically based on the actual experiences of information seekers, where she identified a six stage information process that students in her study encountered before they could start writing up their assignment (Kuhlthau, 1983). This is in comparison to models such as those identified above, that were instructional process models developed by teachers based on a sequence of steps or phases which the authors proposed as scaffolds to support inquiry and/or resource-based learning tasks.

Of particular note from Kuhlthau’s original exploratory study was the finding that:

> Students’ expectations of the search process frequently did not match the process they experienced during the study. The search process was not only concealed from the observer's view, it was also often interpreted by students as an ideosyncratic, personal process that no one else was experiencing. (1988, p. 241)

She concluded that the process of information seeking is both dynamic and complex, where students develop basic constructs and seek meaning from their encounters with information, and as they progress, students’ understandings are construed and re-construed as they work through defining and refining their information needs – moving from ambiguous to specific – while searching for information to complete an assignment. In other words, information seeking is a constructive process that involves the whole person (cognitive, affective, physical), where people construct meaning from the information they encounter. The outcomes of her study suggested a process approach to library instruction could be implemented to make students aware of the information seeking experience as a process, where students learned about the thoughts, actions, and feelings associated with each stage of the ISP, thus helping them develop an understanding of what to expect when completing assignment work, and knowing the challenges they encounter are common to other students.

After extensive research over a period of two decades across a range of information contexts including educational tasks undertaken by school and college students,
Kuhlthau expanded the ISP model by adding a seventh and final stage called ‘assessment’ as part of the emerging Guided Inquiry framework (Kuhlthau, Caspari, & Maniotes, 2007, p. 19). These seven stages of initiation, selection, exploration, formulation, collection, presentation and assessment have become the information process model being implemented in schools by TLs and teachers to support inquiry learning units (Scheffers, 2008; Schmidt, Kowalski, & Nevins, 2010; Fitzgerald, 2011; McLean, 2011; Sheerman, 2011a; Schmidt, 2013).

Several studies since the original study by Kuhlthau (1983) have confirmed the influences and effects of the three dimensions of cognitive, affective and physical on information seeking behaviour of school and university students, including Mellon (1986, 1988); Onwuegbuzie & Jiao, 1998, 2004), Bilal (2000, 2002), Heinström (2002), and Kracker (2002), to name a few. Each have contributed to our further understanding of students’ information experiences, particularly with regard to students’ approaches to information search and retrieval which are examined in the next sections.

2.3.2.2 Students’ online seeking behaviour

The Web has become an everyday resource that supports teaching and learning at all levels of education (Bilal & Kirby, 2001; Chen, 2003). Pre-Web, some studies explored individuals’ searching behaviour of online databases and CD-ROM resources (Bates, 1989; Marchionini, 1989; Branch, 2000). For example, Bates (1989) conceptualised individuals’ online information seeking behaviour as being similar to “berrypicking” where users pick bits of information through a particular online information space, moving from resource to resource, and where the processes of browsing and searching were complementary activities within one’s information seeking experience (p. 410). She proposed this berrypicking method resulted in the evolution of a typical search experience where “searchers commonly gather information in bits and pieces instead of in one grand best retrieved set”, with each bit informing the refining or reshaping of the searcher’s original query. She also posited hypertext information environments (such as the Web as we now know it) as lending themselves to berrypicking behaviour (p. 421).
Branch’s (2000) case study of 12-15 year old students using think aloud and think after protocols to describe their search experiences found that each student could find the same answer to a question in the CD-ROM encyclopaedia using different search terms and in different ways. In other words, they all approached the construction of their searches based on their own conceptions of the topic under investigation and their previous experience with searching for information. These students’ experiences also highlighted the importance of good reading strategies in searching for information in CD-ROM encyclopaedias with each student employing skimming, scanning, speed-reading, and focused reading to locate and to determine if the information they found was correct.

Since the 2000s, studies have found with increased access to the Internet in schools that students now regularly turn to the Web to find answers to their questions, or information to support the exploration of a topic (for example, Enochsson, 2001; Chelton & Cool, 2004; Bawden & Vilar, 2006; Gunter, Rowlands, & Nicholas, 2009). Shenton and Dixon (2003) compared students’ use of CD-ROM and the Web as information resources, and found students’ used similar search strategies for both digital information environments. Hirsh’s (1999) study of the search behaviour of ten Year 5 students using print, CD-ROM and the Web and Wallace, Kuppenan and Krajcik’s (2000) study of Year 6 students’ Web search behaviour found that students encountered difficulties in formulating and revising search queries, with students in the latter study not being attuned to search engine feedback to improve their results. These findings also build on findings from the earlier studies of school students’ information seeking behaviour using electronic encyclopaedias, which found that students tended to use natural language queries, with them trusting the system to understand what they were searching for (Marchionini, 1989; Branch, 2000). Similarly, the Year 5 and 6 students in the Schacter, Chung and Dorr (1998) and Large, Beheshti, and Moukdad (1999) studies did not use any of the advanced search features of the Web-based search engines available to them.

The above challenges and problems have been reported in a number of studies on students’ information seeking via online catalogues and Web search engines, highlighting the fact that students as information searchers are often unaware of the use of controlled vocabulary by information systems and search techniques such as Boolean
logic, with their preference being to create search queries based on natural language (Borgman, Hirsh, Walter, & Gallagher, 1995; Nahl & Harada, 1996; Bilal, 2000; Schacter, Chung & Dorr, 1998; Shenton & Dixon, 2003; Bilal, 2004). For example, Nahl and Harada’s (1996) experimental study of 191 secondary students completion of a pre-search activity found that students had considerable cognitive difficulties with creating logical search statements using Boolean logic and in the selection of appropriate search terms with students overall tested scoring 60% correct in a decoding and encoding search task (p. 202). Furthermore, a study of thirty two Year 5-6 students in a study by Schacter, Chung and Dorr (1998) found that not one of the students used Boolean search terms to find information they were looking for on the Web. While these students were motivated “interactive information seekers”, they had a preference using some keywords followed by browsing (with browsing representing 80% of students’ total information seeking behaviour), as opposed to developing “systematic analytic-based searching strategies” (p. 840, 848). In addition, Fidel and colleagues (1999) observation of eight Year 11 and 12 school students found that this interactive nature of the Web led to students’ searches being “largely determined by what they saw on the screen… which was highly reactive” (p. 27), as opposed to a planned search strategy as suggested by Nahl and Harada (1996). They also found student tendency to browse at high speed through the Web, as well as skimming quickly rather than carefully read web pages. Bilal’s (2000; 2001; 2002) study of 7-12 year old students searching Yahooligans! Search engine to complete fact-based, research, and self-generated tasks also found that students defaulted to browsing when their search attempts using keywords failed to find information on their topic.

Often students believe the information they find on the Web is inherently true, thinking there is no need to question sources found, as observed in studies by Schacter, Chung and Dorr (1998), Kafai and Bates (1998), Large, Beheshti, and Moukdad (1999). Kuiper, Volman and Terwel (2005) argue that children as young as 10 years of age need to become effective information searchers and evaluators:

> Children must learn how to make it [the Web] a useful contribution to their learning processes. Knowledge acquired through the Web must meet the requirements for all knowledge acquired at school: It must be accurate, and it must be deep, flexible, and meaningful. (p. 287)
After analysing the results of a number of information search studies, they concluded that there needs to be more research on “strategies for supporting students, with the aim of developing search skills and critical thinking skills” (p. 331), in other words, examining what students do with the information they have found. (This is examined in more detail in the next section, 2.3.2.3)

Although students may have difficulty searching the Web, Ng and Gunstone’s (2002) interviews with 22 Year 10 students on how effective they perceived the Web to assist them in completing a science-based research task found that a number of students liked using the Web because they found the experience both motivating and empowering. These students were also aware of the limitations of the Web but they felt accessing the online sources gave them some control over their learning process, which in turn made them feel less dependent on their teacher and their classmates. It was, however, different for some of the weaker students to find really relevant and quality information, which required greater supervision and help with structuring their work properly.

Given the differences in cognitive development between mid-late primary age students to those in middle and senior school age students based on the staged development of children and adolescent cognition (Inhelder & Piaget, 1958; Piaget & Inhelder, 1969), it is surprising to see the similarities observed in students’ information seeking behaviour across the above studies in terms of preference for browsing instead of specific, planned search strategies with little use of Boolean logic, and difficulties with determining authenticity and accuracy of found information.

In addition, students tend to replicate information seeking behaviour, even if it lacks efficiency. For example, in his case study of forty two senior high school students’ use of the Web to support inquiry projects, Todd (1998) he found that students’ poorly developed search skills resulted in their having to sift through huge volumes of information, impacting on their productivity as inquiry learners due to them having to undertake a “prolonged and frustrating search process… [that] impacted both on students' productivity as well as on time-cost efficiencies” of searching on the Web to find relevant information on their topic (p. 21). For this reason, Hirsh (1999) found many students have a preferred search engine which they use on a regular basis. Shenton
and Dixon (2003) refer to this as the development of a “habitual information-seeking pattern”, where students tend to be attracted to a search engine they consider will help them fulfill their information needs “for much of the time” (p. 1040). This has been confirmed in later studies, specifically with regard to what has been coined as “the Google generation” (Gunter, Rowlands, & Nicholas, 2009; Nicholas, Rowlands, Clark, & Williams, 2011).

From these and other studies, we understand that students (from upper primary school through to undergraduate years) often lack schema for searching a range of information systems, including web portals and search engines, which creates difficulties when students are required to modify their searches to retrieve more relevant hits. This can impact greatly on the time it takes for them to find relevant information, which in turn can impact on their ability to complete their assignments in a timely fashion (Schacter, Chung, & Dorr, 1998; Broch, 2000; Savolainen, 2006; Prabha, Connaway, Olszewski, & Jenkins, 2007; Connaway, Dickey, & Radford, 2011). (Note the issue of time is explored further as a factor influencing students’ information behaviour in Section 2.3.2.3).

Another aspect of information seeking behaviour is the concept of “satisficing” which was first described by Simon (1956) and further developed by March (March & Simon, 1993; March, 1994). Based on Simon’s behavioural model of rational choice theory, satisficers are people who are willing to pursue a “good enough” option rather than the best possible option (Simon, 1956). In Simon’s own words, “we are concerned only with finding a choice mechanism that will lead it to pursue, a ‘satisficing’ path, a path that will permit satisfaction at some specified level of all of its needs.” (p. 136) He argued that time constraints and cognitive limitations do not allow an individual to explore all possible options fully to make choices, thus rejecting the idea of optimal choice. Thus, he proposed a theory of “bounded rationality”, where “organisms adapt well enough to ‘satisfice’; [and] they do not, in general ‘optimize’” (Simon, 1956, p. 129). He refers to this as “the rational principles that underlie nonoptimizing adaptive behaviour” of people (p. 15).
March (1994) proposed “satisficing” and “maximising” as behaviours of decision makers, where maximising “involves choosing the best alternative”, in comparison to satisficing which “involves choosing an alternative that exceeds some criterion or target” (p. 18). In other words, maximising requires a person to have considered and compared all possible alternatives with “the best one chosen”, whereas satisficing only requires “a comparison of alternatives with a target until one that is good enough is found” (p. 19). While Choo (1998) built on Simon and March’s work in terms of organisational information behaviour, Marchionini (1995) was the first to demonstrate the relevance of bounded rationality and satisficing in library settings, as he explained:

This principle is clearly demonstrated in libraries, whose users show high levels of satisfaction because they are able to find at least some relevant items with minimal investments of time and effort. This result is even more common in electronic environments because time and effort can be minimal and the scope of the sources can be broader. Satisficing is essential to most information seeking because all pertinent information for open-ended problems can seldom be assembled and assimilated optimally. (pp. 63–64)

Some studies of youth and their information seeking behaviors have indicated that young people use satisficing behaviors. For example, Bilal’s (1998) exploration of seventh grade students’ use of Yahooligans! (Web search engine) found that young Web users tended to examine briefly the first few hits on the initial results pages before performing new searches, rather than examining every hit in detail. Hirsh (1999) found that elementary school children tended to skim resources when making relevance decisions, and Higgins (1999) examined the effect of source credibility on decision making and the effect of time constraints on reliance on source credibility. She found that time limits influenced study participants’ decision making, causing them to rely less heavily on source credibility when operating with limited time than when operating with unlimited time. Since then, Savolainen (2006) and Connaway, Dickey and Radford (2011) have confirmed time as one of the main contextual factors influencing individual’s decision making with regard to information seeking outcomes.

Furthermore, within the context of young adults, Agosto’s (2002) exploratory study of 22 teenage girls in Years 9-10 examined participants’ decision-making processes when evaluating websites. Agosto concluded that “satisficing is a highly rational, efficient decision-making behaviour” (p. 17). Satisficing behaviours help “simplify a complex
world. Instead of having to worry about an infinite number of gradations in the environment, individuals simplify the world in two parts – good enough and not good enough” (March, 1994, p. 21). Choo (1998) built on March’s ideas within the context of the information behaviour in organisations where people “satisfice” by following actions or “routines that simplify the decision-making process by reducing the need for search, problem solving, or choice” (p. 165). This confirms that individuals employ a conscious decision making process when confronted with “choice” while seeking information.

Kuhlthau’s (1999) research added to this aspect of information seeking when she introduced the concept of “enough”, when individuals are seeking online information. She suggested that searchers must define “the concept of enough as what is enough to make sense for oneself within a context and to accomplish the task at hand” (p. 16). She explained this further with:

Enough. The concept of enough involves the deceptively simple question of, "What is enough?" What is enough may have been a fairly straightforward notion when a person could gather all there was to know on a problem or topic in a contained collection. The concept of enough is quite a different matter in the present information environment. Understanding "what is enough" is essential for making sense of the information available to us. Enough relates to seeking meaning in a quantity of information by determining what one needs to know and by formulating a perspective on which to build. (p. 16)

She argued users applying the concept of enough as they work through each phase of the ISP. The above concepts of ‘satisficing’ and ‘enough’ are valuable for TLs and teachers when designing scaffolds for students to assist them in moving forward through each of the stages of an information process as inquirers.

A number of studies have also shown that motivation and students’ conceptions of information seeking influence their information search behaviour. For example, Limberg (2007) tried to determine how search behaviour was dependent on task-specific motivation. Her research of school age students found those who conceptualise information seeking as finding the right answer to meet task requirements tend to judge relevance based on easy access and choose information sources by fairly superficial criteria, whereas students who aim to understand a topic in depth are more likely to
invest time in analysing multiple information sources, and tend to take a wider perspective on their search topic.

Heinström’s (2000; 2002; 2006b) research has demonstrated how personality can influence one’s information seeking behaviour. She concluded while personality does not “determine” one’s behaviour, it does create “boundaries and possibilities for the way information seeking is executed” (2005, p. 244). By way of example is Heinström’s (2006b) study of the information-seeking styles of 574 school students in Years 6 to 12 while independently searching for information to complete guided inquiry projects, based on Tait, Entwistle and McCune’s (1998) surface, deep and strategic styles using a short version of the ASSIST (approaches to study inventory). She successfully extracted a range of approaches employed by those students identified having one style as their predominant approach to learning. From this she concluded that students’ level of engagement in a search task can influence the nature of their information seeking behaviour. For example, students in her study with a surface approach were quite reluctant to invest time and energy in information seeking, preferred to select a topic that was not cognitively challenging, and preferred to access resources that were easily available, with their information seeking focused on fact finding, without regard for information quality. In comparison, students identified as deep learners demonstrated engagement with and ownership of their selected topic, with their interest in the topic motivating them to want to learn more and focusing on the quality of found information. A third group of students identified as strategic focused on the organisational aspects of using information they found, and were strategic with regard to the time needed to deal with this information and what was required when searching for information. She also demonstrated how the search patterns of students in this study resembled those information seeking styles identified her previous studies. This latter study by Heinström is particularly relevant to the research design employed by the researcher of this thesis.

2.3.2.3 Information use and knowledge construction

By the mid-1990s the concept of inquiry learning began to emerge as one solution to address an increase in the complexity of information and resources being made available to society as a result of access to the Internet. This new era of technology and
information overload was labelled “The Information Age”, where it was predicted that as a society “we have embarked on a journey in which information and communications will become the dominant forces in defining and shaping human actions, interactions, activities, and institutions” (Alberts & Papp, 1997, p. 2). At this time educators argued the need for students to develop greater independence as information users and critical thinkers to effectively function within an increasingly information-driven society, where they are engaged in a process of learning from a variety of sources to construct their own understandings, as opposed to the industrial educational model where students learned from textbooks and principally used rote memorisation to remember and recall ideas and facts (Donham, Bishop, Kuhlthau, & Oberg, 2001).

However, Stripling (2003) argued that inquiry “is much more than simply following a process. It is an essence of teaching and learning that places students at the heart of learning by empowering them to follow their sense of wonder into new discoveries and insights about the way the world works” (p. 4), with the nature of inquiry being contextualized by the discipline within which the inquiry takes place. This began to emerge in the redesign of Australia’s national curriculum in the early 2010s where inquiry was viewed as both process and skills that reflected disciplinary thinking within a learning area, with the focus being on developing students’ capacity to develop greater understanding of a discipline by immersing themselves as an ‘inquirer’ and developing disciplinary understandings, i.e., constructing new knowledge.

One particularly critical point in students’ information experience as inquirers is that of focus formulation. An important finding of Kuhlthau’s (1983; 2004) studies of students’ information seeking behaviour, was the identification of focus formulation (later simplified to formulation) as the fourth and critical stage of the ISP experience, which she argued was the ‘turning point’ in the search process for many students. This is when a student develops a particular focus within their topic based on the reading, evaluation and reflection of the information found about a general topic area, i.e., the building of background knowledge. The nature of their focus needs to demonstrate that they have developed an informed personal perspective, question or hypothesis about a specific topic, and that they can articulate this. Based on her observation of students’ information behaviour at this formulation stage, Kuhlthau (1988) discovered that the feelings
experienced by students changed from those of confusion and doubt to that of optimism and confidence. She also found those students who did not form a focus during the search process, did not gain a sense of direction, and they “commonly experienced difficulty throughout the remainder of the assignment” (p. 239).

A number of other studies on students’ inquiry learning experiences have also confirmed formulation as the critical point in the successful completion of assignments by students, particularly those by Fister (1992), Tallman (1998), Gordon (1999), and Fitzgerald (2007). Furthermore, Tanni and Sormunen’s (2008) critical review of research on information behaviour and learning tasks proposed that the concept of focus formulation (based on Kuhlthau’s ISP) appears to be the critical link that intersects information seeking and learning. In other words, formulating a focus requires students to move from searching for information about a topic to actually developing new understandings (i.e., new learning) in order to articulate the specific focus of their inquiry, thus allowing them to develop a more targeted information search. Studies by Ford (2004), Limberg and colleagues (Hultgren & Limberg, 2003; Alexandersson & Limberg, 2003) and Vakkari (1999; 2001) support this view, and have shown how students with prior knowledge of a topic are better able to formulate their own questions, identify appropriate search terms and phrases, and select relevant information to support their inquiry, which does lead to knowledge construction because it represents the development of student understanding.

More recently, a study by Cole et al. (2013) analysed sixteen student-group proposals for a middle school history project to identify elements of students’ prior knowledge as they transitioned from the exploration (third) stage to the formulation (fourth) stage of Kuhlthau’s (2004) ISP. They attempted to define more clearly the nature of this intersection between information seeking and learning by hypothesising that the generation of new knowledge could be identified by exploring the nature of “implicit knowledge” in students’ thesis statements. Results of a two-tier process of analyses found that evidence of “implicit knowledge” elements in project proposals (or thesis statements) was a marker for successful student performance. For example, proposals that gained the highest marks from the teachers included one or more of the following structural “knowledge” elements: the articulation of both positive and negative aspects
of an issue; critical perspectives on an issue based on evidence; use of an argument-based structure such as compare/contrast or cause/effect; information demonstrating the broadening or narrowing of a topic to develop a clear thesis statement; provision of definitions; and provision of keywords and search phrases used to find relevant information. By identifying the above structural knowledge elements within student proposals, Cole and colleagues have provided the beginning of a typology that shows those elements that students can employ to demonstrate the formulation of their focus. In addition, teachers can use these to assess students’ ability to “use the found information to generate new knowledge and a critical perspective” on their topic, i.e., new learning (p. 571). This also relates to review of research literature regarding building background knowledge to develop deep or authentic inquiry questions which was presented in Section 2.2.1. Thus, within the framework of Kuhlthau’s (2004) ISP, the development of deep or authentic questions for an inquiry project is part of the focus formulation stage that provides students with the confidence and direction to progress towards the successful completion of their project.

Time-related issues experienced by students influence the nature of their information behaviour. Studies by Kuhlthau (2004), Zach (2005), Savolainen (2006) and Tanni and Sormunen (2008) have identified time management as a critical factor in students’ inquiry experiences. A study by Prabha, Connaway, Olszewski, and Jenkins (2007) concluded that time can affect the thoroughness of an individual’s information seeking behaviour, the quality of sources accessed, and the mode of an inquiry context. Kennedy, Cole and Carter’s (1999) earlier study of undergraduate students experiences using Kuhlthau’s ISP found that students often resorted to a “false focus” when undertaking open-ended assignments due to time pressures, thus “choosing a topic and thesis based on expediency, without consideration of the contextual placement of the topic or of personal interest” (p. 270). The researchers found this caused difficulties for these students in the later stages of the information process, collection and presentation. They concluded that “topic formation stemming from the user's real information need must progress in a natural fashion”; however, external pressures such as time and other pending deadlines often do not allow this (p. 272). They highlighted the need for greater instructional intervention to occur with students facing this dilemma, which goes beyond
finding information to engaging with that information critically within the context of their chosen topic to formulate a focus.

Connaway, Dickey and Radford’s (2011) concept of “convenience” comes in to play here. Their study of college and university students’ information behaviour identified convenience as “a situational criterion in peoples' choices and actions during all stages of the information-seeking process”, where convenience is applied to the choice of an information source, the level of satisfaction with a specific source and its ease of use, and their perceived time horizon to complete the information task. Therefore, time is a critical factor which impacts on the nature of a students’ information experience. Savolainen (2006) argues that information seeking is “temporal”, where an individual’s information experience changes over time, and while information process models, such as Kuhlthau’s (2004) ISP, suggest a time progression exists as a student works through a series of phases or stages, this does not necessarily translate into a student progressing, thus time pressures and constraints.

Studies show that the impact of time, or running out of time, often occurs in the latter stages of a student’s information experience due to the considerable amount of time invested in topic selection, searching for information and formulating a focus (Kuhlthau, 2004; Savolainen, 2006). This is often problematic for secondary students undertaking inquiry projects where they may have an unrealistic estimation of time it will take (usually less than is required) to complete the writing up phase of their project (Kuhlthau, 2004; Sadeh & Zion, 2012). While other studies have shown that students can often generate project plans and carry out individual project steps, however, they often struggle with managing their time to complete their project (Helic, Krottmaier, Maurer, & Scerbakov, 2005). An outcome of this is, ultimately, that students are not left with adequate time at the end of their inquiry project to cope with the higher-order thinking demands of the knowledge construction phase (Helic et al., 2005; Sadeh & Zion, 2012).

Compared to the considerable number of studies investigating students’ online information behaviour, few information seeking studies extend to the actual use of information or the learner’s ways of understanding information content (Alexandersson
Todd’s (1998) case study of senior students found their abilities to analyse and synthesise information, and to construct a personal answer that demonstrated understanding of ideas from found information, were poorly developed. He found students’ information behaviour consisted of scrolling through webpages to find answers, followed by copy and pasting relevant paragraphs into a Word document that eventually became their assignment product. A decade later, Tanni and Sormunen (2008) concluded similarly, that studies on students’ information behaviour suggest they “often search documents for the ‘right’ answers, copying and pasting pieces of text instead of constructing and articulating their personal understanding” (p. 894). From an informational comprehension perspective, Burbules and Callister (2000) argued that compared to printed text, the hypertext nature of the Web require readers to take a much more active role in determining both the quality and coherence of the information they read on and between webpages. These concerns focus on the non-linear and deep ways that web-based information is structured, which can be an impediment to young people’s comprehension when exploring online content related to their topic (Cohen, 2006).

Studies have shown that lack of time can lead to students copying and pasting large slabs of text (McGregor & Streitenberger, 1998; Todd, 1998; Sisti, 2007; Roberts, 2008; Klein, 2011; Williamson & McGregor, 2011). In fact, Todd (1998) forecast that plagiarism would be widespread if not enough time was allowed for students’ information seeking, and concluded that encouraging students to go beyond a cut and paste approach can only be addressed “through the methodical identification and acquisition of appropriate critical literacies and skills” (p. 21). A phenomenological study of 36 middle school students in Ohio found that the digital nature of the Web encouraged digital plagiarism by middle school students due to the “convenience” of copying and pasting information from online articles, concluding that “digital cheating seems to them [the students] a common practice” (Hongyan, Yong Lu, Turner, &
Guofang, 2007, p. 76), while their teachers believed that technology had influenced young people’s conception of copying and pasting to thinking that this was acceptable practice, where “copying and pasting was just a matter of several clicks” (p. 77). This is also supported by two other studies of middle and high school students which found there was greater acceptance of copy and pasting from online sources that from physical books when discussing unethical information behaviour (Ma, Lu, & Turner, 2007; Poole, 2007).

Assignment design can, however, influence this type of information behaviour. Hultgren and Limberg’s (2003) review of learning and information seeking literature suggested a strong relationship between the nature of school assignments and the ways in which students seek and use information. Asselin, Kymes and Lam (2007) argue that a common problem that still exists in schools with regard to assignment design is that often the tasks are predominantly fact-gathering activities rather than designed for meaningful inquiry. This is supported by the research of Limburg (1999a, 1999b, 2007), Gordon (1999, 2010), Kuhlthau (2001) and Asselin and Moayeri (2008), to name a few.

McGregor (1994) identified the importance of having students come up with their own problem or question to investigate when completing project work, to encourage students to think critically and demonstrate effective and independent information use. The research of McGregor identified students’ approaches to completing research-based tasks as being either product- or process-oriented, with product-oriented students lacking metacognitive awareness about the research process with their activities predominantly involving categorising, sequencing and copying from sources. Those students adopting a process-oriented approach used analysis and synthesis skills, tended not to copy from sources, and appeared to recognise that learning should be a result of their research activities. The latter research of Williamson, McGregor and Archibald (2010) identified the need for teachers and TLs to actively work at valuing “the processes of learning, thinking and exploring instead of focusing on the creation of a perfectly written assignment” (p. 23).

These reflect findings from a study by Alexandersson and Limberg (2003) on the information behaviour of students completing a research project where they observed
students’ “transportation” and (later for some) the “transformation” of text found in print and/or online sources to form the basis of their project report content. Alexandersson and Limberg referred to copy and pasting of text from information sources as “transportation”, which was one of three types of information use observed by students. The second type was transformation where students paraphrased content from a source, with “reformulation” being the third type of information use where students completely rewrite content from a source in their own words. The researchers recommended the need for greater intervention by the teacher and the TL as co-constructors of knowledge with the students, rather than playing a more passive facilitation role, for students to actively engage in knowledge construction.

This supports Hart’s (1999; 2000) research which explored information literacy education as part of students’ ‘project work’ in disadvantaged primary schools. Hart found teachers’ conceptions of teaching and learning heavily influenced the instructional role(s) they played while supporting students’ completion of project-based assignments. She concluded, “that if teachers’ fundamental conception of teaching is “giving” information, and of learning is “finding the right answer” then a few afternoon workshops will not help them make the fundamental shifts in thinking required for effective information literacy education” (2000, para 4). The above studies clearly demonstrate the need for teacher and TL instructional intervention to move beyond helping students ‘find information’ to providing more explicit instruction in helping students construct new knowledge, which is the ultimate goal of inquiry learning.

The results of an investigation into inquiry learning in ten school libraries in New Jersey also support the above recommendation by Alexandersson and Limberg (2003). The New Jersey study found that some students developed an integrative approach to knowledge construction where the TL partnered with the teacher to guide students through the phases of the inquiry process (Todd, 2006a). This resulted in students using their first gathered facts to build an “information foundation” which assisted in their development of new knowledge that showed “higher levels of coherence and centrality” (para 9). The central tenet of this and the other studies above is that greater instructional support and intervention at the point-of-need by the teacher and TL can lead to students’ greater personal understanding of their topic, i.e., knowledge construction (Kuhlthau,
The ultimate aim of knowledge construction scaffolds is to assist students in structuring, expanding on, and then restructuring students ideas to develop new understandings. In practice, Tanni and Sormunen (2008) succinctly capture what this knowledge construction process looks like:

Learning is about the restructuring and expansion of the existing construction. The cognitive structure becomes increasingly more specified and complex as knowledge of a subject matter increases. The more interrelated concepts to differentiate in the aspects of topic, the more the learner knows, and the more focused statements she is able to make on the topic. (p. 898)

A final aspect of students’ information use and knowledge construction is the influence of their mental models on their information behaviour. A mental model is a “psychologic representation that aids in understanding, explaining, or predicting how a system works… [and] a user constructs a mental model by interaction or experience with a system.” (Slone, 2002, p. 1153). As a result of his review of research on children and teenagers’ use of the Web, Large (2005) concluded:

More research is needed to explore the mental models children of different ages have formed of the Internet in general and the Web in particular and the extent to which the accuracy of these models influences their success in using the Web to find information. (p. 355)

The research of Moore and St. George (1991) and Solomon (1993) identified this lack of sufficiently developed mental models as a crucial factor in successful information searching. Studies show that the information needed at various phases of information and inquiry processes varies (Kuhlthau, 1993; Spink, 1996; Vakkari & Hakala, 2000). For example, at the beginning of the process, subjects’ mental models of a task are vague, and they are not necessarily aware of the dimensions of a task or how to structure it (Kuhlthau, 1993).

As a result of research on mental models of middle school students as they undertook a science-based inquiry task, Kuhn, Black, Keselman and Kaplan (2000) concluded that within the context of inquiry, “mental models are the individual’s representation of the (virtual or actual) reality that is being investigated… and for this reason they are likely to influence the strategies that are brought to bear on the task” (p. 516). Furthermore,
these may be resistant to change, so for educators, it is often not clear how to encourage a transition beyond what an individual perceives as reality. This can be a challenge for researchers and practitioners in that mental models “of any sort remain essentially unobservable theoretical constructs” (p. 516). They also conclude that any shift in an individual’s mental model “more likely takes place slowly and in gradual steps” (p. 518).

Slone’s (2002) study of mental models of 31 public library users which included 11 children and teenagers, found that unfamiliarity with the Internet resulted in the use of vague language to describe the Internet, e.g., the mystery surrounding the Internet led to users describing it as “magical”. She concluded such “descriptions point to fragmented or immature mental models” (p. 1165).

Findings from Fidel et al. (1999) found similar words used by teenagers when articulating their mental model of the Internet, i.e., that included the belief that anything or everything can be found on the Internet which provides one explanation for why young people persist searching on the Web even though they may receive disappointing results to their queries. Thus, mental models can motivate individuals to maintain habitual approaches to using the Web as an information user.

Pitts’ (1995) research of school students’ mental models observed the experiences of 26 middle school students’ as they undertook an inquiry project. Her focus on students’ mental models as they made decisions about seeking information as well as using information found their mental models were shaped by prior learning experiences. She identified two types of prior learning: those representing single, isolated ideas, and those representing connected, interrelated ideas. While using the dichotomy of novice versus expert to illustrate the different cognitive representation of each, Pitts did place learners on a continuum of novice-expert knowledge base, thus highlighting the potential progression a student could make based on the adequacy of prior learning to inform new learning contexts. Here the student as novice’s personal understandings tended to be based on a limited perspective, that were subjective, either accurate or inaccurate, and were often used inappropriately, whereas the student as expert’s understandings tended to be connected, based on a global perspective, were objective, accurate and were used appropriately. She found students often chose their topics quickly because they did not have mental models of any alternatives for topic selection, demonstrating a lack of
building of background knowledge as espoused by Kuhlthau (1983). These were content- or subject-based mental models, where “incomplete subject-matter mental models led to incomplete identification of information need” (p. 180). She also found students had limited mental models of information seeking and use, which she referred as systems- based mental models, where students “lacked framework understandings of the organization and types of information” (p. 181).

Pitts (1995) concluded that if students’ prior experience with information seeking and use had been limited, “their mental models related to information were not adequate to provide support for their learning” (p. 177). Pitts also identified these same mental model structures in teachers, which could have a significant impact on students’ information experiences and the development of their own mental models, particularly with regard to information seeking and use systems. This resulted in students having to find their own way through the inquiry project. This latter finding of her research with regard to teachers, is particularly relevant to both teachers and TLs working with students while completing inquiry projects, because mental models of both students and teachers/TLs can significantly shape the learning experiences of students as inquirers.

2.4 How Web 2.0 technologies can support teaching and learning

This review of the literature draws upon the findings and conclusions of studies that have explored the different ways that Web 2.0 technologies can be used to support teaching and learning. While the majority of research reviewed here has occurred in secondary school settings to reflect the context of the study presented in this thesis, some research exploring the use of Web 2.0 technologies in primary schools and undergraduate programs have been included based on their relevance to the study.

2.4.1 Wikis

Numerous studies have explored the use of wikis to support teaching and learning, particularly with regard to inquiry- and project-based learning, and collaborative learning tasks. Of all Web 2.0 technologies, the wiki appears to be the predominant
platform of choice of educators to support online learning tasks. Studies have demonstrated a range of applications and use of wikis.

One advantage of the wiki as a shared learning space, whether it be a class space, group space, or individual student’s learning space, is the capability for collecting and sharing digital information and ideas, and uploading documents and artefacts for others to access, regardless of the location of teacher and student (Fountain, 2005; Chen et al, 2005; Schaffert et al, 2006; Littlejohn & Peglar, 2007; Chandra & Chalmers, 2010). Teaching teams of guided inquiry (GI) units often use a wiki as a class-based portal to store all GI assignment guidelines, process templates, and information- and inquiry-based scaffolds in one central place that can be accessed by students at school and from home (McLean, 2009; Fitzgerald, 2011; Harkness, 2011; Sheerman, 2011b; Voskuyl, 2011). Thus, the wiki satisfies both students’ and teachers’ desire to access shared information and files in terms of ‘any time’ and ‘any place’. Wikis as class portals are also relatively easy to replicate, so a TL working with more than one class on a specific unit can readily create individual class portals using a wiki, and upon completion of the inquiry unit, provide the teaching team with an archive of all documents, artefacts and scaffolds which can be drawn upon when revising a unit for other classes or the following year (Fitzgerald, 2011).

While wikis provide capacity for collection and sharing of information with others, Engstrom and Jewett’s (2005) study of 11 teachers and nearly 400 middle school students undertaking a collaborative inquiry geography project found that their students primarily used the wiki to collect information without substantially engaging with it. Grant’s (2006) observation of three classes of Year 9 ICT students undertaking group projects using Wikispaces also found that students’ focus was principally on the selection and collection of content to be stored on their wiki page rather than focusing on the development of their ideas. This suggests that teachers may need to provide greater scaffolding of students’ use of wikis if the goal is to have students use the wiki as more than a place to store ‘found’ information. That said, teachers have found wikis to be particularly useful in saving students’ work on a wiki page as they undertake learning tasks, because this saved archive of students’ work reduces the chance of students losing drafts of their writing (Atkins, Braunwart, Klare, & Runge, 2014).
Another advantage of wikis as reported by school teachers, is the ability to regularly communicate with their students outside of normal class time. It provides a way of capturing student questions and teacher feedback that can be referred to at a later date (Schaffert et al, 2006; Littlejohn & Peglar, 2007). For example, the study by Todd and Dadlani (2014) that observed a teacher and TL’s use of a wiki to support a Year 9 collaborative inquiry project in Language Arts found that the teacher and TL really valued the ability to communicate online with the students and provide feedback on students’ progress and reflections. Other studies of GI unit experiences have reported similar results (Fitzgerald, 2011; Sheerman, 2011a). Likewise, Zorko’s (2009) study of undergraduate students found the wiki helped them communicate more effectively with their instructors because they could access comments left by the instructors on their wikis, thus adding value in terms of increasing the opportunity to make their contact with the tutors.

While wikis have the capability of demonstrating the progress in students’ processing of information and generation of ideas leading to the publication of new understandings, very few studies have observed this with students. For example, Engstrom and Jewett’s (2005) study found that teachers reported the need for greater instruction to support students’ critical thinking skills due to the fact that the majority of students posted content that demonstrated minimal cognitive engagement with the information they had found, resulting in submissions that reflect surface rather than deep learning. Grant (2006) observed similar behaviour of 15-16 years old while working on a group project using group-based wikis to support collaborative research and writing. He also found that individuals or pairs within a group contributed their own research to the group space but there was little evidence of content collaboratively constructed as a group and concluded there was little collective engagement with ideas that one would expect of a collaborative writing task. He concluded that teachers need to explicitly state the expectations of using a Web 2.0 technology, such as wiki, with students. The findings from the above studies suggests that some educators may introduce a new technology to their class without providing students with the scaffolding required to understand the potential application of the technology, or sufficient scaffolding to assist students in developing higher order thinking skills.
Other studies have also reported the wikis as a useful collaborative writing tool where students create and share their ideas with other students and their teachers (Fountain, 2005; Gunawardena et., 2009). From the range of Web 2.0 technologies available, Boulos, Maramba and Wheeler (2006) and (Koopman, 2011) found that wikis, in particular, actively involved learners in thinking and knowledge building. Allsop’s (2011) study observed various types of collaborative behaviour while a class of Year 5 students helped each other with their tasks as part of a collaborative building of a dictionary of words they found challenging words (referred to as a WOW dictionary). She found the wiki brought the group members together which allowed students with similar ideas to collaboratively build on each other’s work. Yukawa’s (2005) use of wikis to support a narrative analysis task demonstrated the effectiveness of wikis in supporting the reviewability and revisability of students’ writing, due to the wiki’s capacity to save and archive the history of each writing or revision session undertaken by a student. A number of studies in both school and university settings have identified this feature as being particularly attractive when teachers are selecting an online platform to support inquiry learning, writing tasks and group work, given their ability to see how and when students make revisions (Elgort, Smith, & Toland, 2008; Zorko, 2009; Hsu, Ching, & Grabowski, 2013; Atkins et al., 2014).

Wikis can provide a significant degree of interaction between participants and greatly enrich collaborative projects (Baird & Fisher, 2005). For example, McLean’s (2009) use of wikis with Kindergarten students to support a fable unit was also designed to facilitate students’ interactions with parents about the literacy outcomes being achieved at school. The study found using a wiki for literacy activities with very young students can assist them in forming mental maps of what the Internet is and how it works, and provide students with the opportunity to receive real world feedback on their learning from within the school community, as well as gain an authentic international audience for their work. Woo, Chu and Li (2011) found that one of the positive responses from students with regard to using a wiki was how it helped in scaffolding their writing. They found storing and sharing online information they had found was both convenient and motivating. Educational outcomes from the use of the wiki to support students’ writing included the fact that they were more motivated to read more, and learned to use some
new vocabulary and language forms. Teachers observed an improvement in students’ reading, ICT, collaboration skills and subject knowledge. Pifarre’s and Fisher’s (2011) exploratory study of upper primary school students’ experience with wikis concluded that they provide the facility for students to publish writing in a space where “others can read it, and add, reorganise, revise or delete ideas, which gives young writers’ the opportunity to learn through others' ideas and points of view to enrich their own writing” (p. 462).

Some studies have highlighted teachers’ preference for using a wiki to support group work and individual projects with their class because of their ability to monitor students’ progress while completing a task and monitor the record of suggested edits made by other contributors (Engstrom & Jewett, 2005; Francke, Sundin, & Limberg, 2011; Assaf, Eickstead, Kaynes, & Woollven, 2014; Todd & Dadlani, 2014). Some studies, however, have found that students do not feel comfortable using the wiki as a project space because they do not want others monitoring their work (for example, see Lin & Kelsey, 2009).

Wikis also have the potential to support both formal and informal instructional support. For example, the TL and classroom teacher in Todd and Dadlani’s (2014) study found that they could provide instruction for students at the ‘point of need’. In other words, some of this instructional support was able to be provided due to the ‘any time, any place’ nature of the wiki as a Web 2.0 technology. The teaching team in Fitzgerald’s (2011) study also reported this as a valuable application of wiki technology. Furthermore, school teachers prefer to use wikis for writing instruction because they can provide feedback specifically for the student as author of each wiki page, which the student can then refer to while making revisions per page (Atkins, Braunwart, Klare, & Runge, 2014). In other words, the wiki provides teachers with a place to provide instructional support ‘in situ’.

This type of instructional support being captured on a student’s wiki has also been identified as encouraging students’ metacognition, in that students can view the learning process they have undertaken while completing a project, which allows them to reflect upon their learning, thus gaining a greater understand of their own learning processes (Chen et al., 2005; Fountain, 2005; Assaf, Eickstead, Kaynes, & Woollven, 2014). In
addition, Assaf et al. (2014) recommend that teachers take the opportunity to be involved in this reflective process where a teacher and student can reflect on the construction of text on a wiki page using the version archive of the wiki.

Other studies have shown how wikis work as an effective project planning platform to support group- or team-based learning projects, by providing planning and documentation management, people management capabilities for students working as project teams, reduction of students’ use of email messages between members, and better management of version control of collaboratively written documentation (Schaffert et al., 2006; Naish, 2006; Chao, 2007).

2.4.2 Blogs

Blogs have also been used by educators to support teaching and learning. While these do not provide the same online ‘group space’ features of a wiki, blogs do provide students with a place to publish their ideas in a space that can be accessed at school or from home, where they can seek feedback from their teachers and peers, and potentially seek authentic feedback from the wider world (Barrios, 2003; Cottle, 2009, Francke, Sundin, & Limberg, 2011; Angelaina & Jimoiyannis, 2012). For example, Ayers’ (2011) observation of his Language Arts students using blogs to support the writing and publication of their ideas found that his students really valued receiving comments from people other than him as their teacher, thus providing an authentic audience for their work and the ability to interact with the ideas in responses made by others. McGrail and McGrail (2014) also found Year 5 students’ blogs provided them with an authentic audience (including family members) which motivated them to continue with their writing.

Likewise, Hsu, Ching, and Grabowski’s (2013) analysis of blogging studies found a “positive impact on learning with additional affective benefits when learners used blogs to share learning progress and achievement with peers” (p. 750). For example, students using blogs to post and respond to each other’s writing experience has been shown to increase student motivation (Shifflet, 2008; Taylor, 2012), and this peer interaction can
also alleviate self-doubt and help students become more confident in their learning (Ladyshewsky & Gardner, 2008; Angelaina & Jimoyiannis, 2012).

In comparison, a study of 20 Year 5 students’ use of a class blog as part of a Language Arts unit on time machines, found that while students’ were willing to express their personal opinions about content uploaded on the blog by the teacher, they did not comment on their classmates’ responses (Eteokleous-Grigoriou & Photiou, 2014). The researchers concluded that students needed “more guidance, monitoring, assistance (promote interaction, debate, and dialogue)”, and as a result the teacher had not created “the appropriate environment for students’ interaction, dialogue and discussion through the blog” (p. 132).

While blogs can encourage students to write, Shifflet’s (2008) study which involved interviews with eight K-12 teachers about their use of technologies to support their students learning concluded that it “is incumbent upon the instructor to design activities that are open-ended, involve defining and solving real-world problems in order to engage higher levels of thinking and increase opportunities to construct knowledge” (p. 193). This is similar to findings in the previous section on the use of wikis. While a number of teachers have been using these Web 2.0 technologies, in a number of cases reported in the research literature, there is little evidence of instructional scaffolds to help students’ maximise the potential benefits of use of these technologies. This appears to be lacking in the design of curriculum units and learning tasks reported here.

Of the research literature reviewed regarding the use of blogs to support teaching and learning, Zawilinski’s (2009) case study on developing student’s higher order thinking (HOT) skills and improve online reading comprehension using the ‘HOT blogging’ framework was the only one that presented a comprehensive set of instructional scaffolds being used by a teacher as part of the unit design. The HOT blogging approach consists of four recursive steps of “bolster background”, “prime the pump”, “continue the conversation”, and “make multiplicity explicit” (p. 655). This framework includes a collection of scaffolds and strategies for teachers to implement throughout a curriculum unit using blogs.
Blogs have been also used to create collaborative learning environments to support project-based learning. For example, Poling (2005) brought together a group of primary students from different classes to work on a group project about the environment, where students were encouraged to complete a writing task followed by reading and commenting on other students’ posts, and sharing their reflections on what they had learned. Gunawardena et al. (2009), Ladyshewsky and Gardner (2008), and McGrail and McGrail (2014) also discovered the potential of blogging for metacognition, especially for students to reflect on their ideas and the learning experience. In fact, Xie, Ke and Sharma’s (2008) experimental study examining the effects of blogging on college students’ reflective thinking skills and learning approaches found students’ level of reflective thinking increased significantly over time.

In a similar study to that of Poling’s (2005) but in the secondary school setting, students from two different classes were brought together to collaborate on a term project about doping issues and the use of drugs by athletes to improve their performance in sports (Angelaina & Jimoyiannis, 2009). The researchers analysed the “cognitive presence” of the students, and the ideas sharing and debating that occurred throughout the unit, which did demonstrate the use of blogs as effective tools to support collaborative knowledge building within a class (p. 137). These same researchers conducted a further study on the use of a class blog to support a joint primary-middle school PBL unit on ‘Acid Rain’. Key findings included students used blog posts to provide each other with social and emotional support which contributed to a more collaborative learning environment that enabled both individual reflection and peer interaction (Angelaina & Jimoyiannis, 2012).

As a result of their studies and those of others, Angelaina and Jimoyiannis (2012) identified what they perceive to be gaps in the current research on educational blogging which include “the issues of pedagogical design of educational blogs and the consequent teachers’ scaffolding strategies in order to support students’ engagement, presentation and interchange of ideas, collaborative and reflective thinking” (p. 180). This supports observations from other studies reported here, i.e., the essential contribution of the teacher in providing the necessary instructional support for students to maximise the
benefits of engaging in blogging to develop higher order thinking and collaborative skills as problems solvers, inquirers and writers.

### 2.4.3 Social bookmarking tools

There are few studies in the use of social bookmarking tools, particularly with school students, while some studies have examined the use of these Web 2.0 technologies within the tertiary context. For example, a group of academics and students used Delicious as a collaborative resource sharing space in writing a literature review (Gunawardena et al., 2009), while a study examining 19 university students’ use of Diigo to support their research of online History sources found that some students were reluctant to sign up for another social media account, and a number of students did not see the point in using such a tool to support their learning (Wood et al., 2014). The main benefit, however, that lecturers saw in using Diigo was those students who used the social bookmarking site had the ability to evaluate and tag information sources more effectively, and overall engage more with online sources for historical research. Twelve of the students identified finding new materials and sharing materials as benefits of using Diigo, while seven students liked using it because it helped them not lose track of online resources, and four stated that they felt they had developed skills in searching for information. Out of the 19 students in the group, 13 said they would use Diigo to support other research projects on their own, and 16 said they would recommend it to others. Overall, students reported that it was relatively easy to use and they felt they could organise their work better, while one student stated that using Diigo was an easier way to save bookmarks compared to saving them on their web browser. This highlights the challenge when introducing a new Web 2.0 tool to a group of students – while some students are willing to give a new tool a try, others are not interested – and educators have to then consider other ways that they may be able to support those who elect not to trial a tool to complete an assigned task.

Within the school context, Diigo was successfully used with sixty-seven Grade 5 students as part of an English writing project to identify, categorise, and save bibliographic data and URLs for sources, which also helped students’ save time when needing to revisit online resources they had previously located (Anderson, Mitchell,
Thompson, & Trefz, 2014). The teacher of Anderson et al.’s case study also instructed the students on the use of Diigo to use the highlighting and annotation features for notetaking. Similar results were found with a pre-service teacher course where groups of 5 and 6 students were encouraged to collaborate on inquiry topics using Diigo as the group’s collaborative resourcing space (Li, Pow, & Cheung, 2015). The researchers concluded this social bookmarking environment was found to be conducive to fostering high-level cognitive and metacognitive activities, particularly in the use of the text highlighting feature of Diigo which leveraged learners’ comprehension ability and provided “the necessary anchors and scaffolds for learners to engage in meaning negotiations and knowledge building” (p. 11).

Overall, studies that have examined the use of more than one Web 2.0 technology as part of a specific project or learning have found the social bookmarking tools have the least uptake from students (Yew, Gibson, & Teasley, 2006a; Yew, Gibson, & Teasley, 2006b; Saeed & Yang, 2008; Grosseck, 2008; Saeed et al., 2009; Al-Daihani (2009). As a result of poor interest in and use of social bookmarking with library science Masters student, Al-Daihani (2009) concluded that students need to receive specific training in the use of such new technologies if uptake is to be improved within a cohort. Farwell and Waters’ (2010) study of 53 undergraduate students also highlighted the need for instructors to provide basic training in a Web 2.0 technology like Delicious, especially when the tool is completely unfamiliar to them and/or they are unaware of potential application of such a tool. The researchers found with some basic instruction the students could “easily navigate information on the topic that was tagged by others, not just the professor, thereby gaining additional depth and viewpoints” (p. 405). They also found that some students were willing to tag and add content they found relevant which promoted further interaction and participation from the group.

Based on their comparative analysis of educators trialling social bookmarking tools in secondary school and tertiary settings, Taha, Wood and Cox (2014) concluded that:

The main barrier to the use of SB seems to be lack of familiarity with the technology on the part of the students. Whereas students are already very familiar with many social networking tools and therefore arguably more open to using similar tools in their learning, they are generally less familiar with SB which may mean that they are less disposed to make use of it in educational settings…. [However] there is some evidence the SB is
particularly effective when its use is carefully structured and facilitated by tutors and/or where its use is made mandatory. (p. 27)

In summary, there are a number of ways that Web 2.0 technologies such as wikis, blogs and social bookmarking platforms can support teaching and learning. From the above examples, it is clear that these technologies provide a variety of purposes such as in-class collaboration; group projects and discussions; collaboration for learning from peers; as a tool for educators to provide prompt feedback and review to their students’ work, from within and outside the classroom; to develop information literacy skills allowing students to make their own judgements regarding the accuracy of information; collaborative writing; supporting writing instruction; problem-based learning projects and problem-solving tasks; a space to submit assignments and publish projects; and to seek feedback from authentic audiences. There is, however, a lot more to be explored regarding the use of these technologies to support teaching learning, as Yonezawa, McClure, and Jones (2012) warn in their research report on the Personalization of Schools:

The newness of this body of work using today’s technological advances (compared to those from even a few years ago) forces us into a wait-and-see mode. Most problematic is that this body of research has typically focused on higher education’s implementation of technology in coursework, with far fewer studies examining implementation in secondary schools. (p. 20)

2.5 Teacher librarian as instructional partner in guided inquiry

The collaborative partnership of the teacher and TL in curriculum planning and team teaching has been explored extensively in the research literature for the past four decades. For the purposes of the study presented in this thesis, the review of the literature in this section focuses specifically on the role of the TL as instructional partner within a guided inquiry (GI) context. Five central roles are explored based on findings from the empirical research literature and practitioner literature that includes either an action research or evidence-based practice component in its reporting. These five roles include the TL as designer of inquiry units, as teaching team member, as assessor of student learning, as innovator of information and technology practice, and as evidence-builder.
The instructional role of the TL as a ‘designer of inquiry units’ is fundamental in making GI work in a school. Based on the practitioner-based reporting in action research and evidence-based practice initiatives about GI units undertaken in schools, the majority of these highlight the role of the TL as pivotal in designing these units. This should be of little surprise given that a GI approach was introduced to the school librarianship profession as an extension of the instructional guidelines published by Kuhlthau (2004) regarding her ISP.

One of the main reasons why a TL should be involved in the design and teaching of a GI unit is the design of information search scaffolds to guide the development of students’ information search skills, such as interrogating the school library catalogue, full-text databases and the Web, to help students locate relevant information on their chosen topic. The following is an example of a ‘Structured Searching Approach’ scaffold, based on Kuhlthau, Caspari and Maniotes (2007, p. 84) concepts for locating, that Fitzgerald (2011) designed to help senior History students understand the different types of information searches they needed to undertake throughout the inquiry process. This consisted of:

- ‘Broad preliminary searching’ to occur at the beginning of task during the Initiation stage, to develop a concept of the scope of the topic, and to focus on reading broadly for understanding the scope of the topic;
- ‘Exploratory searching’ to occur during the Exploration stage, to do deeper searching, and explore the potential scope of the topic;
- ‘Comprehensive searching’ at the Formulation stage, to find relevant information to help formulate their own understanding of the topic, and formulate their own point of view of the topic; and
- ‘Summary searching’ for the documenting tasks required during the Collection and Presentation stages, before writing the product of the research, checking to make sure vital information has not been missed, and checking that information has not changed. (Based on Figure 2 on p. 28)

Some studies demonstrate a sustained program of scaffolding and instructional intervention designed by the TL to support students’ needs during the demands of a
major inquiry project. The pilot study of the experiences of two Korean Year 11 ELL (English Language Learner) students while undertaking a Scientific Literature Review is a good example of this with the TL providing up to eighteen workshops as formal, planned instructional interventions in Year 11 Biology and Psychology classes for a nine week period (Kim & Todd, 2008). These workshops focused on the method of researching and writing a scientific literature review for senior students, which have been published by Schmidt, Smyth and Kowalski (2014).

Another reason why a TL should be involved in the design and teaching of a GI unit, is that they receive feedback regarding the design of the unit throughout the duration of the GI experience. This provides valuable information for future revisions of those units that may become embedded into the annual programming of a subject area for a particular year level in a school. Therefore, the insights of the TL along with other members of the GI team are necessary when evaluating unit design. For example, Fitzgerald’s (2007) case study of 120 Year 7 History students found that students were having difficulty articulating their own inquiry question, and she concluded this was in part due to the very broad nature of the inquiry unit and the age of the students. As a result Fitzgerald recommended to the teaching team that future inquiry units for Year 7 students in their school needed some additional parameters built into the experience to assist students of this age with the demands of open-ended inquiry. One of the strategies to help deal with this was the development of a series of scaffolds to model questioning skills along with sample questions very early on in the inquiry process to help Year 7 students manage the cognitive demands of choosing a broad topic, then searching for information to build background knowledge, and then formulating their focus as a specific question. Without the TL being part of this instructional team, she would not have observed, first hand, the problems faced by students, which would have made it difficult to make an informed decision about revising the unit for the following year. What Fitzgerald learned from this initial Year 7 History unit also led to the application of a similar approach in GI units in her school for other Year 7 subjects.

Another example of being a designer of GI units, is the development of ‘The research river analogy’ by Fitzgerald (2011) as a Powerpoint presentation (pp. 40-41). She designed this scaffold to help make the language and the interpretation of Kuhlthau’s
ISP more ‘accessible’ to her school community, and trialled it in 2010 as part of a Year 11 modern historical investigation, as she explains:

This PowerPoint presentation aligns the stages of the ISP to the passage of a river to the sea, from small and weak beginnings, to basking in the shallows of information, to steadily getting deeper into the flow of information, to falling down the waterfall then plunging headlong into the dip (confusion/frustration/doubt), predicted by Kuhlthau at the exploration phase. After that, the river streams through various paths to the sea, leaving behind much of its water, and dividing into many possible paths. The analogy has proved helpful to students in describing and experiencing their information process. (p. 27)

Use of the Research River analogy has also been adapted for primary school students by McLean (2011) as an instructional scaffold, and Scheffers’ (2007) case study of five Year 5/6 classes participating in a ten week GI unit on International Aid Organisations demonstrates how a WebQuest was used as part of the unit design to provide a scaffold for students’ information use and knowledge building experiences.

An assumption of the GI framework is the ‘learning intervention’ role of the TL, as defined by Kuhlthau and Todd (2007), where GI is the “carefully planned, closely supervised, targeted intervention of an instructional team of school librarians and teachers to guide students through curriculum-based inquiry units that build deep knowledge and deep understanding of a curriculum topic, and gradually lead towards independent learning” (para 2). This shifts the role of the TL from a provider of resources to support inquiry projects to an essential instructional partner in designing, implementing and evaluating GI experiences for students, thus the role of the TL as ‘teaching team member’.

Gordon (2009b) articulates this succinctly when she states at “the heart of the collaboration is the content knowledge of the classroom teacher and the expertise in information behavior and knowledge construction of the teacher librarian” (p. 27). The expertise of the TL as the school’s information specialist adds value to the teaching team. Fitzgerald (2011) states that GI “asks both teachers and students to develop a greater awareness of process in research” (p. 26). It is, therefore, the TL’s knowledge, skills and experience with working with information resources, information skills and information process that a school needs to help build teachers’ and students’ knowledge
and skills in inquiry. An example of this, is the development of her research river analogy, discussed above.

A guided inquiry approach, as espoused by Kuhlthau and colleagues (Kuhlthau & Todd, 2007; Kuhlthau, Caspari, & Maniotes, 2007), requires individual students to explore topics of their own choice as part of the inquiry learning process, which in turn places demands on the teacher and TL to assist students in developing a focus for their projects. Some interventions may be planned based on scaffolds that have been developed and used by both researchers and practitioners in the past, while other interventions may be more ad hoc and provided on a just-in-time basis. As a result, classroom teachers find the additional ‘teacher’ of the TL valuable because the lower teacher to pupil ratio enables students to receive more responsive teacher assistance (Kuhlthau, Caspari, & Maniotes, 2007; Scheffers, 2007; Fitzgerald, 2011; Sheerman, 2011a).

An important benefit for the TL of being an active teaching member of a GI team is the opportunity for him/her to work with teachers and students using the school library’s print and digital collections. For example, Fitzgerald (2011) discovered a valuable insight into her school library’s resourcing capacity from working as the TL on the GI team for a Year 11 History GI unit, as she describes:

> As far as this teacher librarian is concerned, accompanying students right through this learning journey, showed me that my resourcing changed in each individual case, mirroring each student’s journey to defining question and locating the area of debate. I found the work intense as I helped them with online databases, using our own and the State Library’s excellent range, trying to help students locate the perfect piece that might have been missing, for example, the Siege of Malta question which was completely missing the Maltese reaction side, and it took the student and me a very long time to locate the missing links. (p. 36)

Thus, the experience as a teaching team member can also contribute to the TL’s role as a resourcing expert when the team evaluate the GI unit and revise it for the following year, because it will inform her collection development plan and budget for the coming year to strengthen those parts of the collection that she found lacking to support a specific GI unit.
Studies show how students value the role of the TL as a member of the teaching team. For example, results of Heinström, and Todd’s (2006) survey research of 574 students in Year 6-12 undertaking GI projects across 10 public schools in New Jersey found that those students whose approaches to study represented surface learners valued the instructional support of their TL, particularly with regard to information use. This was also evident in studies by Scheffers (2007, 2013, 2015), Fitzgerald (2007, 2011), and Sheerman (2011a).

The GI process also provides TLs with an opportunity for TLs to be an ‘assessor of student learning’. The majority of GI units reviewed in the literature included the assessment of process as well as product when marking students’ final projects. For example, in Fitzgerald’s (2011) case study of a Year 11 History unit which involved students presenting what they had learned as a scholarly essay, the teachers marked the essays, while the teacher librarian marked the process. The TL found cross-marking of the essays allowed her to “see the impact of process on product” (p. 30). Being involved in the assessment of students’ assignments also provides an opportunity for TLs to contribute to subsequent revisions of the design of a unit, which Fitzgerald had been involved in for the previous three years for this GI unit. This experience as an assessor of students’ work helps in the design and refinement of GI scaffolds, such as the ‘Structured Searching Approach’ scaffold earlier in this section. Other examples of the TLs’ involvement in the assessment of students’ work have been reported by Kim and Todd (2008), Kurvink and Turnbull (2009), Fitzgerald (2011), Scheffers and Bryant (2013), and Scheffers and Alekna (2015).

As presented in the review of literature of Web 2.0 technologies support teaching and learning in Section 2.4, numerous studies and evidence-based reports have documented the use of a wiki as a preferred Web 2.0 technology to support GI units. This demonstrates the role of the TL as ‘technology integrator’. A number of the studies reviewed above have included examples of the role of the TL as technology innovator with teaching staff and as a learning technology instructor with students. In addition to wikis, the use of blogs and iPad apps are presented to further illustrate the TL’s technology leadership role in the school.
Blogs have also been used to support some collaborative work between two TLs and their classes in different primary schools (Scheffers, 2008; McLean, 2010; McLean, 2011). For example, Scheffers’ (2008) use of Gold quest blog on Australian goldfields with Year 5/6 classes collaborated with McLean’s Year 5/6 classes who were also studying bushrangers in the gold era. While the students completed their projects in-school, the two groups used a joint blog to allow students from both schools to share their research findings and experiences; thus the blog expanded these students’ audience for their work, and the TLs were able to demonstrate to the classroom teachers the potential of blogs to support GI units. In addition, McLean (2011) used a blog to support a GI unit on Endangered animals for Year 5/6 classes which stored all programming and planning documentation for the GI teaching team to collate appropriate online resources required for students’ weekly research tasks, indicated where the explicit teaching of various aspects was required, and hosted the students final projects to be shared with a wider audience. McLean reported that “the blog has enabled the school to provide an efficient, appealing and motivational online exhibition of student work that can be accessed from home” (p. 34). This also raises the profile of the integration of GI within the broader school community, including parents, and highlights the technology leadership of the TL beyond the school library.

Scheffers and Bryant’s (2013) GI unit with five Year 2 classes exploring Australian native animals had students working in pairs to complete their inquiry project while being part of their school’s first trial of iPad devices and the use of iOS apps suitable for younger children. The students were introduced to a range of iPad apps and Web 2.0 tools, including Popplet, StickyNotes, 7notesHD, iBooks and SurveyMonkey. One unexpected outcome of students’ use of these apps (besides increased motivation to be engaged in the inquiry project) was the significant improvement in students’ reading levels. This was due to the structured GI activities throughout the unit which required students to read websites and print resources, as individuals and in pairs, both aloud and independently, and use the text to speech functionality of the iPads. As a result of the significant increase in student outcomes of this unit, an additional 60 iPads were purchased by the school, wifi was installed in other areas of the school (including the library), with 20 of the iPads allocated to the library to support inquiry learning initiatives.
A second iPad case reported by Scheffers and Alekna (2015) with a special needs class with seven students with autism spectrum disorder (ASD) undertaking a GI project on animals using iPads found that the iPad apps and Web 2.0 tools used was extremely motivating for the students as strong visual learners. The TL provided direct instruction on using the Book creator app to help students set up individual research iBooks, which included a book cover, contents page, research question mind map (designed using the Popplet app), notetaking pages and focus question response area. Student also completed Morfo recordings and used SurveyMonkey to submit their progress reports. In addition to significant student outcomes reported, the project “fostered closer relationships between the teacher librarian, class teacher, ICT teacher and students” (p. 19).

The final role of the TL in GI is that of ‘evidence builder’. A number of Australian studies on school library impact include research on the implementation of a GI approach in supporting student research projects, including the application of the evidence-based practice toolkit, known as the School Library Impact Measure (SLIM) survey toolkit, developed by Kuhlthau and colleagues (Todd, Kuhlthau, & Heinström, 2005b; Kuhlthau, Caspari, & Maniotes, 2007). These Australian studies feature the work of TL practitioners such as Fitzgerald (2007, 2011), Drury and Martin (2009), Maitland-Smith, Twitchett, and Davey (2009), McLean (2011), Sheerman (2011a) and Sheerman, Little, and Breward (2011). Some TLs simplified the SLIM Toolkit for their EBP by developing what they refer to as ‘The Skinny toolkit’, which is designed to reduce the burden of analysing very large amounts of data that the original SLIM toolkits generate, especially when one TL is working with a number of GI teams and classes in a single school term. (Examples of the implementation and results can be found in Scheffers, 2008, 2013; Fitzgerald, 2008, 2011; Sheerman, 2011a).

Other TLs, both in Australia and North America have been involved in building evidence as part of action research projects, by either collaborating with other TLs colleagues (Schutz, Pick, & Knox, 2006), or as part of a school-based research project (Schmidt, Smyth, & Kowalski, 2008; Drury & Martin, 2009; Kurvink & Turnbull, 2009; Schmidt, Kowalski, & Nevins, 2010; Stubeck, 2015). A strength of the evidence-based movement in school librarianship is the increasing contribution that TL practitioners are making to this pool of evidence, and from the above review of the literature, it is evident
that the guided inquiry approach as espoused by Kuhlthau and colleagues (Kuhlthau, Caspari, & Maniotes, 2007) has provided TLs with a framework and techniques that equips them to become evidence-based practitioners and action researchers.

Fitzgerald (2011) sums up the experiences of twelve TLs who participated in a NSW Association of Independent Schools’ action research project which involved the planning, teaching and reporting a GI unit with teachers in their schools. She concluded that TLs have used scaffolds to support students’ inquiry projects in the past; however, using a GI framework provides a more integrated approach to the design and teaching of inquiry units in schools where:

The context is the Information search process, which allows students to become aware of their own processes and allows teachers and teacher librarians to frame the task, and to bring together in a meaningful way scaffolds which we might have used in an unconnected way in the past. New also, and central to the success of Guided Inquiry, is the feedback sought from students throughout their process, which allows teachers and teacher librarians to frame individual and group interventions, and which forms the basis for ongoing evidence based practice. (p. 40)

2.6 Summary

This chapter has presented the background to this study in terms of the contexts of schooling, school libraries and emergence of new technologies. This includes the contribution of school libraries in supporting student learning, the introduction of guided inquiry as an instructional framework for school libraries, and how school libraries were responding to the emergence of Web 2.0 technologies to support student learning. This was followed by a review of the research literature which examined the four key areas of student learning through inquiry learning; students’ approaches to learning, including learning styles, and students’ information behaviour as inquiry learners; the use of Web 2.0 technologies to support teaching and learning, with an emphasis on the use of wikis, blogs and social bookmarking platforms in education; and the teacher librarian’s role as instructional partner in guided inquiry.
Chapter 3  Conceptual framework and methodology

This chapter outlines theoretical and philosophical frameworks underpinning the research design, and details three constructivist theories informing the study. This is followed by a discussion on the methodological approach employed in the study. A review of ethical considerations required to conduct the study, and procedures used for data collection and analysis are presented in a separate chapter (Chapter 4).

3.1 Conceptual framework

As outlined in Section 3.2.2, this study adopted a mixed methods approach to data collection, including qualitative and quantitative data, however, the label ‘qualitative research’ is applied to the study as a whole. Denzin and Lincoln (2003) articulated this breadth of opportunity offered by qualitative research as:

> a complex, interconnected family of terms, concepts, and assumptions…. [which] include traditions associated with foundationalism, positivism, postfoundationalism, postpositivism, poststructuralism, and the many qualitative research perspectives, and/or methods, connected to cultural and interpretive studies. (p. 3)

Further, their conception of qualitative research as a “situated activity that locates the observer in the world… [and studies] things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meaning people bring to them” (pp. 4-5) represents the context of this study. Moreover, the study deploys “a wide range of interconnected interpretive methods” to seek better ways of understanding the experiences being studied (p. 31).

Bogdan and Biklen’s (2007) five characteristics of qualitative research provide a useful framework in further defining the qualitative nature of this study:

- Qualitative research is **naturalistic** in that it assumes “that human behaviour is significantly influenced by the setting in which it occurs” and therefore is concerned with **context** (p. 4). The context of the present project examines the learning experiences, information behaviours and interpersonal relationships of a
particular group of students, along with their teacher and a TL, during the completion of a PIP over a three month period.

- Qualitative research principally employs descriptive data to represent the richness of the phenomena under study here, including qualitative questionnaire responses, classroom observations, observation of Web 2.0 learning spaces, interview transcripts, and teaching and learning documentation generated by students, the teacher and TL. It also examines “the world… with the assumption that nothing is trivial, that everything has the potential of being a clue that might unlock a more comprehensive understanding of what is being studied” (p. 5).

- Qualitative research is “concerned with process rather than simply with outcomes or products” (p. 6). The present study explores the information behaviours and processes employed by students while completing a PIP, delves into a range of facilitators and inhibitors that affect successful communication and collaboration between participants (including guided inquiry as a process of instructional intervention), and seeks out the different ways the participants use Web 2.0 technologies to support students’ learning.

- Qualitative research is mostly inductive in its approach to analysing data and theory building, by way of “constructing a picture that takes shape” as data is collected and examined. In this study initial data gathered was used to inform the development of further, important questions in the latter part of the study, specifically the final teacher, TL and student interviews (pp. 6-7).

- Central to this study is the investigation of the different perspectives of students, teacher and TL in the use of Web 2.0 technologies, the conceptions and expectations of students as independent learners, and the face-to-face and online dynamics required for student, teacher and TL to work as effective learning teams. Therefore, meaning “is of essential concern” to this qualitative study where the researcher is interested in “how different people make sense of their lives” and how this influences their relationship with others and the use of technologies to support these relationships (p. 7).
Furthermore, Williamson (2006) argued that defining one’s research as “qualitative, on its own, does not provide an indication of the ontological view of the researcher” (p. 84). With this in mind, the following section presents the philosophical underpinnings of the study presented in this thesis.

### 3.1.1 Philosophical underpinnings

There are two main traditions, or paradigms, of research in the social sciences, positivism and interpretivism. A paradigm is “a world view, a general perspective, a way of breaking down the complexity of the real world” (Guba & Lincoln, 1989, p. 43). More specifically, Kuhn (1970) defines a paradigm as “a set of interrelated assumptions about the social world which provides a philosophical and conceptual framework for the systematic study of the world” (p. 10). Thus one’s worldview is underpinned by philosophies, or more specifically ontologies, which are based on particular assumptions which shape a researcher’s approach to social inquiry.

Positivists believe that events or occurrences in the world can be measured, and try to apply research methods from the natural sciences to the social sciences (Williamson, Burnstein, & McKemmish, 2002). Positivist approaches are often associated with quantitative methods and thus the researcher’s capacity to *objectively measure* what occurs in the world. Charmaz (2006) summarised the main thrust of a positivist as one who “seeks causes, favours deterministic explanations, and emphasizes generality and universality” (p. 126). In comparison, interpretivists see research as “naturalistic inquiry”, where the world is social (as opposed to the world of nature); where the world can be personally constructed by individuals; and where “people are constantly involved in interpreting their ever-changing world” (Williamson, Burnstein, & McKemmish, 2002, p. 30). Charmaz (2006) referred to interpretive theory as a call for “the imaginative understanding of the studied phenomenon... [which] assumes emergent, multiple realities; indeterminacy; facts and values as linked; truth as provisional; and social life as processual” (p. 126).
While a philosophical dichotomy has existed between these two traditions since the mid-nineteenth century (Hammersley, 1992), in the 1970s and 1980s this debate became couched within the polarisation of quantitative and qualitative approaches to research, with quantitative data directly aligned with the positivist tradition and qualitative data with interpretivism (Smith & Heshusius, 1986; Gage, 1989; Guba, 1990; Hammersley, 1992, 1996). This debate has continued into the 21st century (Williamson, Burnstein, & McKemmish, 2002; Denzin & Lincoln, 2003; Lather, 2004; Hatch, 2006; Donmoyer, 2006; Denzin, 2008).

Miles and Huberman (1994) argued that it is tempting in epistemological debates to “operate at the poles. But in the actual practice of empirical research … realists, interpretivists, critical theorists … are closer to the center, with multiple overlaps” (pp. 4-5). Brannen (2007) took this argument a step further, challenging us with her view that “ontological and epistemological assumptions and theoretical considerations are relevant to the choice of the research method. However, there is no necessary linkage between assumptions on the one hand, and methodological approaches on the other” (p. 283). She asserted that a particular “ontological/epistemological stance may lead to very different kinds of methods”, giving the example that a researcher adopting a “realist stance” could employ “either quantitative or qualitative methods, or both” (p. 283).

Lin (1998) argued the “juxtaposition of qualitative research against quantitative research makes it easy to miss the fact that qualitative research itself encompasses [these] two traditions” (p. 162). This resonates with the earlier definition of qualitative research by Denzin and Lincoln (2003) referred to above. Lin defined positivist approaches within qualitative research as identifying “qualitative data with propositions that can then be tested or identified in other cases, while interpretive work seeks to combine those data into systems of belief whose manifestations are specific to a case” (p. 162). The development of propositions in qualitative research is also associated with post-positivists who believe “that reality must be subjected to the widest possible critical examination” because reality “is not easy to discover”, and it is important to gain ‘emic’ or insider views of the world in natural settings which require qualitative methods (Williamson, Burnstein, & McKemmish, 2002, p. 28).
The qualitative study reported in this thesis principally adopted an interpretivist philosophy where the experiences, understandings and meanings of all participants involved are the focus. Nevertheless, it also encompassed a quantitative component in the form of a measurement tool used to identify students’ approaches to learning in terms of deep, strategic and surface approaches to learning – categories based on the work of Entwistle and his colleagues from the past three decades (e.g., Entwistle, Hanley, & Hounsell 1979; Entwistle, 1981; Entwistle, 1988; Entwistle & Tait, 1995; Tait, Entwistle, & McCune, 1998; Entwistle, Tait, & McCune, 2000; Entwistle & McCune, 2004; Entwistle, McCune, & Scheja, 2006), and the more recent work of Heinström (2000, 2002, 2005, 2006a, 2006b, 2006c; Heinström & Todd, 2006). Even though this instrument has been used in research undertaken from a positivist standpoint, its use in this study as a source of data about the disposition of individuals is consistent with the overall interpretivist approach employed.

This researcher acknowledges there are different ways of seeing and knowing the very complex world in which we live. While interpretivist inquiry provides the framework for exploring the experiences of students, teacher and TL in the study, she also believes that the lens of a learning styles measure may contribute to analysing data and theory building and thus to constructing a picture of how students engage with information and technology as part of the inquiry learning process. This view is based on research exploring how middle and high school students’ approaches to studying influence their difficulties, feelings, and need for help while working on a guided inquiry project (Heinström, 2006b; Heinström & Todd, 2006). This blending of methods across paradigms was emergent in the early 1980s as a result of the pragmatic nature of inquiry, as Miles and Huberman (1984) observed:

> It is getting harder to find any methodologists solidly encamped in one epistemology or the other. More and more ‘quantitative’ methodologists, operating from a logical positivist stance, are using naturalistic and phenomenological approaches to complement tests, surveys, and structured interviews. On the other side, an increasing number of ethnographers and qualitative researchers are using predesigned conceptual frameworks and prestructured instrumentation, especially when dealing with more than one institution or community. (p. 20)

Hesse-Biber and Leavy (2008) argued that “emergent methods often invite multiple meanings and contradictions due to the fact that different paradigms offer different and
often opposing interpretations” (p. 4). They believed recent, major theoretical developments in qualitative research “have opened the way for researchers to create methodologies that actively seek multiple meanings, tensions, and alternate viewpoints” (p. 4). This researcher shares Hesse-Biber and Leavy’s view, and believes the inclusion of the learning styles measure can contribute to the development of descriptive analysis to elicit a deeper, interpretive understanding of the ways the students engage with information, technology and people while completing an inquiry learning project (Glesne, 1999). This is supported by Flick (2002) who saw qualitative research as multimethod in focus (pp. 226-227), and Denzin and Lincoln (2003) who argued that the “combination of multiple methodological practices, empirical materials, perspectives... in a single study is best understood as a strategy that adds rigor, breadth, complexity, richness, and depth to any inquiry” (p. 8).

3.1.2 Interpretivist/constructivist framework

Interpretivist qualitative research explores the complexities and intricacies of the world as viewed and experienced by individuals, groups and organisations. It examines situations, encounters and phenomena as they occur within a particular social or organisational context, and assumes the world is constructed by and through the ‘multiple realities’ of those who inhabit it (Glazier, 1992a; 1992b).

Encompassed within an inductive-interpretivist approach is constructivist philosophy which was considered appropriate as the dominant paradigm for the present research. Constructivism is “concerned with the ways in which people construct their worlds” (Williamson, 2006, p. 85). Researchers using constructivism as their dominant paradigm “are oriented to the production of reconstructed understandings of the social world”, they “value transactional knowledge”, which is appropriate to the study presented in this thesis as it examines the experiences of student, teacher and TL as they construct understandings as learning teams (Denzin & Lincoln, 2005, p.184).

A constructivist approach is based on the assumptions that there are multiple realities for any given situation (“relativist ontology”), that researcher and participant co-create understandings (“subjectivist epistemology”), and that methodological procedures are
naturalistic, where findings are presented in terms of grounded theory building based on criteria or “pattern theories” (Denzin & Lincoln, 2005, p. 24). Thus, within an interpretivist framework, the researcher examines the world with a view to building theory for understanding through the realities that are “multiply constructed by individuals and groups who ground their constructions in the particulars of their own personal experiences” (Lincoln, 1995, p. 92). Constructivists do not seek a single ‘truth’. Rather they try to picture a particular social reality by focusing “on the meaning-making activities of individuals and groups who must make sense of contexts in which they find themselves” (p. 92). They also pursue “insights into the webs and patterns of influence that operate on individual lives”, to gain an understanding of how people may behave, respond and learn as a result of interacting with those things that influence their world (p. 92). The emphasis is on the “socially constructed nature of reality” based on human interaction and experience (Patton, 2002, p. 98), as a means of understanding a particular phenomenon.

Guba and Lincoln (1989) argued that the primary assumptions of a constructivist paradigm include that: truth is not derived as an objective reality but rather consensus of understanding from participants involved in a process of co-construction (p. 86-87); facts cannot be presented as an objective assessment of what has been studied, except within “some value framework” (p. 88-89); causes and effects are shaped simultaneously which means causal relationships cannot be determined but can be better understood (p. 96-97); findings cannot be generalisable as they are bound by the context in which phenomena are investigated (pp. 93-94); and data collected can only represent constructions derived from an inquiry because all inquiry involving humans occurs “in some local value context” (p. 102).

In addition, Charmaz (2003) posited that, if constructivism’s main focus is about seeking meanings, this must include the meanings of those being studied as well as the researcher’s meanings. Charmaz (2003) referred to the challenge of taking “our inquiry into the world. Through sharing the worlds of our subjects, we come to conjure an image of their constructions and of our own” (p. 281). An ethnographic method thus lends itself to the above interpretivist, constructivist approach where the researcher draws extensively
on the voice of participants to accurately present their views and experiences, explored in detail in the next section.

3.1.3 Constructivist theories informing the study

Consistent with the interpretivist, constructivist standpoint underpinning the research methodology, the research also draws on constructivist learning theory as a lens for understanding the problem domain. Constructivist learning theory is based on the central notion that as learners we construct our own understanding of the world around us based on the experiences we encounter. As learners, we “select and transform information from past and current knowledge and experience into new personal knowledge and understanding” (Pritchard & Woollard, 2010, p. 8). Constructivism can be viewed in two ways, either as a personal, individual construction of one’s reality or a social, shared construction of knowing and understanding (reality) as a result of individuals working together. Kelly’s (1963) Personal Construct Theory informs the former, while two constructivist theories inform the latter, including Berger and Luckmann’s (1967) Social Construction Theory and Vygotsky’s (1978) Zone of Proximal Development.

3.1.3.1 Personal Construct Theory

This researcher views learning as a process of personal construction based on Kelly’s (1963) Personal Construct Theory (PCT), where students are actively involved in making sense of new information they encounter in relationship to what they already know, so that new learning can take place. His theory focuses on the general processes by which people “construe” or make sense of, and navigate, the social world (Fransella & Neimeyer, 2005, p. 9). Kelly’s (1963) fundamental postulate is that: “A person’s processes are psychologically channelized by the ways in which he anticipates events” (p. 46). Put simply, Kelly proposed that we interpret the world through mental “constructs” or patterns which we create. When we encounter a new experience, we attempt to fit these “constructs” or patterns over the new experience. Based on previous experiences we can then hypothesise about new experiences and, upon reflection, we can formulate expectations about what we encounter. This leads to the development of beliefs which we in turn use to interpret experiences. These hypotheses become our ‘personal
constructs’ which can be reinforced by some new experiences, or challenged by new encounters.

Fosnot (1996) defined constructivism according to the following principles which reflect Kelly’s PCT:

- Knowledge consists of past constructions (or conceptions). How and what one learns depends on what one already knows; “learning is development” (p. 29).
- Constructions come about through assimilation and accommodation, where “progressive structural shifts in perspective are constructed” (p. 30). As a learner is introduced to new ideas, they are required to adapt and change their old ideas.
- Learning is an organic process of invention, rather than a mechanical process of accumulation of facts where new ideas are constructed as learners question the world, “generate their own hypotheses”, and “test them for viability” (p. 29).
- Meaningful learning occurs through reflection and resolution of challenges and contradictions (caused by “disequilibrium”) which negates earlier incomplete levels of understanding (p. 29). The learner is forced to draw conclusions about new ideas and acknowledge that their ‘old ideas’ need to be reshaped or recast to build on existing knowledge.
- Dialogue “engenders further thinking”. For example, in a classroom setting a learner should be “responsible for defending, proving, justifying, and communicating their ideas”. This helps “deeper conceptual understanding come about” (p. 30).

In his 1966 essay reflecting on his theory (and later published in 1970), Kelly consolidated and simplified the language used to describe each of the corollaries of his PCT. Here, Kelly (1970) argued that the psychology of personal constructs reminds us “that all our present perceptions are open to question and reconsideration, and it does broadly suggest that even the most obvious occurrences of everyday life might appear utterly transformed if we were inventive enough to construe them differently” (p. 1). This is reflected in Fosnot’s (1996) points with regard to the constructivist view that learning is a process of invention, constantly seeking new ways to look at, or interpret the world.
In fact, Kelly’s (1970) theory articulates the very foundation of inquiry, or learning by way of inquiry, as illustrated in the following statement:

Thus any proposition we contrive must be regarded as a crude formulation of a question which, at best, can serve only as an invitation to further inquiry, and one that can be answered only through personal experience and in terms of the ad interim criterion of anticipated events. Indeed, the answer we get is not likely to be exactly an answer to our question at all, but an answer to some other question we have not yet thought to ask. (pp. 5)

Kelly (1970) expanded his basic postulate of PCT by employing a set of eleven corollaries. Seven of his corollaries that are of particular relevance to this thesis are presented below:

- Construction corollary is where a person anticipates events by construing their replications (p. 11).
- Individuality corollary is where persons differ from each other in their constructions of events (p. 12).
- Organisation corollary is where each person characteristically evolves their own construction system to infer relationships or make links between constructs, which assists them in anticipating events (p. 12).
- Dichotomy corollary refers to a person’s construction system which is “composed of a finite number of dichotomous constructs” (p. 12). Kelly argued: “A construct is the basic contrast between two groups. When it is imposed it serves both to distinguish between its elements and to group them” (p. 13). In other words, construing is bipolar, personal constructs have opposites.
- Choice corollary is where a person chooses for himself/herself which alternative, in a “dichotomous construct”, bears the greatest potential in extending his/her understanding. “Developing the usefulness of a construction system involves, as far as I can see, two things: defining it and extending it” (p. 15).
- Range corollary refers to the “focus of convenience” of a construct, meaning that a construct only has a finite range of applicability or usefulness in terms of applying it to a particular event or occurrence (p. 16).
- Experience corollary refers to how a person’s construction system varies as he/she “successively construes the replications of events”, with the variances of constructs building on one another and contributing to the development of one’s
Kelly viewed a “unit of experience” as a “cycle embracing five phases: anticipation, investment, encounter, confirmation or disconformation, and constructive revision”, followed by “new anticipations, as the first phase of a subsequent experiential cycle gets underway” (p. 18-19).

Kelly’s PCT also informs learning theory. Constructivism as a learning theory views “learner inquiry and discovery, learner autonomy, and self-motivation of the learner” as critical elements in the learning process and successful learning experiences (Leonard, 2002, p. 38). Constructivism “seeks to place the learners in an open-ended learning environment” and “focuses on how to help learners construct content that is highly iterative, subjective, and not fixed according to a single symbol system or mental construct” (Leonard, 2002, p. 38). This is represented in Kuhlthau’s (2004) research on information seeking behaviour which draws upon Kelly’s concept of construction in terms of his description of the emotional experiences encountered by individuals when constructing meaning from new information. That is, when one’s “personal constructs” are challenged this can result in emotional states such as confusion, anxiety, and doubt.

In the original words of Kelly (1955), anxiety is defined as “the awareness that the events with which one is confronted lie mostly outside the range of convenience of one’s construct system” (p. 489). As Kuhlthau (2007) stated:

The disruption caused by the new ideas may become so threatening that the new information is discarded and construction abandoned. At this point, Kelly proposes another alternative to move the process of construction along. (p. 15)

Based on Kelly’s work regarding the emotional experience of constructing meaning, Kuhlthau developed the ‘Uncertainty Principle’ for information seeking, where she argued that uncertainty occurs “due to a lack of understanding, a gap in meaning, or a limited construct” and that this underpins “the process of information seeking” (2004, p. 92). She used Kelly’s corollaries as a prototype for theory building to develop her own set of six corollaries: process, formulation, redundancy, mood, prediction, and interest (Kuhlthau, 2004, p. 103).

The works of Kelly and Kuhlthau help to explain the information-to-knowledge journey experienced by students while completing their inquiry learning project in the present study. In addition, Kuhlthau’s Information Search Process model (2004) and Guided
Inquiry framework (Kuhlthau, Caspari, & Maniotes, 2007) provided important instructional scaffolding. Both of which are designed to support students in effective information use and knowledge construction and inform the types of instructional intervention a teacher and TL can provide students during the inquiry learning process. Kelly (1970) argued that the “best we can ever do is project our anticipations with frank uncertainty and observe the outcomes in terms in which we have a bit more confidence” (p. 4). This notion captures the work of teachers and TLs as they try to help build students’ cognitive and affective capacity to successfully complete inquiry-based projects. It also informs the analysis of data in the present study with regard to use of information, use of technology and the relationships and communication that occurs within each learning team.

3.1.3.2 Social Construction Theory

Social constructionists, as they are widely referred to now in the literature, view knowledge as a social product, and learning as a social process. That is, “knowledge is created by learners in the context of, and as a result of social interaction” (van Harmelen, 2008, p. 36). This is in comparison to constructivists, who “study the multiple realities constructed by people and the implications of those constructions for their lives and interactions with others” (Patton, 2002, p. 96). Patton (2002) claimed the terms constructivism and constructionism are “difficult to distinguish and easy to confuse” (p.97). Crotty (2003) agreed that this is problematic, and argued the importance in making a distinction between constructivism and constructionism. He defined constructionism as the view that “all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context” (2003, p. 42).

This is supported by the likes of Gergen (1985) and Schwandt (1994). Crotty (2003) argued that it would be useful if the term ‘constructivism’ was reserved “for the epistemological considerations focusing exclusively on ‘the meaning-making activity of the individual mind’ and constructionism was used where the focus includes ‘the collective generation [and transmission] of meaning’” (p. 58). He saw this as one way of being able to clearly articulate the difference between the two, stating that:
Constructivism taken in this sense points out the unique experience of each of us. It suggests that each one’s way of making sense of the world is as valid and worthy of respect as any other, thereby tending to scotch any hint of a critical spirit. On the other hand, social constructionism emphasizes the hold our culture has on us: it shapes the way in which we see things (even in the way in which we feel things!) and gives us a quite definite view of the world. (2003, p. 58)

Indeed, this approach tends to be the dominant one in the literature.

Crotty (2003) argued the term constructivism, and in particular “social constructivism”, is derived largely from the work of Mannheim (1936) and Berger and Luckmann (1967) in developing “a sociology of knowledge” (p. 7). Berger and Luckmann examined the methods that members of a society use to create, or construct reality. They believed that what society, a community or a group of individuals regard as social reality is a construction based on “common-sense knowledge”, to which each individual or member contributes by selecting from all available information, to develop a picture of the world (p. 37). From an individual’s perspective, when they interact with others, they do so with the understanding that their respective perceptions of reality are related and, as they act upon this understanding, their common knowledge of reality is reinforced. To achieve this, people need to negotiate with each other regarding the meaning of the information provided within an interaction or encounter. This is aptly captured by Schwandt (2000) in the statement: “We do not construct our interpretations in isolation but against a backdrop of shared understandings, practices, language, and so forth” (p. 197). Support is thus provided to the assumption underpinning this study: that Web 2.0 technologies, such as social bookmarking platforms, blogs and wikis, are not only personal tools that can support information use and knowledge construction, but they also provide a platform for communication and collaboration between members of learning teams. These technologies are viewed as creating ‘online learning environments’ that have the power to facilitate learning conversations between the TL and students and teachers, and enhance student engagement in the learning process.

Therefore, the constructions of the teacher and TL are important as they are viewed as the facilitators of the learning process by way of conversations with the students (both face-to-face and online), placing an emphasis on helping students build independence in their use of information and technologies to inform their learning. In addition, this study
examines conversations and interactions from the student perspective as they negotiate with information, technology, processes and procedures, and with members of their learning team, family and peers.

The social construction of reality can expose the way in which a particular belief has been shaped by the sharing of ideas within a social group, or community, or society, in general. Berger and Luckmann (1967) argued these kind of reciprocal interactions lead to “institutionalisation” and, in the process of this institutionalisation, meaning is embedded in society (p. 74). Individuals’ conceptions (and beliefs), of what reality is, becomes embedded in the institutional fabric of society. Thus reality is socially constructed.

Berger and Luckmann (1967) proposed society as both an objective reality and as a subjective reality. Objective reality is based on the development of social processes which create customs, habits and beliefs that support and reinforce institutions, which can be passed from generation to generation, referred to as a social, “objective world” (p. 77). Interpreted at a micro-level, the same phenomena can apply to organisations, communities or groups, even schools or classrooms as small societies or “worlds” where common rules, protocols and understandings are “institutionalised”. Berger and Luckmann argued:

The most important gain is that each [member of society] will be able to predict the other’s actions. Concomitantly, the interaction of both becomes predictable... further widening the background common to both individuals... [thus] expanding institutional order. (pp. 74-75)

Nevertheless, when a second generation inherits certain institutions which, by society’s standards, are self-evident, they may not understand why:

A social world [is]... a comprehensive and given reality confronting the individual in a manner analogous to the reality of the natural world… In early phases of socialization the child is quite incapable of distinguishing between the objectivity of natural phenomena and the objectivity of the social formations… The objective reality of institutions is not diminished if the individual does not understand their purpose or their mode of operation… He must ‘go out’ and learn about them, just as he must learn about nature. (pp. 77-78)

The need for an individual to “go out and learn” leads to the second part of the theory where society exists as subjective reality. This requires a process of socialisation where
an individual becomes inducted into society, where he/she can participate in the institutional structure of society, i.e., its objective reality. An individual “is not born a member of society. … he becomes a member of society” (p. 149). When an individual becomes “successfully socialised”, this results in “the establishment of a high degree of symmetry between objective and subjective reality” (p. 183). Conversations between individuals, and communication within a group, organisation or society assist in the maintenance of an individual’s subjective reality. This also supports the existence of personal “identity”, and, ultimately, an individual’s sense of belonging (pp. 194-5). Social construction theory adds further depth to the philosophical underpinnings of the present study. It can be used to understand how individuals (students, teacher and TL) develop shared meanings about the rules, protocols, expectations and practices within the classroom and in online learning spaces. The framework it provides is also important for exploring the relationships and dynamics between a student, teacher and TL as a learning team, and in the blended classroom.

3.1.3.3 Zone of Proximal Development

As part of Vygotsky's theory of social learning, he developed the concept of identifying a “zone” where intervention would be most useful or helpful for a learner when encountering new information, skills or understandings. He called this the Zone of Proximal Development (ZPD), defining it as “the distance between the actual developmental level determined by individual problem solving and the level of development as determined through problem solving under guidance or in collaboration with more capable peers” (Vygotsky, 1978, p. 86). The level of “actual development” is the level of development that a learner has already reached where he/she is capable of solving problems independently, whereas the level of potential development is the level of development that a learner is capable of achieving with the support of others. In their critique of Vygotsky’s ZPD theory, Bruner and Rieber (2004) proposed that this definition suggests ‘thought’ as a process of dialogue with oneself and others, resulting in “both an individual achievement and a social one” (p. 12). This reflects the social constructionist’s view of knowledge as a social product and learning as a social process.

Pritchard and Woollard (2010) stated that: “Appropriate and timely interventions in the course of learning within an individual’s ZPD has become an essential strategy for
teachers working with the social constructivist [sic] approach” (p. 9). Individuals require scaffolding to support new learning. Wells (1999) referred to scaffolding as “a way of operationalising Vygotsky’s (1987) concept of working in the zone of proximal development” (p. 127). Wells identified three important features of scaffolding which fit within the Vygotskian ZPD framework, including: the dialogic nature of discourse in which knowledge is co-constructed; the significance of the activity in which ‘knowing’ is embedded; and the role of artefacts that mediate ‘knowing’ (p. 127). Ultimately the role of a mediator or teacher in supporting a learner’s development is to provide scaffolding to assist the learner in getting to the next stage, phase or level in the learning or knowledge construction process. Within the context of the present study, which explores learning team interactions within a blended learning environment, i.e., a blend of face-to-face classroom and online learning spaces, the Web 2.0 technologies provide a platform for observing and recording the above three features of scaffolding in operation.

Kuhlthau (2004) saw Vygotsky’s theory as providing “a way of understanding intervention in the constructive process of another person” (p. 129) and therefore it is a useful lens to examine students’ information behaviour. As a result, she developed what she coined the “zone of intervention” which is “that area in which an information user can do with advice and assistance that he or she cannot do alone or can do only with great difficulty” (p. 129). This ‘zone’ is where Kuhlthau proposed that a teacher and/or TL can provide the necessary scaffolding to help a student continue on the process of construction. McKechnie (1997) also applied Vygotsky’s ZPD as a conceptual framework within the public library context to explore how parents and librarians can support young children’s access to and use of information resources. She observed how the library services and collections provided many learning opportunities for pre-school age children and their mothers while visiting their public library, “particularly for learning how libraries work and for acquiring emergent literacy skills” (1997, p. 67). Her study identified a range of services and ‘strategies’ that could be employed by librarians to provide greater and/or more effective scaffolding to support pre-school age library use and learning.

Pritchard and Woollard (2010) referred to scaffolding as being both planned and opportunistic, with interventions principally being planned by the teacher where they
expect or anticipate instructional support will need to be given as a means to assist student progress to meet a learning outcome (p. 38). They viewed those opportunistic interventions as ‘ad hoc’ because they are more difficult to plan and are dependent upon the teacher being “in the right place at the right time” to provide the support a learner or group of learners may need (p.38). This is particularly relevant to Kuhlthau, Maniotes, and Caspari’s (2007) Guided Inquiry framework, which has ‘planned’ interventions built into the inquiry process, with teachers and TLs being provided with a suite of strategies to support ‘ad hoc’ interventions at the point-of-need for each student. Diagnosis of need is often involved so that intervention can be based on students’ reactions and feelings during different stages of the Information Search Process.

In terms of the social construct context and scaffolding, the added dimension of using technologies by teachers, to provide scaffolding in a Zone of Proximal Development, has also been recently explored by researchers, particularly in higher education as outlined by Dyke, Conole, Ravenscroft and de Freitas (2007) with regards to dialogic activity in e-learning. Hung (2001), and Hung and Chen (2001) have explored how Vygotsky’s theory can inform design principles for web-based learning and supporting participant collaboration in knowledge building environments. Van Harmelen (2008) explored ZPD within the context of supporting students’ Personal Learning Environments (PLEs) at the tertiary level using learning management system tools and Web 2.0 technologies, or a combination of both. Chandra and Chalmers’ (2010) study of pre-service teachers using blogs and wikis concluded: “Social constructivist approaches are particularly aided by Web 2.0 tools as mediating mechanisms between collaborating students and between students and teachers”. Scaffolding can take place in these online spaces, allowing a teacher to “help the students progress their learning in a Zone of Proximal Development” (p. 40). Therefore, these studies are particularly pertinent to the research presented in this thesis, because the researcher was interested in exploring how teachers and TLs may be able to provide instructional intervention using Web 2.0 technologies. In addition, Vygotsky’s ZPD theory can be used as a lens to explore the provision of online scaffolding to assist students’ progress throughout the inquiry process.
Zone of Proximal Development theory is the final theoretical strand underpinning the method adopted for the research undertaken for this thesis. The next section introduces ‘ethnography’, the method used for the study.

3.2 Methodology

3.2.1 Ethnography

Suthers (2005) defined ethnography as a “descriptive methodology”, i.e., “data-driven, seeking to discover theoretical categories in the data rather than impose them in the analysis” (p. 667). Thus ethnography can be a useful way of describing what actually happens in a social context or within a specific phenomenon, particularly when that social context or phenomenon is new or emerging, and has not (as yet) been formally explored in empirical research. This is the case with the investigation of how Web 2.0 technologies support student learning using a guided inquiry approach in the study presented in this thesis.

Ethnography has a complex history which, according to Hammersley and Atkinson (2007) is “one of the reasons why ‘ethnography’ does not have a standard, well-defined meaning” (p. 2). The term ethnography has been used to label a range of research areas, including ‘qualitative inquiry’, ‘fieldwork’, ‘interpretive method’, and ‘case study’ (p. 1). A range of definitions have been offered by prominent qualitative methodologists and ethnographers including Spradley (1979), Glesne (1999), Brewer (2000), Goodall (2000), Denzin and Lincoln (2005), Angrosino (2007), Creswell (2007), Fetterman (2007), Hammersley and Atkinson (2007), Davies (2008), Walford (2008), Wolcott (2008), Morse and Niehaus (2009), and Murchison (2010).

Ethnography, as naturalistic inquiry, is designed to describe or capture what happens in the field: how the people involved view and interpret their own actions and experiences, along with the actions of those with whom they interact; as well as the processes and outcomes of these interactions. Murchison (2010) highlighted the breadth of ethnography as a method in the following statement:
Researchers employ ethnography as a research strategy in a number of disciplines, including anthropology, sociology, and education, and as a practical research strategy in marketing, management, and public policy arenas. This breadth of use indicates that the utility of the approach has become apparent in many different circumstances where better understanding of social and cultural dynamics is desirable. (p. 4)

A number of new ethnographic approaches have emerged in the past few decades – not necessarily within the traditional ethnographic mould - in response to race, gender, identity, postcolonial and indigenous issues. They include critical ethnography, feminist ethnography, auto-ethnography, performance ethnography, portraiture and photo-ethnography (Mertens, 2010, pp. 231-233). As a result of greater access to ICTs for individuals, homes and organisations in the late 1990s, along with the emergence and later ubiquity of online communities, virtual ethnography (also referred to as online ethnography or digital ethnography) has developed. Now a more popular approach to ethnography in the twenty-first century, it will be dealt with in detail in the next section of this chapter (see 3.4.).

Hammersley and Atkinson (2007) identified five features which usually form a part of ethnographic work. These include the following:

- People’s experiences are studied in everyday contexts, as opposed to experimental conditions, thus the research takes place “in the field”.
- Data gathering involves a range of sources, including interviews and documentary evidence, with participant observation and/or relatively informal conversations as techniques for collecting data.
- Data collection is relatively unstructured in that categories emerge from the data, “generated out of the process of data analysis” as opposed to being built into the research design.
- The focus is usually on a few cases to facilitate in-depth inquiry. Studies are usually relatively small-scale, with some observing a single subject or group.
- Data analysis involves “interpretation of the meanings, functions, and consequences of human actions and institutional practices, including how these are implicated in local, and perhaps also wider, contexts”. Verbal descriptions, explanations, and
theories are usually produced, with “quantification and statistical analysis play[ing] a subordinate role at most” (p. 3).

Troman and his editorial colleagues (2006) argued that ethnography has become “one of the major methods of researching” educational settings due to the fact that they are “sites for social and cultural reproduction of structures and relations and key sites of mediation, contestation and resistance” (p. 1). In addition to the generic five features listed above by Hammersley and Atkinson (2007), Troman and colleagues identified the following key elements as central to ethnographic research in education (Troman, Gordon, Jeffrey, & Walford, 2006). These include: a focus on “the study of cultural formation and maintenance”; “direct involvement and long-term engagement” of the researcher; recognition of the researcher as “the main research instrument”; the “high status given to the accounts of participants’ perspectives and understandings”; the researcher’s “engagement in a spiral of data collection, hypothesis building and theory testing/leading to further data collection; and a “focus on a particular case in depth, but providing the basis for theoretical generalization” (p. 1).

Williamson (2006) argued that ethnography as method is “especially suited” to those research questions “requiring in-depth exploration” (p. 98). Whenever human behaviours are being observed, multiple perspectives or realities of processes, encounters and experiences are, in the words of Kelly (1963), construed by individuals within that social context. Such complexities require in-depth exploration, and the ethnographic method allows for the gathering of data that generate thick description (Geertz, 1973), which is one of its strengths. Allard and Anderson (2005) believed this is best achieved by researchers immersing themselves “into the setting, to uncover the different meanings given to the behavior by the actors involved, and then describing these interpretations in a rich, layered (thick) manner” (p. 833). Based on Geertz’s (1973) pioneering concept, it encourages an ethnographer to present a detailed picture of what he or she has observed and even ‘lived’ as a participant observer (p. 10).

Williamson (2006) also postulated that an ethnographic approach is “well suited to constructivist frameworks”, enabling the “meanings or perspectives of participants to be studied in-depth and their particular words to be used to convey their meanings directly
to the reader” (p. 89). She argued: “Ways of thinking about issues, which may not have occurred to the researchers, are often revealed. Thus, the complexities of the real world have some chance of emerging” (p. 98). However, as Geertz (1973) warns this is one of the major challenges faced by ethnographers. He argues that because ethnographic description is interpretative and often based on the “flow of social discourse”, the “interpreting involved consists in trying to rescue the said of such discourse from its perishing occasions and fix it in perusable terms” (p. 20).

The researcher of this thesis acknowledges Geertz’s warning of the above challenge, and has attempted to convey participants’ meanings as directly as possible, by making extensive use of quotations drawn from interviews with the participants and from field notes made when observing the students, teacher and TL in class and online. The goal is to illustrate the multiple perspectives or realities experienced by individuals while completing inquiry learning projects. In addition, three vignettes are used throughout the findings chapter (see Chapter 5: Findings) to present short ‘stories’ or mini-cases describing individual incidents that occurred throughout the period the researcher was observing the class. The final interviews with students, the teacher and TL were also used to inform the development of these ‘cases’. These vignettes are referred as ‘cases in point’, and are inserted throughout Chapter 5 when and where the researcher felt it was the most appropriate way of illustrating particular issues or experiences encountered by participants. This was an attempt to accurately present participants’ views and experiences ‘in their own words’. Another reason for this approach was the complex and highly individualistic nature of open-ended inquiry-based projects, with technology access and use resulting in further layers of complexity for participants in the study.

### 3.2.2 Mixed methods ethnography

Because the research involves predominantly qualitative elements with a component of measurement, it is also appropriate to label this study as ‘mixed methods’ ethnography. Tashakkori and Creswell (2007) stated that mixed methods researchers place “mixed methods on a continuum that includes qualitative, quantitative, and mixed approaches rather than using the dichotomy of qualitative or quantitative” (p. 207). They cited the work of Newman, Ridenour, Newman and DeMarco (2003) and Teddlie, Tashakkori, and

The rising popularity of mixed methods shifts the debate from a focus on the differences between approaches to a concern that one employs the most appropriate methods for a particular study. Mixed method approaches are being seen as an increasingly legitimate way of exploring complex issues in social and behavioural research. In fact, in the closing chapter of their edited work, *Handbook of Mixed Methods in Social and Behavioral Research*, Tashakkori and Teddlie (2003) concluded:

> Mixed methods research is a distinct third methodological movement in the social and behavioural sciences. This third methodological movement rejects the “either-or” of the quantitative-qualitative approaches. It has its own nomenclature, paradigm orientations, designs, and practices that are different from the other two movements. (p. 672)

By 2009, Teddlie and Tashakkori presented mixed methods as “the third research community”, devoting one half of their textbook, *Foundations of Mixed Methods Research*, to the examination of mixed methods as a methodological movement, arguing that mixed methods has matured considerably in the latter half of the 2000s. They concluded by asserting the importance of providing such a text to support the “ability of single researchers to examine issues and research problems from multiple perspectives” (p. 328). Other prominent mixed methods methodologists include Newman and Benz (1998), Tashakkori and Teddlie (1998), Krathwohl (2004), Brewer and Hunter (2005), Bryman (2007), Collins, Onwuegbuzie and Jiao (2007), and Creswell and Plano Clark (2007).

In relation to mixed methods, ethnography can draw on qualitative and quantitative data, resulting in the use of varied techniques. As Morse (2003) stated, ethnography consists of:

fieldwork (informal interviews and participant observation)... semi-structured interviews, surveys” as well as “any other sources that the ethnographer sees fit such as documents, psychometric tests or scales… and whatever will help the ethnographer to answer the research question. (pp. 191-192)

Regardless of whether ethnographic approaches are included or not, there are reasons to take care with the way in which methods and/or techniques are brought together in mixed
methods research. While appreciating the benefits of mixed methods research, Greene and Caracelli (2003, p.107) urged consideration of the assumptions underpinning different epistemologies which constitute “different ways of seeing, knowing, and valuing”. Although Mellon (1990) believed that methodologies can be profitably combined, she warned that great care needs to be taken because they “are separate and distinct from one another, with different purposes, methods and outcomes” (p. 5). Greene and Caracelli (2003) expressed particular concern about the nature and role of inquiry paradigms in mixed methods practice. This view was later echoed by Richard and Acheson (2009) who while seeing the need to encourage mixed methods research, believed a mixed methods researcher must place a strong emphasis on articulating the “philosophical intersections” of the methods they employ (p. 23).

As a way to avoid problems caused by “muddling methods”, Morse (2003) advocated the importance of recognising the “theoretical drive of the project” (p. 193), which she defined as “the overall direction of the project as determined by the original questions or purpose and is primarily inductive or deductive” (p. 190). Once the theoretical drive is determined, “supplemental research strategies” can be used to collect data that would not otherwise be obtainable by using the main method (p. 191).

Although the “theoretical drive” of the present research is clearly inductive, and the ethnographic study was undertaken within a constructivist paradigm, the researcher reached the conclusion that there could be considerable benefit resulting from the use of a well-tested instrument to measure students’ dispositions in terms of ‘learning styles’ (as stated in Section 3.1). Although measurement of learning styles and dispositions is often used in a positivist way to make inferences about large samples of students, its use here as an additional source of data about individual students is consistent with the interpretivist standpoint adopted. The fact that learning styles had been successfully measured in the past by Heinström and Todd (Heinström, 2006a, 2006b, 2006c; Heinström & Todd, 2006) in a study examining student experiences in completing Guided Inquiry projects, this provided a sound argument for the adoption of this approach within this particular component of research. Thus, the instrument was used in the present study to inform the analyses of students’ use of Web 2.0 technologies in terms of any differences between the experiences, preferences or behaviours of the students as surface,
deep and strategic learners. Such experiences, preferences or behaviours could have important implications for the design and implementation of instructional interventions, either planned or ad hoc, by TLs and teachers.

This researcher also heeded the advice of Tashakkori and Creswell (2007) who stated that “research questions are shaped by the purpose of a study and in turn form the methods and the design of the investigation” (p. 207). They argued that “a strong mixed methods study starts with a strong mixed methods research question or objective”, and recommend that such a study should include “at least one explicitly formulated mixed methods question or objective about the nature of mixing, linking, or integration (i.e. how the findings of various strands relate to one another)” (p. 207). Teddlie and Tashakkori (2009) refer to this as a ‘hybrid’ or ‘integrated’ research question that comprises separate quantitative and qualitative sub-questions to answer a particular strand or phase of a study. In the present study, the second of the five main research questions, “(b) How do learning styles affect students’ use of Web 2.0 technologies, if at all, while they are in the process of completing a project-based assignment?”, is specifically a mixed methods research question which requires the integration of quantitative data (based on results of the ASSIST questionnaire for each student) with qualitative data of students’ use of Web 2.0 technologies.

For Tashakkori and Creswell (2007), the nature of such integration should be complementary and, in this study, the results of the quantitative data are used to provide an additional lens to explore students’ use of Web 2.0 technologies, as well as to provide triangulation. Thus elaboration and further insights are provided to complement the more extensive results from the qualitative component of this study. In fact, both the quantitative and qualitative elements of this second research question (as above) are exploratory in nature, which fits within the parameters of ethnography as a method as discussed in Section 3.2.1.

3.3 Summary

This chapter has discussed, in detail, the methodological strands involved in the research presented in this thesis. The components have been blended to provide a framework for
undertaking, analysing and reporting the study. The key interpretivist underpinnings include a constructivist approach in which ‘zone of proximal development’, ‘personal construct’ and ‘social construction’ theories have played their part. Details of the interpretivist ethnographic approach underpinning the study has been presented, and the mixed methods nature of the inquiry has also been highlighted.
Chapter 4 Research procedures and techniques

This chapter outlines in detail how the sample was selected and the data were collected and analysed using a range of ethnographic techniques. It begins with the sample, including the sampling technique employed to select the research site and participants, along with the ethical procedures employed in gaining access to the site. This is followed by descriptions of the school setting used as the research site and the design of the inquiry unit under investigation, as well as descriptions of the teacher, student and TL participants. The chapter then describes data collection techniques including student questionnaire, semi-structured interviews, classroom observation, online observation of student Web 2.0 learning spaces, review of student-generated documentation, and review of learning task and assessment documentation, highlighting the reasons for the choice of each. This is followed by procedures carried out in the analysis of data collected, including the use of SPSS 14.0 and QSR NVivo8 software programs, and the use of memo writing as an analytic technique. The chapter concludes with an exploration of the trustworthiness of the research.

4.1 The sample

Qualitative or interpretive research depends on small samples that are purposively or purposefully selected. Patton (2002) observed that:

the logic and power of purposeful sampling derive from the emphasis on in-depth understanding… [which] leads to selecting information-rich cases for study in depth… from which one can learn a great deal about issues of central importance to the purpose of research. (p. 46)

Purposeful sampling means selecting subjects who represent the important characteristics that a researcher considers of interest to the study. Based on the researcher’s personal knowledge, “subjects with the required expertise or background for the study” are hand-picked (Tanner, 2002, p. 91). Maxwell (1997) argued purposive sampling is an important technique used for those qualitative studies where ‘‘particular settings, persons, or events are deliberately selected for the important information they can provide that cannot be gotten as well from other choices’’ (p. 87). In other words, the researcher selects cases from whom he or she can learn the most. With this approach,
the researcher is not compelled to sample multiple cases that do not meet the uniqueness of a particular case (Teddlie & Yu, 2007).

Criterion sampling is a type of purposeful sampling which is designed to assist in the selection of cases that “meet some predetermined criterion of importance” to the investigation, i.e., the sample becomes “representative of the phenomenon of interest” (Patton, 2002, p. 238), thus appropriate to key aspects of the research questions under investigation. The key aspects required within a school for the purposes of the study included:

(1) a TL with expertise in, and willingness to trial, Web 2.0 technologies;
(2) a school facility with an adequate level of access to computer and Internet technologies for all participants in the classroom, including in IT labs and the school library, as well as participant access from home;
(3) a TL at the school with a knowledge of subjects, units of work and assignment work which could potentially meet the requirements of the research, i.e., that students complete a project-based assignment within a guided inquiry framework, selecting their own topics, developing focus question-argument-hypotheses about their topics, then conducting their own research to address these before finally creating a report of their findings/conclusions;
(4) a teacher of a class with a project-based assignment as part of the curriculum as described in (3), who was also planning to integrate Web 2.0 technologies as part of the assignment design, and who was willing to collaborate with the TL;
(5) a class with a project-based assignment to be undertaken in the year of data collection; and
(6) a teacher and students who would tolerate the researcher’s presence in the classroom a number of times during the project, allow the researcher access to students’ Web 2.0 learning spaces, and be willing to complete a questionnaire and be interviewed as per a set of ethical procedures outlined in Section 4.1.4.

The researcher used her own professional network to contact TLs in three secondary schools in Australia to see if their school site met the above criteria. These TLs were selected as potential participants because of their work as Web 2.0 technology innovators.
in their respective schools and because they had a history of collaboratively planning and teaching with teachers as part of their role as a TL. While one of the three TLs contacted was intending to trial a range of Web 2.0 technologies with a number of classes throughout the year, these would not involve a class that was completing a project-based assignment using a guided inquiry framework. Another TL was hoping to work with a class on a guided inquiry project later in the year, but she was in very initial stages of negotiation with teachers at her school and was not confident that this would definitely eventuate in the time period of the study. The third TL was able to identify a potential collaborative partnership with a teacher of a Year 10 elective subject which involved an independent project component as part of the curriculum, and which would occur in the proposed timeline for data collection. This TL was also planning on trialling a guided inquiry approach, and she was expected to work with teachers in the same year to trial the use of Web 2.0 technologies in the curriculum. Given this TL was able to identify a teacher and class undertaking a Year 10 elective subject as a ‘best fit’ in terms of meeting the above professional goals for the year while also addressing the study selection criteria, the TL sought permission from her Principal, Head of Library Services and the classroom teacher to volunteer their school as the research site for this study.

4.1.1 Description of the research site

Based on the sampling technique outlined above, the research site became a large independent school located in metropolitan Sydney, New South Wales, Australia. At the time data collection was undertaken, the school consisted of primary and secondary school campuses. The primary campus was dedicated to boys education only in Years 3-6 (Junior School) and the secondary campus enrolled boys from Years 7-9 (Middle School), with co-education commencing in Year 10 (Senior School). The secondary school also catered for a small group of boarding students for Years 10-12. Total student population at this school ranged between 1800-1950 students per year, with a population of just under 200 teaching staff. The New South Wales school year consisted of four (4) school terms of approximately 10-12 weeks per term.

The school maintained a strong reputation for academic excellence with a focus on supporting individual student achievement across a range of scholarly, creative and
sporting arenas. It employed the New South Wales Board of Studies’ curriculum as well as the Teaching for Understanding framework from the Harvard Graduate School of Education’s and Project Zero (Wiske, 1998) to develop deep thinking across the curriculum.

4.1.1.1 The school’s technology infrastructure

The school was well-equipped with desktop computers throughout many classrooms as well as the IT labs, along with desktop and laptop computers in the school library. All teachers and TLs were given a laptop to support teaching and administrative functions. The school was cable-networked throughout with student Internet access provided principally via desktop computers in some classrooms and common learning areas such as the library. Those students who were boarders were also provided with desktop computers in their rooms. Students and teachers had access to file storage on a shared drive which could be accessed within the school network and from home via a username/password log-in to the school’s intranet. Students in the secondary school and all staff were provided with their own school email account.

4.1.1.2 The school library

The secondary school library was located in the centre of the secondary school precinct and was open from 8am to early evening on most week nights and for restricted hours on the weekend and during school holidays. Thus, provision was made for extended library hours for teacher and student use throughout the school year. The library team consisted of a Head of Library, a team of TLs (at the time of data collection there were seven TL positions), and a support team of library technicians and administrative staff. Each TL was formally assigned as a librarian and teaching partner to a set of subject/year level teachers per year with the express responsibility of providing targeted, customised information services to each of their teaching teams. They also participated in all curriculum planning meetings conducted by these teaching teams, and collaborated with individual teachers within these teams as information-IT-learning specialists as required. For example, the TL who participated in this study was assigned Year 8 English, Years 7-12 Music, Years 9-10 Global Studies and Years 11-12 Legal Studies, while another TL within the Library team might have been assigned Year 9 English, Years 7-12 History
and Years 9-12 Drama for the year. While a TL’s subject/year allocation might be rolled over into subsequent years, one or more of their subject/year responsibilities could be revised at the beginning of a school year based on staffing changes within the library team. These changes were negotiated with the Head of Library as required.

4.1.1.3 The Global Studies curriculum

At the time of the research, Global Studies was a subject which was taught as an elective within Stage 5 (i.e., Years 9-10) of the school’s curriculum. The Global Studies syllabus was endorsed by the Board of Studies NSW as part of its School Developed Board Endorsed Course (SDBEC) program (Board of Studies NSW, 2011). It is a humanities-based, multidisciplinary subject which is designed to assist students’ understanding of contemporary events and issues, such as human rights, international aid, social injustice, future studies, philosophy, conflict and international issues and politics. Students are encouraged to explore the impact of events and issues at the global, national and local levels to help them develop skills for global citizenship.

The majority of learning in the Global Studies subject involved students working on in-depth research projects, both individually and in groups. Students chose their own topics to explore, conducted primary and secondary research to inform their understanding of topics, and were often required to select their own mode of presentation for their project findings and conclusions – in effect, taking on the role of expert for a topic and teaching the rest of the class about the topic.

4.1.2 Description of the research participants

Research participants were twelve students in a Year 10 Global Studies class and their teacher. The TL assigned to support the Global Studies curriculum was also a participant.

4.1.2.1 The Global Studies teacher

At the time data were collected (in 2007), the teacher participant had been teaching for seven years, five of which were at the research site. She was qualified to teach Legal Studies, Global Studies, Geography, Society and Culture, Commerce and History, and
was enrolled in a Masters in International Relations course which directly informed her teaching of Global Studies. The teacher’s understanding of, and use of technologies to support teaching and learning had been developed solely through school-based professional learning programs and ‘learning on the job’. She had not undertaken other external or postgraduate study in educational technology.

In her teaching of Year 9 and 10 Global Studies classes in previous years, she had developed a collaborative partnership with one of the TLs on staff, principally based on resource provision where the TL would locate relevant resources to support a unit of work and develop a customised collection of high-demand materials to be placed on ‘Special Reserve’. The TL was also used to provide some supplementary teaching on “How to do research”, including how to search for resources using full-text databases such as EBSCOhost and teaching the conventions of in-text referencing and bibliographies.

The teacher had been assigned a new TL partner for the year, to support the teaching of Global Studies (the latter being the TL participant observed in this study). The teacher had collaborated for the first time with this newly assigned TL in Term 2 on a group-based issues project with the Year 10 Global Studies class. She had also spent time in Term 2 planning with the newly assigned TL to revise the Global Studies unit of work for Term 3 which was an individual inquiry-based assignment task known as the Personal Interest Project (PIP).

4.1.2.2 The Global Studies students

The class consisted of twelve Year 10 students, with eight of the students being male and four female students between the age of 15 and 16 years old. To gain entry to Global Studies as an elective subject, these students were required to nominate their interest in taking the subject as a preferred elective, and then undertake an interview with one of the Global Studies teachers to determine their capacity to cope with the demands of the ‘independent learning approach’ employed by this subject. Students were required to demonstrate how their approach to studying made them ‘eligible’ to enrol in the Global Studies elective. This selection process also reinforced the independent learning demands of the Global Studies curriculum, as well as the teachers’ expectations of students’ performance as independent learners.
Three of the twelve students were residents of the school’s boarding house. Each boarding student was allocated a single bedroom which was furnished with a study desk area and a school-issued laptop computer. The boarding house computers were connected to the school network, with Internet access provided between the hours of 6am and 11pm. Students who were working online from the computers in their bedroom were automatically logged off the network at 11pm.

The other nine students in the class lived at home, with all of them having access to a computer and the Internet there. Five of these students had their own desktop or laptop computer at home, while two of the students shared a computer with their siblings and two students shared a computer that was used by the parents as well as the children in the family. All households subscribed to a broadband Internet service.

All students, no matter whether they were day students or boarders could also gain access to the school library’s computer and Internet facilities, along with its collection and services between 8am and 9pm on weekdays and for a limited number of hours during the day on weekends, and during selected weeks within the school holidays.

4.1.2.3 The teacher librarian

The TL participant had been teaching for thirty years with the last five years of her career working as a TL. Her teaching background included the teaching of Physical Education (PE), Geography, Legal Studies, History and Economics before she retrained as a TL, graduating with a Masters qualification in 2002. She had been working at the research site for five years as part of the school library team. At the time of this study, she was assigned as the TL responsible to work with teachers of Years 11-12 Legal Studies, Year 8 English, Year 7-12 Music and Year 9-10 Global Studies. This resulted in the TL working closely with approximately twenty teachers across four curriculum areas throughout the year.

The TL’s role in supporting these subject areas and teaching staff included attendance at all subject planning meetings, working with teachers to build the school library collection in these subject areas, providing customised resourcing support and information services
for the teachers and students of these subjects, and the collaborative planning and teaching of units of work, along with the assessment of student work as required.

While the TL had no formal qualifications or training in the use of educational technology, she had a keen interest in the use of technologies to support teaching and learning. The majority of her learning about Web 2.0 and emerging technologies was informed through her reading of a range of professional education and technology journals, and from discussions with students at her school, whom she found to be excellent sources of information and inspiration on new technology hardware (what she called ‘gadgets’), computer programs and Web 2.0 applications. One of the TL’s performance goals for the year of the data collection was to test and trial new Web 2.0 technologies and support teachers’ integration of Web 2.0 technologies in the curriculum. In that year she had already presented a number of sessions on a range of Web 2.0 technologies at a whole school professional development day, as well as providing faculty-based workshops and individual training sessions for teaching staff. Her technology leadership role as a TL was also formally acknowledged in her membership on the school’s Information Technology Committee and a newly formed school-based Web 2.0 Working Party in that year.

In the year of this study, the TL had already team taught the Year 10 Global Studies class in Term 2 where the students worked in groups using a wiki to complete an issues-based inquiry project. The TL’s main role as a teaching partner of this unit of work was to support the student group’s use of a wiki as their collaborative learning space. In this same term, the TL worked with the teacher to revise the inquiry-based unit of work planned for Term 3 which involved students’ completion of an individual personal interest project.

4.1.3 Description of the inquiry-based unit

The PIP unit required students to explore an international issue of their choice with the main compulsory criterion being that each student was to explore a global studies issue of personal interest to them that had some international significance, i.e., its impact needed to extend beyond Australia.
Students were required to maintain a ‘learning log’ where they reflected on their experiences throughout the inquiry learning process. They were provided with a PIP Information Booklet that contained a range of instructional scaffolds to help them work through the inquiry process, including an outline of an information process model based on the NSW Department of Education and Training (2007) model. Students were also required to complete three short progress reports using a template which the teacher and TL designed based on guided inquiry progress report templates devised by Fitzgerald (2007) and the School Library Impact Measure (SLIM) survey toolkit (Todd, Kuhlthau, & Heinström, 2005). These progress reports were designed to capture student feedback in terms of the physical, cognitive and affective dimensions of the inquiry learning and information process experience throughout the PIP, and their use of the wiki, blog or social bookmarking technologies (see Figures 4.1, 4.2 and 4.3).

Students were asked to use either a wiki or a blog as their own personal online ‘project space’ for the completion of their PIP. The TL also introduced students to the social bookmarking tool, Delicious (http://www.delicious.com), as a way of supporting the information-gathering phase of their project. She also created a Global Studies Delicious site to support the resourcing of students’ projects. The TL’s role as a teaching partner was principally one of Web 2.0 technology expert both for the teacher and her students, providing topic selection and resourcing support for students, and assessor of student bibliographies and learning logs. The teacher’s role in the teaching team involved topic selection/approval, project design and research process support, support for students’ writing up of project content, and assessment of project reports. The teacher, TL and researcher were registered as ‘members’ to each student’s Web 2.0 project space and social bookmarking space. Students were also able to email the TL and teacher out of normal class time to ask questions and to request help from them as required.
**Personal interest project: Progress report 1**

Due: Term 3, Week 5 (uploaded to your wiki/blog)

The purpose of this report is to help you to reflect on the research topic and question you have chosen for your PIP. Please provide as much detail as possible so that Ms [Teacher] and Mrs [TL] can identify areas where they can help you.

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Research Topic (area of research)</th>
</tr>
</thead>
</table>

What do you already know about this topic?

<table>
<thead>
<tr>
<th>Research Question</th>
</tr>
</thead>
</table>

Briefly explain why you feel it is important to ask this question.

<table>
<thead>
<tr>
<th>Describe any difficulties you had in deciding on your topic and developing your research question.</th>
</tr>
</thead>
</table>

How did you feel during this part of your research project? Briefly describe how you felt (e.g. anxious, confident, frustrated, happy, relieved) at different times or stages while deciding on your topic and developing your research question.
### Personal interest project: Progress report 2

**Due: Term 3, Week 8 (uploaded to your wiki/blog)**

The purpose of this report is to help you to reflect on your process of collecting and organising the information for your PIP. Please provide as much detail as possible so that Ms [Teacher] and Mrs [TL] can identify areas where they can help you.

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research Topic (area of research)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research Question (If your question has changed, please explain why)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**What MORE do you now know about your topic?**

**Describe any difficulties you had during the locating, selecting and organising stages of your research.** For example, did you have any problems collecting and analysing your data, or problems trying to develop a convincing argument based on your data?

**Describe any difficulties you have had using your wiki/blog or del.icio.us?**

**How did you feel during this part of your research project?** Briefly describe how you felt (e.g. focused, satisfied, anxious, confident, frustrated) during the locating, selecting and organising stages of your research.
<table>
<thead>
<tr>
<th>Stage of Research</th>
<th>What Would You Do Differently?</th>
<th>What Did Not Work?</th>
<th>Worked Well?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining Topic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presenting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| What do you understand about your topic as a result of doing this research? Describe your feelings at this time...

Use the following table to reflect upon your successes and failures at each stage of the research process.
4.1.4 Access to the research site and informed consent

Before the research could begin the researcher as a PhD candidate was required to submit an Application for Approval for Use of Human Participants or Materials in Research form to Charles Sturt University’s Ethics in Human Research Committee (EHRC). The project was approved and assigned protocol number 2007/079. A copy of the EHRC approval letter and copies of ethics support documentation is presented in Appendix A.

The application identified the following ethical issues that needed to be considered in undertaking the study: confidentiality, anonymity, informed consent, and time requirements. Provision was made in the information sheets and consent forms to assure all student, teacher and TL participants of their confidentiality and anonymity in the reporting of research findings through the use of pseudonyms. Real names were only used on the signed consent forms, while in the reporting of this study, the teacher is referred throughout as ‘Ms [Teacher]’, the TL is referred to as ‘Mrs [TL]’, and each student is referred to as a number, i.e., ‘Student01’, ‘Student02’, ‘Student03’, and so on. In addition, all transcripts of interviews, questionnaire results, and copies of student-generated documentation were de-identified using the above pseudonyms. This meant the researcher’s supervisory team only viewed raw data in a de-identified format. Confidential records about each participant were stored and destroyed as per University EHRC guidelines.

In terms of informed consent, the information sheets and consent forms clearly stated that the teacher, TL and student participants (and their parents) had the right to be fully informed of the intent, nature and scope of the research being undertaken before deciding if they wished to participate. Given that the students were minors, measures were taken to ensure their rights were protected and that they felt empowered in their decision to participate or not participate in the study. The information sheet and consent form clearly stated that participation was voluntary and that any student not wishing to participate would not be penalised academically in any way, and that their relationship with their teacher, TL and school would not be adversely affected. Thus students could nominate their agreement to participate by signing the consent form, or not signing the consent form. While in NSW students above age 14 are legally able to sign such a
In terms of time requirements, every effort was made to minimise disruption to the work completed during class time. The researcher was positioned in the classroom as a silent observer instead of interrupting students by asking them questions or interacting with them as a teacher participant. Although, students’ completion of an entry questionnaire and a final interview were undertaken during normal class time, each took only on average 15-20 minutes to complete, resulting in a total of 30-40 minutes of each student’s time being taken from their Global Studies classwork during the three month period of data collection. Thus an attempt was made to minimise the burden of time for participants.

In addition to University requirements, to conduct research within a NSW school one must meet the procedures and standards of a Working With Children Check in accordance with Section 36 (1) (f) of the Commission for Children and Young People Act 1998. This approval allowed the researcher to visit the school to conduct classroom observations and student interviews.

4.2 Data collection

As discussed in Chapter 3, ethnographic research “relies on developing a full description of a society or group of people… [which] provides the details of their everyday lives” (Charmaz & Mitchell, 2007, p. 160). Data from multiple sources were collected and a variety of techniques was employed in order to develop a rich description of participants’ backgrounds, perceptions, beliefs, and experiences. Techniques included a student questionnaire, fieldnotes of face-to-face and online observations, review of documentation created by participants, and semi-structured interviews, to obtain an emic (an insider’s) perspective of the participants’ world (Williamson, 2013c).

In this study, quantitative and qualitative data were collected concurrently, with the quantitative data collected at the beginning of the data collection period (by way of student questionnaire) along with qualitative data from teacher and TL interviews. The analysis of these informed the fieldwork component of data collection. Likewise, early
analysis of fieldwork and document review component of data collection informed the questions asked in the semi-structured interviews of the students, teacher and TL at the conclusion of the PIP unit. In other words, data collection and analysis were *iterative* throughout the project, with themes and issues emerging from earlier stages of data collection and analysis informing the design of data collection instruments utilised in the latter stages of fieldwork and interviews. Thus, various elements in the research design were being “interwoven, with the development of one influencing decisions about the others” (Williamson, 2006, p. 87).

According to Angrosino’s (2007) definition of ethnographic method, this approach was also *inductive* in the “accumulation of descriptive detail to build towards general patterns” across multiple sources of data, it was *dialogic* by way of the researcher’s observations and interpretations in the field being commented on by participants in final interviews, and it was *holistic* in the collection of data from a range of sources “to yield the fullest possible portrait” of the Global Studies class under study (p. 15). While the analysis of data is outlined further in Section 4.3, the following sections present in detail each of the techniques employed and nature of the data collected.

### 4.2.1 Online student questionnaire

A student self-administered, online questionnaire, consisting of two parts, was used as part of the lesson introducing the PIP unit to the class. Part A consisted of an adaptation of the ‘Approaches to studying’ section of the ASSIST instrument by Entwistle and Tait (1997). The adaptation was also informed by the Heinström’s (2006c) ASSIST instrument for school age students which removed the rating scale of ‘Unsure’ from the instrument using a 4 point Likert scale of ‘Strongly agree – Agree – Disagree – Strongly disagree’.

Part B of the questionnaire collected demographic data concerning gender, levels of students’ Internet access and use, students’ previous experience with Web 2.0 technologies, main problems or frustrations experienced when working on project-based assignments, and the types of school library help sought by students when completing these assignments. The questionnaire was created using the online survey software tool, *Zoomerang* (http://www.zoomerang.com/).
A draft version of the questionnaire was piloted by two Year 10 students and organised by the TL involved. These students were not members of the Global Studies class who were to participate in the study. The purpose of the pilot was to ensure that the language used represented that of the school context and students of the sample, and to ensure that students were able to successfully access and complete the online questionnaire on Zoomerang. This pilot was also used to determine whether the estimated time of 30 minutes to complete the questionnaire was accurate. In piloting the questionnaire, the students were asked to record the actual length of time it took them to complete each part, along with any words or phrases in any of the questions they found confusing or ambiguous, and to identify any questions where they were unsure of what was being asked of them.

Based on feedback from the pilot, the time taken to complete each section was less than the estimated 30 minutes and the language used in a number of the statements from the original ASSIST tool were changed, upon consultation with the TL participant, to better reflect the language and context of the Year 10 Global Studies students. For example, the word ‘lectures’, in the original statement “Often I find myself questioning things I hear in lectures or read in books”, was replaced with the term ‘class’ to better reflect the school context. The terms ‘lecturers’ and ‘tutors’ used in the original statements were revised to ‘teacher’ and ‘teacher librarian’, again to better reflect the school context. A copy of the original versus revised 52 ASSIST statements is presented in Appendix B (B.1). In addition, a copy of the complete student questionnaire as viewed online by students in Zoomerang is available in Appendix B (B2).

4.2.2 Observation, face-to-face and online

Participant observation is one of the main ethnographic techniques used to collect data. It is used to describe where a researcher becomes “immersed in a group in their natural setting in order to gain experience and deep understanding of the community being studied” (Allard & Anderson, 2005, p. 833). In fact, Murchison (2010) went so far as to argue that participant observation is “an essential component of ethnographic research” (p. 84), supporting Hammersley’s (1990) view that an ethnographer who relies “on what people say about what they believe and do, without also observing what they do” is neglecting “the complex relationship between attitudes and behavior” (p. 597). While
participant observation is, at times, used synonymously with ethnography in the literature (Baker, 2006; Williamson, 2013a), participant observation has been employed in this research as a data collection technique.

Within the context of a study involving observation, researchers must define their relationships to those being studied. The role of a researcher in participant observation is related to their degree of participation which extends on a continuum from complete observer to full participant. The concept of participation observation as a technique has been described by researchers for over 50 years, including by Gold (1958) and Junker (1960), Spradley (1980), Glesne and Peshkin (1992), Adler and Adler (1998), Patton (2002) and Angrosino (2005). For the purposes of this study, the roles of the researcher as observer and participant have been explored within the definitions proposed by Glesne and Peshkin (1992). Figure 4.4 illustrates the four levels of participant observation according to Glesne and Peshkin’s continuum (1992, p. 40).

![Complete Observer](Complete_Observer) ![Observer as Participant](Observer_as_Participant) ![Participant as Observer](Participant_as_Observer) ![Full Participant](Full_Participant)

Figure 4.4 The participant-observer continuum

The complete observer has little or no interaction with participants. In fact, educational researchers, Johnson and Christensen (2008) go so far as to state that a complete observer does not inform those observed that they are being observed, often with the subjects unaware they are being observed. For example, a complete observer might use a one-way window to observe unobtrusively, or might sit at the back of a room to observe attendees at an open meeting without disclosing their identity or intentions as an observer.

The role of observer as participant refers to a researcher who primarily observes a situation but also interacts to some degree with people at the research site, with participants being aware they are being observed (Glesne, 1999). This is where some non-verbal communication may occur between the researcher and participants. For example within the context of a classroom setting, a researcher observing/participating to this degree might be sitting at the back of the classroom to observe and take notes, without
offering advice, speaking, answering questions or providing assistance to teachers or students (Mertler, 2012, p. 92). In the role of participant as observer, the researcher’s level of participation increases to the point where they are more participant than observer, often spending extended periods of time in the field and attempting to take on (in part) the role of an ‘insider’ to gain a greater opportunity to “learn firsthand what goes on in that setting” (p.92). In this situation, the researcher’s identity and intentions as an investigator are made clear to the participants, i.e., they know they are being observed while the researcher inhabits and interacts within their world (Johnson & Christensen, 2008, p. 214).

At the right-hand end of the continuum in Figure 4.4, the degree of participation is greatest where a researcher becomes a functioning member of the group of participants under investigation (Glesne & Peshkin, 1992). Here their role as full participant allows him or her to take on the role of a ‘complete insider’ – as opposed to being an ‘outsider’. Ethical considerations are of utmost importance when observation takes place in this kind of ‘undercover’ role.

Articulating four levels of participant observation along a continuum allows flexibility for researchers to change their roles during the observation phase of a study (Patton, 2002; Williamson, 2013a). Johnson and Christensen (2008) argued that the “form of interaction or type of role by the researcher” during a study can vary along the participant-observer continuum, particularly if the researcher is observing “in the field for an extended period of time” (p. 213). Thus, left-right arrows between each level within the continuum in Figure 4.4 are included to illustrate this flexibility.

The role of the researcher of the present study tended more towards the observer end of Glesnè’s (1999) participant-observation continuum, where she was not formally nor actively engaged as a participant in the learning activities of the students in the Global Studies class. The teacher introduced her to the students as a guest of the class who was a lecturer at a university who had also been a school teacher, and that she would be observing “what we do in class” for some Global Studies periods throughout Term 3. In other words, the role was one of observing participant where the teacher, TL and students accepted the researcher’s presence in their classroom while she sat at the same table at the back of the classroom for each of the periods to observe participants’ actions and
listen to conversations between participants. The ‘degree of intervention’ as an observing participant involved informally greeting the teacher and students upon entering the classroom at the beginning of each lesson, and waiting for the students to leave at the end of each period before speaking to the teacher or TL. Often at the end of each observed class, the researcher would conduct a short ‘debrief’ with the teacher and TL regarding what occurred during the lesson.

Classroom observations occurred on five occasions in the first three weeks of the inquiry unit while students were setting up their Web 2.0 spaces, defining and refining their PIP topic, and locating information on their topic. At the end of the inquiry unit, observation occurred on three occasions when the students were presenting short oral presentations about their project work to the class. Classroom observation data were recorded in the form of handwritten fieldnotes during the Global Studies periods. These were then transcribed into a Word document where the researcher recorded preliminary analysis of each set of fieldnotes in the form of memo notes before observing the next lesson. (See Appendix C for an example of a fieldnotes/memo transcript).

The researcher’s other role as an observer was that of a silent observer (Angrosino & Mays de Perez, 2000) in the students’ Web 2.0 spaces, where she visited the students’ wiki, blog and Delicious sites on a weekly basis to view online activity completed by each student and any communication that occurred in these online spaces between each student and the teacher or TL. While the students gave permission for the researcher to view their Web 2.0 spaces, observation of student, teacher or TL activity did not occur at the same time participants were logged in to these sites (i.e., the observation occurred asynchronously) to ensure the researcher did not ‘engage’ with the participants synchronously in their Web 2.0 spaces. This was to ensure the natural online behaviour of participants was not disturbed or influenced as a result of being observed (Angrosino & Mays de Perez, 2000).

Online observation data collection was guided by an observation schedule and recorded in a Word document which included screen shots of pages or entries of students’ Web 2.0 spaces that demonstrated their uses of different features and functionality of the wiki, blog, Delicious, and any other Web 2.0 tools which students had linked to through their online project spaces. Fieldnotes of these observations in the schedule were recorded,
followed by memo notes from preliminary analysis. Notes on the behaviour of particular students were also made as prompts for further observation during the next classroom visit. Possible questions to include in the interview schedule for each student’s interview upon completion of their PIP were also noted.

4.2.3 Interviews

Hammersley and Atkinson (2007) argued there are “distinct advantages in combining participant observation with interviews” with data collected from one informing the other (p.102). This was certainly applicable to the collection of observation and interview data, where analysis of face-to-face classroom observations and online observations of students’ Web 2.0 spaces informed the development of additional questions for the final interviews with each student, the teacher and the TL. In-depth interviews have been used extensively as an ethnographic technique in naturalistic, interpretivist research to understand people’s worlds from their own viewpoint (Markham, 1998; Williamson, 2013b). Through in-depth interviewing, a researcher can explore with each participant the range of beliefs, values, material conditions and structural forces that influence or underpin their decisions and behaviours (Forsey, 2008).

Thus, in-depth interviews can provide a researcher with data that generate “thick description” (Geertz, 1973), based on individuals’ perceptions of their lived experience which is expressed in language that is natural to them. This supports Featherston’s (2008) argument for qualitative researchers to “make an effort to highlight the voices of the participants in any good qualitative report” (p. 95). Ethnographic interviews allow researchers to identify aspects of an interviewee’s “personal story [relevant] to the issues” he or she is “seeking to describe and analyse in the formal write-ups of our research data” (Forsey, 2008, p. 59). Thus, the researcher’s goal of trying to capture the students’ voices (Lincoln, 1995) was intended to posit students as active participants in learning about and constructing their own views on the informational and technological world around them as they encountered an inquiry learning task. This approach also reflects the interpretivist/constructivist framework as outlined in Chapter 3 (Section 3.1.2), and the view of learning as a process of personal construction based on Kelly’s Personal Construct Theory (1963) which was articulated in Section 3.1.3.1.
Lincoln (1995) argued, that “it makes sense to attend to ways in which children actively shape their contexts and begin to model their worlds and the way in which we [as educators], in turn, shape the possibilities available for learners” (p. 89). Thus in-depth interviews, and the consequent ability to represent students’ voices, equip educators and educational researchers to gain a greater understanding of how students make sense of their world, and of what is important to them as information and technology users in school and at home, by indicating how they can be supported to make greater sense of their world. This process reflects Berger and Luckmann’s (1967) theory of the social construction of reality which has been used in this thesis (see Chapter 3, Section 3.1.3.2). That is, learning should also be viewed as a process of social process, involving social as well as personal construction. For example, from each student’s perspective when they interact with fellow students, the teachers or TL, they do so with the understanding that their respective personal perceptions of reality are related and, as they act upon this understanding, their common knowledge of reality although not fully supplanting their personal reality, is developed. This is what influences the rapport of individuals within a class and contributes to the development of teacher expectations and the tone of a class. Therefore, the students, teacher and TL were asked questions in the final interviews to elicit how each participant negotiated with others in the class and their personal support network beyond the class, to assist them in successfully completing their inquiry project.

All individual interviews were undertaken using a semi-structured interview schedule with a predetermined list of broad questions, along with a selection of questions specific for each participant based on incidents identified by the researcher from observation fieldnotes. Provision was also made to allow participants to tell their own story in their own words, focusing on those aspects of their inquiry learning and technology experiences they felt, upon reflection, were most important to them. All interviews were audio-taped with the permission of participants. At the beginning of each interview, participants were reminded of the content of the letter of consent they signed, specifically with regard to anonymity, confidentiality, the option of electing not to answer a question or questions they did not wish to answer, and the option of being able to conclude the interview at any time, if they wished.

The audiotapes of the interviews were transcribed by an experienced transcriptionist. The content of each transcript was then reviewed in relation to the respective audio file of
each interview, and corrections or additions made according to errors or omissions in the interview dialogue.

4.2.3.1 Teacher and TL interviews
The teacher and TL participants were interviewed at the commencement and upon completion of the student project. The duration of teacher and TL interviews ranged between 50 minutes and 1 hour each. The first interview included questions about their experience in teacher-TL collaboration, collaborative assignment design, and use of Web 2.0 tools to support student learning; any issues or concerns they had with regard to using blog, wiki and social bookmarking tools to support the Year 10 Global Studies project in Term 3; their understanding of the guided inquiry process, their expected role(s) in this process and how they saw this process enhancing the support they could provide to students; and any additional comments they wished to raise before commencement of the project. (See Appendix D for teacher/TL interview schedules).

The second teacher and TL interviews were conducted after students had submitted their project reports and presented their project findings to the class, and once the students’ PIPs had been marked by the teacher and TL. The nature of questions asked of the teacher and TL in the second interview were informed by their responses to questions asked in the first interview, as well as fieldnotes and memo notes generated as a result of classroom observations and observation of students’ Web 2.0 spaces, and analysis of students’ project documentation throughout Term 3. The semi-structured interview schedule for the second interviews included questions about:

- the inquiry project design and value of the three progress reports in monitoring student progress;
- teacher/TL evaluation of students’ use of wiki, blog and social bookmarking technologies and the value of these in supporting students’ completion of a PIP;
- their intention to use any of these Web 2.0 tools for future inquiry learning units;
- the different types of support they provided students throughout the unit, including identification of critical points along the way where they felt they needed to invest a lot of time/effort/energy in supporting students;
- identification of additional assistance they might need to provide students if implementing the same inquiry unit with another class in the future;
the nature of the collaborative partnership between the teacher and TL in terms of what worked well, what did not work, what was problematic (if anything), and what they learned about themselves as teaching partners; and

• what they would recommend in terms of revision of the Global Studies PIP unit for the following year. (See Appendix D for teacher/TL interview schedules).

4.2.3.2 Student interviews

Eleven of the twelve students in the class were interviewed in the first two weeks of Term 4, which was after the students had submitted their PIP report and completed the oral presentation of their PIP findings to the class. Student 12 was not available for interviewing due to a long absence from school as a result of ill health.

The duration of the student interviews ranged between 10 and 30 minutes with the average length of interviews being approximately 19 minutes. A semi-structured interview schedule was developed based on student responses to the questionnaire, observations of students’ activity in class and in their Web 2.0 spaces, as well as analysis of students’ project documentation throughout Term 3. Questions asked of students included:

• their views on the technologies they used to help them complete their PIP and their reasons for either using or not using particular technologies that were available to them;

• the different ways they used the wiki, blog, social bookmarking tools, and any other technologies used;

• any difficulties or problems they faced while trying to gain access to or use these tools at school and when at home;

• their views on what technologies they would consider using again in the future to support their learning;

• the types of assistance they received (or they would have liked to receive) from the teacher and TL via the wiki, blog and/or social bookmarking tools;

• the types of face-to-face assistance they received at school from the teacher and TL;

• the types of assistance they received from other people (e.g., family, friends) to complete their project;
• any other forms of technology they used to communicate with people for their project;
• any other types of assistance they would have liked to help them complete their PIP successfully; and
• any additional comments they wished to raise about their project experience. (See Appendix E for student interview schedule).

4.2.4 Review of documents

Document analysis was employed as a fourth ethnographic technique. Atkinson and Coffey (2004) argued that the collection of documents as sources provides a researcher with potentially rich contextual data which capture constructions of “documentary reality” (p.61). They viewed documents as “social facts, in that they are produced, shared and used in socially organized ways” (p.58). Document analysis involves the examination of written documents for content to illustrate a number of the themes and issues identified from the analysis of other data such as interview transcripts and observation field notes. As mentioned in Section 4.2, the collection and analysis of documentation was part of the iterative and ongoing process throughout the data collection and analysis phases of the study.

Documents such as the PIP Information Booklet, progress report templates, marking rubric, students’ PIP reports and PowerPoint presentations provided information about the context being studied. All documentation created by a student, teacher or TL and collected throughout the study were labelled according to a set of participant codes, i.e., all documents about student 1 (project report, survey responses, wiki comments) were allocated ‘student01’. In this way, the researcher could construct each individual student’s realities of the PIP unit experience, e.g., the development of Case in Point vignettes (included in Chapter 5) telling the stories of individual students’ challenges, concerns and experiences as they progressed through the school term.

On other occasions document analysis provided a point of corroboration or confirmation for data collected in participant interviews or from classroom and online observation, which according to Hammersley and Atkinson (2007) can capture “‘facts’, ‘records’, ‘diagnoses’, ‘decisions’, and ‘rules’ that are crucially involved in social activities”
Thus the collection of documents contributed to this researcher’s observation of participant engagement in their own personal construction of reality (Kelly, 1963), as well as their learning and understanding as a process of social construction (Berger & Luckmann, 1967), as informed by the theoretical framework of this study.

### 4.2.5 Summary of participants and data collection

A daily schedule of data collection between the months of August and November is presented in Appendix F, which includes fifteen days of on-site school visits by the researcher (noted in *red italics*). Table 4.1 presents a summary of the types of, and frequency of, data collection for each type of participant in this study.

### 4.3 Data analysis

Analysing ethnographic data is iterative in the extreme, a constant cycle of watching, interpreting, sifting, sorting and linking data from every source available.

*(Pickard, 2007, p. 240)*

Given the multiple sources of data used in this study (as outlined in Section 4.2), a grounded analysis was employed throughout the data collection and analysis phase of the study. This was initiated with a process of open coding, where descriptive and in vivo codes were used to identify primary topics, issues, actions, opinions and feelings of participants in the first reading of questionnaire, interview and observation data. These initial codes formed the basis of a coding schedule, which was revised and refined throughout the data collection and analysis phase of the study. This is in keeping with Charmaz’s (2006) interpretation of grounded analysis as a “process of qualitative analysis not a research method” that uses “simultaneous data collection and analysis” (p. 20). For example, the analysis of the responses from the semi-structured interviews of the teacher and TL before students commenced their projects was used to inform the development of the questions for the second teacher and TL interviews at the end of the inquiry unit. Likewise, analysis of the fieldnotes of observations of face-to-face class activities, as well as teacher and TL responses to student questions via email and those recorded within students’ Web 2.0 spaces, helped inform the development of the questions for both student interviews and teacher-TL interviews upon completion of the student projects.
Table 4.1 Types of, and frequency of, data collection for each type of participant

<table>
<thead>
<tr>
<th>Type of Participant</th>
<th>Questionnaire</th>
<th>Interviews</th>
<th>Observations</th>
<th>Online</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>1 x TL</td>
<td>2 interviews</td>
<td>8 periods</td>
<td>5 periods</td>
<td>3 progress reports per student, media files per student</td>
</tr>
<tr>
<td>Teacher</td>
<td>1 x Teacher</td>
<td>2 interviews</td>
<td>7 periods</td>
<td>8 observation periods of Web 2.0 activities</td>
<td>8 observation periods of Web 2.0 activities</td>
</tr>
</tbody>
</table>

Note: The table is not fully visible due to the cropping of the image. The table contains details about the types of data collection methods and their frequencies for students and teachers. The data includes interviews, observations, online activities, and documents.
Although the overall methodological approach was not grounded theory and the study does not meet all of the normal characteristics of a grounded theory study, it was influenced by the “constructivist grounded theory” analysis approach of Charmaz (2003), which “recognises that the viewer creates the data and ensuing analysis through interaction with the viewed” (p. 273). Thus, analysis was a continuous process with the initial categories, determined by way of observation schedule data, being continually reassessed and expanded as more data were collected. A matrix of demographic information was also developed upon analysis of student questionnaire responses and initial teacher and TL interviews to help inform the observation of classroom and online activities.

According to Charmaz (2003), a strength of this approach as an ethnographic technique is that it “provides a systematic analytic approach to qualitative analysis of ethnographic materials because it consists of a set of explicit strategies… [including] the self-correcting nature of the data collection process… and … emphasis on comparative methods” (p. 270-271). For example, the analysis of questionnaire and observation data throughout Term 3 informed the design of the question schedule for the semi-structured interviews with the students, teacher and TL, which occurred in the beginning of Term 4.

In addition, Charmaz and Mitchell (2007) posited a grounded theory approach to analysis strengthens ethnographic research as it moves “toward theoretical development by raising description to abstract categories and theoretical explanations” and “prompts taking a fresh look and creating novel categories and concepts”, rather than having ethnographers “fall back on lifting stock concepts from their disciplinary shelves” (p. 162). This approach is central to the analyses of data in this study.

An example of this is the teacher introducing the New South Wales Department of Education (2007) information processing model to her students’ as a scaffold for the completion of their project. While this model was documented in the PIP Information Booklet, neither the students or teacher explicitly applied the six stages nor the language of this model throughout the guided inquiry experience. Therefore, the language used to label the categories and concepts of the inquiry learning process were developed as a result of analyses was based on the language used by the participants in the present study. For example, the codes devised to represent the key components of the inquiry learning

The iterative process of data collection and analysis employed by the present study was informed by Miles and Huberman (1994). The three types of analysis activity included: data reduction where the researcher wrote memos, teased out themes, identified data sets, developed a coding schedule and coded data; data display where the researcher identified relationships between coded data sets and interrogated groups of data sets to assist in the identification of new ideas; and conclusion drawing and verification where the researcher analysed the data displays to develop preliminary conclusions. The iterative nature of the analyses meant that preliminary conclusions led to further data collection, reduction and display to assist in the verification of preliminary conclusions and/or the development of further preliminary conclusions. The following sections provide further detail regarding the procedures employed to analyse the quantitative and qualitative data sets.

4.3.1 Quantitative analysis

Quantitative data collected by way of the online student questionnaire at the beginning of the PIP unit consisted of demographic data and ‘approach to study’ data based on the ASSIST instrument (Entwistle & Tait, 1997; Heinström, 2006). The questionnaire data set was imported into the statistical analysis software program, SPSS 14.0 for Windows (‘Statistical Package for the Social Sciences’, version 14.0.2). Descriptive statistics were generated from the demographic data in terms of counts and percentages of students within the class. Variables included age, gender, types of computer and Internet access in the home, percentage of time students estimated their completion of researching assignments in class/school library/at home, main problems/frustrations students have when working on school projects, types of help students seek from the school library, and use of blogs, wikis and social bookmarking tools for school and/or personal use.

While findings derived from the questionnaire data are presented in detail in Chapter 5 (Section 5.1), demographic data were used to develop a ‘working profile’ of each
participant. These working profiles were used by the researcher to familiarise herself with the background of each student in preparation for observing students’ behaviour in class and in the Web 2.0 spaces. The open comment responses in the questionnaire also provided a foundation for the building of each student’s story as inquiry learners from the very beginning of Term 3 as captured by their ‘own voice’. Two examples of these working profiles are presented in Appendix G.

The ASSIST instrument data set, collected as part of the student questionnaire, was used to identify the learning style of each student using the three categories of ‘deep’, ‘strategic’ and ‘surface’ approaches to learning based on Entwistle and Tait (1997). Students’ responses to each of the 52 ‘learning approach’ statements was measured on the 4-point Likert scale of ‘Strongly disagree-Disagree-Agree-Strongly agree’ using the value scale of ‘1-2-3-4’, which were later labelled, coded, and converted to values as per instructions provided by the ‘Scoring Key for the Approaches and Study Skills Inventory for Students (ASSIST)’ (Entwistle & Tait, 1997), to ensure consistency with the ASSIST calculation of scores. Variables were then entered for each of these statements using SPSS 14.0 for Windows (version 14.0.2) and each set of student responses was allocated a label, i.e., ‘student01’, ‘student02’, which corresponded with the label used for each student’s interview and documentation data sets. This meant that student01’s responses to the ASSIST statements could be matched with student01’s interview transcript and project documentation, ‘student02’s responses to the ASSIST statements could later be matched with the interview transcript file and project files labelled ‘student02’, and so on. Responses for each variable were then calculated to form a final, summarised score for each of the three study approaches for each student. A detailed set of the learning approach variables, and outline of ASSIST coding procedures and scoring procedures, are presented in Appendix H.

These ASSIST results were used, along with students’ demographics, to construct a descriptive profile of each student in terms of their approach to study, the results of which are presented in Chapter 5 (Section 5.1). While Heinström (2006, para 7) warned these three categories of approaches to learning “are over simplified in relation to the complexity and social dynamics of everyday teaching and learning experiences”, she did recommend this ‘approaches to study’ model as “a useful analytical framework for understanding student differences in learning as well as information seeking”. Therefore,
variables in the demographic and ‘approaches to study’ data were used as an analytical framework to identify patterns in the data with regard to the impact of learning styles on students’ level of use of the Web 2.0 technologies in completing their project, including the level of online engagement throughout a guided inquiry process with both teacher and TL; level of students’ use of blog and wiki tools to record their ideas, construct drafts and artefacts, and publish their final project report; and the TL and teacher’s assessments of each student’s completed project (presented in Chapter 5, Section 5.6).

The third and final type of quantitative data involved counts of the technologies used by students while completing their PIP. These counts were derived from observation and interview data throughout the entire data collection phase, and were used to develop a profile of each student’s suite of technology tools and identify interactions between learner type and preferred technology use, the results of which were used to inform findings presented in Sections 5.2, 5.4 and 5.5 of Chapter 5.

### 4.3.2 Qualitative analysis

Due to the volume and breadth of data collected, the qualitative data analysis software QSR NVivo 8 (QSR International, 2008) was used for the coding and analysis of qualitative data sets. These included qualitative data collected from observational fieldnotes, interview transcripts, documents and communication between participants recorded in Web 2.0 spaces, student project and assessment documents, as well as researcher memos and observation schedule documentation.

As shown in Figure 4.5, the process of data analysis employed in this thesis was continuous and iterative, where initial analysis informed the nature and scope of further data collection. For example, demographic data from the online questionnaire informed the development of initial ‘working profiles’ for each student. The initial interviews with the teacher and TL provided data to develop similar ‘working profiles’ for them in preparation for the observation phase of the study, and provided a lot of the contextual data regarding the school and classroom settings. Some of these data were also used to develop detailed outlines of the context of the study presented earlier in this chapter in Section 4.1. This contextual data also helped preparations for both classroom and online observation (as outlined in Section 4.2.2), where terms such as ‘wiki’, ‘blog’, ‘Delicious’,
‘inquiry process’, ‘PIP design’, ‘TL role’, ‘teacher role’, ‘ict training’, ‘ict use’, and ‘types of instruction’ were identified as potential aspects of the inquiry unit experience that could be observed. These categories (among others) became descriptive codes as part of an initial open coding process, resulting in a “start list” of open codes (Miles & Huberman, 1994, p. 58).

### 4.3.2.1 Coding

The development of the coding schedule was an iterative process, evolving through five versions, to support the complete analyses of all data. As new categories and subcategories were added, the researcher revisited previously collected and analysed data sets to add the new codes as appropriate. Thus a process of constant comparison was being used between existing and new data sets in the allocation of codes, in addition to comparisons between individual participants (Charmaz, 2006; Kolb, 2012).

The codes in the first version of the coding schedule were primarily descriptive and in vivo codes (based on participant’s own language) as part of the data reduction process (Saldaña, 2009), with some categories requiring further granularity due to the emergence of patterns in the data, and thus the development of subcategories. Pattern codes are explanatory codes which identify an emergent theme, issue or explanation in the data (Miles & Huberman, 1994, p. 69). The coding of such patterns is inferential, where a researcher develops category or subcategory labels to best summarise a theme or aspects of a theme, then allocates a code – to words, phrases, sentences or paragraphs within data sets – that identifies “good explanatory exemplars” of the subcategory (p. 65). For example, in Appendix I (Example I.1), based on classroom and online observation of students’ use of Web 2.0 technologies throughout the school term, a set of subcategories were developed to highlight the different ways students used the wiki, blog and Delicious tool while completing their inquiry project. Thus, each of the subcategory codes was empirically driven from the observation data, i.e., isolating the range of functionality of each Web 2.0 tool.

In the development of the coding schedule, some in vivo codes emerged from the initial open coding process due to the fact that they best reflected the language and meaning of the participants. In vivo codes are appropriate to a grounded analyses approach to data reduction, helping a researcher to “preserve participants’ meanings of their views and
actions in the coding itself” (Charmaz, 2006, p. 55). Charmaz recommends the use of in vivo codes when the language of these codes use those “general terms everyone ‘knows’ that flag condensed but significant meanings” (p. 55). In the interviews each student provided an explanation in their own words for why they chose to use or not use certain technologies to complete their inquiry project. For example, through the process of open coding of the first few transcripts of these student interviews, particular language was used by the students to describe their reasons for choosing to use one or more technologies over others, for example, “easy to use”, “not as easy as”, “familiar with”, “it was convenient”, “didn’t have enough time”, or “would take too long”. Thus, the labelling of some of the subcategories was derived directly from the language of the students.

In some cases where there was greater variation in the language of participants, labels in the form of inferential codes were developed by the researcher. For example, Appendix I (Example I.2), of the set of seven subcategories for the category ‘reasons for choice of ICTs used’, four subcategories were in vivo codes with the remaining three subcategories were inferential codes.

A third type of coding – axial coding – was also employed as a grounded analytical technique. Axial coding is a higher level of pattern coding, where the purpose is to “sort, synthesize, and organize large amounts of data and reassemble them in new ways after open coding” (Charmaz, 2006, p. 60). Axial codes were generated when greater granularity occurred in some subcategories, as a result of identifying relationships with other categories. For example, the category ‘ict experience’ with subcategories ‘levels of use’ and ‘mental models of ICTs’ indicated relationships between the three Web 2.0 technology categories and categories of ‘reasons for choice of ICTs used’, ‘ict access’, ‘ict training’ and ‘ict expertise’. The relationship of these two subcategories (and their corresponding dimensions) with the above seven ICT-related categories in Figure I.2 were developed on a conceptual rather than descriptive level, providing coherence to the categories involving participants’ access to, use of, and motivations for using specific technologies. Example I.3 in Appendix I presents the granularity of conceptual coding (indicated as axial codes) for the two subcategories of ‘ict experience’, i.e., ‘levels of use’ and ‘mental models of ICTs). Each contains three ‘dimension codes’ defining the variations within each subcategory. Charmaz (2006) advises that axial coding helps apply an analytic frame to the data. It was a help in this research in the move from data display,
to drawing and verifying conclusions. A copy of the final version of the coding schedule is presented in Appendix J.

4.3.2.2 Memoing

Memo writing was also an analytic technique employed to move through the cycles of data reduction to data display to drawing/verifying conclusion (Miles & Huberman, 1994). The researcher also used the recording of audio ‘voice notes’ as part of the memo writing process. This was a particularly useful strategy when trying to “engage [with] a category” or trying to articulate potential relationships between categories or subcategories. Charmaz (2006) recommended a memoing process of letting “your mind rove freely in, around, under, and from the category”, thus forming “a space and place for exploration and discovery” to help “study your emerging data” (p. 81-82). Memos are a researcher’s working documentation, the intention of their development being informal, using a language that is personal and speaks to the researcher. They are mental notes that capture the progress of a researcher’s analytic journey and are usually not published as research evidence.

For the purposes of this study, memo writing informed the development of definitions, and revision of definitions for the categories, subcategories and dimensions in the coding schedule, gradually clarifying the analytic properties for each code (as illustrated in Appendix J). Other memos recorded draft knowledge claims (or propositions) based on the interrogation of data sets and the combining of particular codes. All of this demonstrated the process of induction employed throughout the analyses of data (Punch, 2009, p. 180).

Memoing became more frequent in later analyses where memo content provided a bridge between data display and developing conclusions, as well as supporting initial drafts of sections for the findings chapter. Appendix K presents an example of memo writing employed by the researcher as an analytic technique. This example demonstrates the breadth of functionality a memo could have in helping to define/refine the conceptualisation of a category, isolate specific exemplars of codes within datasets to represent the scope of a category, and highlight additional aspects of a category that required further interrogation. This memo was used to articulate and elucidate aspects within students’ inquiry learning experiences that were influenced by their own and
others’ conceptions of ‘independent learning’. It illustrates the process of developing working definitions for categories and subcategories by working across different types of data sets, identifying possible patterns, raising further questions, and recording further steps in the analytic process, including interrogation of the theoretical and research literature to inform the shaping of the concept of ‘independent learning’ within the context of this research site. It is an example of how memo writing provided this researcher with ways to investigate codes with “analytic mileage” and that carried “conceptual weight” (Charmaz, 2006, p. 83).

A second phase of memoing was employed as part of the writing up phase of this thesis. This involved the researcher writing memos based on the clustering of themes, issues and relationships across quantitative and qualitative data sets for individual students. These clusters were used to develop descriptions and provide examples of students’ use of technologies, as well as drawing upon quotations from student interviews and Web 2.0 spaces to illustrate individuals’ inquiry experience ‘in their own words’. This documenting of student stories allowed the representation of student voice to be presented as part of the reporting process. Therefore, in addition to the extensive integration of student quotations throughout the reporting of the findings, a selection of vignettes have been included in Chapter 5. These vignettes, referred to as cases in point (abbreviated to CIPs), present snapshots of individuals’ experiences in an attempt to illustrate significant findings from the personal perspective of students.

4.4 Trustworthiness of the research

Interpretivist research needs to be rigorous (Williamson, 2013c). Rigour in the positivist domain is viewed in terms of validity and reliability, where quantitative researchers can demonstrate validity and reliability of their data through statistical means. However, the research quality of interpretivist/constructivist research where researchers are ‘immersed in the field’ and explore how ‘multiple realities’ are constructed by individuals, needs to be assessed using different criteria. The articulation of rigour within naturalistic inquiry was first labeled by Guba and Lincoln in 1981 as “trustworthiness” (1985, p. 289). They posited that the four criteria of credibility, transferability, dependability, and confirmability must be met to convey to the reader of a study that the study’s design and findings are “worthy of confidence” (p. 328).
This approach was later refined by Denzin and Lincoln (2003), recommending trustworthiness, credibility, transferability and confirmability as the most appropriate criteria on which to determine the quality of those studies whose research design is positioned within a constructivist-interpretative paradigm. In addition, reflexivity has gained traction as another important criterion to enhance a study’s trustworthiness (Denzin & Lincoln, 1998; Charmaz, 2006; Gibbs, 2007). Thus, these criteria are pertinent in determining the rigour of the research design and conclusions presented in this thesis. The techniques employed by the researcher to improve the trustworthiness of this study in terms of credibility, dependability, transferability, confirmability, and reflexivity are briefly outlined below.

4.4.1 Credibility

A number of techniques can be employed to establish trustworthiness of a study through examining its credibility (Guba & Lincoln, 1985). These include prolonged engagement in the field and persistent observation, triangulation, and member checking (p. 328). With regard to persistent observation as part of the iterative data collection/analysis process, the researcher was engaged \textit{in the field} before, during and after the Year 10 Global Studies inquiry unit. She also monitored students’ Web 2.0 spaces from the time students’ accounts were first created until twelve months after they completed their inquiry project. Classroom observations occurred during the three key periods within the inquiry unit – the beginning, middle and end – and, throughout the entire inquiry unit, relevant documentation (print, web and email) was collected and analysed to inform future classroom and online observation.

Triangulation was recommended by Denzin and Lincoln (2003) to add “rigor, breadth, complexity, richness, and depth” to the exploration of phenomena in a study (p. 8). Triangulation is a technique used to increase fidelity of interpretation of data by using multiple methods of data collection, as well as multiple sources of data. Both approaches were applied in the research design of this study. Both qualitative and quantitative data were collected and analysed. Quantitative data included demographic data, approaches to study scores, and counts of technologies used by students. Qualitative data included observational fieldnotes, interview transcripts, documents and
communication between participants recorded in Web 2.0 spaces, student project and assessment documents, and researcher memos and observation schedule documentation. The multiple sources of data were the students, the teacher and the TL who provided different perspectives. The “convergence of findings from different types of data and analytic methods” (Entwistle, McCune, & Scheja, 2006, p.11), was used to increase readers’ confidence in the credibility of conclusions presented in the final chapters of this thesis. Miles and Huberman (1994) see this as one way of enhancing the “authenticity” and “plausibility” of the research (p. 278). Additionally, credibility was enhanced by the use of the analytic technique of constant comparison between data sets throughout the data collection/analyses process.

4.4.2 Dependability

Dependability builds on the concept of triangulation providing complementary integration of data to strengthen research design. Guba and Lincoln (1985) advised that the dependability of a study can be demonstrated through detailing an “audit trail” that shows a consistent and stable process across methods and over time. Sections 4.1, 4.2 and 4.3, and corresponding documentation in the appendices, have provided considerable detail regarding the processes employed in the research design of this study and the procedures and range of techniques employed to collect and analyse the data. As noted above, the data collection instruments are available for scrutiny in the appendices. The design of the approaches to study component of student questionnaire was based on validated ASSIST instruments (Entwistle & Tait, 1997; Heinström, 2006), and appropriateness of language for both ASSIST statements and demographic questions was confirmed by pilot testing the instrument. The coding and memoing procedures documented in Section 4.3 involved coding checks with the supervisory team throughout analytic episodes, and the development and revision of some memo content occurred as a result of discussions with the supervisory team on the nature and scope of categories and relationships between categories.

4.4.3 Confirmability

Confirmability of a study also refers to provision of an “audit trail” where a researcher shows how data can be tracked to their original source or sources, and detailing the logic
used to interpret the data (Lincoln & Guba, 1985, p. 318). Techniques used to enhance dependability in this study, above, also contributed to strengthening the confirmability. In addition, Section 4.3.2 in this chapter provided detail of the iterative collection and analytic procedures employed to move from data reduction to data display to identifying/verifying conclusion, thus demonstrating how findings of this study are grounded in the data. Miles and Huberman (1994) also identified researcher bias and awareness of personal assumptions as something that needs to be explicitly addressed to strengthen a study’s confirmability (p. 278). While the author of this thesis acknowledges these as aspects contributing to the confirmability of a study, to reduce duplication, this is addressed in detail in Section 4.4.5 as part of the reflexivity criterion.

4.4.4 Transferability

Transferability within the context of naturalist inquiry refers to the level of thick description provided by a researcher that details the context and conditions within which a study was undertaken to inform others of the extent to which the findings may be transferred to other research settings. Lincoln and Guba (1985) argued that it is not a researcher’s task to “provide an index of transferability; it is his or her responsibility to provide the data base that makes transferability judgements possible on the part of potential appliers” (p. 316). Techniques used to establish transferability in the study include the use a specific set of criteria for the purposive sampling undertaken; detailed descriptions of the research context including school site, research participants, curriculum unit design, and Web 2.0 technologies used by the class; and provision of data collection instruments, ethics documentation, and data analysis instruments as appendices. In addition, the overall ethnographic reporting in this thesis is presented as thick description, thus enhancing readers’ understanding of the context and conditions specific to the research setting of the study.

4.4.5 Reflexivity

Given the ethnographic nature of this study, the issue of reflexivity needs to be acknowledged as part of the study’s trustworthiness. Reflexivity is the recognition that “the product of research inevitably reflects some of the background, milieu and predilections of the researcher” (Gibbs, 2007, p. 91). Denzin and Lincoln (1998)
suggested researchers think of this “validity as reflexive accounting” (p. 278). However, it is important to note that the issue of reflexivity is not ‘dealt with’ in the writing up phase of a study. Reflexivity is a process that permeates the life of a study – it is integral to a researcher’s practice. In the words of Charmaz (2006), reflexivity is “the researcher’s scrutiny of his or her research experience, decisions, and interpretations in ways that bring the researcher into the process”, which allows “the reader to assess how and to what extent the researcher’s interests, positions, and assumptions influenced inquiry” (p. 188).

Techniques employed in this study to demonstrate reflexivity include: the articulation of the researcher’s worldview with regard to learning and instruction in the theoretical framework (outlined in Chapter 3); the acknowledgement of the researcher’s use of her professional network in the purposive sampling process (detailed in Section 4.1 of this chapter); the use of observation schedules to document activity in the classroom and online spaces, and the articulation of the researcher’s position on the participant-observer continuum (in Section 4.2.2); the use of memos and triangulation as part of the iterative data collection and analysis process (in Section 4.3.2.2); and the use of student voice (i.e., using the language of the participants in the form of quotations) to present individual’s experiences in the reporting of this study.

4.5 Summary

This chapter has discussed, in detail, the research procedures and techniques employed by the researcher of this study. It has described the sample selection process, the nature and context of the research site and participants, the design and components of the inquiry-based unit under investigation, and the ethical issues considered in gaining access to the research site and informed consent of participants. The chapter then described the data collection techniques used, highlighting the reasons for the choice of each, followed by the procedures used in carrying out the analysis of data collected, including the use of SPSS 14.0 and QSR NVivo8 software programs, and the use of coding and memo writing as an analytic techniques. The chapter then concluded with an outline of techniques used to establish trustworthiness of the research, by examining aspects of credibility, dependability, confirmability, transferability, and reflexivity pertinent to the study’s research design.
Chapter 5 Findings

Five focus questions were used to scaffold the exploration of how Web 2.0 technologies can be used to support student learning through a guided inquiry process. These were:

1. How can Web 2.0 technologies be used to support students in the process of completing a project-based assignment?
2. How do learning styles affect students’ use of Web 2.0 technologies while they are in the process of completing a project-based assignment?
3. What types of instructional intervention within a guided inquiry framework can be provided by the teacher librarian and class teacher when students are using Web 2.0 technologies as learning environments?
4. What kind of ‘online dynamics’ among students, teachers and teacher librarians exist in Web 2.0 learning environments, and how does this influence students’ learning?
5. How do teacher, teacher librarian and student experiences with Web 2.0 technologies influence their views on using these in the future to support students’ learning?

While these questions guided the exploration of the main research question, grounded analysis of data identified a range of issues regarding the use of technologies by each of the participants which the researcher found could influence the use of Web 2.0 technologies by the students, teacher and TL in supporting the inquiry learning process. Therefore, the findings are presented within six major areas, with findings organised into sections focusing on students’ approaches to study and learning styles, students’ approaches to technology use (in general), their use of Web 2.0 technologies to support inquiry, the impact of learning styles on students’ use of Web 2.0 technologies, the nature of learning teams and instructional intervention using Web 2.0 for inquiry, and implications of this Web 2.0-based inquiry learning experience on participants in terms of technology use in the future.

Each findings section specifically addresses aspects of one or more of the focus questions. These are listed in parentheses next to each section heading:

5.1 Students’ approaches to study (Q2)
5.2 Students’ approaches to technology use (Q1, 2, 3, 4, 5)
5.1 Students’ approaches to study

Students’ completion of the online questionnaire at the very beginning of the inquiry unit (before they began working on their PIP) provided the researcher with basic demographic data that informed the development of the description of the student cohort presented in the previous chapter (Section 4.1.2.2). The remaining questions in the first part of the questionnaire required students to provide some background information about how they undertook ‘researching assignments’. The second part of the questionnaire included a set of 52 statements based on the ‘Approaches to Studying’ section of the ASSIST instrument to determine students’ preferred learning style (Entwistle & Tait, 1997; Heinström, 2006). Results from the two parts of the approaches to study questionnaire are presented below.

5.1.1 Background information about researching assignments

Questions in the second part of the questionnaire ‘Some background information about you and researching assignments’, required students: to estimate the percentage of the time they completed assignment work in class compared to the school library and at home; identify the main problems or frustrations they had when working on school projects and assignments; identify the types of help they would normally seek of the teacher and TL when completing assignments; and identify their knowledge of, and use of Web 2.0 technologies.

5.1.1.1 Percentage of time estimated to complete school assignments

Students estimated the percentage of time they invested during class, in the school library and at home to complete assignment tasks for school (out of a total of 100%). The nine non-boarding students estimated between 60-80% of their assignment work was completed at home, with 15-30% of assignment work completed during class time, and 5-10% of assignment work completed in the school library. The three boarding students’
estimates were quite disparate with one male student estimating that 65% of his assignment work was completed in the school library, with 15% completed in class and approximately 20% of assignment being completed at home, which was a combination of time spent living in the boarding house as well as working from the location of his family home and/or other family and friends’ homes on weekends and during school holidays. In contrast, the other male boarder estimated 10% of his assignment work being completed in the school library and 25% completion in class, preferring to complete the majority of his assignment work (65%) when at home. The only female boarding student in the class estimated an even 40% split between the class and home, with 20% of her assignment work completed in the school library.

Table 5.1 presents estimates for each student across the three main locations for study time (in class, in school library, and at home) in the first three columns, with a final and fourth column presenting the total out-of-class time, which was calculated by adding the estimates for the school library and home locations.

Table 5.1 Comparison between in class and out of class estimates of time

<table>
<thead>
<tr>
<th>Student</th>
<th>In class time</th>
<th>Out-of-class time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>In school library</td>
</tr>
<tr>
<td>student01</td>
<td>20%</td>
<td>5%</td>
</tr>
<tr>
<td>student02</td>
<td>20%</td>
<td>10%</td>
</tr>
<tr>
<td>student03</td>
<td>30%</td>
<td>10%</td>
</tr>
<tr>
<td>student04</td>
<td>25%</td>
<td>5%</td>
</tr>
<tr>
<td>student05</td>
<td>20%</td>
<td>5%</td>
</tr>
<tr>
<td>*student06</td>
<td>25%</td>
<td>10%</td>
</tr>
<tr>
<td>student07</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>*student08</td>
<td>15%</td>
<td>65%</td>
</tr>
<tr>
<td>*student09</td>
<td>40%</td>
<td>20%</td>
</tr>
<tr>
<td>student10</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>student11</td>
<td>15%</td>
<td>5%</td>
</tr>
<tr>
<td>student12</td>
<td>#</td>
<td>#</td>
</tr>
</tbody>
</table>

Note. The asterisk * denotes boarding students, and the hash # denotes non-submission of questionnaire.
Thus, this table provides a point of comparison between the estimated percentage of time spent in class versus the estimated percentage of time a student works on their assignments out of class. These estimates identified a significantly large proportion of the out-of-class time used by students to work on their school assignments (60-85%), with the lowest estimate of in class time being 15% compared to the highest estimate of 40%. This suggests that up to 85% of the time students are working on assignments occurs without face-to-face teacher supervision or instructional intervention. Furthermore, based on these estimates, only 5-20% of the time these students spent working on their assignments occurred in the school library, suggesting an even smaller margin of opportunity for a TL to provide face-to-face instructional support to these students while working on their school assignments.

This begs the question, what other ways could a teacher and/or TL employ to increase the potential contact time with students while working on assignments? Could Web 2.0 technologies provide one possible solution in increasing opportunities for teachers and TLs to communicate and provide instruction to students while working on assignments during out-of-class time? The large amount of out-of-class time used to complete assignment work as estimated by the students of this class suggests the teacher and TL may need to find other ways to provide additional instruction beyond the confines of the timetabled class time allocated per week to support students’ inquiry learning needs. An assumption of this study is that Web 2.0 technologies may have the potential to achieve this.

5.1.1.2 Problems and frustrations when working on school assignments

Students were asked to identify what they saw as the main problems or frustrations they normally faced when working on school projects and assignments. Given this was an open comment-style question, some students responded with a single phrase or a couple of bullet points, while other students provided a more detailed explanation. Issues regarding time, finding information, motivation, assignment design, and topic selection were identified as the main problems or frustrations for the students. Table 5.2 presents a summary of the range of problems and frustrations identified by the students and the total number of students per problem/frustration.
Table 5.2 Problems/frustrations with assignments identified by students

<table>
<thead>
<tr>
<th>Problem/frustration</th>
<th>No. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>7</td>
</tr>
<tr>
<td>Finding information</td>
<td>5</td>
</tr>
<tr>
<td>Motivation</td>
<td>4</td>
</tr>
<tr>
<td>Assignment design</td>
<td>4</td>
</tr>
<tr>
<td>Topic selection</td>
<td>3</td>
</tr>
</tbody>
</table>

Issues regarding time were identified by the majority of students in this class. Being able to manage one’s time during the completion of an assignment was the most commonly cited problem or frustration, with comments such as “how to manage my time”, “leaving it [to] the end”, “leaving everything to the last week or so”, and “My lack of enthusiasm when time-managing or planning to do work”. Some students couched their frustration with time in terms of the due dates, suggesting that they required more time than was allowed. Other students commented on the amount of time it takes to work on an assignment, with some students responding to the investment of time required as a frustration – they waste time, or they can take a while to get a good topic and get started.

While these issues regarding time were identified by students before they commenced their PIP, time-related challenges were faced by students throughout the completion of their PIP, the findings of which are reported later in this chapter, particularly with regard to the impact of time on students’ use of technologies (in general) and the potential application of Web 2.0 technologies to help overcome time-related challenges.

The four students who identified finding information as a challenge, used phrases like “finding relevant information”, “information that is reliable” and “cannot find enough information” to describe their frustration with trying to find information for their assignments. One student commented on her frustration with trying to manage different “research applications” on the computer to find information for her assignments. Like time, challenges with finding information was a recurrent issue during students’ inquiry learning experience. Students often need assistance with finding “relevant”, “reliable” or “enough” information, especially when searching for current affairs or emergent or
international issues. Some Web 2.0 technologies can potentially assist students in finding information – this is presented as part of the findings in Section 5.3 of this thesis.

Another problem, identified by four students, was motivation which was articulated in similar ways by them. Lack of motivation or enthusiasm occurred as a result of being given a prescribed topic to research, which meant they often found it difficult to be motivated if the topic was not something they found “interesting” or “relevant”. This became a source of frustration for them in terms of not being given the opportunity to be engaged in their learning, as expressed in these comments: “It frustrates me if I’m working on a topic that I am not interested in or don’t find relevant”, “I can only fully motivate myself if I am working on an assignment that is engaging”, and “I usually try really hard and if I am not fully up to it or really motivated I cannot do my best work”. In other words, these students did want to be motivated and engaged by those topics they were required to research for a subject.

Another frustration experienced by some students was the restrictions placed on them as part of the assignment design. Two students referred to this in terms of the word limit imposed by the teacher for an assignment, where one student found word limits often restricted him from dealing with a topic as fully as he would have liked. Conversely, the other student viewed word limits as being a challenge because he often struggled to reach them. Due dates for assignments were also viewed as being restrictive, with two student voicing their frustration with not being able to meet all the requirements of assignments within the given time period. In addition, one student stated his frustration at the “lack of clarity... about the project” and how it “will be marked”. When being asked to undertake an assignment he needed to know what was being expected of him, and if this was not clear then it hampered his ability to “get started”.

Topic selection was specifically identified by three students as a source of frustration when completing assignment work. Students were keen to pick a “good topic” because this influenced their motivation to complete an assignment (as mentioned previously), with one student stating that part of this frustration was due to the length of time it often took him to “get a good topic”.
5.1.1.3 Types of help students seek from the teacher and the TL

Students were asked to identify tasks they asked the teacher and TL to help them with while working on projects and assignments in the school library. Students identified some different forms of help sought from the teacher compared to those from the TL. Three of the eleven students who completed the questionnaire stated they did not seek any forms of assistance from the TL while working in the school library on assignment work. Of the remaining eight students, four broad areas of help from the TL were identified including help with finding information, assistance with using technology, help with topic selection or refinement, or advice regarding the organisation and/or presentation of an assignment. Table 5.3 presents a summary of the types of help and the number of students who seek each type of help from the TL.

Table 5.3 Types of TL help sought by students

<table>
<thead>
<tr>
<th>Type of TL help</th>
<th>No. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finding information</td>
<td>7</td>
</tr>
<tr>
<td>Using technologies</td>
<td>5</td>
</tr>
<tr>
<td>Topic selection</td>
<td>2</td>
</tr>
<tr>
<td>Organising/presenting</td>
<td>2</td>
</tr>
<tr>
<td>No or little help</td>
<td>3</td>
</tr>
</tbody>
</table>

Assistance with finding information was the predominant form of help students sought from the TL. This is not surprising given the school library context of the question. Students defined this type of help from simply “finding books” to “finding relevant books or articles”, to help with finding a variety of resources on a topic or “different resources such as books or videos”, as well as “referencing help”. References made concerning assistance with using technologies involved the use of the school library computers to find information, and technical help with equipment such as the school library printers. Most comments with regard to technology support were stated in general terms such as “to help me with certain programs on the computer”, “help with technology” and “presentation or computer work”. Only one student provided a more detailed list of the intellectual support provided by the TL in terms of assignment help including
“broadening ideas on my topic”, “ideas for furthering my research” and “advice on organisation”. Overall, these students’ awareness of what the potential breadth of assistance the TL could provide with regard to completing their assignment work was quite limited, with the majority of help sought being of a technical or procedural nature, rather than intellectual or academic support.

In comparison, students expected academic support from their teacher with ten of the eleven students providing examples of the type of assistance sought. Table 5.4 presents a summary of the four main categories of help these students would normally seek from their teacher, including assistance with regard to assignment guidelines and expectations, help with selecting a topic, advice on where to look for information about their topic, and assistance with constructing their assignment.

Table 5.4 Types of teacher help sought by students

<table>
<thead>
<tr>
<th>Type of teacher help</th>
<th>No. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment guidelines/expectations</td>
<td>7</td>
</tr>
<tr>
<td>Topic selection</td>
<td>4</td>
</tr>
<tr>
<td>Finding information</td>
<td>3</td>
</tr>
<tr>
<td>Assignment construction</td>
<td>3</td>
</tr>
<tr>
<td>No or little help</td>
<td>1</td>
</tr>
</tbody>
</table>

Seeking clarification of assignment guidelines and getting an idea of “what is expected” of the students while completing an assignment were the main form of help sought by students of their teacher. Four of the seven student responses regarding this form of help articulated this in terms of “the end result”, i.e., they wanted to gain a sense of what the teacher wanted, as illustrated by the following comments:

*Explaining marking criteria, what is wanted in the project etc.*

*What specifically do we have to find out and what information we need in order to achieve the best marks possible.*

*... if I am heading in the right direction.*
What he/she is looking for in the end result.

Four students specifically identified help with topic selection and/or refinement as a key form of assistance from teachers, with three of these students also referring to finding information as part of topic-related help. For example, “what topic should I do. What my focus should be. How I should find my information”, “ideas that I need to develop, research techniques”, and “if they think the information I'm getting is reliable”, expressed these students’ approaches to seeking assistance from their teacher while completing an assignment in the school library. In terms of assignment construction, only one student specifically stated that they consulted their teacher for assistance with “wording for sentences or essays”, while another couched this in terms of seeking assistance when he had “specific questions” relating to his topic. No student identified technology support as a type of help they sought from their teachers while working in the school library. This begs the questions, where do the majority of these students gain assistance with technologies, if not the teacher or TL?

5.1.1.4 Students’ use of Web 2.0 technologies for school or personal use

Given that blogs, wikis and a social bookmarking tool were being introduced as part of the PIP unit in Term 3, students were also asked to identify whether they had used any of these tools for school-related purposes or for personal use (other than school work). Table 5.5 summarises the class response regarding their previous use of these three types of Web 2.0 technologies before commencing the PIP unit.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I don't know what this is</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blogs (school)</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Blogs (personal)</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Wikis (school)</td>
<td>11</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Wikis (personal)</td>
<td>2</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Social bookmarking (school)</td>
<td>7</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Social bookmarking (personal)</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
Of the eleven students who completed the questionnaire, all of them stated they had previously used a wiki to complete school work. Given that this class had used a wiki to support a group-based project in Term 2 of the same year, this confirms their understanding of the term ‘wiki’ to identify the Web 2.0 technology they had used. However, the majority of the students had not used a wiki for personal use, nor blogs or social bookmarking tools, with four students stating they did not know what social bookmarking was. Overall, these results highlighted the limited use these students had had with this range of Web 2.0 technologies, with some students stating they had used a blog as a reader only, not an author, citing the school library’s fiction promotion blog.

Some students used the open comment box to share their views on how they liked using one or more of these technologies. For example, “Had to make a wiki for a school project. I liked using it”, or “We had to use them in Global, pretty much disliked them”. One student went as far as to say, “I have used blogs and wikis for school work, as I use them for research and inspiration”. These comments suggested a possible affective reaction by students when confronted with the use of a Web 2.0 technology, the latter statement citing “inspiration” suggesting the possibility of deeper emotional and intellectual impact of a technology on students’ approach to study. This is explored further in Section 5.2 with regard to mental models of technologies. These comments also identified that students’ level of interest in, and preference for using versus not using some technologies may influence how they approach the use of technologies when next faced with this dilemma. This raised the concepts of ‘choice’ and ‘decision making’ as being potentially influential in students’ approach to technology use, the results of which are presented in Section 5.2.

Other students explained what they found useful about a Web 2.0 technology. For example with using a wiki, student comments included “I suppose it helped us communicate”, “I used a wiki for a group assessment task. It was mainly used for communication purposes between me and my partner as well as for saving work to it so my partner could access it too”, and “It was tricky to get the hang of and some features we were unsure on how to use. It was useful as a way of communicating and as a teaching tool for our finished assignment”. It was here that the functionality of Web 2.0 technologies first emerged as a possible aspect of student use. For example, the function of a wiki as a communication tool was identified by four of the eleven students as a result
of their previous experience with wiki technology. This is examined in detail in Section 5.3.

5.1.2 Learning styles

The first part of the questionnaire ‘Your research style and approach to studying’, included a set of 52 statements based on the ‘Approaches to studying’ section of the ASSIST instrument (Entwistle & Tait, 1997; Heinström, 2006). Please revisit Figure 2.1 in Chapter 2 for a summary of the intentions underpinning each approach, which define the predominant processes, strategies and motivations employed by students based on each intention.

The central focus of a student employing a deep approach is the intention to form their own personal understanding of the topic they are studying. A student utilising a deep approach will tend to show active engagement and interest in what they are studying (McCune & Entwistle, 2000). They try to relate ideas to previous knowledge and experience, question what they encounter and use evidence critically to draw conclusions, and try to see the purpose of learning within a wider context than the immediate task at hand. Thus, the transformational aspect of a deep approach.

In contrast, a student who employs a surface approach to their learning, functions within a domain of ‘reproduction’, where the intention is to “cope” with the demands of the curriculum by memorising facts and studying without a clear purpose nor reflection on what they are doing. Surface learners often feel under pressure with the demands of study and do not make coherent connections between previous knowledge and new learning.

The third style of learning is the strategic approach. Based on the fact that students determine how much effort they will put into different aspects of their studies, this third approach was identified due to the influence of assessment on students’ approach to study. This approach is driven by the student intent to achieve the highest possible grade(s) for their work. Learning behaviours include being organised and consistent in their efforts to get their work done, finding the right conditions to maximise their work efforts including finding the resources to inform their learning, being aware of what is required in completing assessment tasks, and effective management their time.
Entwistle (2007) advises that “everyone has the basic mental processes” used across these three approaches, and it is up to individual students to decide “how learning tasks are tackled”, with results across a number of studies showing that a student’s “previous success in using one or other approach will, however, lead to its subsequent use, and can build towards its more habitual use” (p. 133). Furthermore, students who are motivated by a need to achieve (being strategic) have the ability to determine whether a deep or surface learning approach will more likely be rewarded by the design of an assessment task.

For the purposes of the study presented in this thesis, student responses to the set of 52 ASSIST statements were calculated to gain a raw score for each of the three styles of learning, i.e., a deep approach, a strategic approach, and a surface approach, for each student. The results of these raw scores are presented in Figure 5.1, with each student’s results recorded as a set of 3 columns representing their score on the deep (blue), strategic (green), and surface (yellow) styles. The results of eight of the eleven students identifies the predominance of one style over the others, with five of the students’ responses to ASSIST resulting in high raw scores on the strategic scale (students 01, 02, 03, 05 and 07), and three rating their highest score on the deep scale (students 08, 09 and 10). Of interest in these results, is the trend showing the three students with a predominantly deep approach, all rating the lowest scores in the class on the surface scale. Also of note is Student03 who rated the highest score for strategic approach and was ranked third highest in the class on the deep scale, while Students 04 and 11 results show comparable scores for deep and strategic, rather than one of these being most pronounced. The results of Student06 demonstrates no single tendency towards any of the three broad approaches, however, he did receive the highest score in the class on the surface scale.

Further research by Entwistle and others on the implications of student approaches and effective teaching at the higher education level has shown that different types of assessment can encourage either deep or surface approaches (Entwistle & Entwistle, 2005). For example, essay questions or problems can encourage a deep approach, but only if the question demands student demonstration of personal understanding. This is relevant to the design of the inquiry unit investigated as part of this thesis because the nature of the inquiry project completed by the students was intended to be based on students’ own personal interest. Furthermore, the design of the inquiry unit allowed
students to draw upon a range of technologies, including Web 2.0 tools, to support their PIP. The findings from this section are used later in this chapter to determine the relationship (if any) between students’ approaches to study and their use of Web 2.0 technologies, in an attempt to address focus Question 2.

Figure 5.1 Results of students’ ASSIST scores
5.2 Students’ approaches to technology use

While students were given a choice to use a blog or wiki, and access to a social bookmarking tool to support the completion of their PIP, they also used a number of other technologies to help them complete particular steps or tasks within their project. A summary of the technologies used by each student to complete their PIP can be found in Table 5.6. This illustrates the complex suite of technologies individual students can bring to the inquiry learning process, in addition to any technologies introduced by the teacher and TL as part of the design of an inquiry unit. It also demonstrates the ability of students to customise a suite of technologies to help them undertake particular components of an inquiry project.

Observations of students’ technology use throughout the project identified the phenomenon of students employing a decision-making process while customising their suite of technologies. This decision-making process was employed to determine whether they would use or not use a specific technology available to them to complete a particular task for their project. This led the researcher to explore this phenomenon as part of the individual interviews conducted upon completion of the PIP. Here students shared reasons why they chose to use particular technologies over others as part of the inquiry learning process, and they also identified a number of factors influencing their use, non-use, and/or adoption of particular technologies to support their learning in the Global Studies class and other subjects in the past, present and future. This resulted in the identification of four elements that contribute to an individual student’s ‘approach to technology use’. In other words, these elements influence the manner with which a student approaches technologies to support their learning. The four elements of a student’s approach to technology use include criteria determining technology use, mental models of technology, technology informants, and a student’s personal technology toolkit.

5.2.1 Criteria determining technology use

Students identified a range of reasons why they elected to either use or not use specific technologies to complete particular tasks for their project. These became criteria for determining technology use. Therefore, students critically evaluated available technologies based on the criteria of accessibility, ease of use, familiarity, utility, time,
return on investment, and experience. They often identified more than one criterion in determining their use of a particular technology. The nature and scope of each criterion and how students applied these when making decisions on technology use are presented below.

Table 5.6 Technologies used by each student to complete their PIP

<table>
<thead>
<tr>
<th>Student01</th>
<th>Student02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiki</td>
<td>Blog (created this but stopped using early in project)</td>
</tr>
<tr>
<td>Web browser and search engines</td>
<td>Wiki</td>
</tr>
<tr>
<td>Web browser bookmarks</td>
<td>Web browser and search engines</td>
</tr>
<tr>
<td><em>EBSCOhost</em> full-text journal database</td>
<td>Proxy websites</td>
</tr>
<tr>
<td>Online survey tool (<em>SurveyMonkey</em>)</td>
<td>Web browser bookmarks</td>
</tr>
<tr>
<td>Word processor</td>
<td>Email</td>
</tr>
<tr>
<td><em>YouTube</em> (inserted <em>YouTube</em> video in his wiki)</td>
<td>Instant messaging</td>
</tr>
<tr>
<td><em>Powerpoint</em></td>
<td><em>Photobucket.com</em></td>
</tr>
<tr>
<td>Photosharing website</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student03</th>
<th>Student04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiki</td>
<td>Wiki</td>
</tr>
<tr>
<td>Web browser and search engines</td>
<td>Web browser and search engines</td>
</tr>
<tr>
<td>Library catalogue</td>
<td><em>EBSCOhost</em> full-text journal database</td>
</tr>
<tr>
<td>Word processor</td>
<td><em>Microsoft Word</em></td>
</tr>
<tr>
<td></td>
<td>Email</td>
</tr>
<tr>
<td></td>
<td>Instant messaging</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student05</th>
<th>Student06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiki</td>
<td>Wiki</td>
</tr>
<tr>
<td>Word processor</td>
<td><em>Powerpoint</em> slideshow (with audio of rap music embedded)</td>
</tr>
<tr>
<td>Web browser and search engines</td>
<td>Web browser and search engines</td>
</tr>
<tr>
<td><em>Microsoft Photo Story</em> to create a <em>Windows Media™ movie</em></td>
<td>Library catalogue</td>
</tr>
<tr>
<td></td>
<td><em>EBSCOhost</em> full-text journal database</td>
</tr>
<tr>
<td></td>
<td><em>Microsoft Excel</em> (to create tables/graphs for PPT slideshow)</td>
</tr>
</tbody>
</table>
### 5.2.1.1 Accessibility

One reason a student decided to use a specific technology, or not, was the level of access they had to that technology. This included access to the technology at school, both during class time and out-of-class time, i.e., access via the library’s computers, computer labs or while residing in the boarders’ residence. Access via the school network was also identified as an issue which is explored in greater detail in Section 5.6. Students also identified the importance of being able to access a particular technology from their home computer, including the ability to access technologies hosted on a school server or intranet. The ability to access a particular technology while at school as well as at home
was identified as an important factor in trying to use, or continuing to use that technology, as articulated by one student:

*I find at home, my computer blocks the school site so I can’t get on to the [school] site. So the wiki was a really good idea, like I saved all my work onto the wiki, I never saved it to my school account because I could always access the wiki from home, and it was quicker to get onto... so I saved everything I did in class onto the wiki.* (Student05)

Some students also identified the importance of being able to use a particular technology from other access points, including computer and Internet access at other family or friends’ homes. Those students who were boarders at the school identified accessibility from multiple places as important, particularly during the school term when they might go to stay at friends’ or relatives’ homes on a weekend, with the ability to “be able to go back and constantly edit from lots of different computers” (Student09).

Accessibility beyond school or home was also identified as an issue, particularly with regard to working on homework and projects while on school holidays, as mentioned by Student05 who had saved all his work on a wiki and was able to access his project work from his holiday destination, “So it was a lot easier to do it then.” This was in contrast to Student09 holidaying with her family who was unable to gain Internet access while at their destination, “We’d been away the first week so I didn’t have computer or internet. I couldn’t even look at my wiki.”

Accessibility was also identified by some students in terms of having multiple online tools which required the management of multiple accounts and ‘log ins’ to gain access to each technology. For example, Student02 explained how she began using her wiki to record the references to the websites and articles she found as part of the information gathering phase of her project. The effectiveness of this strategy led her to the decision not to create and maintain a Delicious site. In her words, “Delicious is probably easier, but like... it was just another – yeah, it was another log in, and another this and that”.

This student had also created a blog at the beginning of her project, thinking it would be the best tool to record entries for her learning journal, but soon after stopped using it because she found she could record her entries on her wiki, thus only having to access one online learning space using one log in. In addition, some students preferred to continue saving their website details and URLs to a Word document (instead of Delicious) to reduce their number of log ins.
5.2.1.2 Ease of use

The majority of students commented at some point in their interview about the decision to use a specific technology because they found it easy to use, or the decision not to use a particular technology because they found it difficult to use, or in some cases perceived that a particular technology would not be as easy to use compared to a tool they were already using on a regular basis. (Note regularity of use is explored in Section 5.2.1.7).

Ease of use was expressed in terms of the technical ease of using a particular technology for a specific task. The following comments from the interviews illustrate the range of student responses with regard to technical ease of use as a criterion for using a particular technology:

Because we had been given the choice to use it [wiki], we had used it before on the project before, and I found it really easy to navigate and use. So you know, I thought it best to go with that. (Student05)

Well, the reason I chose it was because we’d previously done something with the wiki in History, and I knew how to use it, so I thought it would have been easier. … Also, I think it would be easier to create than a blog, it’s – I think it’s easier to work and use. (Student01)

It [wiki] was pretty simple to use and, yeah it was also good for our reflections ’cause I could just type it in, the date would come up. (Student09)

Students made comparisons between the ease of use of different tools in determining their preference to complete a particular task, as expressed by Student02:

Originally I thought it would be easy to do a blog for my journal, because it would be more professional… but we’d used the wiki, we’d been taught how to use the wiki beforehand. And so, I could just basically do it on the wiki, it’d be much easier.

Students also discussed ease of use in terms of managing a number of technologies within a given project, where their decision was based on trying to simplify the technology-related elements to best achieve the learning outcomes, e.g., “after a while it got really annoying logging on to two of them”, and “there was just one site that I could use the whole time, and I wouldn’t have to really be concerned about another one. It was just easier in the long run, really.” (Student02)

Further to this desire to “keep it simple”, some students identified ease of use as the principal reason why they chose a technology so they could focus more of their time and
energy on the requirements of the inquiry learning process. The following two responses from students illustrate this desire:

\[\text{I wanted to focus more on actually getting the project done and really focusing on the research... so I just felt it a bit easier for me to do. (Student07)}\]

\[\text{They’d already showed us what a wiki was and how to use it, so it was just like, an easier option. (Student10)}\]

When discussing ease of use, a number of students also made reference to familiarity with a technology, thus its inclusion as a criterion (below).

5.2.1.3 Familiarity

The familiarity a student had with a technology contributed to their decision to use it again for a given task. Many students referred to being “familiar”, as one of the main criteria for using a particular technology, for example:

\[\text{I chose wiki probably because I’ve, we used it once before, actually we used it, yeah, before in Global studies and in another subject, History... so I was fairly familiar with the technology that we were going to be using. ... You want to work with something that’s familiar. (Student03)}\]

\[\text{I knew how to use it [wiki], which I think was a big thing. (Student09)}\]

\[\text{Mainly because I already knew how to work it... without trying to have to learn a new sort of piece of technology to work. (Student07)}\]

\[\text{We’d used it before. I knew how to use it, so I was just like comfortable with it. (Student10)}\]

Conversely, lack of familiarity with a particular technology contributed to a student’s decision not to use it, or not even attempt to use it as a way of exploring its potential, as explained by Student09:

\[\text{When we did the wiki before we had to spend a fair amount of time just learning how to use it. And so I didn’t really want to do that again with the blog, and I figured I knew how to use it [wiki] and it worked.}\]

Students articulated their preference for the ‘known’ over the ‘unknown’ when faced with a choice of using a range of technologies. In other words, when a student already had established another way of completing a specific task, the requirement to invest more time into learning a new technology often outweighed the motivation to explore the potential of a new tool. For example, when Student01 was asked why he decided not to
set up a *Delicious* account, he stated it was not something that he had used before, that he already had a system for recording websites using the bookmark function of his web browser, and “*my own web page at home has bookmarking stuff, and I’ve never really needed to change from one thing to the other.*” This was seconded by other students with regard to using a social bookmarking tool. “*I just put it all in Favourites*”, was mentioned by a number of students, while others demonstrated a more considered approach. For example, the following response by Student03 illustrates how he weighed up his options with regard to using *Delicious*, and decided to go with a keep it simple approach to the technologies he used to support his PIP:

> No, I suppose it was also because I hadn’t used it a lot before... I wasn’t familiar with it, I didn’t want to have to spend I don’t know, a lesson going through setting it up, and trying to make myself familiar with it. It might have been useful, I don’t know. I probably missed out on doing something there, but... I really needed to get into the actual project.

When talking about familiarity as a criterion for determining technology use, some students also made reference to the affective dimension as contributing to their familiarity. For example:

> *Because I’d used a wiki before, and it felt more comfortable using that than a blog.* (Student04)

> *We’d used it before. I knew how to use it, so I was just like comfortable with it.* (Student05)

> *If there’s a project that would use it, that I’m going to get given, I would definitely use it because I know how to use it now. Like once you’re comfortable with a program, it’s good. If it’s a new program that you’re having to learn and you have a choice of an old one, I’m the kind of lazy guy that won’t bother.* (Student10)

This is illustrated further by Student07 who decided to use an *Excel* spreadsheet to create graphs for her project report and *Powerpoint* presentation (as did a number of students, as per Figure 5.8). She stated that she had selected *Excel* as her preferred tool for this task because she had used it before and felt comfortable with it:

> *With my survey I used Excel to work out graphs for my essay, just to show some of the responses from the survey. And how the results varied. At my previous school we had laptops from year 5 onwards, so, I got used to computers from a young age, and... I was taught how to use Excel.*
While she felt confident Excel was going to best meet her needs in completing this task, this statement also highlights that being formally taught how to use a particular technology can contribute to the development of one’s familiarity with it. It also highlights the role of the affective dimension in building familiarity with, and capacity to use, a particular technology.

A number of students acknowledged that being formally taught to use a wiki for a previous assignment contributed to their feeling familiar enough with it to use it again for their PIP, e.g., “I didn’t really know how to use the blog web site, so – and we’d used the wiki, we’d been taught how to use the wiki beforehand” (Student02). Student07 explained how she was familiar with searching for journal articles using the school library’s full-text databases as a result of being taught how to search them when completing some science projects in the past year, as well as having been exposed to them at her previous school:

> I’ve used EBSCO a couple of times before... I learnt how to use it last year, at my previous school, but, I was reintroduced to it this year... so I just came back to that.

In fact a number of students used full-text databases to locate relevant journal articles (as per Table 5.6), with some of these occurrences being generated by the TL when working with students in the classroom or providing advice on students’ wikis. These examples across a range of technologies highlight the important contribution formal tuition of technologies can make to students’ familiarity with tools, both in terms of technical, informational, and affective capacity building as technology users.

### 5.2.1.4 Utility

The concept of utility was also identified by students as a criterion in determining technology use. Utility was described in terms of a technology being the ‘best’ tool to meet an immediate need, where they viewed a specific technology as being the most effective and/or efficient tool “to get the job done”. Utility involved the technological capacity of a tool to assist in completing a specific task, which in turn contributed to the value of this tool for future use. For example, Student02 explained how she liked the utility of the wiki as a single storage space for her project content and documentation, “It was very useful. ... Every time I went on a site, I’d add it to my...bibliography”. This student stated that using the wiki had actually helped her improve the way she would...
normally approach the information gathering phase of a project, and it helped her to be more diligent in terms of tracking and documenting the sources she used for her PIP. She concluded, “I had all my sites there.”

Other students commented on utility playing a part in their decision to use a wiki over another technology, as articulated by Student03:

_**I recognised that it would be useful for what I was going to be doing in that I wanted to make lots of edits, be able to just put it out in a nice clear format, basically just type it up, almost as a word document online and be able to go back and constantly edit from lots of different computers. And that’s what I ended up using it as.**_

In this example, accessibility was also seen as contributing to the wiki’s utility. Other students made similar comments, such as those made by Student05: “Yes it was. Because… by copying and pasting it into the wiki it was always there and I could get it from home too. Like, I didn’t have to look the site up again, you know.

The utility of technologies other than Web 2.0 tools was also identified. This highlighted students’ capacity to think critically and creatively about the selection of the most appropriate technology to meet a particular need. The following Case in Point (CIP 5.1) illustrates the decision making process regarding the choice of technology tools from the perspective on one student, which features utility as one of her three main criteria.

CIP 5.1 Criteria determining technology use

---

**Case in Point 1:**
**Decision making process of students regarding choice of technologies**

Two students used the greatest range of technologies to support the completion of their PIP, and Student07 was one of these, using a total of ten different tools (see Table 5.6). This included a wiki as her main project space, a Web 2.0 calendaring tool used as a plug in to her wiki, the use of a web browser and search engines, the *EBSCOhost* full-text journal database available via the school library, email to communicate with her teacher, the TL and make contact with outside agencies and organisations regarding her project topic, instant messaging to communicate with her classmates about her project, and three tools from the *Microsoft* suite – *Word*, *Excel* and *Photo Story*. 
When asked about the reasons why she chose this group of tools to support her project, she identified familiarity, ease of use and utility as the main criteria to make her decision. She referred to the wiki as “effective” and “easy to use”, and because she had used it before (i.e., familiarity), she felt this could help reduce her workload in terms of managing the overall demands of the project:

Because I already knew how to work it, and I wanted to focus more on actually getting the project done and really focusing on the research without trying to have to learn a new sort of piece of technology to work, so I just felt it a bit easier for me to do.

When asked if she would consider using a wiki (again) to complete a project in the future, whether for Global Studies or another subject, she replied, “Yeah, actually I would. It was effective and easy to use, so yeah.” This student made conscious decisions about what technologies were going to help her be as organised as possible in completing her project, “I have a lot of stuff on during the year so I really need to actually manage my time properly, so I don’t get left behind”.

The class was being asked to complete a log or learning journal as part of the project process and she decided to use her wiki to record her ideas, steps, and decisions along the way. On the front page of her wiki, under the heading of ‘Log’, she plugged in a calendaring tool. When asked whether this type of calendar was something that she used all the time to organise herself, she replied:

First I tried a table [in her wiki], but then I realised that I’d have to continue, like making brand new tables, every time I wanted to write something down, and then I saw calendar and I was, yeah, okay, I’ll just use that.

This proved to be an effective way of recording log entries because it meant that she could click on a date and put in some notes about what she had done or needed to do, and pressed ‘Save’. As the project progressed she recorded fewer notes, although she discovered a “bonus” with recording the details of the websites she had found while completing web searches:

It actually really helped me for the bibliography because I was writing that, like the night before it was due, and I’m like, oh no, when did I look at this site, and so it really helped to, because I’ve never really done a log before on projects. So yeah, it just helped me a lot, I didn’t realise that it would.

This is an example of a student trialling a new technology and discovering the breadth of its potential use and ‘utility’ as a result.

Student 07 also created a movie file to support her oral presentation to the class. It involved a series of images (of under-nourished, starving children from a range of developing countries) being presented to the sound track of John Lennon’s song, Imagine. When asked why she chose this technology over another presentation format, she replied:
It works better than PowerPoint, because PowerPoint, you have to, I guess, click the button every time you want a picture. But I thought just the flow of pictures, you know, without words, maybe people could think... “Let the pictures speak for themselves”.

She used the movie as the introductory segment of her presentation to the class on World Vision’s 40 Hour Famine. At the end of the movie, the audience remained still. No one uttered a sound. Her movie evoked an emotional response, as she had hoped it would. She had grabbed their attention, just like she wanted to do. They were now ready to listen to what she had to say. She had clearly identified what she thought was the most effective and efficient tool “to get the job done” for this part of her project, i.e., utility.

Two students decided to use an online survey tool to collect data for their project. One had serious reservations about the time involved in collating data from print survey forms. The TL introduced her to the SurveyMonkey website, and she decided to “give it a try”. In terms of its utility, SurveyMonkey helped her not just collect the survey data, it collated the responses for each question, and automatically presented her results in a graphic form which she could copy and paste into her project report and Powerpoint slides for her oral presentation. She concluded, “Yeah, that was really, really good”. Again this demonstrates the value to be gained from the utility of a particular tool to best meet information, technology and project management needs.

In some cases trialling a new technology resulted in a student deciding the tool did not have the utility they originally thought. For example, some students felt they could have used a Word document to compile, construct and save their project work, as illustrated by Student04’s conclusion upon completion of her project:

But in my opinion, it didn’t really help. Like, I could have just used Word and stuff, like I always have, and I would have been fine.

This was also evident for one student who decided to create a Delicious account. He acknowledged, after trialling it, that Delicious provided people with the ability to store and recommend websites for each other, “so you're part of the social group”, but decided it did not have the utility he envisaged for the purposes of completing his PIP:

But it's just one more website you have to go to, one more tool you have to use, one more set of results you have to add to your final work. So if you can just copy URLs onto your blog, what's the point of having a website which does the same thing but only that? (Student 08)
Alternatively, a student’s perception of a particular technology could act as a barrier to exploring the potential application of a tool, i.e., resulting in the utility of the technology not being recognised. This was evident in a number of students’ decision not to create a Delicious account, with comments like “I just didn’t think it was necessary” (Student01), and “I just put the link on my wiki or on the Word document or whatever” (Student04). Furthermore, Student11 decided not to use a wiki as his principal project space, defaulting to a Word document because:

I kind of don’t like having the whole fiddly technology for the sake of technology stuff... It didn’t add anything to it, apart from the fact that it was a place to store stuff... I just kind of throw them [Word documents] in my folder on the computer and just keep them there... I can access my folder [from home]. Or I just put it on a USB and take it home... There are ways to get it home.

This was in contrast to the majority of students, who upon completion of their projects acknowledged the wiki (at a minimum) was a useful repository for their documents and writing, with access from multiple computers and locations, an additional factor contributing to the wiki’s utility. Later in Student11’s interview he confessed that he “probably needed some help” with setting up his wiki to explore its potential. This is an example of an opportunity for instructional intervention that had been missed, with the student, teacher and TL all unaware of this potential point of intervention. (Note this is explored further in Section 5.4).

In terms of using a blog or a wiki to receive feedback from the teacher, TL, or other member of their learning team, the Comments feature of these tools provided utility in terms of students receiving written feedback by others, captured on their Web 2.0 learning space. Since some students completed the majority of the work out of class time, the utility of the wiki Comments feature provided a communication channel when required. The application of this feature is examined in detail in Section 5.3.2.

On the other hand, two students were actually critical of the utility of the Comments feature because of (a) lack of immediate feedback: “The only other problem is that there’s delay, because someone posts a comment and you only see it the next day when you’ve already done something else” (Student01), and (b) it could not be compared (in terms of value) with the face-to-face feedback:
There’s 3 lessons a week, so there’s not that much time that goes past without seeing someone, and you also see... the teachers on a more regular basis as well just walking around the school. So if there’s something that I really needed to ask, I had that sort of opportunity to.

The concept of utility was also raised by the teacher in the interview upon the commencement of the PIP unit when she commented that she “was quite happy to do it for the group work project, because it made a lot of sense that they could communicate with each other” and publish their group work on the wiki. However, she confessed she had initial reservations about providing students with the choice of using a wiki for the individual PIP unit because, in her words, “I guess, the utility of it is not as immediately obvious.” This was reinforced by the TL who identified utility as a criterion when making decisions regarding the use of a new technology:

> Web 2.0 is exciting... but the trouble is, when you start thinking about how can this be applied in the classroom... you have to also think: Is it actually offering anything that is not already being achieved by what is currently there? So, it actually has to value add, I think, before teachers will embrace it.

5.2.1.5 Time

Students identified time pressures as impacting on their decision to use, or not use, a particular technology, with the investment of time related mainly to those technologies that were new to the students. Thus, time is another criterion determining technology use. The following is an example of weighing up the time required to learn how to use a blog which was new to Student09, versus selecting the wiki which she had used before: “I knew how to use it. ... When we did the wiki before we had to spend a fair amount of time just learning how to use it. And so I didn’t really want to do that again with the blog.”

Time pressure was a dimension of this criterion, with some students feeling pressured to get their online project spaces created as quickly and efficiently as possible, as described by Student03 regarding the wiki: “Because I’d used it before, I knew how to set it up quickly, I just did it really fast, and I had it all there. Time pressures were particularly a problem where there were delays in the decision on a final PIP topic or in beginning the project itself. For example, when asked why he had not created a Delicious account to record any websites found, Student03 responded:
I hadn’t used it a lot before, and I was starting slightly later than some of the other people. Like, I was really working hard to try and hammer down a topic, get information, really start that information process... Because I hadn’t used it before, I wasn’t familiar with it... I really needed to get into the actual project.

Thus, the decision not to use a specific technology was sometimes made because students felt they had little or no time to invest in exploring its functionality and utilising its features, i.e., getting to know a new technology.

In comparison, some students viewed the wiki as a time-saving technology which contributed to their efficiency in terms of keeping all of their project ideas and documents in the one place, and being able to access it from school, home or other locations:

*I had trouble defining my topic and I guess I wanted to research more on my category... So by copying and pasting it into the wiki it was always there and I could get it from home too. Like, I didn’t have to look the site up again you know.* (Student05)

Some students used other technologies to help them deal with time pressures while working on their project during the school holidays and/or out-of-class times. For example, email was used to proof drafts of work, “*Just say check this out, what do you think, kind of thing*” (Student10), and provide advice, ‘*Just make your question more clear, try and do a little bit more on the media and that’s what I did*’ (Student04). Instant messaging (IM) was used by four students to keep in contact with each other, provide feedback on drafts and generally provide moral support at the ‘eleventh hour’, as Student10 explained:

*Well we had a kind of a night before, black market community going. Because me, well I should say, [student02], [student07], [student04] and I, we all kind of have each other on MSN. We just kind of like... traded last minute drafts and proof read it.*

5.2.1.6 Return on investment

In students’ discussions about the utility of different technologies, the concept of value emerged as mentioned in Section 5.2.1.4. While utility relates to a student’s belief that a particular technology is “the best tool for the job” due to its technological, informational and/or technical capabilities, the productivity and rewards components regarding a tool’s utility also emerged from the data. As previously mentioned, students weighed up the pros and cons of using, versus not using, a particular technology, and the impact their
decision would make on the inquiry learning experience and the successful completion of their project. This can best be described as their desire to gain a return on their investment. In the interviews, students outlined their thinking behind decisions to use or not use particular technologies, and some students argued they had selected a particular technology because they believed it would provide the best value for them in terms of a return on investment (ROI), i.e., with regard to the investment of time, energy and cognitive load involved in using this tool to complete a specific task.

This was evident for those students who identified themselves as particularly time pressured. For example in the case of Student03; “I didn’t want to have to spend ... a lesson going through setting it up, and trying to make myself familiar with it.” Students were quite astute in their capacity to assess possible ROI, especially in deciding when not to use a technology, where they estimated receiving no or little return as a result of investing the necessary time and energy to gain maximum value or utility from a technology. For example, “When we did the wiki before we had to spend a fair amount of time just learning how to use it. And so I didn’t really want to do that again with the blog” (Student09), and “[I] had to kind of prioritise so the wiki just kind of went out the door” (Student11).

This was also reflected in comments made by Student09 who decided to use SurveyMonkey to manage the survey component of her project. She considered the time it would take for her to conduct a print-based survey, and she was prepared to consider another method for collecting data on her topic if she could not find a more time-efficient way of completing this component of her project. In this case, she concluded the use of an online survey tool would provide her with a good ROI, even though she had to invest some time in learning how to use this new tool as part of this inquiry experience.

5.2.1.7 Experience

Students’ previous experiences with particular technologies were also found to influence their decision to use them for their project. This led the researcher to explore with students in the interviews the concept of ‘levels of use’ as a dimension of technology experience, and how this might influence their use of a particular technology in the future. From the interview data, four levels of use emerged as potentially contributing to a student’s decision to choose a particular technology to complete a specific task or tasks.
These included previous use, successful use, regular use, and future use. The first three levels contribute to the criterion of experience and are discussed in this section, while future use is examined as part of Section 5.6.

This study found a student’s previous use of a technology could be a major determinant for the student using that technology again. Nine of the eleven students interviewed gave examples of how their previous experiences with a particular technology influenced their decision to use it for their PIP. Examples were quoted in both ease of use and familiarity sections above. Furthermore, the level of success a student has had when using a particular technology, including both successful and unsuccessful experiences, could have an impact on a student’s decision to use that technology again. For example, this was made clear by Student05’s comment in the ease of use section, above: “We had used... [a wiki] on the project before and I found it really easy to navigate and use.” This is in contrast to the impact of a previous, unsuccessful experience on technology use, as expressed by Student11, “It just kind of – it didn’t add anything to it, apart from the fact that it was a place to store stuff.... So I wasn’t a fan of the wiki thing.”

Regular use was also identified as a dimension of students’ technology experience. Examples of regular use provided by some students demonstrated a preference for using an existing technology along with well-practised techniques, rather than adopting a new Web 2.0 tool to complete a particular task. Some of these included students’ decisions:

- to save web resource titles and URLs using the bookmarking function of a web browser rather than using a social bookmarking tool like Delicious;
- to copy and paste titles and URLs of web resources into a Word document rather than using a social bookmarking tool like Delicious;
- to collect chunks of information from web resources and paste these into a Word document rather than using a wiki to do this;
- to present sections of a PIP report as an essay in a Word document rather than presenting each section as a separate webpage within a wiki; or
- to record learning log entries into a Word document rather than record them as posts on a blog or entries within a wiki or calendaring tool.
Nevertheless, Table 5.6 demonstrates that other students were more than willing to use a range of technologies to support their inquiry learning experience. In fact a number of the technologies used by students in this study were technologies that already existed as part of a suite of tools they had used previously and regularly to support their learning, whether these had been used as either compulsory or optional components of a curriculum unit or project as directed by a teacher, or were tools a student chose based on their own personal preference. The emergence of students’ decision-making processes with regard to technology use in this study, suggest that these processes contribute to the development of a students’ ‘personal toolkit’. This is examined in detail in Section 5.2.3 as the fourth dimension of students’ approach to technology use.

5.2.1.8 Breadth of students’ criteria in determining technology use

In this study, familiarity, ease of use, utility and experience were cited by students as the four main criteria determining technology use. As shown in a number of quotes presented in the previous sections, some students demonstrated strong critical abilities when applying one or more of the criteria to a particular technology when making a decision with regard to use. The criterion of time was identified as a strong inhibitor to a student trialling a new technology. Due to time pressures, students either reverted to another technology that they already knew, i.e., familiarity and ease of use, or moved to another new technology that looked like it had potential in meeting their needs in terms of utility and ROI, or they employed a non-technology method to complete the task.

In some cases though, a student’s critical evaluation of new technologies was based on a restricted set of criteria such as familiarity and time pressures (only), and this could limit their exposure to, and exploration of, the potential application of new technologies at their disposal. Other students demonstrated the application of a far broader set of criteria when customising a suite of tools to support the completion of their inquiry project. The breadth of an individual’s set of criteria for determining technology use could also be influenced by how one conceptualises the value or impact of technologies in facilitating one’s learning. These conceptualisations, or ‘mental models’ are explored in the next section.
5.2.2 Mental models of technology

The influence of participants’ conceptions or ‘mental models’ of technologies emerged as a result of exploring their technology experiences and expertise. The themes of conceptual ‘vagueness’, ‘technical’, and ‘enrichment’ emerged from the analysis of classroom observation schedule and interview data. These themes informed the development of three mental models – vagueness, technicality and enrichment – which are presented here as the second element that contributes to an individual student’s approaches to technology use. As these themes are introduced, below, a transition phase (progress in conceptual development) is also discussed. Before introducing the themes, background perspectives gleaned from the data, are presented.

An indication of student thinking was that they did not talk about technologies in terms of the categories or taxonomies that their teachers often used when talking about the different types of technologies. They used the specific name of a technology tool, saying “I use MSN”, rather than talking about the generic type of technology, e.g., an instant messaging tool. Or when using a search engine, they would say, “I just use Google”, or “I Googled it”. Most students did not conceptualise the technologies they used as tools that existed as a category or type in some kind of taxonomy of technologies.

This raises issues regarding students’ ability to think generically about categories of tools and to evaluate critically the features and functionalities of different tools. For example, when using Google, do they have a mental model of what a search engine is and what it does? Are they aware of other search engines that may help them locate relevant information more efficiently and effectively? Do they understand the similarities and differences between a number of search engines? Do they understand the limitations and strengths of one particular search engine over another? Similarly, what are the features and functionality of a blogging type tool compared to a wiki tool? Do students have a mental model of how these tools fit within the broader context of Web 2.0 platforms and tools?

Although one of the eleven students interviewed did articulate their understanding of Web 2.0 technologies in terms of types of tools, this appeared to be influenced by his exposure to one example of a tool. When discussing his experience with blogging, Student 08 referred to a specific name of a blog but articulated this within the broader context of
blogs in general, “Like Wordpress is quite good. I've actually been doing some creative writing work on a blog I've made on Wordpress. And the library blog and those things, I use them occasionally.” However, when asked if he saw a wiki having potential to be used for other projects, or other subjects, as a place to think about and/or publish his work, Student08 replied:

\[
\text{Not in the way it's meant to be used. A wiki is meant to have people accessing it and changing it and we did something in history, and it was fun to do, but I don't think it ever could be used properly... the whole essence of having people adding together, just wouldn't work.}
\]

In other words, this student’s mental model of a wiki was based on his understanding of how Wikipedia was being used as a communal publishing space, and he did not see the potential of a wiki as a tool to build his own website, or as a project creation and publishing space to support his completion of project-based assignments in the future. While this student’s mental model of Web 2.0 technologies did, in part, reflect a broader view of platform and tool types, the above illustrates that his mental model of technologies was developing as he encountered a range of Web 2.0 tools.

In comparison to the majority of students, the teacher and TL often referred to technology categories when discussing what they used for their work and/or personal use, e.g., “I took the library blog to the English meeting, not only to sort of show them that this is a blog about reading, but also to say, well this particular technology has implications if you want kids to be sort of e-journaling”, or “I really like the wiki for the group work”, or “the wiki is going to be great for me, because I'm going to be able to see who did what, and when”. Sometimes the TL would qualify the technology category with the specific name of a tool within that category, e.g., “I use blogs, such as Wordpress for...”, or “I do use Skype – Skype Chat and VOIP”. This illustrates a broader conceptual view of technologies in general, and specific types of platforms and tools.

5.2.2.1 Vagueness

Interviews with the students found their mental model of Web 2.0 technologies, and the Internet and technologies in general, could influence their perceptions about a particular technology, and therefore their decision to use or not use that technology. This was often based on their previous experience with a particular technology, or lack of experience with a technology. When describing their decision to use or not use a particular
technology, often these students’ explanations were expressed with vagueness, showing a lack of understanding of the features, functionality and potential application of the technology. For example, the following student comments illustrate a lack of conceptual understanding regarding some of the tools they had used to support their project work. Note that these comments were recorded upon completion of their PIP:

I set it [Delicious] up and I had it and it's still somewhere on the internet. (Student08)

I don’t even know what a blog is. (Student10)

The wiki – it was really easy to use, like it was really interesting, and it was really like, it was kind of like a blog, kind of like something you could upload files onto it too. (Student02)

No one really uses wikis, that I know. Though I guess My Space and all those things do count as wikis. Actually they're blogs, aren't they? (Student08)

Two other issues arose while observing students working on their project in class. These were a result of students’ vague mental models regarding the use of a wiki. In the first example, Student02 asked the TL for help with her wiki. She explained that she had created a blog for her journal and a wiki to publish her project, but she was having trouble navigating the wiki. The TL looked at the student’s wiki on her computer screen and realised that, although the student had followed most of the steps as demonstrated, she had created a ‘commercial’ wiki rather than an educational one. This was because she had not developed a mental model of how a wiki hosting site provides its platform for different client groups, in this case one for ‘educational’ users, and the other for ‘commercial’ users.

The second example involved Student05 who did not understand the difference between making a wiki’s content either public or private. Again, the class had been instructed to check the ‘Private’ box in their settings as part of the wiki and blog creation process. While in class (two lessons after the students were instructed to create their wiki), the teacher was talking to Student05 about refining his topic on aviation, and she asked him for his wiki address so she could see what he had written so far about his topic. When she found that she could get into his wiki without a password, she instructed Student05: “You need to go into your settings and make it private”, the setting preference of the teacher. In the same lesson, while Student08 was conducting Google searches, he turned to Student 01 and announced, “Hey, I found my blog in the Google image searches”.
This student had also not edited the settings of his Web 2.0 space to ‘private’. Again, these are examples of a student’s lack of mental model in terms of the features or functionality of a particular technology.

5.2.2.2 Progress in conceptual development

In comparison, some students had started to develop their mental models of the Web 2.0 tools they had used for their project. For example, Student02 was comparing the times she had used a wiki to support her learning, the first time involved using a wiki to support group work and the second was for her PIP, as she explained:

*It was a joint project and we used a wiki, more to talk to each other, like when we were at home. Whereas, with this one, we put all our information on there – not all of it, but a lot of it – and we used it more as a research tool, rather than an email kind of thing.*

While somewhat vaguely comparing the use of the Comments feature of the wiki for communication as “an email kind of thing”, she had been able to articulate the different ways a wiki space could be used, i.e., as a collaborative group space, and as an individual project space. Similarly, Student08’s discussion about using Delicious illustrates how his mental model of social bookmarking was developing, “You’ve got a Delicious account so you’re part of the social group, though I’m not sure what social group would be involved in Delicious.”

He realised as a Delicious user that he could see other people’s Delicious sites, and that he could add other people to his site through the networking feature (because another student and the TL had connected with him in that way). Nevertheless, he was still trying to work out how this fits within the broader community of Delicious users, in his words “the social group”. He later commented, “but there just isn’t a point piling up account after account after account”. While he had trialled Delicious in the first two weeks of his project, he decided to record any URLs in his log. This is an example of a student’s mental model of a Web 2.0 technology influencing his decision to use a tool for an immediate purpose or in the future.

Upon completion of her project, Student07 was still trying to develop a mental model of how her calendar tool was integrated into her wiki, as she explained:
Researcher: *So how did you find the calendar tool, how did you come across that?*

Student07: *I think when you edit the page and it says like insert different things you just choose calendar, and when it's on your page you can just press on it and then you can put in a longer note than just say what you type in, and it can get your log for you.*

Researcher: *Yeah, because it's actually, I think it's called 30 boxes dot com, so it's actually on a separate website-*

Student07: *Oh.*

Researcher: *... which plugged in to your wiki, so you didn’t realise that-*

Student07: *No, I didn’t realise that, it was just a link on the wiki, so it was really interesting... Yeah.*

The student went on to explain what a useful tool the calendar had been and did not appear to be worried about how “it all connected”. It worked for her, and her focus was on its functionality in terms of supporting her in “getting the job done”. In this case, developing a deeper understanding of the technology (thus her mental model) was less important to the student because “it worked” for her, meaning that she did not feel that she needed to invest any more time in conceptualising the mechanics of how it worked.

It is interesting to note how some of the students used the interview as an opportunity to talk about their thoughts and conclusions on using one or more of the technologies. This suggests that some students benefit from reflecting on their use of technologies and, by way of discussion with another person, such reflection can contribute to the development of mental models of technologies they experience as part of their project work. As a result of such discussion, the vagueness of their conceptualisations can move towards stronger mental models, whether they be towards a technical conceptualisation, or one of conceptual enrichment, both of which are outlined below.

### 5.2.2.3 Technicality

Some participants expressed their understanding of different technologies principally in technical terms, i.e., detailing the features and functions of technologies, thus demonstrating a deeper understanding of the nature of the technology or technologies
they chose to use. Students, the TL and the teacher differed to a degree within this conceptualisation and so are discussed separately.

The students

The following explanation by Student03 on using a wiki illustrates a student’s technical conceptualisation of a technology:

*I chose wiki probably because I’ve, we used it once before... I recognised that it would be useful for what I was going to be doing in that I wanted to make lots of edits, be able to just put it out in a nice clear format, basically just type it up, almost as a word document online and be able to go back and constantly edit from lots of different computers. And that’s what I ended up using it as. I suppose that’s why I chose it because... I have a good knowledge of the technology.*

This was similar to Student09’s evaluation of using a wiki for her learning log: “*It was pretty simple to use and, yeah it was also good for our reflections ‘cause I could just type it in, and the date would come up*”. In his discussion about frustrations with the school network blocking websites, part of the school’s Internet access/filtering policy, Student08 explained about using web proxies to by-pass the school network server:

*So there were these proxies, which are now blocked, which I used to get on to the blog... Peachsurf.info was a proxy which bypassed the school and went to Wordpress. But they blocked it... and then you find a new one, and then the new one might not work as well. So, at the moment one of my friends actually made a proxy... you type in proxymacron.google.com and it comes up with a proxy maker and you make your proxy and the school can’t do anything. But soon it will be blocked.*

While still unsure of the programming behind the school’s filtering system, this quotation shows that the student had developed a fairly sophisticated mental model of what web proxies are and how they work.

A simpler example which was expressed by a number of students was an explanation about how they stored and kept track of the URLs of useful websites. A number of students who decided not to create a Delicious account were able to explain the technical process they employed to save URLs to either a Word document or their wiki. The following comments are illustrative:
I usually just copy the address into a Word document and when I open it, like the next class, I can usually just click on it and it’ll... open up the internet explorer and it will go to the page.

The habit that I do is I go to the website, find, like I copy/paste what’s interesting and the URL and italic it... So anything that I write myself I do in normal [font]... but anything that’s pasted is italics. So you can just see a chronology of what you’ve done.

Both these examples are illustrative of students’ mental models in terms of their ability to explain their understandings of the technicalities of using a particular technology. Thus some students had the capacity to ‘think about’ technologies in this way, i.e., to develop mental models of how a technology works and can be utilised.

**The teacher librarian**

The TL’s mental models in terms of technicality emerged from the pre- and post-interviews. For example, in describing the use of the library blog, she indicated its role in communication between the TL and students, commenting that “it may not just be reviewing books, it might be making a comment on reading, recommendations or inserting YouTube clips to engage students”. Another example is the TL’s explanation illustrating her mental model in terms of technical requirements for unblocking sites:

*The primary concern would have to be that the IT structure is not supporting the most efficient use of the technology... [reflecting] the problems with the server, so that sites are blocked, etcetera. A lot of the sites where you actually have to set up the blogs and wikis have been blocked, so it’s been a matter of trying to get those sites unblocked.*

Wikis and blogs were fairly new to the TL at the time, who had only used a blog for about ten months and wikis for six months prior to the PIP unit. Nevertheless her explanation anticipating how the Web 2.0 tools could support instructional intervention in a guided inquiry process demonstrates the technical dimension of her mental model regarding capabilities of the blog and wiki tools:

*I think... those interventions are actually supported by the technologies, because the technologies also provide a record – you know, your wikis and your blogs, because they provide dates, they also provide supporting evidence of whether the kids are actually doing it along the way, or actually leaving it until the last minute.*
The teacher

In the pre-interview the teacher had foreseen the wiki’s attributes when she stated, “the wiki is going to be great for me, because I’m going to be able to see who did what, and when”, although, the use of technologies were often expressed in less technical terms compared to the TL’s explanations. In fact, a mental model that was most prominent in the teacher’s pre-interview was that technology can be a major time-waster, especially for those students who had a reputation for being “easily distracted” or “not on task”. Her concern was students could waste too much time “playing” with the technology rather than investing the majority of their time on the research process components of the project. This was based on her own personal use of Web 2.0 technologies as well as her previous experience with her students, as captured in the following comment:

I’ve got Facebook and whatever, and it is a massive time sucker, and so there’s that concern as well, that there’s a clear correlation between what they’re doing on the wiki or the blog, or whatever it is, and what they’re doing on Delicious. Because, you know, we’ve all sat there and tidied our desk, and rearranged our sheets instead of doing our assignment, and I think, when you’ve gotwikis and blogs, and Delicious, and things like that, the temptation is to spend the lesson sitting there organising all your bookmarks into categories, rather than... actually do it [the assignment]. And I think, like that’s a concern that I have about these kind of technologies, that they can suck up the time.

A mental model of technology being used in the curriculum as a “time sucker” could potentially influence whether teachers decide to trial or integrate technologies into curriculum units. In this case, the teacher was willing to trial Web 2.0 technologies as part of the design of this revised PIP unit because she had seen the benefits with previous classes, including this Global Studies class who had used a wiki in the previous term to support group project work. However, for other teachers, developing a mental model based on such a concern could become a barrier to their willingness to trial technologies in their teaching.

5.2.2.4 Enrichment

A third type of mental model was that of enrichment. Some of the students and the TL discussed their views on the value of technology as enriching and enabling life, and empowering teaching and learning experiences. Those participants who expressed their understanding of, and experiences using, technology in these terms were those who were not just willing but very keen to explore the potential of a new technology, and discussed
the technologies in their lives as ‘value adding’ to their work, learning and/or communicating with others. For example, when asked about her use of the Comments feature in her wiki, Student09 replied:

> That was really good and I used the comments for my reflections... So that was useful for that and it was good, yeah. Miss [TL], you know, she’d give me links to sites and she’d, yeah help me narrow down my topic and it was good because I did check my wiki every time I went on the internet.

This student liked the fact that she could “check my wiki” when she was not in a Global Studies period, i.e., when she was in the library, or after school, or when she was in her room at night as a boarder on campus. She also created a Delicious account and when asked how this supported the completion of her PIP, she discussed the benefits of storing the URLs of websites and webpages she found in the one place which could also be accessed by any computer and at any time. In addition she noted, “So it was good and it’s just good to come back to, they’re all there. Oh and also Miss [TL], a couple of times she had good sites and so she’d do this ‘Links for You’ thing, you click on Links for You and they come up.”

This student discussed the value of the wiki and Delicious in terms of them enriching her PIP experience, particularly with regard to having greater contact with, and instructional assistance from the TL during out-of-class times. Eighteen months after this student had created her Delicious account for her PIP, there was evidence of further activity on her Delicious account where she was using it to support the information gathering phase of a project she was working on, when she was in Year 12. Thus a student’s mental model of a technology being one of enrichment can contribute to their decision to use it in the future to support their learning.

The teacher also expressed the view of a wiki as enriching her ability as a teacher to monitor student progress in another one of her classes, Year 9 Global Studies. In her words:

> It’s going to be fantastic. I mean, I really like the wiki for the group work, and in Year 9, their PIP is actually done in a group of three... so, there’s always that issue with any kind of group work, about who did what, and who contributed what.
She also discussed the desire that her Year 9 students would see the value of the wiki in enriching their learning, particularly in terms of project management: “And they might see the utility in actually organising – it’s also a good way to keep Year 9 boys organised, or attempt to keep them organised!” This is an example of a teacher’s mental model of a technology acting as an enabler in terms of encouraging them not just to trial a particular technology in their teaching but to, firstly, integrate it into other or subsequent curriculum units in the future and, secondly, hope to influence their students’ use and adoption of a new technology to support their learning. The latter aspect is explored in detail in Section 5.6.

In the pre-interview with the TL, she discussed how one of her emerging roles in the past few years had been to work with other TLs in the Library team and with teachers to introduce and trial the application of new and emerging technologies. She had done this through professional learning sessions, including offerings as part of the Library’s professional learning program for teachers in the past year. Her view was that it was part of her role to explore the Web 2.0 landscape to find technologies that had potential in supporting the needs of teaching staff. She argued the real challenge for educators at this time with Web 2.0 technologies was “because there are so many new technologies being exponentially offered, that people are trying to address them all and become involved in them all, that you actually spread yourself so thinly that you don’t do any of them effectively”. Therefore, in terms of Web 2.0 innovation, she described working with teachers as a curriculum and teaching partner to help “look at your learning outcomes and just choose whichever the best alternatives [technologies] are, because... you can’t do everything”. When asked did she see part of her role to act as a ‘filter’ in selecting appropriate new and emerging tools, she stated:

Well not only a filter, I think that I’ve got almost an obligation, I guess, to be a leader in taking technologies that can be used in the classroom to the teaching staff, because... teachers are busy people. They don’t want to... having to experiment, they want something’s that tried and tested... Teaching staff haven’t got time to sort of spend their evenings, or whatever, just wading through this sort of absolute swamp of Web 2.0 technologies that are – you know, where the water is rising constantly... Is it actually offering anything that is not already being achieved by what is currently there? So, it actually has to value add, I think, before teachers will embrace it.

In other words, before recommending a new technology to a teacher for trial, the TL needed to have developed a mental model of that technology in terms of enrichment, and
if she did not see a technology as potentially enriching, she would feel less confident in suggesting that a teacher consider using it to support their teaching. Therefore, a TL’s mental model of a particular technology can also influence teachers’ choices of technologies as well as those of students.

In conclusion, mental models of technologies can influence students, teachers or TLs’ decisions to use or not use a particular technology. Furthermore, mental models of others can influence the mental model of a teacher, TL or student, thus potentially shaping an individual’s approach to technology use.

5.2.3 Technology informants

A third element contributing to a student’s approach to technology use is the people within their sphere of influence. Be they classmates, teachers, TLs, family or friends, their opinions about, expertise in, and preferences for technologies can influence a student’s decision to use a particular technology. In other words, they become ‘technology informants’ who based on the circumstances can either dictate or encourage a student to use one or more technologies. Based on a student’s experience with a particular technology, these people can contribute to a student’s knowledge about the features of, and potential applications of, the technology. They can also engage with the student using a particular technology to assist them in skill development, and as mentioned in the previous section, can assist in the development of a student’s mental models of technology. Furthermore, students themselves can play the role of technology informants in the lives of those around them, taking on a role of instructor, trouble shooter, or mentor. This process of ‘informing’ with regard to technology use between participants was observed throughout the inquiry learning experience.

For example, in this study an obvious influence was the teacher who introduced new technologies as part of design of curriculum units. The teacher’s use of a wiki to support the group project in Term 2 is an example of this, as was one of the school’s History teachers who also used a wiki earlier in the year with his Year 10 class (some of whom were also in this Global Studies class). In addition, Student07 discussed how she had been taught Microsoft Excel when she was in primary school (Year 5) and how she has used it a number of times since, felt very comfortable with it and decided to use it create
tables and graphs to insert in her written PIP report. She also discussed how she had been taught how to use EBSCOhost earlier in her schooling, “I learnt how to use it last year, at my previous school, but, I was reintroduced to it this year... when we were doing... a science assessment.” She therefore felt confident in using it for her PIP since “you can easily get there from the school portal” without needing assistance from her teacher or the TL.

Interviews with some students also revealed a complex tension between their level of tolerance, interest and willingness with regard to adopting a new technology when it was introduced to them by a teacher compared to a friend or family member. On one hand, some students were sceptical of the ‘faddism’ of technology, especially when introduced by some teachers. As Student11 expressed:

There’s always the fiddly stuff trying out the new technology and doing all these new programs, and you kind of just get a little bit sick of it... I kind of don’t like having the whole fiddly technology for the sake of technology stuff.

Classroom observation also revealed this scepticism by Student12 who challenged the teacher at the early stage of the PIP asking: “Why can’t I create a big book rather than using a blog or a wiki?”. His quiet comment to Student 08, sitting next to him, was that all the teachers in the school “are wanting us” [the students] to use wikis because they had recently learned about them at a professional development day. “So they want everyone to use wikis now”, Student12 concluded.

This scepticism of teacher-led technology innovation is interesting when compared to students’ interest and willingness to try new technologies introduced by their peers. An example of this was presented in Section 5.2.1.5 where a number of students in the class used MSN instant messaging to connect with their classmates and friends while working on their projects from home because it was the ‘collectively accepted’ tool of choice, and was considered very useful by the students to discuss the final writing/proof reading phase on the eve of the project submission date. In fact, some student’s used MSN as a major part of their support network, as described by Student10:

So I usually work at night and there’s usually someone else that’s got some ridiculous pressure going on. So like over MSN I’ll be talking to them about it. They’ll probably help me with it; ideas, that kind of thing. So I actually find that a lot more useful than you’d think.
Interviews with some students highlighted they were clearly persuaded to use certain technologies as a result of their friends’ use and preference for a particular technology, and student behaviour in class particularly reflected this with the use of web proxies to break through filters on the school network, and references regarding MSN and MySpace for personal use which was described as being part of a ‘social club’.

That said, students were willing to consider the use of a new technology suggested by the TL in this study, especially when they had a specific information need or task to complete, and they were not sure of what technological options were available to them. The two students who decided to use the web-based survey tool, SurveyMonkey, is a good example of this (as outlined in Section 5.3.4). A number of the students were also willing to learn how to use the school library’s full-text journal databases such as EBSCOhost because they could see the TL had expertise in using this technology, and she was not trying to push the use of this just for the sake of using a technology. They had an immediate need, and the technology recommended by the TL was going to help meet that need. In cases such as this, they were not sceptical of technologies that were recommended by the TL as a teacher.

Throughout the inquiry experience, all students at some stage demonstrated their technology expertise by helping other students in the class with using a particular tool, i.e., they were the technology informants. Given the layout of the classroom consisted of a bank of desktop computers at tables along three walls of the room (where the majority of the project work was completed during class time), the students regularly discussed what they were working on with those sitting beside or near them. Often a student would share their frustration with a technology problem, or ask a question of those around them about “how did you add that to your wiki” or “how did you do that on Delicious”, and one or more students would offer advice. This provided a lot of scope for students in the class to share their expertise with others, which also contributed to the development of their own and others’ mental models of technology.

5.2.4 Students’ personal technology toolkit

While a major focus of the study was to examine the use of Web 2.0 technologies to support student learning, the concept of a student’s personal technology toolkit (PTT)
emerged from the analysis of data, including classroom observation, Web 2.0 spaces observation, PIP presentations, reports and artefacts, and student interviews. The concept emerged as a result of the identification of many other technology tools being used by students to complete tasks for their PIP (as summarised in Table 5.6). Therefore, the existence of a student’s PTT is identified as the fourth and final element comprising a student’s approach to technology use.

While the elements of criteria determining technology use, mental models of technologies, and influence of technology informants affect students’ use of Web 2.0 technologies, this fourth phenomenon of the personal technology toolkit also impacted on the degree to which the students used Web 2.0 technologies to undertake their inquiry project. This concept demonstrates that it is important for teachers and TLs to understand what technologies students bring with them to a new learning experience such as an inquiry unit, as this can influence their decision to use technology tools or functions to complete certain tasks. In other words, teachers and TLs need to acknowledge the existence of a student’s PTT as part of the learning environment. It is only then that we can fully understand what Web 2.0 technologies they use, when and how they use them, and why they use them to support the inquiry learning process.

An examination of a student’s experience in Section 5.2.1.7 demonstrated how previous and successful use of a particular technology could contribute to a decision to use that technology again, whether this eventuated in trying it another time in the future, or whether successive uses had lead the student to ‘adopt’ that technology as part of their own toolkit.

A student’s personal technology toolkit can be defined as that suite of information and communication technologies an individual uses on a regular basis to complete specific tasks, whether for personal or school use. The toolkit consists of an individual’s own personal collection of “preferred” technology tools, where each of the technologies in this collection have been trialled, evaluated and then selected as the preferred tool over other tools available to complete the same task. In other words, these technologies have been “adopted” by individuals to help them function effectively as digital citizens in today’s complex informational and technological world.
The toolkit is a suite of not just preferred technology tools, but also of techniques and strategies an individual employs to effectively use each of these tools. The *Macquarie Dictionary* (2012) defines toolkit as “a collection of tools kept together and usually so comprehensive that it contains all the tools likely to be needed generally by its owner for some particular work”. This aptly describes the nature of a PTT. The notion of a toolkit suggests a level of compatibility and complementarity between the tools and techniques within such a collection. For the purposes of this study, a PTT is a student’s individual, customised collection of preferred technology tools and techniques that he or she uses on a regular basis to complete a range of school and/or personal information, communication and learning tasks.

Technology tools may include computer hardware, computer software programs, online websites that support programs and applications, and online platforms that support social media and social networks. Technology techniques are the ways students apply skills, understandings and strategies when using tools to accomplish tasks, i.e., it is a way of “doing” or performing a task. For example, if the tool is *Microsoft Word*, copying and pasting content from a website into a *Word* document would be a technique. If the tool is the *Google* search engine, the skills and understanding in developing a search string of keywords or a phrase, is a technique. A student using a blog (the tool) may create a blog entry by writing a body of text using heading levels and hyperlinks, then embedding a *YouTube* video, followed by the insertion of keywords using the tags feature – the three of which are all techniques. The following quotation from Student10, some of which was used before in a different context, provides an example of one of the main techniques in his toolkit which he uses on a regular basis to reduce plagiarising chunks of text that he collects from web resources when writing up a school assignment:

*You get into habits and the habit that I do is I go to the website, find, like I copy/paste what’s interesting and the URL and italic it and then go down. So anything that I write myself I do in normal [font]... but anything that’s pasted is italics. So you can just see a chronology of what you’ve done. And that’s what I usually do.* (Student10)

An assumption underlying the concept of the PTT is that a student has consciously adopted a particular technology tool or technique for it to be part of their toolkit. In other words, the toolkit comprises a student’s ‘tools of choice’, i.e., the tools and techniques they prefer to use to fulfil a specific functionality. The types of technology tools and their
functions identified in students’ PTT prior to completing the inquiry unit are presented in Table 5.7.

Table 5.7 Types of tools and functions in students’ personal technology toolkit

<table>
<thead>
<tr>
<th>Tool types</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop computer</td>
<td>used at home, in classrooms, school library, IT labs and boarding house, on holidays</td>
</tr>
<tr>
<td>Laptop computer</td>
<td>used at home, in school library, on holidays</td>
</tr>
<tr>
<td>Mobile phone</td>
<td>used to communicate with others individually via voice and SMS</td>
</tr>
<tr>
<td>Digital camera</td>
<td>used to capture digital images for school or personal use</td>
</tr>
<tr>
<td>Email</td>
<td>used for communication between student/teacher/ TL, and transferring files to/from school and home.</td>
</tr>
<tr>
<td>Instant messaging</td>
<td>used to communicate with other students individually or in groups (viewed as more immediate than email)</td>
</tr>
<tr>
<td>Web browsers</td>
<td>used to locate and collect web resources and websites as bookmarks (eg. <em>Internet Explorer Favourites</em>, <em>Firefox</em> or <em>Safari Bookmarks</em>)</td>
</tr>
<tr>
<td>Search engines</td>
<td>used to search for information and websites (students used Google as their ‘default’ search engine)</td>
</tr>
<tr>
<td>Library catalogue</td>
<td>used to locate within school library collection</td>
</tr>
<tr>
<td>Library full-text databases</td>
<td>used to locate e-journal articles, newspaper articles</td>
</tr>
<tr>
<td>Web proxies</td>
<td>used to access web resources and websites blocked from the school's filtering system</td>
</tr>
<tr>
<td>Microsoft Office tools</td>
<td>used <em>Word, Excel and/or Powerpoint</em> as information collection, analysis, knowledge construction or publishing tools</td>
</tr>
<tr>
<td>Presentation software</td>
<td>used to create presentations to supplement standard Office tools, eg., <em>Microsoft Photostory, Windows Media™ Movie, Microsoft Picture Manager</em></td>
</tr>
<tr>
<td>Printer</td>
<td>used to print hard copy versions of articles and web resources; to print work out for editing purposes, seeking feedback from others, and to publish final project documentation</td>
</tr>
<tr>
<td>Online survey tools</td>
<td>used to design surveys and polls, automatically compile survey data</td>
</tr>
<tr>
<td>Wikis</td>
<td>used on a group project to record ideas and communicate</td>
</tr>
<tr>
<td>Blog</td>
<td>used for creative writing</td>
</tr>
<tr>
<td>Social bookmarking tools</td>
<td>used to collect web resources and websites as bookmarks</td>
</tr>
<tr>
<td>Other Web 2.0 tools</td>
<td>used for either educational or personal use to communicate with others or view online content, including MySpace, Facebook, Twitter, Bebo, YouTube</td>
</tr>
</tbody>
</table>
As presented in Table 5.6, some students drew upon more tools from their PTT than others. This depended on the nature of the topic they explored and how they recorded their learning log, their approach to information gathering/storage and recording of bibliographic details, the research method(s) used for the primary research aspect of their PIP, and the format(s) used for their project report and oral presentation, or a combination of some or all of these.

As a result of completing the inquiry unit where eleven of twelve students were exposed to the three Web 2.0 tools of a wiki, blog and social bookmarking site, all of the eleven acknowledged that they would consider using one or more of these tools as part of their personal toolkit in the future. This emerged from the interviews where each student identified which of the three Web 2.0 tools they planned to use again in the future. For example, all eleven students stated that they would use a wiki again to support their learning, with one student (Student11) qualifying his adoption of the wiki as a group collaboration tool only, i.e., he did not see the point of using it as an individual project space because he would prefer to use a Word document. One student (Student08) also said he would continue to use a blog as a thinking and publishing space in preference to a wiki space, and another (Student09) stated she would use Delicious again in the future to store her web resources. In addition, two students also adopted other Web tools as part of their PTT, namely an online survey tool, SurveyMonkey (Student 09) and a web calendaring tool, 30boxes.com (Student 07). Thus the exposure to these Web 2.0 tools did influence the composition of all students’ PTT in some way.

In a student’s PTT, some of the tools and techniques were used frequently. For example a tool might be used multiple times per day, or once a day, while others were used less frequently – once a week, fortnight, monthly or even per school term. No matter what the frequency, each tool or technique in a student’s toolkit was used as regularly as a new task required in terms of functionality. When a student was faced with a task that required functionality that no tool or technique in his or her toolkit could accomplish, it was only then that they sought out a potential new tool. Alternatively, if a student diagnosed that he or she needed to find a different tool to meet their needs because their toolkit did not contain a tool with the required functionality, they were willing to receive advice or recommendations from others, be that a teacher, TL, peer, or other person within their sphere of influence such as a family member or friend.
In Table 5.6 it was also important to note the range in the breadth of tools used by students, with some student using up to ten tools compared to the smaller sets of tools used by others. This demonstrates that there is no ‘one size fits all’ approach to the development of students’ PTT and how these may be utilised to complete particular tasks. It should also be noted that a student is not going to draw upon all tools within their toolkit for each learning task. The simplicity or complexity of a task will determine which mix of tools and techniques have the best utility in terms of completing a task, efficiently and effectively, which is illustrated by Student09’s experiences as described in CIP 5.2.

CIP 5.2 Developing your personal technology toolkit

<table>
<thead>
<tr>
<th>Case in Point 2: Experiences that shape development of a personal technology toolkit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student09 was one of two students who used the greatest range of technologies to</td>
</tr>
<tr>
<td>support the completion of their PIP, using a total of ten different tools (see Table</td>
</tr>
<tr>
<td>5.6). This included a wiki as her main project space, a web browser and search</td>
</tr>
<tr>
<td>engines, an online survey tool to collect and compile her primary data, email to</td>
</tr>
<tr>
<td>communicate with her teacher, four tools from Microsoft suite – Word, Excel,</td>
</tr>
<tr>
<td>Picture Manager and Document Scanning, Delicious for social bookmarking, and</td>
</tr>
<tr>
<td>proxy websites.</td>
</tr>
<tr>
<td>For her main PIP online space, Student09 selected a wiki because she had used it</td>
</tr>
<tr>
<td>in the previous term for the Global Studies group project:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>So I knew how to use it, which I think was a big thing. We had to kind of, when</td>
</tr>
<tr>
<td>we did the wiki before we had to spend a fair amount of time just learning how</td>
</tr>
<tr>
<td>to use it. And so I didn’t really want to do that again with the blog, and I</td>
</tr>
<tr>
<td>figured I knew how to use it and it worked.</td>
</tr>
<tr>
<td>Familiarity, ease of use, return on investment and utility were the main criteria</td>
</tr>
<tr>
<td>she applied to decide on the wiki to support her PIP, as she concluded, “It was</td>
</tr>
<tr>
<td>pretty simple to use”. Although she was not interested investing further time in</td>
</tr>
<tr>
<td>getting to know another tool such as a blog, and she already had a ‘technique’ for</td>
</tr>
<tr>
<td>recording websites, she saw potential in “giving Delicious a go” because she</td>
</tr>
<tr>
<td>liked the idea of keeping a record of websites she found them. She saw Delicious</td>
</tr>
<tr>
<td>as a possible way of improving her current approach:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>When you’re trying to write your bibliography as you’re going along, and just so</td>
</tr>
<tr>
<td>you can keep sites that you’ve used that you might want to come back to [referring</td>
</tr>
<tr>
<td>to Delicious]. You know, I usually just put them into a Word document, like copy</td>
</tr>
<tr>
<td>and paste and that doesn’t get all the information. Like it doesn’t get when you</td>
</tr>
<tr>
<td>used them and stuff. And I always forget to do that.</td>
</tr>
</tbody>
</table>
She also liked the ‘Links for you’ feature of Delicious where another user in your Delicious network could recommend web resources for you, which you could then save as part of your Delicious bookmarks. Upon completion of her PIP she concluded this was a tool that she would use again in the future. Delicious and the techniques she used as a result of its features and functionality to record and manage bibliographic information, made them candidates for inclusion in her PTT.

She also found greater functionality in the wiki this time she used it. For example, she used the Comments feature in her wiki to record her reflections on the project experience (this became her log). She also liked the way the TL used the Comments feature on her wiki to “help me narrow down my topic” and recommend resources on her topic “to check out”. She appreciated the contact she was getting with the TL on her wiki and this led to her developing a new habit: “It was good because I did check my wiki every time I went on the internet... I’d just go and check my wiki and see if there was any comments and stuff. And you know, just do a reflection if I’d thought about something”. She is used to journaling her thoughts because she does it in other subjects, e.g., “we do log books in drama”. So she saw this tool had potential application in completing writing and reflecting tasks for other subjects.

All students were asked to use the same password access to their wiki (globstud) principally as an easy way for the teacher and TL to access each student’s wiki without having to remember individual passwords. However, this also allowed students to access each other’s wiki to see what they were doing. Student09 liked this feature. She made comments on the wikis of two of her classmates, and this showed her the potential use of the Comments feature for future projects where you might want to invite classmates to provide feedback on your work. Her mental model of the wiki as a project space was developing from ‘technicality’ to one of ‘enrichment’. The collective benefits of the wiki’s functionality made it a strong candidate for inclusion in her PTT.

Student09 was a boarder at the school and, like a lot of the boarders, she used web proxies to access “stuff on the Internet” that was blocked by the school network’s filter. In the interview she explained how the boarders “depend on the proxies”, and when the proxy you were using gets blocked “someone else finds more, and then you ask people”. Web proxies were already part of her PTT. She used them on a regular basis, often a number of times per day.

For her PIP topic Student09 explored perceptions of homeless people, and how homelessness was addressed in Australia and internationally. In class (in the second week of the project), she discussed with the TL the possibility of interviewing people about their perceptions of homelessness, but the protocols and permissions needed, as well as the technical aspects of recording the interviews and transcribing the interviews sounded a bit too complicated. So Student09 decided to explore the option of surveying people.
The next week Student09 decided to undertake a survey but she did not want to spend “hours collating these surveys”. She discussed this with the TL who suggested she try an online survey tool such as Zoomerang. She created an account and started to create her survey, but she did not go back to the site for a few days and when she logged back in it asked her “to register, you know, pay X amount of money. And I was like, I don’t really want to do that.” [It sounded like she had selected an offer to trial a business account and after seven days it had defaulted to a paid service, but she did not seek advice from the TL or teacher about this]. Instead, she tried SurveyMonkey (someone else in class was using it) and she was really happy with the results, “The way the results were presented were really good”. In her interview she identified SurveyMonkey as a tool that she would use again in the future to conduct a survey. This became another candidate for inclusion in her PTT.

As a result of this inquiry learning unit, Student09 had therefore considered adding three technology tools to her toolkit – a social bookmarking tool (Delicious), a wiki, and an online survey tool (SurveyMonkey).

While Student09 was conscious of wasting too much time learning new technologies, she was open to exploring the possibilities, particularly if she thought a tool could either save time and effort such as an online survey tool that collects data and automatically compiles the results, or when she thought a tool might be able to help her be more effective or methodical in her technique, e.g., the use of Delicious to collect and manage bibliographic information of online resources. Student09 is an example of a student with a broad set of criteria for technology use, and a willingness to embrace new technologies, some of which were influenced by the mental models – technicality moving into enrichment – she had developed.

In comparison, Student10 had a restricted set of criteria for technology use, as illustrated by the following comments on his future use of the technologies:

*I would definitely use it [a wiki again] because I know how to use it now. Like once you’re comfortable with a program, it’s good. If it’s a new program that you’re having to learn and you have a choice of an old one, I’m the kind of lazy guy that won’t bother. Like that Delicious thing, I didn’t really see the point in that, to be honest.*

Student10 had a preference for using an existing tool from his toolkit, if it can “do the job” instead of trying to learn a new technology. Return on investment, accessibility,
utility and ease of use were not as important to him as familiarity in choosing to use or not use a particular technology. Thus, Student10 had a fairly limited set of criteria. In addition, when he explained what tools he used and how he used them, this was often expressed in vague terms, i.e., the way he articulated his understanding of the technologies, their features and functionality and how to use them were characteristic of a person whose mental models of the technologies were vague. His explanation of his technique of copying and pasting using italic font was the only technical explanation given throughout his interview. Such elements influenced a student’s willingness to trial new technologies.

The comparison between these two kinds of attitudes is stark. Those who evaluated new tools using a broad set of criteria, whose mental models of technologies encouraged the exploration of ‘the new’ and who considered potential applications, were the ones most willing to expand and/or revise their PTT with the emergence of new technologies. The following concluding statement by Student07 in her interview illustrates such willingness:

*I think I have learned a lot... learning to use the technology and the different, like, programs they have on the computer, such as the wiki.*

These findings also demonstrate the complex nature of the suite of technology tools and techniques that each student brings to the classroom, and to inquiry-based curriculum units, if the learning environment of the school is networked and connecting students and teachers to the online world of information, communication and learning beyond the walls of the school.

### 5.3 Functionality of Web 2.0 technologies

Students were given a choice to use a blog or wiki, and access to a social bookmarking tool to support the completion of their inquiry project. As presented in Section 5.2, this research showed individual students made decisions about which of these tools they would use based on their approach to technology use, comprising the four elements of: criteria determining technology use; mental models of technology, technology informants, and students’ PTT. Based on these insights into students’ approaches to
technology use, this section will present findings on the functionality of Web 2.0 technologies with regard to supporting students’ inquiry learning experience.

Analysis of students’ blog, wiki and Delicious spaces identified seven broad functions these Web 2.0 tools provided. These functions included:

- information collection and repository;
- communication;
- project management;
- data collection and analysis;
- knowledge construction;
- publishing; and
- self-reflection.

As noted in Section 5.2, all students did not fully embrace or equally utilise the Web 2.0 technologies available to them (if at all, in some cases). For example, only two of the twelve students attempted to set up a Delicious account (one of whom used this throughout the completion of her project), three of the twelve students created blogs (two of whom stopped using these in the early stages of their PIP), and all but one of the students created a wiki (one of whom did not use it to complete their PIP). Furthermore, three students used additional Web 2.0 technologies, namely an online survey tool and a calendar tool, to support their project work. While the functionality of these tools did not expand the range of functions identified, the way the students used these did broaden the scope of the data collection and analysis, and project management functions as defined in Sections 5.3.3 and 5.3.4.

Table 5.8 presents a summary of how each of the seven broad functions were actualised by students using the wiki, blog, social bookmarking, survey and calendar tools. The remainder of this section explores the application of these Web 2.0 tools according to each of these seven functions in detail.
<table>
<thead>
<tr>
<th>Functionality</th>
<th>Wiki</th>
<th>Blog</th>
<th>Social bookmarking</th>
<th>Online survey</th>
<th>Web calendar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information collection and repository</td>
<td>Can be used as a storage space for documents, and recording information from sources, collecting useful quotes, recording ideas, capturing bibliographic information of sources. Lends itself to supporting 'copy &amp; paste' of full text from digital resources – students can store these 'chunks of information' to draw upon in the knowledge construction phase of their project. As a repository provides students with a rich 'storehouse' of information on their topic and the page creation feature can be used to create separate pages for each sub-topic.</td>
<td>Can be used as a storage space to record information from sources, collecting useful quotes, recording ideas, capturing bibliographic information of sources. Lends itself to supporting 'copy &amp; paste' of full text from digital resources. The page creation feature can be used to create separate pages for each sub-topic.</td>
<td>Can be used to collect titles, URLs and annotations of web resources, and bibliographic references etc. The use of tags helps students build a collection of resources on particular topics and sub-topics.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Calendar</td>
<td>Online Survey</td>
<td>Social Bookmarking</td>
<td>Blog</td>
<td>Wiki</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
<td>--------------------</td>
<td>------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td><strong>Project management</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can be used as a tool to record tasks to be completed by certain employees, planned, recorded, and tracked.</td>
<td>Can be used as a tool to record tasks to be completed by certain employees, planned, recorded, and tracked.</td>
<td>Can be used as a tool to record tasks to be completed by certain employees, planned, recorded, and tracked.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functionality</td>
<td>Wiki</td>
<td>Blog</td>
<td>Social bookmarking</td>
<td>Online survey</td>
<td>Web calendar</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Data collection and analysis</td>
<td>Can be used as a place to design survey and interview questions, upload audio files of interview data, record transcripts of interview data, and record notes of focus group interviews. Can also be used to compile and analyse survey data collected from print-based survey forms.</td>
<td></td>
<td>Can be used to design sets of survey questions, automatically collect survey responses, and automatically analyse quantitative responses and present these in graphic formats. Can also provide downloadable summaries of data in a range of exportable formats for further analyses.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge construction</td>
<td>Can be used as a knowledge construction tool where students document their thinking and development of their ideas. A powerful function for teachers and TJs is that they can monitor the knowledge construction process of students through the ‘history’ feature of wikis.</td>
<td></td>
<td>Can be as a knowledge construction tool where students document their thinking and development of their ideas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functionality</td>
<td>Web calendar</td>
<td>Online survey</td>
<td>Social bookmarking</td>
<td>Blog</td>
<td>Wiki</td>
</tr>
<tr>
<td>---------------</td>
<td>--------------</td>
<td>---------------</td>
<td>--------------------</td>
<td>-----</td>
<td>------</td>
</tr>
<tr>
<td>Support project work.</td>
<td>2.0 scope used to websites, or other web plug-ins to a wiki, blog. It can be inserted as a Google form. Experience throughout inquiry learning. Reflections of their learning can be recorded in the project portfolio. Students can record their reflections where they can self-reflection tool to be used as a tool for self-reflection.</td>
<td>Self-reflection can be used as a tool.</td>
<td>Solving these: Conducting thorough example of projects and programs. Identifying problems and inquiry process. Students can record their feelings throughout the self-reflection. Students can record their feelings throughout the project portfolio. Can be used as a tool.</td>
<td>Publishing work of their final project. Published piece of a project or published assessment as a presentation. This could include their final assessments. The could be an audience other than their work to an audience other than students or present students to present their work to an audience other than students. Publishing tool for students.</td>
<td>Publishing can be used as a tool.</td>
</tr>
</tbody>
</table>
5.3.1 Information collection and repository functions

A wiki or blog can be used as a storage space for recording information from sources, collecting useful quotes, collecting and storing image and video files, recording ideas, capturing bibliographic information of sources, and uploading and storing digital copies of sources, documents and learning artefacts. A social bookmarking tool can be used as a storage space for capturing bibliographic information of sources, collecting useful quotes, and collecting URLs of web resources and websites. The *Oxford English Dictionary* (2012) defines a repository as a place where “things are or may be deposited, esp. for storage or safe keeping”. This definition captures the way the wiki, blog and social bookmarking tools were used by the students of this study.

5.3.1.1 Function of wikis

Students used the wiki as a central storage place for all of the different pieces of information, templates and documentation they gathered on their topic. Because the wiki could be accessed by any of the computers at school or from home, this central repository was used as a place for ‘safekeeping’ a student’s collection of sources, artefacts, objects and ideas, i.e., it was being saved on the Web (in ‘the cloud’) as opposed to saving it on a USB drive or personal folder on the school server, or having to constantly email bits and pieces to transport them between school and home computers. The wiki’s simple navigation list in the left hand column allowed students to build a directory of each page created. Students created a range of pages in their wikis. These included:

- a topic page or pages where they stored selected chunks of information gathered from websites and resources;
- a project log or journal page where they recorded the steps in the inquiry process undertaken, resultant actions and problems (if any), and how they felt about specific incidents along the way;
- a project organisation page where they developed a research plan and uploaded the progress report templates;
- a bibliography page to record the bibliographic details of sources used;
- a research page or pages to develop the questions for survey design or interview schedule, upload transcripts of interviews, and compile and analyse survey data; and
Students built their wikis throughout the course of the unit in different ways. For example, some students started with using the frontpage template provided by the wiki platform as their sole page to store information they gathered from online searches. Other students approached the construction of their wikis by creating a series of pages as a ‘shell’, each designed for a different purpose. Other students started with a couple of pages and slowly expanded to a series of pages as the need arose.

The schedule in Figure 5.2 presents edits and additions made to Student02’s wiki within the first 2 weeks of its creation. Each time a student created a new page or edited a page and saved their work, the date and time that this occurred was automatically logged by the wiki platform, i.e. ‘timestamped’. The wiki platform’s use of timestamping meant that the teacher and TL could look under the ‘Changes’ feature of each student wiki to monitor what activity had occurred on the wiki throughout the duration of the inquiry unit. Further use of timestamping for monitoring purposes will also be examined under Section 5.4.3 and 5.4.5.

As presented in Figure 5.2, the Changes schedule listed activity on the wiki per day, and included four columns of data which were time of activity, name of person who completed the activity, the type of activity (whether a page was added or edited), and the name of the page on which the activity occurred. When content was revised, this was denoted by a red plus sign to the left of each timestamp. For example, Figure 5.2 provides evidence that Student02 worked on her wiki every second day in the first week upon creating it, on Monday, Wednesday, and Friday during Global Studies class time, and she also worked on her wiki on the evening of the day she created it on Monday, August 20 between 7.00-8.15pm, and on the morning of Sunday, August 26 between 10.00-11.00am. On the first day of creating her wiki, she just added content to the frontpage template. On the second day while in class (August 22, Period 3 ran from 9.35-10.35am), she created a new page called ‘PMI’, where she uploaded a ‘Plus – Minus –Interesting’
Figure 5.2 Schedule of wiki page creation, edits and comments
template the teacher had asked the students to complete in the second week of the unit to help them record their initial ideas on their topic of interest. She then proceeded to draft her topic ideas on the frontpage of her wiki, and as the lesson drew to a close, she created a new page labelled ‘Journal’ for her to start to record her learning log.

Furthermore, from Figure 5.2 the teacher and TL could see that Student02 had worked on the completion of her first progress report during the third and final lesson in the second week of the inquiry unit, and created a new page labelled ‘Progress Reports’ to store these as she completed them. She also created a new page called ‘Research Plan’ on which she continued to work on August 26 for about 45 minutes, which was on the weekend (Sunday morning), along with adding to her frontpage and journal page.

The next week during class time Student02 edited her interview plan and created a new page called ‘Bibliography’ (on August 28), and created a new page called ‘Culture’ (on August 29). However the majority of her activity continued to occur on her frontpage where she pasted information found during her searches on the Web and from full-text databases, and added the reference details of a number of bibliographic references to her ‘Bibliography’ page. The schedule also shows she continued to work on her project after school finished on that day, working on her interview plan and adding more references to her Bibliography page.

All of the work Student02 had been doing on her wiki involved collecting information on her topic and recording bibliographic data of sources used, completing inquiry unit templates and uploading these for safe storage, as well as storing reflective notes on her ‘Journal’ page. In her interview, Student02 commented on how she liked the wiki as a central storage place for information she found on her topic as well as recording details of each source as she collected her information. In fact, she developed a new technique in her toolkit as a result, as she explained:

*Every time I went on a site, I’d add it. That’s what was good about the wiki, you could just add it to the wiki, on my bibliography on my wiki, and then I could just add it there and just keep going.*

Later in the term, Student02 used her wiki to store notes made from the interviews she had conducted with people as part of her primary research phase, and she used the wiki to upload and store a draft of her *Powerpoint* presentation which she used to support her
oral presentation to the class. Thus, Student02 is an example of how a student could extensively use the information collection and central repository functionality of a wiki tool.

Observation across students’ wiki spaces identified that wikis were mostly used for collecting information and storing chunks of information, adding image and video files, and uploading PMI and progress report templates. For example, the following excerpt from the researcher’s observation memo on August 22 (Period 3) captures the behaviour of two students during class time:

Student05 opens his wikispace and opens Google search. He begins a search on 'Emirates' and clicks on the first entry which is a Google-sponsored link (a commercial online airfares website). He ends up clicking on a Qantas link and goes to a webpage on Qantas's security measures. He copies the whole page of text, goes to his wiki space, creates a new page based on the pasting of this content - he calls the new page ‘Airline Safety Info - From all parts of the globe’. He continues to search other websites of commercial airlines, e.g., British Airways, and continues to copy and paste content from webpages from a range of airlines into his wiki page.

Later in the same lesson, his behaviour was memoed again:

Student05 continues to populate his wiki with ‘copy & pastes’ - there is no record of the source of each of his copied sections, including text, graphics, airline logos, etc.

In the same lesson Student06 was being shown by the TL how to complete a search on EBSCOhost using the search phrase ‘youth gangs’. They found an article on ethnic youth gangs in New Zealand. The TL instructed Student06, “You can email these articles to your email account.” Student06 replied, “No, I'll just put it in my wiki”, and he copied the text of the full article and pasted it into his wiki. For the remainder of the lesson Student06 searched the Web, using ‘youth gangs’ as his search phrase in Google. Any bits of information he found, he pasted into the frontpage of his wiki. This “harvesting” behaviour of the students in gathering information from digital sources was considerable in the first three weeks of the inquiry unit. The *Oxford English Dictionary* (2012) defines the action of “harvest” as the process of gathering to “lay up in store”, which aptly describes the action of these students’ use of the information collection and repository function of the wiki, particularly in the initial phases of the inquiry unit.
While a wiki tool lends itself to supporting the copy and paste of full text from digital resources, i.e., harvesting and storing of information, students liked the functionality it provided to store these chunks of information which they planned to draw upon in the knowledge construction phase of their project (which is explored in Section 5.3.5). The wiki as repository provided students with a rich storehouse of information on their topic, with a number of the students quite satisfied with their harvesting efforts, as expressed by these students in their interviews:

_We put all our information on there – not all of it, but a lot of it – and we used it more as a research tool... It was very useful._ (Student02)

_I had trouble defining my topic and I guess I wanted to research more on my category before [deciding]. So by copying and pasting it into the wiki it was always there and I could get it from home too. Like, I didn’t have to look the site up again you know._ (Student05)

_I collected all this information and then I focused a lot on getting my primary research because that, I knew, would take a bit of a while._ (Student07)

### 5.3.1.2 Function of blogs

Only one student (Student08) continued to use a blog as his main project space. Although he used the blog in similar ways to other students’ use of a wiki, he did not create separate pages on his blog to host different types of information such as ‘Bibliography’, ‘Research Plan’ and topic pages as wiki users had done. He used the blog posting feature to do this because posts created on the WordPress blogging platform could be revised or updated using the edit feature. This resulted in Student08’s blog consisting of a number of posts about his topic ideas and the refinement of these ideas. However, he did not use his blog to collect and store selected chunks of information gathered from websites and resources as much as those students who used a wiki, partly because of the nature of his topic on internationalisation of the media as represented in newspapers, which principally involved the analysis of newspaper content rather than the construction of a significant literature review based on secondary sources. He used the blog to record posts about the work he needed to complete for each step of the inquiry process, and uploaded and stored his research plan and each of the progress reports he completed. Figure 5.3 illustrates Student08’s use of a blog post to capture his first progress report, i.e., using the blog as a repository.
Instead of uploading a completed version of the Word document template provided by the teacher, Student08 copied the questions into a blog post and then proceeded to answer them. Figure 5.3 also shows how the blogging platform timestamps a post by recording the date it was created at the top of the post under its title, with the name of the person who created it listed at the bottom of the post. However it did not provide as much detail as the wiki regarding the time of the day a post was created or edited.

Figure 5.5.3 Example of student use of blog for recording and storing documentation
Nevertheless, the potential application of the blogging platform in terms of the information collection and repository functionality was not fully explored by this one student. For example, if his topic had required a considerable review of sub-topics from secondary sources, the blogging platform’s page creation feature could have provided the student with similar functionality to the wiki. The blog’s menu feature, where a menu tab is automatically created with each new page (see ‘Home’ and ‘About’ tabs at top of Student08’s blog in Figure 5.3), also provided similar functionality in terms of navigability of pages to the wiki’s editable menu feature.

As previously mentioned, not all students using a wiki explored and actualised the full functionality. If a number of students in the class had selected a blog as their principal Web 2.0 space, a greater breadth of features and its functionality may have been achieved across the cohort, thus providing richer evidence of a blog’s information collection and repository function.

### 5.4.1.3 Functions of social bookmarking

The social bookmarking tool, Delicious was used by the TL as a repository for web resources and websites she collected and recommended to students in the class. At the beginning of the inquiry unit she created a Delicious account specifically for the purposes of this class (with the URL http://delicious.com/globstud). As the TL explained in her interview at the beginning of the inquiry unit, she saw this as a useful strategy in modelling the use of Delicious to both the students and teacher in the class, particularly in the use of the tagging feature in Delicious. In her words, “I guess what we are doing here is we are walking the walk, talking the talk.”

Figure 5.4 presents a screenshot of the class Delicious space, which consisted of a list of items (bookmarks) in the main section of the page with each bookmark timestamped with the date it was saved, and the title of each bookmark (in blue font) was a hyperlink to the URL of the item. All but one bookmark in this screenshot contains a brief annotation and a tag or set of tags provided by the TL. She created tags of general interest to the majority of students in the class such as ‘research’, ‘questionnaires’ and ‘web2.0’, and tags that were specifically related to individual students’ project topics, such as ‘homelessness’, ‘eatingdisorders’ and ‘refugee’. She also trialled the use of the ‘tag bundles’ feature of Delicious to group a series of tags under a ‘bundle’ labelled with individual students’
Figure 5.4 Class Delicious account (globstud) created by the TL.
names, e.g., ‘student06’, ‘student12’, ‘student10’, and ‘student08’. However, by the end of the second week of the inquiry unit, the TL reverted to the practice of simply tagging any bookmark specifically recommended for each student with their name, which meant when a student visited the ‘globstud’ Delicious site they only needed to click on their name listed in the tag list on the top right of the page to retrieve any items specifically recommended to them by the TL.

Eight of the twelve students received bookmark recommendations via the class Delicious account the TL. The TL’s application of Delicious demonstrates the potential use of a social bookmarking tool as a class-based portal where relevant resources can be stored as a collection to support the information needs of students for a specific unit of work, or be maintained for the entire year of study. Such a space could be populated principally by the TL, or it could be populated by the teacher and students as a ‘team of collectors’, particularly if the whole class was working on a single topic or issue, or if a unit involved group-based inquiry projects on a range of aspects within a topic. While, at the beginning of the inquiry unit, the TL suggested to the teacher that she consider posting links to the class Delicious site as well, the latter in her interview stated that she actually found she preferred to do this face-to-face in class, or would post a comment on a student’s wiki. In fact, due to the harvesting behaviour of students using their wikis, this latter technique ended up becoming the predominant method used by both the teacher and the TL as the inquiry unit progressed. This is explored in detail in Section 5.3.2 as part of the communication function of the wiki.

While three-quarters of the class actually visited the class Delicious site to follow up resourcing recommendations made by the TL, only two students decided to trial the creation of their own Delicious account to collect and store web resources and websites. Figure 5.5 presents a screenshot of Student09’s Delicious page. It illustrates the student’s adoption of a new technique in her toolkit using a social bookmarking tool, i.e., allocating tags to bookmarks which identify the main aspects of each item as they relate to her topic. For example, Student09 allocated tags such as ‘homelessness’, ‘statistics’, ‘facts’, ‘census’, ‘youth’, ‘technology’, ‘survey’ and ‘awareness’, to name a few. For the majority of her bookmarks she did not bother including additional content in the ‘Notes’ section.
Student09 saved some bookmarks that the TL sent to her via the Delicious ‘Send’ facility which she really liked, as she explained in her interview, “a couple of times she [TL] had good sites and so she’d do this ‘Links for You’ thing, you click on Links for You and they come up.” Student09 also saved some of the bookmarks from the ‘globstud’ account directly into her own account, one of which was a webpage explaining the methodology of narrative inquiry. This resource informed the writing of part of Student09’s final project report where she as the ‘researcher’ constructed her own narrative based on the conversations she had with three homeless people in the inner city of Sydney while on a photography field trip. While this item was not saved in the ‘globstud’ account by the TL specifically for this student, it does show how the collection and storage of carefully selected web resources and websites in a social bookmarking tool for a class by a TL as a resourcing specialist can inform the design of the authentic or primary research phase of a student’s inquiry project.

As detailed in the previous Case in Point (5.2) featuring Student09, she also liked the way Delicious timestamped each bookmark as she collected her information so that she had a record of when she had accessed each source. She then referred to her Delicious site.
when finalising the bibliography for her project. This is an example of a student developing a new collecting and recording technique with a new tool that could potentially replace the “old way” of doing it.

In his final progress report, Student01 concluded that he would try to use Delicious next time he was working on a project to help him record and track what web resources and websites he had consulted during his information gathering phase, after seeing how satisfied his friend (Student09) was with using it for her project. The use of Delicious, particularly by Student09 and the TL identified a range of ways a social bookmarking tool can be used to support the information collection and storage activities of students while completing an inquiry unit.

In summary, Web 2.0 technologies can function as a repository tool ‘in the cloud’ to safely store students’ collection of documents, ideas, quotes, photos and graphics, web links (URLs) and bibliographic references, particularly in the initial stages of an inquiry unit. This repository function can support such information behaviour such copying and pasting and harvesting, where students store chunks of information in preparation for the writing up phase of their project. The timestamping and history features of Web 2.0 technologies capture students’ online activity, thus providing teachers and TLs with the capacity to closely monitor student progress throughout an inquiry experience.

5.3.2 Communication functions

In terms of the communication functions of these Web 2.0 tools, a few students used the functionality afforded by blog, wiki or social bookmarking tools to communicate with the teacher, TL, or each other, although, the majority of communication within students’ Web 2.0 spaces was instigated by the TL. As mentioned in the previous section (5.3.1.3), the teacher chose not to communicate with students via Delicious because she felt it easier to speak to students during class time or via their wiki. She also explained in her initial interview that she had regular face-to-face contact with the boarding students out of school hours as a house supervisor (which worked well), therefore she did not feel the need to communicate with them online.
The examination of how the TL and Student09 used the social bookmarking tool in the previous section (5.3.1.3) has already identified their use of the communication function of Delicious in terms of the sharing of bookmarks using the ‘Send’ feature of Delicious, and using student names when tagging bookmarks. The TL saw social bookmarking as an efficient way of communicating with the students in the class about resources she had found to support their topics. This technique was employed in preference to having to send numerous emails to each student when locating useful web resources during the course of her working day. The only additional, and third channel of communication that Delicious supported was the use of the ‘Notes’ field to communicate between individuals by way of adding a personal message or annotation as a ‘note’ when one was saving a bookmark. Given few students utilised Delicious as a tool to support their inquiry project, this functionality was not fully explored by participants in the study.

As stated in Section 5.3.1.3, due to the harvesting behaviour of the majority of students using a wiki, the main technique used by the teacher and the TL was to use the Comments feature to communicate with them online throughout the inquiry unit. The TL also used a similar Comments feature on WordPress to communicate with Student08 on his blog. The main communications between the TL and students involved six types of support, including:

- advice and feedback regarding topic selection and refinement;
- advice regarding students’ use of the wiki or blog tool, and technology troubleshooting;
- advice on locating relevant resources;
- advice regarding writing or recording conventions;
- feedback on students’ log reflections and progress reports; and
- provision of affective support, in terms of praise, encouragement and motivation, to help build students’ confidence in using the technologies and completing tasks for their project.

Upon commencement of the inquiry unit, the TL also used the Comments feature to develop a presence in students’ Web 2.0 space. In fact this was done across the wiki, blog and social bookmarking spaces. Some examples include:
You've done some great work on your PIP, Student02. You've bitten off a pretty big topic, so it will be interesting to see whether, as you collect info and data, you think it needs more focus. [comment on Student02's ‘Frontpage’]

Hi Student04, I just received an email with some information on an Eating Disorders seminar to be held at [name of local] Library on 5th September at 7.30. Please see me if you'd like to know more. [comment on Student04’s ‘Frontpage’]

I'm glad you found SurveyMonkey useful. I'll be interested to hear what you think of it after you have gathered your survey results. [comment on Student01’s ‘Survey’ page]

Figure 5.6 presents a screenshot of the schedule of changes to Student02’s wiki which illustrates the type of communication the TL and teacher had with students using the Comments feature or by editing a page. For example, on September 11 the teacher edited Student02’s ‘Interview Plan’ page on her wiki which was timestamped as being in class time. This illustrates how a Web 2.0 project space can be used to document changes and/or decisions made about an aspect of a student’s inquiry project as a result of one-to-one conferencing with their teacher during class time.

On September 4, the TL spent approximately 15 minutes reviewing five of Student02’s wiki pages including her ‘frontpage’, ‘Bibliography’, ‘Culture’, ‘Interview Plan’ and ‘Progress Reports’ page, providing feedback using the Comments feature at the bottom of each of these pages. Note this was at a time during the school day when Year 10 did not have a Global Studies class timetabled, thus illustrating an advantage for students in using a Web 2.0 tool as a project space, because they can also gain feedback from their teacher and/or TL out of class time. It was particularly useful for them to provide follow-up support if they found they simply ran out of time during a period to make contact with all students.

By way of another example, Figure 5.7 presents a communication exchange between the TL and student on his wiki, each of them adding their comments out of class time with the student’s comment made in the evening from home. This exchange illustrates how the TL provided advice asynchronously in terms of locating resources to help inform the selection and refinement of a student’s project topic in the early stages of their inquiry.
Figure 5.6 Evidence of communication between teacher and TL with a student on their wiki
In other words, as she found relevant information or thought of a new way of approaching a particular student’s topic, the TL could go directly to that student’s Web 2.0 space and document her ideas or recommendations as they arose, rather than making a note of these in a Word doc or on a notepad to share with the students when they were next in class, or if she happened to see them in the library or playground at other times.

The conversation between the TL and Student01 continued across a number of pages on his wiki. The following comment was the result of the TL reviewing each of the students’ first progress reports in the fourth week of the inquiry unit:

*Hi Student01, it looks as though you have firmed up your research topic and question and this should now help you with your search for information. Let me know if I can help. I see you were feeling anxious about the early stage of the project and this is understandable. I think defining the question is the hardest part of the research process.* [comment posted 29 August]

Firstly, this illustrates how the TL and student managed to carry their initial conversation (in Figure 5.7) over to a different page on Student01’s wiki without losing the context of that conversation. Secondly, it shows how the TL used comments to encourage students to make contact with her for further learning support, i.e., working at keeping the
communication channels open with students online, as well as in class. And thirdly, it demonstrates how the TL used the Comments feature to provide affective support for students. This became a valuable place to record comments to support the affective needs of students because they were retained in the student’s wiki as a permanent record of conversation, where students could revisit and re-read the comments to help build their confidence that they were “doing OK” with their inquiry project. Furthermore, by providing this type of instructional support via students’ Web 2.0 spaces during out-of-class time, this freed the TL up during class time to communicate with, and provide instruction to those students whose needs were best met in face-to-face mode.

In summary, the communication functionality of Web 2.0 technologies allows the teacher and TL to provide instructional support to individual students out of class time. The timestamping and Comments features create a permanent record of conversation that can be used as evidence of the instructional intervention provided to each student. TLs can use the communication functionality of Web 2.0 spaces to build their presence with individual students and within a class as an instructional partner. The Comments feature of Web 2.0 spaces provides teachers and TLs with a powerful communication channel to support the affective needs of students – in terms of praise, encouragement, and motivation – with students being able to revisit and re-read these comments to help build confidence throughout an inquiry unit.

5.3.3 Project management function

In the interviews, students identified project management as an aspect of the inquiry learning process, with the majority of them commenting that this was something they were not very good at when completing assignment work in general. Students described this in terms of “I’m not an organised person”, or “I’ve got distracted and lost track of what I’m meant to be doing”, or “I could have been a lot better”, or “I’m the most ludicrously disorganised person ever”. Ten of the eleven students who completed the inquiry project commented on time management issues as being problematic or of concern to them in their interviews. They often blamed a lack of time management skills or spending too much time on a specific task that had “put them behind”:

I think I wasted a lot of time trying to figure out what I wanted to do. If I had
known what I was doing from the start, then I would have been good. [Student01]

I have really dodgy time management skills. This has taught me, I really need to sort of work on that. [Student04]

I found that I was falling behind, because like, creating my question, I spent too much time with that. That put me behind a lot. [Student05]

These comments on time management reflect those made by students about problems and frustration in the approaches to study questionnaire (presented in Section 5.1.1.2), as well as comments made with regard to time as a criterion determining technology use as reported in Section 5.2.1.5.

Other students expressed their inability to work on assignments and project work for a sustained period of time because they could not maintain the motivation to do so, as Student10 explained:

I have a short, short attention span for that kind of thing. I’d prefer to put everything into a project for like a week and then move on with something else, because I don’t have that kind of “I’ll do this this lesson and that that lesson”.

They found that putting themselves under pressure by leaving tasks to the last minute was the “best way” to get motivated, as described by these students:

I am the sort of person who really needs like, the pressure of time to motivate me to do something, so a really long project like this was really difficult for me because I sort of left it a bit to the last minute, because I need to know that like, it’s due in like tomorrow or something, right I’ve got to do it, and I only focus when that sort of happens. [Student04]

I leave it to the end, but I always finish it, but I need that stress to finish and do my best. [Student05]

Student08 and Student10 were quite candid in their interviews about their inability to change the way they managed their time to complete tasks for project work, for example:

It's the same mistake I make every time, so there's no point really in retrospect saying: “I won't do that again”, when I always will. Next time you'll make exactly the same mistakes. [Student08]

The above comment also suggests that some students did not see this persistent behaviour as something that could be fixed or improved on, with no real understanding of their
dilemma fitting within the project management context. In fact, a number of the students were quite fatalistic about the problems they faced when trying to juggle all the different aspects of the inquiry project and the time demands and shortfalls. They seemed to accept that “this is just what happens when you work on these kinds of projects” and did not see any ways available to them to help improve the management of the process or the overall project experience. That said, all of the students in the class were able to produce a final product that they felt fairly confident would gain them a pass, and more than likely attain quite a good mark. This resulted in a lack of motivation for some to change the way they “do things” because they have always managed to achieve some level of success. As Student04 concluded: “I got it done, and it was fine, and it was good, like what I passed up was quite good quality, so it doesn’t really matter I guess.”

In their interviews, students could often identify the problem areas that affected them in terms of completing tasks in a timely fashion. These included:

- having taken too long to decide on a topic and finalising a specific research question;
- not having tracked the bibliographic details for sources in the information gathering phase and having to try to find these in the final days of writing up the project report;
- getting easily distracted during class time and wasting periods by chatting, or surfing the Web on topics not related to the project;
- having missed some classes due to illness or attending other school functions or excursions;
- having to catch up on project work at home which they had not completed in class which pushed back progress in moving onto the next task or phase;
- having difficulty finding enough participants to interview or survey for the primary research phase;
- the time required to collate data from print surveys;
- the time required to collate interview data and make decisions about what quotes to include and what to leave out, and how to synthesise these and write these up as findings; and
- not leaving enough time for the writing up phase.
Few students referred to their Web 2.0 spaces as having impeded their progress. Student11 made the decision early in the inquiry unit that he would use a Word document instead of a wiki, which was his way of ensuring the wiki did not impede his progress (as discussed in Section 5.2.1). Student08 felt he wasted more than one lesson early in the term setting up his Delicious account and trying to work out a way of installing the bookmarklet feature to the web browser on the classroom computers (with no success) due to the school’s computer networking policy that did not allow users to customise and save web browser settings. Student09 originally created an account with Zoomerang to create her online survey tool, not realising that she had signed up for a free trial of a few days which was not enough time for her to complete her data collection phase, so she moved to the SurveyMonkey online tool instead.

Student09 also referred to having a technology problem for the writing up phase of her project during the holiday period involving a saving and version control problem between her home computer and the disk being used to save and store her project report. This resulted in the loss of some of her final report. In hindsight, this may have been avoided if she had drafted and saved her project report on her wiki because the track changes feature of the wiki had the functionality of reverting to a previously saved version if content on a wiki page was accidently deleted. Similarly, Student02 had a problem with not being able to upload her large Powerpoint file into the class-based assignment box on the school intranet so she had to buy a USB drive to save it and submit directly to the teacher to be marked. Later in the week she realised she could upload a copy of her Powerpoint file to her wiki (which she did four days after the submission date). This would have saved her buying the USB drive. In other words, the wiki could have helped these students manage their project in more efficient and less costly ways.

A number of students believed the use of the wiki had made them more efficient and effective in terms of gathering and storing information on their topic, and in the management of recording bibliographic details and tracking sources used:

Because I thought it [his topic] would be something that would have a lot of references, and so I’d need to keep up. I didn’t want to go back in the end and think well, where did I get this from? I was able to do a bibliography quite fast. [Student03]
Every time I went on a site... you could just add it to the wiki, on my bibliography on my wiki, and then I could just add it there and just keep going... just keep adding and saving. [Student02]

It [wiki] actually really helped me for the bibliography because I was writing that, like the night before it was due, and I’m like, oh no, when did I look at this site? It just helped me a lot, I didn’t realise that it would. [Student07]

Being able to access the wiki from a number of computers was also viewed by students as contributing to the management of their project and being more efficient. For example, “I... just used it as a way of being able to edit the one same document just from a number of different places, and that’s what I found really useful” [Student03], “I’d try and get what information I needed from there [in class], and then post it on the wiki, which I could then get at home” [Student01], and “I saved all my work onto the wiki, I never saved it to my school account because I could always access the wiki from home, and it was quicker to get onto” [Student05]. These explanations were echoed by students in their interviews and project reflection sheets.

Two students from the class stood out as being task focused and quite motivated to be as organised as they possibly could throughout their project:

I have a lot of stuff on during the year so I really need to actually manage my time properly, so I don’t get left behind and I can keep up with school work and my co-curricular activities. So yeah, I really try and keep on top of things. [Student07]

I was starting slightly later than some of the other people. Like, I was really working hard to try and hammer down a topic, get information, really start that information process. [Student03]

Both of them found the wiki helped them manage their projects better. Student03 found the wiki useful as a project space to collect his information and he saw it as the right tool to help him manage his project in terms of his writing, as he explained:

I recognised that it would be useful for what I was going to be doing in that I wanted to make lots of edits, be able to just put it out in a nice clear format, basically just type it up, almost as a word document online and be able to go back and constantly edit from lots of different computers. And that’s what I ended up using it as.

Student03 was the most articulate of all the students in terms of his being able to estimate the amount of time he allocated to his project. Because he started his project late he was
very conscious of using his time in class effectively as well as time at home. He was able to estimate the amount of time he had allocated as illustrated below:

> It probably worked out to be 50/50 in a way [school and home]. I was thinking I did, because you have about 3 hours a week in class, so that’s probably, yeah, I probably spent those three hours pretty effectively. But then I’d also do you know, one or two hours on the weekend... a couple of half hours during the week, just sort of research.

Compared to the rest of his peers, he was very specific when he discussed how he managed his project time and the tasks involved, and the wiki helped him be more efficient in terms of not having to manage version control between school and home while working on his edits.

In comparison, Student07 used the wiki to support the management of her project in other ways, one of which was the insertion of a Web 2.0 online calendaring tool called 30 boxes (http://30boxes.com/) into the front page of her wiki. In this calendar she added a number of entries for the days she had a Global Studies class. This became her planning and project management tool as illustrated in Figure 5.8.

Figure 5.8 Example of a web calender widget in a wiki
The 30boxes calendaring tool was actually one of a number of widgets hosted by the pb.wiki platform which were offered as optional features for its users upon creating their wiki. A widget is a small application that allows users to access certain content from one website within another website, thus allowing the user to access additional content without needing to visit the host site.

In some of her entries, Student07 added a reflective comment about the development of her project as well as a record of the work she had completed, and the work she was planning to do next, as illustrated by the entry in Figure 5.8. Other entries recorded within the first two weeks of her project included:

On Wed 15 Aug: ‘Decided to present my project in a report/essay form but also do a short photostory to complement it and just act as an introduction to the project. Also started research on world vision and famine.’

On Wed Aug 22: ‘Completed progress report #1 and started my research plan.’

On Fri Aug 24: ‘Finished research plan and uploaded it to the wiki.’

The calendar on the front page of Student07’s wiki became a project management tool in concert with her learning log where she captured reflections of her inquiry learning experiences along the way. This record of completed tasks also supported her affectively, in that she could see she was making progress and feeling confident that she was “on task” and “on time” with her project plan.

Some students identified in the interviews those aspects of project management they could do better at in the future. For example, Student07 who was quite diligent using her web calendar tool to plan, manage and document her project progress, did acknowledge that the knowledge construction phase of a project takes considerable time, and she usually finds she does not leave herself the time she really needs because, “I find that I try and get so much information that when it comes to selecting what I'm going to use and organising it, it's pretty close to the end, and then I have to put in a lot of effort to write”.

Student05 acknowledged he needed to build in more time to seek advice from the teacher or TL to complete the knowledge construction phase of his project, because he found himself working on this phase during the school holidays and he “was really struggling
how to set it out and what information to use”. Knowing they had the school holidays to ‘finish off’ their project reports, a number of students got caught out in this way. That is, their project plan had not built in part of the knowledge construction phase to occur during the final couple of weeks of Term 3 where they had time to consult with the teacher if required. Nor had they factored in that the last week of term was Exam Week which resulted in no scheduled Global Studies class time.

In comparison was Student03 who, even though he had commenced his project later than the rest of the class, had managed to write most of his project report before the end of the school term. The experiences of Student07, Student05 and Student03 highlight that no matter what tools may be available to support a student’s management of their project, a carefully planned timeline of phases and tasks enables consideration of those aspects that require a significant investment of time.

Similarly, Student09 who used an online survey tool in an effort to be more efficient in the collection and collation of responses, found that she had other project management challenges due to a lack of explicit planning in terms of tasks to complete and the estimated time each of these would take. For example, upon drafting her final project report on the evening before she was expected to submit it, she was still collecting survey data:

So I was just planning on finishing that [her report] off when I got to Sydney. And then you know, polishing it and doing all this stuff and updating my survey results and stuff. Because people were still doing my survey by then, like I’d sent it out to all these people and people were still getting back. So I wanted as many people to have done it as possible.

What was missing in her survey design was a specific date range for survey data collection, i.e., publicised start and closing dates for survey submissions. These needed to be built into her project plan to give her significant lead time for the writing up phase of her project. This was compounded by the nature of her topic and project design which required a significant investment of time going ‘into the field’ to observe and photograph homeless people in the city. However, the time this fieldwork would take had not been estimated nor included as part of her project plan. This emerged from her interview where she estimated that approximately 75% of the work she did on her project was completed out of class time during Term 3. Her estimate also did not include the time she needed to
spend writing up her project and working on her presentation during the school holiday break, which was considerable.

In her interview, Student07 described the value of the wiki as a way for the teacher and TL to monitor students’ management of the project process. She stated:

_They can have a look at your log and what you've put on there and that way it can give them some sort of idea of how you're going, and whether you might need some help or what they think you should do. They get, like a whole sort of, instead of just seeing what you do in class. So that way they can get an idea. “Oh well, she did this at home and she's coming along well.” And that way they can get an idea of everything._

This reflected the expectations expressed by the teacher and TL in their initial interviews. They saw the potential of these tools allowing them to observe the progress of each student during class and out of class time. The teacher and TL also believed the Web 2.0 tools selected could be useful in helping the students manage their project more effectively. However, there was little evidence of students’ capacity to utilise these as project management tools independently, and without direct instruction from the teacher or TL. A considered and explicit teaching program would assist students in developing project management skills and techniques, and provide opportunities for them to explore the potential use of Web 2.0 technologies to support the project management process. The instructional support aspects of project management are examined in more detail in Section 5.5.

In summary, while students identified project management as an aspect of the inquiry learning process that they have difficulty with, they discussed this primarily in terms of time management which masked a broader aspect of project management capability. The findings here show that Web 2.0 technologies can help students manage their inquiry projects better, especially when working from a number of computers in school and at home. Students found the central storage and version control features of a wiki helped them be more efficient and effective in the information gathering and writing up phases of a project, including the management of recording bibliographic details and tracking sources used. One student showed the potential of Web calendaring tools in planning, managing and documenting project progress, particularly when integrated into one’s wiki or blog space. The findings also demonstrate how Web 2.0 technologies provide a
platform for teachers and TLs to monitor students’ management of the project process during class and out-of-class time.

5.3.4 Data collection and analysis functions

As already indicated, two students in the class elected to use a Web 2.0-based online survey tool to support the collection and analysis of survey data as part of the primary research phase of their project. The major benefit of using such a tool was the reduction in time students needed to invest in compiling and analysing data, and in presenting the survey results, because the survey tool’s features were designed to automatically complete these tasks. However, the free account with SurveyMonkey only allowed users to create a questionnaire with a maximum of ten questions. Both of the students who decided to use this tool were willing to accept this restriction, when they weighed this up against the time they estimated it would take them to conduct a survey in print format that required manual compilation and analyses. Figure 5.9 presents the SurveyMonkey online survey format used by Student01.

Upon creating an online questionnaire, SurveyMonkey provided the students with a unique URL they could include in the invitation they distributed to people. This URL took survey participants directly to the student’s online survey entry page without requiring participants to create an account or log in. Student01 used the compulsory answer setting in his design, noted in Figure 5.9 by the asterisk to the left of each of the question numbers. This meant that survey participants were required to select one multiple choice response for each question before they could successfully submit their form by pressing the ‘Done’ button. This ensured Student01 received a response to every question from each person.

In comparison, Student09 only used the compulsory question setting for her first question, as illustrated in Figure 5.10. Her survey design involved multiple choice questions (e.g., Question 2) as well as multiple response questions that allowed survey participants to select more than one answer (e.g., Questions 3, 5 and 6). She included open comment questions such as Questions 1 and 4 to collect responses that involved people’s personal definitions, opinions or feelings on her topic. She also used open comment fields in her questionnaire for some of the multiple response questions, which allowed participants to
Figure 5.9 SurveyMonkey online questionnaire used by Student01

World of Warcraft Gold Farming

6. What do you feel about Gold Farming as a whole?
   - Fully support it, as it provides me with gold/items
   - Provides jobs so it is okay
   - Should be abolished
   - Waste of time and money Don't care in the slightest

7. Gold farming provides jobs for approximately 100,000 people in China, who otherwise would be unemployed. Do you think that these people should be able to keep their jobs even though gold farming goes against the ToS of Blizzard entertainment?
   - Yes, I feel sorry for them they should be allowed to keep their jobs
   - Yes, They provide a service to other players
   - No, They should find other work
   - No, They are criminals

8. Gold farmers get paid approximately 30c an hour and work 12 hour shifts. Do you feel that the gold farmers are being exploited by western cultures, or do you think that they are paid fairly for the work that they do?
   - Exploited
   - Paid fairly

9. EBay has recently banned the trade of virtual items on its website. Do you think that this will have a big enough effect to eliminate gold farming?
   - No, people can buy from other sites
   - Yes, without EBay the gold farmers are useless.
   - No, people will do it anyway

10. Gold farmers work under similar or even worse conditions than many sweatshop workers. These conditions are seen as inhumane and unhealthy by westerners. How do you feel about these conditions/employees?
    - Should be illegal
    - Fair considering it is in a developing country
    - We shouldn't support this exploitation by buying their goods
    - I don't care

Done >>
Figure 5.10 *SurveyMonkey* online questionnaire used by Student09

1. What does the term 'homeless' mean to you?

2. Do you think homelessness is an important issue in Australia?
   - Yes
   - No
   - Unsure

3. How do you feel when you see a homeless person on the street? (you may pick more than one answer)
   - Pitiful
   - Angry
   - Sad
   - Amused
   - Nothing
   - Other (please specify)

4. How do you react/what do you do if you see a homeless person on the street?

5. Which people do you think are most likely to suffer from homelessness? (you may pick more than one answer)
   - Men
   - Women
   - Immigrants
   - Indigenous people
   - Young people
   - Elderly people
   - Other (please specify)

6. What do you think are the main reasons people become homeless? (You may pick more than one answer)
   - Family issues
   - Unemployment
   - Drug/alcohol abuse
   - Language problems
   - Lack of education
   - Eviction from housing
   - Laziness
   - Government hasn't provided enough help
add ‘Other’ response categories that she had not thought of as possible answers. While Student09’s survey design provided more scope in terms of the different types of data collected, because Question 1 was the only question that required a compulsory response, she took the chance of receiving an answer to only one out of ten questions from some of her survey participants.

The different ways these two students utilised the survey design features of SurveyMonkey highlights the potential richness of such a tool for survey design and data collection. It also highlights how the format of a questionnaire using such a tool can dictate the design. For example, a student who decided to use a print survey form in preference to an online format may decide not to include open questions due to the time involved in compiling and analysing the qualitative responses manually. Furthermore, a student’s use or non-use of a particular feature of a survey tool such as the compulsory response setting can affect the breadth and amount of data collected. Therefore students needed to fully understand the features and functionality of a particular survey tool and how this may influence, or have an impact on their survey design in relation to the nature of responses sought, or success in gaining a satisfactory number of complete responses from those surveyed. This is another example of a potential point of instructional intervention the students could have received explicit instruction firstly about effective survey design, and secondly understanding what the implications were of utilising specific features of a Web 2.0 survey tool on survey design.

Those students who conducted paper-based surveys compiled their survey data in three ways. They either compiled and analysed their data manually on paper, or used a Microsoft Excel spreadsheet to collect and compile their survey results, while one student used a page on his wiki to collect and compile his results. For example, Figure 5.11 illustrates the changes that Student06 made to a new page he created on his wiki specifically for the purpose of data compilation, namely his ‘Survey results’ page.

Student06 created this page on September 14 and every second day he edited the number of responses to his multiple choice questions, with September 21 being the final day of calculating his results. Note the red font represents the ‘old’ totals, and the numbers in green font are the latest tally of his results on that day. Although he had two open
questions (Questions 9 and 10) he did not add these to his wiki page as responses to these questions were minimal and he ended up not reporting them in his final project report.

Figure 5.11 Use of wiki page for data compilation by Student06

Student06’s main reason for using the wiki to compile his survey data was that everything else he had been working on for his project had been stored in his wiki, i.e., because it was the only tool he was using as a repository for his documents, information gathered,
research plan, and progress reports, it made sense to him to also store his survey results in his wiki, as he explained in his interview, \textit{“It was all on the wiki... Like it was fairly important stuff.”}"

As mentioned previously by a number of students in Section 5.4.1, the notion of the wiki as a central place to store a student’s project work in a ‘safe place’ was emphasised by this student with the decision to use a wiki as his preferred tool for data collection and analysis purposes. Similarly, a page on a blog could have been used for the same purposes. However Student08, who was the only student who used the blog as his main project space, elected to use Excel to collate his survey responses so that the results could be converted into bar charts and graphs for inclusion in his project report and presentation.

In summary, the data collection and analysis functions of Web 2.0 technologies facilitated the incorporation of student questionnaires in a time efficient way to meet task requirements of primary research. However, the restrictions imposed on survey design by some free versions of online survey tools, affected the breadth and amount of data collected by students. Therefore, students require specific instruction with regard to survey design when employing Web 2.0 technologies to undertake the primary research component of an inquiry project.

\textbf{5.3.5 Knowledge construction functions}

Observation of the classroom and Web 2.0 space activity, and individual interviews all identified students using the blog and wiki spaces to support knowledge construction tasks. The term ‘knowledge construction’ is being used to describe students’ use of the Web 2.0 spaces to support the building of background knowledge to inform the selection of their topic, and articulation of their research question and design of their primary research phases, as well as the use of these spaces to construct content for their final project reports.

The students’ wikis and blog became their ‘thinking space’, where they brainstormed ideas, stored chunks of information they gathered from different sources, and used this space to play around with ideas, words and phrases, questions, and statements. This thinking space was a place where the captured ideas were a work in progress, a place
where students could record their thinking one day, which could be added to, edited, or even deleted the next day, depending on what information sources they encountered, or the nature of conversations they had with the teacher, TL, classmates or others about their topic. They treated this space as a place where their work was allowed to remain in a ‘beta’ state where ideas changed or evolved, without the fear of the quality of their work being scrutinised in terms of being of a publishable standard.

Knowledge construction as a process, is based on the premise that all ideas can be improved and where understanding emerges – this is then revised or reshaped, one or more times as new ideas are encountered. Inquiry projects that require students to select their own topics and devise specific research questions, require students to make sense of their ideas. Usually students must undertake background reading to support, expand or refine their ideas. The process of shaping the students’ inquiry interests into specific research questions or statements to be explored, requires students to explain their conceptual development in clear and concise language that can be understood by others. In this case the research questions or statements needed to be written to a standard that gained final approval from the teacher before students could proceed with their inquiry projects. This is the process of knowledge construction, and the wiki and blog spaces used by students in this study captured this process.

By way of example, the following screenshot in Figure 5.12 is the frontpage of Student01’s wiki where he presented the final outline for his proposed topic. Although this was completed in the fourth week of the inquiry unit, his learning log documented the idea of changing his topic during the second week. Student01 had started the inquiry unit wishing to explore the problem of computer game addiction, which over a period of just over three weeks evolved into the exploration of gold farming as a computer gaming issue.

Figure 5.12 presents Student01’s explanation of his revised topic area and the decision making involved in selecting this topic. His explanation is informed by background reading about gold farming as an issue in terms of commerce, ethics and human rights. He clearly articulated how his topic met the compulsory assessment criteria of an ‘international dimension’. He presented background information about gold farming including a definition of what it is, and the issues and concerns that have been raised in
Figure 5.12 Outline of Student01 PIP topic on frontpage of wiki

The wider community regarding the development of a gold farming economy within the computer gaming industry. This was supported by a *YouTube* clip and a graphic to help the teacher and TL gain a clearer understanding of his proposed topic. Student01 concluded the outline of a statement about his plan for the primary research phase of his project. In addition, the navigation bar in the top right hand corner of his wiki identified the range of wiki pages he had created to support his project work including a journal page, a resources page, a page for each of his progress reports, a research plan page, and pages to support his primary research phase. Student01 completed a total of 25 revisions to his frontpage between August 8 when he created it and September 11 when he completed the final version as illustrated in Figure 5.12.

As stated in Section 5.3.3, the version tracking feature of the wiki tool provided the teacher and TL with the ability to monitor individual student’s progress in terms of the work they completed on each of their wiki pages. This feature also provides a user with
the ability to compare all changes made between two different versions, which in effect can be used to observe the knowledge construction process experienced by a student on each page of their wiki. The following three screenshots demonstrate the knowledge construction process undertaken by Student01 to reach the final version (Version No. 25) of his frontpage as illustrated in Figure 5.12.

Figure 5.13 shows Student01 deleting the default text (in red font) that is included on the frontpage of a newly created wiki, and he replaces this with the initial idea for his project topic, ‘Computer Game Addiction’ followed by a definition of the topic (in green font). When viewing revisions to wiki pages using the Changes feature, all ‘old’ text that is deleted is shown as red strikethrough font, all existing text that remains on the page is shown as light grey font, and all ‘new’ text that is added as part of a revised version is presented as green underlined font.

Figure 5.14 illustrates the use of the frontpage by Student01 as a thinking space where he is testing out new ideas to try to work out a specific focus for his topic. Observations of Student01 discussing his topic idea with his teacher in the classroom highlighted a problem with his initial topic idea in that it did not address the international dimension criteria of the inquiry unit. This resulted in Student01 searching for information relating to computer game addiction in China and other countries as one way of trying to address the criteria. Figure 5.14 shows Student01 having typed two possible ways of approaching his topic based on information gathered about this issue in China. While the first idea was written in the student’s own words, the second idea was based on content from the entry on ‘Video game addiction’ in Wikipedia (http://en.wikipedia.org/wiki/Video_game_addiction). Revision No. 13 was saved on August 21. On the afternoon of the same day, the TL posted a series of comments on Student01’s frontpage (which was illustrated previously in Figure 5.7). This resulted in his decision to change his topic from computer addiction to gold farming which he recorded on the ‘Journal’ page of his wiki. The following day during class (Period 3), Student01 discussed this new idea further with the TL and a classmate which resulted in his decision to pursue this new topic, as documented on his journal page:

Tuesday, 21 August 2007

*After receiving advice from Mrs [TL] I decided to refine my topic to ‘gold farmers’, and the effect that they are having on the Chinese economy, its*
Figure 5.13 Initial changes (Revision No. 1) made to content on Student01 wiki

FrontPage Changes

Welcome to your FBwiki:
the Computer Game Addiction

Get started now: To see how easy FBwiki is
1. Click "Edit Page" at the top form of psychological addiction composed of this page
2. Type something
3. Click Save

Videos: 4 easy steps to get started
Videos: How do other educators use FBwiki?
Watch other videos on our educational Videos page:

Thriller: See FBwiki to create a universe compulsive use of pages using pre-made templates
25 ideas for using FBwiki

White papers (PDFs): FAQS about FBwiki computer and video games, most notably massively multiplayer online role-playing games (MMORPGs). Instances have been reported in which users play compulsively, isolating themselves from social contact and The FBwiki Guide to Upgrading

Get FBwiki tips & tricks at our blog: http://blog.fbwiki.com focusing almost entirely on in-game achievements rather than life.

View Count:
Recent Visitors:

Powered by FBwiki | Get Help | Terms of Service | Privacy Policy
Figure 5.14 Changes made to content (Revision No. 13) on Student01 wiki frontpage
Figure 5.5 Changes made to content (Revision No. 21) on Student01 wiki homepage.
workers, its youth and the companies that own the games. I think this is a much better issue to discuss.

Wednesday, 22 August 2007

After further contemplation with [Student08] and Mrs [TL] I have finally narrowed down my topic to World of Warcraft gold farming. This is an international issue as the game is played worldwide.

This led Student01 to complete further searches for information on his revised topic which resulted in seven further revisions of content over Weeks 3 and 4 of the project. Figure 5.15 presents the changes he made as a result of this knowledge construction process which is close to his final version presented in Figure 5.12. This example demonstrates the knowledge construction functionality a wiki tool from the perspective of both the student and the teacher/TL.

Of the Web 2.0 tools used by students, the wiki provided the most powerful and detailed evidence of students’ knowledge construction experiences, especially when a student had also regularly recorded the tasks they have completed, decisions they have made, and their feelings about the completion of these in learning journal entries. In comparison, entries on Student08’s blog only showed the final version of each entry because the blogging platform did not have a version tracking feature. That said, a teacher or TL could still monitor a student’s knowledge construction process on the blog, just not at the same level of granularity of a wiki page. Likewise, if students recorded ideas or comments in the notes field as they saved bookmarks to Delicious, some aspects of knowledge construction could be captured and monitored. In conclusion, if monitoring students’ knowledge construction experiences was fundamental to the design of an inquiry unit, then a wiki would be the most appropriate tool to be included as part of the inquiry unit design, particularly when students are required to use the wiki to publish their final project report.

In summary, Web 2.0 technologies provide an online thinking space to support students’ knowledge construction throughout an inquiry unit. The history feature of the wiki makes it a particularly powerful knowledge construction tool that can be used to demonstrate a student’s conceptual development of their project topic, and capture those instructional interventions that contribute to conceptual development.
5.3.6 Publishing functions

Although two students considered using their wiki to present their project findings, they changed their minds during the term. This resulted in all eleven students presenting their projects in either a report-style format or as an essay saved as a Microsoft Word or pdf file, with supporting PowerPoint or movie files to supplement their oral presentations to the class. Therefore the potential publishing function of a wiki or a blogging tool was not fully realised by any of the students observed in this study.

That said, students used the wiki and blog to publish other content such as their responses to questions on the progress reports, draft versions of written sections to be inserted in their project report documents, and drafts of presentation content. As already illustrated in a number of screenshots of wiki pages presented in Section 5.3, a number of the students had built their wikis using a series of pages for different purposes. This same approach could have been applied to the publishing of each section of their final project report. However, the majority of students ended up completing their project report during the school holidays, so there was little opportunity for the teacher or TL to explore possible options in terms of using their wikis or blogs to publish their final reports.

While Figure 5.16 presents an example of the frontpage of a student’s wiki that had originated as a potential frontpage for her project website, she decided to present her project as a PowerPoint file which she could also use to support her oral presentation instead of presenting her final project content on her wiki. She had created a number of wiki pages, including a topic page labelled ‘Culture’ which she had been using to build content based on text and graphics gathered from a range of sources, and she had already created a bibliography page where she added details of sources used throughout the project. However, she had not edited her navigation bar (labelled ‘Sidebar’) in the top right of her wiki site, which meant that she had not learned about how one uses the Sidebar feature to build navigability into a wiki site – in effect creating a website of sequential and interconnected webpages. Hence, she did not realise the potential publishing function of the wiki beyond that of publishing working drafts and supporting documentation for her project, which was what the majority of students did.

In addition, Student01 had originally intended to use the wiki to present his project, hence the continued revision of his wiki’s frontpage as illustrated in Figures 5.12-5.15, and his
Figure 5.16 Use of wiki as publishing tool by Student02

Students published their progress reports in their Web 2.0 spaces because the progress report template instructed them to do so. They did this in one of two ways. They either uploaded Word document versions onto their wiki, or they pasted the table format from creation of a pages menu in the Sidebar of his wiki. However, as it got closer to the due date for the project he recorded on his Journal page his decision not to use the wiki, but writing it up instead as an essay. In other words, he defaulted to what he saw as the most efficient solution to publishing his project (an essay using Microsoft Word) instead of investing more time in trying to work out the full functionality of the wiki as a publishing tool.
the progress report template and completed it as a page on their wiki as presented in Figure 5.17.

Figure 5.17 Student02 using wiki page to publish progress reports

<table>
<thead>
<tr>
<th>Name</th>
<th>Student02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Topic (area of research)</td>
<td>Globalization &amp; the affect it has on different country's culture.</td>
</tr>
<tr>
<td>What do you already know about this topic?</td>
<td>I know definitions of globalization, culture &amp; basic facts about the country's I am willing to research (Africa, Asia &amp; Europe).</td>
</tr>
<tr>
<td>Research Question</td>
<td>How does globalization affect certain country's cultures?</td>
</tr>
<tr>
<td>Briefly explain why you feel it is important to ask this question.</td>
<td>I feel that it is important to ask this question because globalization globally is destroying important cultures and influential civilizations and customs around the world.</td>
</tr>
<tr>
<td>Describe any difficulties you had in deciding on your topic and developing your research question.</td>
<td>I had trouble deciding on my topic and developing my research question because of the broadness of the topic, it was hard to decide which part of the topic I would be researching.</td>
</tr>
<tr>
<td>How did you feel during this part of your research project? Briefly describe how you felt (e.g. anxious, confident, frustrated, happy, relieved) at different times or stages while deciding on your topic and developing your research question.</td>
<td>I was pretty chuffed when I came to choosing my topic because of the many ways I could point the arrow at the research. However, when I found out that this would be my exact problem, I became a little frustrated - when I decided on changing my topic to culture rather than youth, I was much more relaxed yet overall the decision was confident.</td>
</tr>
</tbody>
</table>

The blog user, Student08 simply pasted the text into a blog post to publish his progress reports as illustrated in Figure 5.18 because WordPress had not created a table formatting plug-in at the time this student used it for his project. The student could have created a table using raw html to re-create the format provided in the Word document template, however, this student did not feel this was essential. His content had been published as a working document and was readable, without needing to invest additional time to improve the look and feel of his blog post.

In summary, wikis and blogs provided the students with the capacity to publish the work they undertake for an inquiry project in two ways. Firstly, they provided a single online place that can be accessed via a number of different computers to publish and edit all project content, including progress reports, final project reports, and supporting documentation. Secondly, the page creation and navigation features of wikis and blogs
Figure 5.18 Student08 using a blog post to publish progress reports

provided the capacity to publish inquiry projects in the form of a navigable, hyperlinked website. The students required instruction with regard to maximising the publishing features of a wiki or blog, instead they only used these as storage and/or knowledge construction spaces.

5.3.7 Self-reflection functions

The design of this inquiry unit required students to maintain some sort of learning log or journal documenting their ideas, decisions and reflections throughout the completion of their PIP. In addition, students were required to complete three one-page progress reports.
throughout the unit, with the first one completed at the end of the third week, the second at the end of the sixth week, and the final progress report upon completion of the PIP at the end of the tenth week. A number of students created a separate page in their wiki to document their experiences throughout the inquiry project as illustrated in Figure 5.19. These often captured students’ reporting of the development of their topic idea, challenges they faced, decisions they made, and updates on their progress in completing specific tasks within their PIP.

Figure 5.19 Screenshot of Student04’s ‘Journal’ page in her wiki

Some students used the Comments feature on the main page of their wiki to record their thoughts. For example, Student10 recorded his thoughts throughout the unit as comments on a number of his wiki pages. Figure 5.20 presents his reflections on topic selection which includes a summary of the different iterations of his topic over a period of two weeks.
Throughout the inquiry project his reflections moved from procedural reporting on what he had been doing (as illustrated in Figure 5.20), to reflective entries that contained more emotive language about how he was feeling as he tried to complete the writing up phase of his PIP report. Examples of his later reflections included comments like:

*I’m finding it hard to plan an essay that doesn’t have a direct question and fear that i might be getting distracted with my writing.*

*I’m about 1500 words in now and am feeling pretty good about it.*

*In my rapping up of the project i stumbled upon the marking criteria which is rather alarming. There is a quite a lot of it that seems not to apply to me.*

*I asked my brother and he said i was freaking out about it too much. and that you are meant to take up a position.*
His project concluded with this final reflective statement:

\[
\text{At the time i wasn't sure about the choice of topic that I had. i really only went with it because i had nothing else and time was running out. Now i realise what a good topic it was for me. It was something that i was already knowledgeable and yet wanted to know more. This project was both interesting and worthwhile.}
\]

Student10’s wiki demonstrates how the Comments feature can be used to capture student reflections about a specific part of their project if they have created a set of pages for different purposes, with their reflections recorded in the comments area of a specific page. This same process can be applied to a blog, where a student uses the Comments feature to capture reflections on an aspect of the project which has been published as a blog entry.

As presented previously in Section 5.3.3, Student07 used a web calendar widget plugged into the front page of her wiki to host her learning log where she captured reflections of her inquiry learning experiences along the way. This is another example of how the self-reflection functions of a Web 2.0 tool can be used to record a student’s challenges and achievements along the way. While the reflective statements captured by students in their Web 2.0 spaces provide the teacher and TL with additional information regarding their progress, particularly in terms of students’ affective state at specific stages throughout the inquiry process, these also provide students with valuable insights into their own project experience overall.

In summary, Web 2.0 technologies such as wikis and blogs provide students with a number of ways for recording reflective comments regarding their inquiry experience. For example, the Comments feature of individual wiki pages and blog entries allows students to capture reflections specific to a single page or entry. This is a particularly useful approach when teachers and TLs are monitoring student progress on students’ wikis or blogs to diagnose where students require instructional support. Wikis and blogs provide students with an opportunity to chart their learning journey by way of timestamped reflective entries throughout an inquiry unit, i.e., documented evidence of challenges faced, decisions made and feelings encountered, throughout the inquiry experience. This can be revisited upon completion of the project as part of the evaluation phase of the unit to assist students identify what aspects of inquiry they are good at, aspects which they need to improve, and reflect on ‘lessons learned’ as a result of their inquiry experience.
5.3.8 Summary of functionality of Web 2.0 technologies

In conclusion, not all seven functions were fully actualised equally by all students (if at all, in some cases) due to a combination of factors outlined in Sections 5.2 and 5.3. Each student’s inquiry learning experience throughout the project was unique, based on the selection and use of a range of tools and techniques drawn upon their PTT and the trialling of a range of Web 2.0 technologies, which included wikis, blogs, social bookmarking, online survey and web calendaring tools. The above findings highlight the breadth in functionality and potential scope of students’ use of technologies while completing an inquiry project. They also highlight the very complex layer of students’ technology experience as part of the inquiry process, which has implications for inquiry unit design and instructional support provided by teachers and TLs. This is examined in detail in Section 5.5.

5.4 Impact of approaches to learning on student use of Web 2.0 technologies

As shown in Section 5.1.2, results of the students’ scores on the ‘Approaches to Studying’ section of the ASSIST instrument identified eight students with a predominance of one style, i.e., five students as strategic learners and three students as deep learners. The scores of two students resulted in a combination of deep and strategic, and one student’s results showed no single tendency towards any of the three broad approaches (although he did receive the highest score in the class on the surface scale). Comparative analysis of students’ predominant styles and their use of Web 2.0 technologies, and technologies in general, did not elicit distinct patterns or trends within each style. For example, of the two students who employed the largest suite of technology tools to complete their project, one rated predominantly as a deep learner and the other as strategic. The number of tools used by the five strategic learners ranged from 4-10, with two students only using four tools, three of which were a wiki, a word processor and web browser. Similarly, the number of tools used by the three deep learners ranged from 5-10, with the student who used five tools, also using the same basic set of wiki, word processor and web browser, as the strategic learners.
### Table 5.9 Summary of students’ predominant learning style and types of technologies used for their PIP

<table>
<thead>
<tr>
<th>Student</th>
<th>Predominant learning style</th>
<th>Number of tools used</th>
<th>Types of technologies used</th>
</tr>
</thead>
<tbody>
<tr>
<td>student01</td>
<td>Strategic</td>
<td>7</td>
<td>Wiki, Web browser and search engines, Web browser bookmarks, EBSCOhost full-text journal database, Online survey tool (SurveyMonkey), Word processor, YouTube (inserted YouTube video in his wiki)</td>
</tr>
<tr>
<td>student02</td>
<td>Strategic</td>
<td>9</td>
<td>Blog (created this but stopped using early in project), Wiki, Web browser and search engines, Proxy websites, Web browser bookmarks, Email, Instant messaging, PowerPoint, Photosharing website (Photobucket.com)</td>
</tr>
<tr>
<td>student03</td>
<td>Strategic</td>
<td>4</td>
<td>Wiki, Web browser and search engines, Library catalogue, Word processor</td>
</tr>
<tr>
<td>student04</td>
<td>Deep/Strategic</td>
<td>6</td>
<td>Wiki, Web browser and search engines, EBSCOhost full-text journal database, Microsoft Word, Email, Instant messaging</td>
</tr>
<tr>
<td>student05</td>
<td>Strategic</td>
<td>4</td>
<td>Wiki, Web browser and search engines, Microsoft Photo Story to create a Windows Media™ Movie</td>
</tr>
<tr>
<td>student06</td>
<td>Deep/Strategic/Surface</td>
<td>6</td>
<td>Wiki, Powerpoint slideshow (with audio of rap music embedded), Web browser and search engines, Library catalogue, EBSCOhost full-text journal database, Microsoft Excel (to create tables/graphs for PPT slideshow)</td>
</tr>
<tr>
<td>Student</td>
<td>Depth</td>
<td>Level</td>
<td>Tools</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>student07</td>
<td>Strategic</td>
<td>10</td>
<td>Wiki 30boxes.com (Web 2.0 calendaring tool used as a widget as part of pb.wiki platform) Web browser and search engines EBSCOhost full-text journal database Email Microsoft Word Microsoft Excel (to create tables/graphs for written report) Microsoft Photo Story (to create Windows Media Movie file inserted as an object in a PowerPoint file) Instant messaging</td>
</tr>
<tr>
<td>student08</td>
<td>Deep</td>
<td>8</td>
<td>Blog Wiki Web browser and search engines Proxy websites Microsoft Word Microsoft Excel (to create tables/graphs for written report) Microsoft PowerPoint Social bookmarking (Delicious)</td>
</tr>
<tr>
<td>student09</td>
<td>Deep</td>
<td>10</td>
<td>Wiki Web browser and search engines Online survey tool (SurveyMonkey) Email Microsoft Word Microsoft Excel (to create tables/graphs for written report) Microsoft Picture Manager Scanning software Social bookmarking (Delicious) Proxy websites</td>
</tr>
<tr>
<td>student10</td>
<td>Deep</td>
<td>5</td>
<td>Wiki Web browser and search engines Microsoft Word Email Instant messaging</td>
</tr>
<tr>
<td>student011</td>
<td>Strategic/Deep</td>
<td>5</td>
<td>Wiki (created it but did not use it) Web browser and search engines Library catalogue EBSCOhost full-text journal database Microsoft Word</td>
</tr>
</tbody>
</table>
No matter a student’s predominant style, they were all prepared to trial the use of a wiki to support their inquiry project at the beginning of the term, even though one of the strategic/deep learners (Student11) decided not to continue using it throughout his project. For example, his comments “I was more interested in the actual assignment rather than let’s check out on how a wiki works, and what we can do with a wiki”, and “It was kind of big rush… when it got to the end I had to kind of prioritise”, reflect that of a strategic approach. That is, he tried to find the right conditions to support his studies, and tried to manage his time and effort effectively to achieve the highest possible grade. However, a later comment by this same student, that he “probably needed some help” with setting up his wiki to explore its potential (as previously cited in Section 5.2.1.4), suggests a tension he also experienced as a deep learner, whose intention is to understand ideas for themselves and being actively interested in their own learning.

This intention to understand ideas for themselves was also evident in the two deep learners who used the largest suite of tools (with Student09 using 10 tools and Student 08 using 8). They both used the greatest range of Web 2.0 tools to support their inquiry project, and while Student09 preferred using the wiki as her main online space and Student 08 preferred using his blog, they were the only two students in the class who persevered with trialling Delicious. In their interviews, these students were also some of the most articulate in discussing the functionality of tools they used, their mental models of different technologies tended to be discussed in terms of technicality moving towards enrichment, and they demonstrated a willingness to try new tools and be open to expanding their PTT. Student09’s inquiry and technology experiences (as presented in CIP 5.2) presents further evidence of her approach as a deep learner in terms of becoming actively engaged in her project by integrating her interest in photography as part of her project design, and trying to understand how each of the technologies available to her could be used to enhance her inquiry learning experience.

In comparison, the main intent of a strategic learner is to achieve the highest possible grade, and they try to do this by putting in consistent effort and being organised. Student07’s use of the web calendaring tool to record her learning log and plan and manage her project to help her manage her time effectively is an example of how a Web 2.0 tool was used to support a strategic approach. Similar to Student11’s strategic approach (as presented above), Student07 tried to find the right conditions and materials
to support her study, and in this instance she achieved this by selecting some preferred tools and techniques from her PTT to help complete her project, namely *EBSCOhost* full-text database searches to support her information gathering phase, and *Excel* and *Photo Story* to create her project presentation. Furthermore, the application of familiarity, ease of use and utility as the main criteria underpinning her decisions regarding technology (as detailed in CIP 5.1) reflects a strategic approach.

Conversely, some of the students for whom strategic was their predominant style employed an approach to technology use that involved minimising the technological dimension of their inquiry experience. In other words, their desire to “*keep it simple*” to best manage time and effort resulted in them using very few technology tools and techniques to complete their project. For example, Student03 used a wiki, web browser and search engines, the library catalogue and a word processor in his suite of project tools, while Student05 used a wiki, web browser and search engines, word processor and *Photo Story*. Both students used the wiki early in the project as a place to store harvested information, and “*as a way of being able to edit the one same document just from a number of different places*” (Student03); i.e., the wiki provided them with the right conditions for this component of their project. The strategic learners were also mindful of the assessment requirements of the project, as well as the time and effort they needed to invest to get their projects done. However, they reacted to this in different ways with regard to the wiki. For example, Student03 preferred to print out sections of his draft project report (in *Word*) to give to his teacher for feedback in the writing up phase of his project, rather than use the Comments feature of the wiki to receive feedback. He saw this as being the quickest and most effective way to find out from his teacher if he was on the right track. On the other hand, Student05 found the Comments feature of the wiki useful in gaining feedback on his project, particularly when communicating with the TL out of normal class time.

In summary, the analysis of students’ technology use as deep, strategic or surface learners did not identify distinct patterns or trends within each style. However, a number of relationships between students’ technology use and some of the defining features within the deep and strategic approaches did emerge, which suggests that distinct patterns or trends might be identified with a much larger sample. Given this cohort did not contain students who were rated predominantly as surface learners, no relationships between the
features of a surface approach and technology use could be identified. Again, this could possibly be achieved with a larger sample.

### 5.5 Learning teams, instructional intervention and Web 2.0

From observation of students’ Web 2.0 spaces and classroom activities, and interviews of students, the teacher and TL emerged the concept of a ‘learning team approach’ to supporting students while undertaking an inquiry project. Throughout the inquiry unit, students demonstrated a capacity to ‘manage’ who were part of their support network, and the nature of these people’s involvement. From the beginning of the inquiry unit, the researcher observed communications and behaviours of students that either encouraged or distanced interactions with those around them. In other words, they were able to ‘shape’ the nature of input from individuals, whether they be the teacher, TL, classmates, other students, or family members. Thus, the concept of an individual student’s learning team emerged as an important ‘unit’ that provided instructional and moral support as they completed their inquiry project. This is explored in Section 5.5.1.

In addition, an assumption of this study was that instructional intervention is an important dimension of the inquiry learning experience and that Web 2.0 technologies have the potential to provide instructional support in a number of ways. This begs the question, what types of instructional intervention can be provided by the teacher and TL when students are using Web 2.0 technologies to support their inquiry learning experiences? While some examples of instruction and support provided in students’ Web 2.0 spaces have already been presented in 5.3 within the context of the functionality of Web 2.0 tools, these and more, are examined in Section 5.5.2 specifically with regard to instructional intervention on Web 2.0 technology use, and instructional intervention on the inquiry process within Web 2.0 spaces as learning environments.

#### 5.5.1 The nature of learning teams to support inquiry

As stated above, each student developed their own learning team to support them throughout the inquiry learning experience. While the ‘teaming’ of a teacher and TL as a collaborative partnership with a class has traditionally been the way instructional relationships have been defined in research and practice (see Section 2.5.1 of the literature
review), the nature of learning teams in this study emerged as a support unit around each individual student, rather than the teacher-TL team as a support team for a class. This was partly as a result of the inquiry unit design which firstly expected students to explore a topic that was of personal interest to them for their individual project, and secondly, it expected students to use one or more Web 2.0 technologies. From the beginning of the inquiry unit, this required individual students to negotiate directly with the teacher for topic approval, and work with the TL to set up their Web 2.0 spaces. Thus each student became the centre of their own learning team for instruction and support, in which they played a role in establishing and maintaining the team based on what students’ perceived to be the expertise and potential contributions of individual learning team members. In addition to the teacher and TL, some students’ teams included students from the Global Studies class as well as other school friends, another teacher, or family members and friends. Some students’ teams also involved members from an industry or the community they engaged with when investigating their topic. The nature of the above aspects is explored in the following sections (5.5.1.1 and 5.5.1.2).

While one would expect each student to have both the teacher and TL as members of their learning team (among others), how much involvement each of them actually had was largely determined by the ‘expertise’ each member brought to a learning team based on the student’s unique needs; the different ‘roles’ each of them developed as they worked within a student’s team; what ‘relationship dynamics’ existed between the student and teacher, student and TL, and teacher and TL, upon commencement of the inquiry unit; and what relationship dynamics occurred between each member throughout the inquiry unit. For example, some students worked very closely with the teacher as the core member of their learning team, encouraging little interaction with or engagement of the TL, while others worked more closely with the TL than the teacher as a core member of their team, due to the students’ views on what each member could do to assist them with their project.

5.5.1.1 Expertise of learning team members

Each member of a student’s learning team brought a level of expertise to that team based on how their knowledge, skills and experience (KSE) matched the information, technology and learning needs of the student. The dimensions of expertise that a team member brought with them included one or more of the following:
Disciplinary expertise – KSE of the discipline or disciplines in which a student’s inquiry topic resides;

Curriculum expertise – KSE of the curriculum in terms of unit outcomes, expectations of the inquiry unit, or assessment requirements;

Process expertise – KSE of the inquiry process, research process, information process, or knowledge construction process;

Technological expertise – KSE in a range of technology tools and techniques; and

Production expertise – KSE in crafting a final product and/or artefacts that represent a student’s learning and meets assessment requirements.

For example, the disciplinary expertise the teacher brought to learning teams was her knowledge of global studies and international relations, geography and society and culture, and commerce, legal studies and history, while the TL’s disciplinary expertise included legal studies, English, music, resourcing and information seeking, information ethics, and ICTs. Given that all students needed to select a topic that included an international dimension, the teacher’s expertise was critical for students when negotiating the specific topic or question for their inquiry. However, some students worked more closely in selecting and refining their topic with the TL due to her interests and expertise. For example, Student01 worked closely with the TL in refining his original topic of computer addition to the issue of ‘World Of Warcraft Gold Farming’ due to her interest in computing and technology-related issues. Student05 also worked more with the TL in developing his broad topic of international travel and aviation safety into the inquiry question, ‘How have the experiences and attitudes of international travellers been affected by actual or threatened terrorist activities?’, as a result of her showing an interest in his exploration of international travel websites at the beginning of the unit, and in his words, “She has a greater knowledge of it”.

As mentioned previously, some students’ teams involved disciplinary expertise beyond the classroom. For example, Student05 included a friend who was a flight attendant and an uncle who was a frequent overseas business traveller as part of his learning team due their knowledge of and experience with international flights and airports. Student10’s inquiry question, ‘Is Shakespeare universally relevant?’, which involved an analysis of Shakespeare’s plays and adaptations across cultures and across centuries, led to the
inclusion of his drama teacher as part of his learning team as a “sounding board” for his ideas, given this was not an area of expertise of the Global Studies teacher.

In terms of curriculum expertise, while the teacher was viewed by all students as the main person to consult regarding the expectations of the inquiry unit and assessment requirements, some students used the TL as their second curriculum expert, particularly when communicating with her via their wiki. Likewise, with regard to process expertise, students often sought approval from the teacher regarding the design of the authentic research component of their project to make sure what they proposed was considerable appropriate within the assignment guidelines. On the other hand, the TL was used for her information process experience, particularly with regard to refining topics, searching for relevant resources and referencing protocols. In addition to the teacher, some students also used their classmates or family members as critical friends in their team to gain feedback with regard to the knowledge construction and writing up phases of their project.

In terms of technological expertise, the TL was viewed as the principal provider of technology instruction and support, particularly with regard to Web 2.0 technologies and the use of library systems such as the catalogue and full-text databases. This was partly due to the fact that the teacher and TL had negotiated this role as part of the TL’s contribution in the design of the inquiry unit. As presented throughout Section 5.3, the TL’s technological expertise supported students’ use of wikis, blogs, Delicious and online survey tools, particularly with the information collection, communication, project management, and data collection and analysis functionality of these tools.

Also, as noted in Section 5.2.3, a number of the students’ technology informants consisted of classmates, family or friends, thus their technological expertise also led to membership in a student’s learning team. This was most evident where the expertise of family and friends involved a combination of both technological and production knowledge, skills and experience. For example, Student02 received advice from her father regarding the effectiveness of the design and layout of her wiki, while Student07 discussed her ideas on using Photo Story to create a movie file of images to the soundtrack of John Lennon’s Imagine (to support her oral presentation on the 40 Hour Famine) with her older sister.
Given that the majority of students completed their final project reports and presentations during the school holidays, a number of students used the production expertise of family and friends to provide advice on how their project products were shaping up. For example, students 02, 04, 07 and 10 used email and MSN to exchange drafts of their project reports and provide feedback to each other. Student01 and Student 07 used their fathers for proof reading and general feedback on readability, while Student04 used her mother and brother, and Student09 used her father, as sounding boards for the ideas they had developed about their topics.

To conclude, each member of a student’s learning team brought a level of expertise to that team based on how their knowledge, skills and experience (KSE) matched the information, technology and learning needs of the student. Students selected team membership based on five broad dimensions of expertise, including disciplinary, curriculum, process, technological, and/or production expertise.

### 5.5.1.2 Roles and relationships within learning teams

While each learning team consisted of a different complement of members, each bringing with them different types of expertise and providing different levels of instructional support throughout the term, the teacher and TL were present in all students’ teams to some degree, based on the expertise they could bring to each student’s inquiry project. The roles the teacher and TL played within a student’s team at the beginning of the inquiry unit were influenced by the relationship that existed between the student and teacher, or student and TL, as a result of contact they had in previous classes, school terms and years. It was also based on the roles the teacher and TL had negotiated as part of the design of the inquiry unit, i.e., the teacher as the discipline expert and manager of the class, and the TL as the information and technology specialist. This provided the TL with some leverage to establish relationships with the students as a result of the teacher formally acknowledging in class the expertise the TL was bringing to the unit.

Given the TL was present for the majority of timetabled Global Studies periods, she had the opportunity to develop relationships with the students face-to-face. In addition, the TL’s presence in the students’ Web 2.0 spaces provided impetus for establishing or strengthening her relationship with each student, however, she was proactive as an initiator for much of the contact made in the early stages of the unit. As presented in
Sections 5.3 and 5.5.1.2, the TL’s technological expertise in supporting students’ use of wikis, blogs, Delicious and online survey tools, particularly with regard to the information collection, communication, project management, and data collection and analysis functions, provided numerous opportunities for her to work with students during class time and in out-of-class time.

In particular, Students 01, 05, 08 and 09 developed a strong relationship with the TL, with her discipline expertise forming the basis of her relationship with the former two, and her discipline, process and technological expertise underpinning the relationship with the latter two. For Student09, her relationship with the TL was new given that she had only started at the school at the beginning of the year, and she was very open to establishing a relationship with the TL as the information and technology specialist. For example, in summing up the TL’s support as a member of her learning team, she concluded:

*She was actually really helpful. At the start, I was pretty clear on my topic. I wanted to do homelessness but... I hadn’t narrowed it down. And so right at the start, Mrs [TL] was there just to help me when I needed to. And setting up the Delicious account... and also she’d send me the links and comment on my wiki, which was good. It was mainly the technical side but she did give me a couple of great definitions that she’d found [and] some articles. So she was looking, and she found some good stuff.*

This is in direct contrast to Student11 who saw the TL’s role as simply technology-related and because he decided he was not going to use the wiki for his project he did not see her as a critical part of his learning team. At the end of his project he reflected, “*she offered assistance but I wasn’t probably very receptive*”. Student04 was another student who was very clear as to what support she thought she needed. While the TL did provide resourcing advice via Student04’s wiki early in the unit, her preference was to work almost exclusively with the teacher because she valued her discipline, curriculum and process expertise, as she explained in her interview:

*She really helped me sort of form the question because that was the bit I found most difficult... I love Ms [Teacher], she’s the greatest teacher I’ve ever had... she’s able to sift through stuff and get questions out of it.*

Thus, Student11 and Student04 demonstrated ways students were able to shape the nature of input from individuals within their learning team, even when instructional roles were formally integrated into the design of an inquiry unit, thus influencing the role of, and relationship dynamic they had with, the teacher and the TL.
5.5.2 Types of instructional intervention using Web 2.0 technologies

Observation of students’ Web 2.0 spaces and their use of Web 2.0 tools during class time identified a number of ways instruction was provided by the teacher and TL, with the majority of assistance being provided by the TL in this study for the reasons mentioned previously in Section 5.3.2. A total of eight types of instructional intervention were identified across students’ Web 2.0 spaces, including topic selection, technology support, resource support, focus formulation, inquiry process, research process, project management, and knowledge construction. While a number of examples of instructional intervention were examined in detail in Section 5.3, this section presents a summary of eight types of instructional intervention using Web 2.0 technologies.

5.5.2.1 Topic selection

The majority of instructional support regarding students’ identification of a topic for inquiry occurred in student wikis and Student08’s blog. Given these spaces were where the majority of students began to brainstorm ideas about potential topics, the teacher and TL could monitor students’ progress with topic selection. While the teacher preferred face-to-face discussions with students regarding topic selection, she did use a student’s wiki or blog as the platform for discussion when conducting individual consultations with them in class. During class time the TL did the same, however, during out-of-class time she also used the Comments feature to communicate on the wiki page or blog post where students recorded initial thoughts about their topic. As stated in Section 5.3.2 some of these comments included the provision of affective support, in terms of praise, encouragement, and motivation, to help build students’ confidence in the initial phase of the inquiry process. For example this comment on Student08’s blog:

*Hi Student08. I note that you were feeling anxious about your research as you tried to define your question. Well you're not alone in feeling this way. This is often the most difficult part of the assignment. Once you've got the question right, the rest often falls into place.*

5.5.2.2 Technology support

In the early stages of the project when students were setting up their Web 2.0 spaces, the majority of technology support was provided face-to-face by the TL in class. This allowed her to provide individual ‘hands on’ technical support where she could ‘walk’
students through a particular process such as creating a set of wiki pages or demonstrate how to add bookmarks to a Delicious account. Once students’ Web 2.0 spaces were established she shifted some of her instruction to the wiki, blog and Delicious. Some of this involved troubleshooting problems that students had recorded in their wiki or blog. For example, Student01 recorded his frustrations with trying to create a table in his wiki and the TL provided advice during out-of-class time in the Comments field on his wiki page, so that he would see this when he logged into his wiki later in the day during the Global Studies period. In his interview he commented on how he appreciated the expertise of the TL concluding, “She’s more technologically able or capable”. Other advice to students included suggestions on using the navigation feature of the wiki for those who had created multiple wiki pages, advice about the features of other tools such as Delicious, using the history feature of the wiki to manage revisions and deletions, and advice on layout and design of wiki pages.

5.5.2.3 Resource support

In the early stages of the inquiry process, the TL also used students’ Web 2.0 spaces to provide resourcing support. She used the Comments feature in the wiki and blog to advise students of specific resources she had located on their topic, or suggestions regarding places to search for information including the library catalogue and the library’s full-text databases, along with advice regarding specific keywords, subject headings and phrases to locate relevant information. At times she also reminded students to revisit the inquiry unit documentation when appropriate, for example her comment on Student02’s ‘Project Report’ wiki page:

Hi Student02. I hope you had a look at pp.11-12 of your booklet where Ms [Teacher] has given you some info on evaluating resources (including websites).

This advice was often provided on the wiki page or pages where students were harvesting information they found as discussed in Section 5.3.1.1. She also used Delicious as a platform for resource support, the details of which were presented in Section 5.3.1.3. This resource support was often provided during out-of-class time when the TL was working from the library or after hours, which benefited those students who accessed their Web 2.0 spaces at home or in the boarding house to work on their projects.
Upon checking students’ wiki spaces at the end of the second week, the TL advised the students in class that they needed to be “mindful” of recording bibliographic details with each of their “copy & pastes” into their wiki. While some students had already developed a technique to do this, whether they created a ‘Bibliography’ page in their wiki (such as Student02), or saved these details along with each URL to Delicious (like Student09), or recorded the details under each chunk of text they pasted into their wiki (like Student03), other students had been busy gathering information on their topic from a whole range of sources without recording where they had collected it from. This latter group of students had not as yet developed a technique in their toolkit to support the effective tracking and recording of information sources as part of their harvesting behaviour. This is an example of a point of intervention within resource support, where the TL identifies a skill or technique that one or more students need to develop to help them become a more effective and efficient information user.

5.5.2.4 Focus formulation

In terms of focus formulation support, the TL used students’ Web 2.0 spaces in similar ways to topic selection. However, a lot of this activity occurred as a result of students uploading their first and second progress reports to their wiki or blog. These progress reports required students to define and refine their topic area, with the second report requiring students to commit to a specific topic statement or inquiry question to research. So the TL used the Comments feature in the wikis and blog to provide feedback based on the ideas, issues and concerns raised by each student in their progress reports. Section 5.3.2 presented a number of student quotes and screenshots of student Web 2.0 spaces as examples of this instructional support provided by the TL. Thus, the dialogue captured between each student and TL in these Web 2.0 spaces became a permanent record of conversation, which could be used to document evidence of the nature and timing of the instructions provided and how these influenced decisions made by students as they navigated their way through the inquiry experience. In her interview the TL reflected that she found the Web 2.0 spaces gave her far more opportunity than in previous classes to provide this type of instruction, as she explained:

*Defining the research question and refining it was really, the most difficult part of the assignment for most of them. That’s where they seemed to be getting stuck. So, at that point, I guess that’s why I was far more active in that particular part of the process... on a daily basis, from what was happening on the wiki, you were actually able to say, Ok, such and such is*
having a problem now, and even though it’s eleven o’clock at night and I’m sitting at home, I can actually address that.

That said, the teacher also commented that she valued the TL’s availability in the classroom, “It’s always good to have a second brain, and to have a second person in the room for that first week or so, when they are bouncing ideas around”, which highlights the importance of a blended approach for the teacher.

5.5.2.5 Inquiry process
The Web 2.0 spaces also captured evidence of the ways the TL assisted students in working through the inquiry learning process. These were mainly in the form of prompts to remind students of the particular stages they needed to work through. For example, posting comments on the wikis and blog to remind students to complete and upload their progress reports, or referring students to specific sections in the PIP booklet that provided advice on how to tackle different aspects of the project. Other times, she would simply leave a comment that she was available to help if she had not had recent contact with them in class, as she reflected on her use of these tools, “Sometimes it was more a comment like, oh this looks really great, and you mightn’t have a lot to say in terms of suggestions, but you let them know that you’re there, and create some sort of relationship”. Therefore, this dropping by their Web 2.0 spaces was a technique the TL used to try to maintain her relationship with a student.

5.5.2.6 Research process
Given that a number of students used their wiki or blog to document the primary research component of their project, this provided the TL with an opportunity to provide some instructional support on aspects of students’ research design, particularly regarding the design of survey questions and interview questions, as well as advice on using an online survey tool. However, the majority of this advice was provided face-to-face in class between the students and the teacher because students felt they needed to gain approval that their data collection instruments were appropriate in meeting the requirements of the primary research component of the assignment. The teacher also referred to students’ wikis in class when discussing their progress in collection and analysing data.
5.5.2.7 Project management

As presented in Section 5.3.3, all students struggled at some point with managing the variety of elements required by this inquiry unit. Throughout the unit, the TL used similar techniques to those identified under ‘Inquiry process’ (Section 5.5.2.5) where she made comments on students’ wiki or blog prompting or reminding them of pending deadlines and submission dates as outlined in the PIP booklet. However, the focus was on time management rather than task management. While this has already been highlighted in Sections 5.3.3 and 5.3.7 with regard to students’ reflections, the TL also focused her criticism of student progress on time management:

The timeline wasn’t really adhered to, so some of them really got behind... for some kids, unless they come up with that timeline, and they – you know, a few of them did admit to mismanagement, “That I’ve left it all till the end etc”.

She felt there needed to be a more formal intervention point identified in the design of the inquiry unit to target the knowledge construction, writing up and presentation phases of students’ projects. Upon reflection she identified this potential point of intervention to be positioned after the second progress report when students were expected to have completed their primary research and to have started the writing up phase of their project findings:

Maybe some sort of point where you’re [the student’s] going to discuss with the teacher and show them what you’ve done, or... just to show that you are actually managing your time.

Some of the students also identified this as the most problematic part of their project, as stated by Student05 who reflected “I was really struggling how to set it out and what information to use”, and Student09 who was still collating survey responses the night before her project report was due.

However, there were some opportunities for the teacher or TL to provide instructional intervention based on student comments on their wiki or blog. For example, in the second week of the inquiry unit, Student07 who identified herself as trying to “be organised” from the outset, recorded in a web calendar entry (as illustrated in Figure 5.8) that she had decided on her topic and planned to develop her primary research approach in the next lesson but “I’m having trouble thinking of how I am going to present my project”. Thus, she was thinking through each of the components of the inquiry process in the very
early stages of the project. This is a good example of a potential point of intervention regarding project management that was missed.

5.5.2.8 Knowledge construction

Given the majority of students completed much of the writing up phase during the school holidays, evidence of interventions regarding students’ knowledge construction in the wikis and blog involved support of students’ building of background knowledge to inform the development of their proposed topic statement or inquiry question. The history feature of the wiki was a particularly useful diagnostic tool for the teacher and TL to view how a student’s ideas were developing on their topic in the first two weeks, examples of which have been presented in Section 5.3.2 and 5.3.5. The majority of instructional intervention provided by the TL involved comments made on students’ pages where they harvested and stored information from their searches and the first two progress reports. Often these comments involved recommendations for resources which the TL thought might help inform the students’ development or refinement of their topic, suggestions regarding possible aspects of a topic that could be pursued, suggested wording for a student’s inquiry statement or question, as well as advice on referencing protocols in preparation for the writing up and presentation phases of the project. For example, on Student06’s ‘Bibliography’ wiki page, she advised, “For print resources (books, journals) you don’t need to include ‘date viewed’. This information is only needed for online resources that may ‘disappear’ at any time.”

In addition, as noted in the previous section (5.5.2.7), the TL saw much more potential for instructional intervention in the wiki or blog by either the teacher or TL if the project timeline ensured that the latter knowledge construction, writing up and presentation phases of the project occurred during the school term (not in the school holidays).

5.5.2.9 The nature of instructional intervention in a blended classroom

Observations of activity during class time highlighted that an inquiry classroom where students are working on individual projects can be quite a hectic classroom environment, with each student working on different tasks, or at different points of progress and completion of a particular task or tasks, throughout the one hour period. Even with the teacher and TL both being present as an instructional team, and with this small class of
eleven students (sometimes less if one or more students were absent), there were some periods when all students’ needs were not able to be met within that one hour. Immediate needs, urgent troubleshooting, whole class announcements about tasks or projected targets, and planned, targeted one-on-one conferencing between the teacher and individual students consumed much of each period.

Using Web 2.0 tools as project spaces where the teacher and TL could add comments or have editing access to students’ wiki pages provided an additional communication channel to offer advice and give feedback between the three timetabled periods of this class each week. As illustrated across the eight types of instructional intervention presented in this Section 5.5.2, it was a way of providing follow-up support that the teacher and TL knew was required but at times they were physically unable to provide it within the confines of the allocated class time of one hour. This challenge was also acknowledged by some students, who saw the Comments feature on the wiki and blog as helping overcome this, as explained by Student01, “That helps if you aren’t having interaction with them, which we weren’t, because they’ve got to go around the whole class. If we had one on one interaction, then it would have been easier.”

In addition, the use of the learning log and the first two progress reports as part of this inquiry unit actually provided the TL and teacher with formal scaffolds on which to base their discussion with students on their progress, and support their affective needs based on students’ reflections. This also relates to the finding presented in Section 5.3.2 regarding the Comments feature of Web 2.0 spaces capturing a record of conversation between a TL and student, which allows students to revisit and re-read affective comments to help build their confidence while completing their inquiry project.

While the teacher principally used face-to-face encounters with students whether in class or during out-of-class times, the TL worked to maintain a presence in the students’ Web 2.0 spaces and a number of students responded positively to this type of online interaction. The interaction between the TL and student is presented in Figure 5.21 as an example of the instructional dynamic that can occur within a blended classroom environment. This illustrates a record of conversation between the TL and Student05 where the student responds positively via the Comments feature regarding the instructional intervention provided by TL.
This screenshot also demonstrates the timely conversation that can occur outside class time and between class times. The TL’s initial comment on August 21 was posted on a school day where a Global Studies period was not scheduled. Very late that evening, Student05 logged into his wiki and found her advice about needing to refine his research question. He edited the frontpage of his wiki based on the TL’s feedback and then posted a second comment which logged his recent decision to rewrite is inquiry question as a result, and additional activities required to progress his project.

On the morning of the next Global Studies class, the TL used time before the school day commenced to review students’ progress on their Web 2.0 spaces, where she posted
follow-up feedback to Student05 (dated Aug 24, 6.24am). This post contained praise about his progress, articulated the affective dimension of the inquiry process in terms of feeling anxious which had now turned into confidence as a result of refining his question, gave Student05 advice about a technique he could apply to effectively record the bibliographic details and location of each of his sources on his wiki (he was a very active harvester as illustrated in Section 5.3.1.1), and she also directed him to one of the scaffolding documents (referencing guide) that students had been given as part of PIP booklet. All of this advice and affective support was sitting there waiting for Student05 in his wiki when he logged in at the beginning of class (at 11am) on that same day, which he appreciated as per his comment timestamped 11.08am. This also meant the TL could focus on meeting the needs of other students in the class, given the support she had already provided to Student05 (along with a couple of others) before they had entered the classroom for that period.

5.5.3 Summary of learning teams, instructional intervention and Web 2.0

To conclude, eight types of instructional intervention by the teacher or TL in students’ Web 2.0 spaces were identified, with the majority of online intervention made by the TL in the earlier phases of the inquiry unit. These illustrate the supports that can be provided by the teacher and TL throughout the inquiry experience including topic selection, technology support, resource support, focus formulation, inquiry process, research process, project management, and knowledge construction. It is also important to note that these supports were provided face-to-face as well as via Web 2.0 technologies. This highlights the emergence of the 21st century classroom as a blended learning environment when Web 2.0 technologies become part of the learning landscape.

Ultimately this shows the teacher and TL made decisions about which mode – either face-to-face or online – were the most appropriate mode for a particular intervention. The example of the TLs’ approach to technology support in this study is one example of this, where she found that some technical instruction such as setting up Web 2.0 accounts was best provided face-to-face, while modelling some of the features and functionality of Web 2.0 was best completed within students’ Web 2.0 spaces.
In addition, this study demonstrates how instruction and support throughout the inquiry experience can be provided in a timely fashion via Web 2.0 technologies, particularly during out-of-class time. This illustrates a new interventional dimension to instructional support within an inquiry unit when using Web 2.0 technologies. The findings also show how Web 2.0 technologies provided the TL with greater opportunities to diagnose and meet students’ information, technological and learning needs throughout the inquiry experience. The use of Web 2.0 tools also allowed the TL to capture and document the nature of, and evidence of, his or her contribution to student outcomes within an inquiry unit.

5.6 Participants’ views on technology use in the future to support inquiry

In the interviews held upon completion of the PIP unit, all participants’ shared their views on their intentions to use or not use technologies in the future based on this inquiry learning experience. The majority of student responses with regard to use of technologies in the future either revolved around their discussion of criteria applied to determine technology use, developments in their PTT, or technology infrastructure issues experienced in school or at home. For the teacher and TL, technology infrastructure issues, integration of technologies in curriculum units, and provision of technology instructional support, were the three main factors influencing their views on technology use in the future.

5.6.1 Students’ views on technology use in the future

5.6.1.1 Criteria determining future technology use

When asked what Web 2.0 technologies the students’ would consider using in the future to support any projects similar to that of their PIP, the majority of students identified ease of use, utility and experience as the main criteria underpinning their decision to use a tool in the future. Nine of the students stated they would consider using a wiki in the future to support an inquiry project. The following quotes reflect students’ views on the wiki:
Yeah, I might actually think about the wiki – it was really easy to use, like it was really interesting, and... you could upload files onto it too, like it was just really easy to keep all your stuff together. (Student02)

Yeah, actually I would. It [wiki] was effective and easy to use, so yeah. (Student07)

Some students’ assessment of the Web 2.0 tools focused on the potential utility in the Comments feature of blogs and wikis for future projects, and a number of students commented on the utility of the wiki as an online learning space to organise future project work, as described by Student06:

It depends on what kind of assignment I do... If I was doing, like, heaps of research and stuff, then I'd probably use [wiki]... It's like good to organise and stuff.

Some compared the utility of the wiki to saving Word documents in their folders on the school network (the way they had saved, stored and accessed documents from multiple computers to date), and were thinking that the wiki might potentially change the way they do things in the future. For example, Student06 reflected, “That's what I used to do because I didn’t, like before, like last year, I didn’t even know what a wiki was... But wiki’s probably easier.” However, Student11’s view was in direct contrast to a number of his classmates regarding the wiki’s value for future projects, “It didn’t add anything to it, apart from the fact that it was a place to store stuff”.

Interestingly, some students were undecided, and were still considering the potential use of some tools in the future. For example, in his interview Student01 explained his decision not to use Delicious was based on his assessment of its utility not really “adding anything” to the way he recorded URLs, e.g., “My own web page at home has bookmarking stuff, and I’ve never really needed to change from one thing to the other. I just didn’t think it was necessary.” However, Student01 reflected in his third and final progress report upon completion of his PIP that his main problem was “Forgetting which websites I had visited”, and in response to the question “What would you do differently next time?”, he replied “Use delicious to help keep track of the websites that I have visited.” In other words, he could see the potential value of Delicious in terms of its utility and saving time in recording the bibliographic data of sources located to create the bibliography for his final project report.
Furthermore, a student’s experience when using a Web 2.0 tool, whether successful and unsuccessful, could influence their intention to use it in the future. For example, Student01 and Student09 were in agreement that their successful experience using the online survey tool SurveyMonkey, would mean that they would consider using it again if they were faced with collecting and analysing a lot of survey responses as part of a primary research component in future projects, as Student09 concluded, “It was pretty neat... the way the results were presented were really good.” While Student08 decided he would not consider using Delicious again until he could successfully set up the web browser bookmarklet plug in using the computers at school, which was dependent on the configuration of the school’s network and unlikely to be changed in the future.

5.6.1.2 Impact of students’ personal technology toolkit on future use

As presented in Section 5.2.4, the concept of a student’s personal technology toolkit emerged as a result of students’ decisions to use a range of technology tools, other than Web 2.0 technologies, to complete specific tasks within their inquiry projects. The PTT is a student’s individual, customised collection of preferred technology tools and techniques that he or she uses on a regular basis to complete a range of school and/or personal information, communication and learning tasks. When a student was faced with a task that required functionality that no tool or technique in his or her toolkit could accomplish, it was only then that they sought out a potential new tool, or were willing to receive advice or recommendations from others about a potential tool.

A number of students commented in the interviews about their decision to take on or adopt a particular tool for future use, with the wiki being one of these as presented in the previous section (5.6.1.1). By way of example, in the interview with Student07 who used a Web 2.0 calendaring tool as a plug in to her wiki, when asked what she felt she had learned about her topic, she responded:

Yeah, I think I have learned a lot. Especially people’s opinions on it, I guess. But I’ve also, not just my topic, but learning to use the technology and the different, like, programs they have on the computer, such as the wiki.

In other words, she saw the value of learning how to use the wiki and web calendar technologies as part of her inquiry experience in addition to gaining a greater understanding of her topic on the 40 Hour Famine. When asked would she consider using
a wiki to complete a project for another subject in the future, she nodded her head in agreement, “For sure, yes.” Thus, the wiki was identified as a potential tool that may become part of Student07’s PTT in the future.

In comparison, a number of students decided not to trial Delicious as part of the inquiry unit. For some students this was a decision to reduce the number of log ins to Web 2.0 sites, in an attempt to try to simplify the number of technology tools they needed to manage as part of their project. Others identified a preferred technique they already used to collect and record website details and URLs, e.g., saving these details to a Word document or a wiki page, or adding the URLs as bookmarks in their web browser. Thus, they made a conscious decision to not trial a new technology based on the utility their existing toolkit afforded. As Student05 observed, when asked would he consider using Delicious in the future:

No, not really. What I usually do is I usually just copy the address into a Word document and when I open it, like the next class, I can usually just click on it and it’ll... open up the internet explorer and it will go to the page.

Thus, students’ own personal suite of tools and techniques will be drawn upon to complete future tasks, unless they are exposed to other tools or techniques that could help them complete a task more efficiently, effectively or creatively, than they would achieve with their existing toolkit.

That said, it is also important to note that a tool or technique may not be adopted as part of a students’ toolkit after an initial trial or subsequent applications of that tool or technique. For example, while nine of the students in this study stated they would consider using a wiki in the future, a number of whom acknowledged they had used a wiki up to twice previous to this inquiry unit, the scope of this study did not allow the researcher to observe any of the Web 2.0 tools being added. This could only be determined as a result of a longitudinal study involving these same eleven students, which is beyond the scope of this study.

5.6.1.3 Technology infrastructure issues influencing future technology use

A number of technology infrastructure issues emerged as a result of analysing data collected from student questionnaires and interviews, classroom observations, and
interviews with the teacher and TL. Some of these issues contributed to students’ decision to use or not use a particular technology to complete a component of their project, and also influenced their intention to use that technology in the future. Other students found ways of overcoming or working around some infrastructure issues, especially those regarding access. Although most students were affected to some extent, there was greater impact on some more than others. Here the emphasis is on a range of home-related and school technology infrastructure issues that influenced students’ intention to use particular technologies in the future.

Student05 could not access the school’s intranet from his home Internet connection, after several attempts to resolve this with the school’s IT department and his Internet Service Provider. This lack of access to Word documents located in his personal folder on the school’s network meant that Student05 really appreciated improved access to his project documentation which was housed in his wiki (in the cloud) which he could access at school and from home, as he explained:

*By copying and pasting it into the wiki it was always there and I could get it from home too… I find at home, my computer blocks the school site so I can’t get on to the [school name] site. So the wiki was a really good idea. We’ve called [school name] up about it numerous times. It just blocks the site - some security setting. So I’m not sure if it’s who we’re with, the company [ISP] blocks it.*

Student05’s previous workaround was to email files to himself so that he could work on them between school and home. However, the wiki helped reduce the technical load placed on him as a technology user and a learner. The use of the wiki meant the avoidance of the version control problems that can arise through emailing documents between computers. Thus the wiki streamlined the file management process he had been employing, reduced the number of emails he had to send to himself, and provided this student with as a more effective workaround in future.

Another technology infrastructure issue involved Student02 who had problems submitting her final project presentation because the school server would not permit large files to be uploaded:

*My Powerpoint was so big, that I couldn’t drop-box it, and I tried to drop-box it, and we thought it was drop-boxed, and then I ended up having to put*
it on a new USB and give it to her [teacher] to look on the USB, because it was so big.

This issue caused frustration for both the student and the teacher, and it was four days after the submission date that Student02 realised she could upload this large file to her wiki, thus overcoming the school network file size limit. Again, the wiki provided a cheap and effective workaround.

The school’s technology infrastructure was also a barrier to students’ wishing to use a Delicious account in that the bookmarklet feature which was designed to be installed as an add-on to a user’s web browser could not be installed onto any web browsers on the school computers by students, only teachers and the TL had this level of installation access on the school’s networked computers. This meant that a student wishing to use their Delicious account while searching for information on the school network could only add ‘found’ sites manually to their Delicious website, as opposed to clicking on the bookmarklet on the browser to automatically add site details to their Delicious collection. This reduced its functionality and the potential efficiencies a student could gain by using Delicious as a resource repository, as Student09 concluded, “I could have used it better I think if I’d used the buttons and if it had all worked properly.”

The lack of up-to-date computer technology throughout the school was also identified as an infrastructure issue, especially those students living in the boarding house where students’ PCs were considered “old” and “too slow” to complete tasks in a timely manner. As Student06 explained, “they're just heaps annoying, so, I don’t use them.” Student06’s workaround was to use the Library’s computers as much as possible to do his work, and as a boarder he managed to do this after dinner time between 6.30pm to 8.00pm. The other two boarding students persevered with the slow PCs in their rooms, however they did identify this as a major source of frustration when trying to complete their project after hours.

As mentioned in 5.2.1.1, students complained about a number of Internet filtering issues such as blocked web resources and websites, many of which they argued were being accessed for educational purposes, i.e., to research their PIP topic. This was first identified as a problem by the researcher when observing classroom activity in the second week of the PIP unit, when Student01 aired his frustration while trying to search for
information on his topic of gaming, as recorded in the observation memo dated 14 August (Period 6):

Gareth is searching about gaming and eBay access in China – he turns to the teacher and says, “Miss, if I’m going to do this, I’m going to need a teacher’s log in”.
(NB: he seems to be having problems accessing any of the websites he clicks on from his Google search results).

In addition to general websites being blocked by the school’s filtering system, one of the Web 2.0 sites recommended as part of the inquiry unit, the WordPress blogging site, was also blocked. WordPress was selected by Student08’s to use for his learning log to record his PIP progress reports and reflections. This led to Student08 using his own method to access WordPress, namely, the use of web proxies. The problem also led a number of students to do most of their project work at home as explained by Student02, when asked how much of her project work was done in class compared to home:

*I did most of my work at home... [Even] the blog web site that we could have used – WordPress - was blocked as well, and so, that just created another obstacle, it was just all easier to do... research at home... It's easier to do it at home.*

Hence, students in this class had two options when dealing with this infrastructure issue, either use web proxies to access those websites blocked by the school filtering system, or complete their project work at home. For those students boarding at the school, the latter was rarely an option, therefore they used web proxies regularly. In fact, in the words of Student09, the boarders “*depend on the proxies*”. In her interview, she laughed saying, “I mean we all want to use My Space and MSN and stuff, so I think that’s why boarders often have the proxies because people work them out”. She then added, “*And having them we can use them for school work as well... to get on to sites that we thought would be useful*”.

The following Case in Point (CIP 5.3) illustrates a number of the above technology infrastructure issues from the personal perspective of one student based on his interview.
Case in Point 5.3:
The student experience regarding technology infrastructure issues at school

Student08 is one of the boarding students of the class. He decided to use a blog (using www.wordpress.com) to record his learning log. He had used a blog before and felt this tool would be the best way to record his reflections about his learning. Familiarity, ease of use and utility were the main criteria he used when deciding on a blog.

When asked about the utility of the blog to regularly record his thoughts and experiences throughout the PIP unit, he responded:

> I sort of did... lots of posts at the same time and then no posts for quite a while... It isn't always the easiest thing to get to a computer and get your blog up and write stuff on it.

When asked to elaborate on those factors inhibiting his use of the blog, he replied that the blogging host (Wordpress) was actually blocked by the school filtering system. It was only in his interview (upon completion of the PIP unit), that this infrastructure issue was discovered as a major inhibitor to this student’s capacity to maximise the features and functionality of the blog to support his inquiry project.

When asked what measures he employed to overcome this issue, he explained that he had been using web proxies to gain access to his blog via the school network over the three month period of the PIP unit, one of which he used (Peachsurf.info) for most of the time he was completing his PIP, except that when he came back from school holidays “they blocked it”, i.e., the school’s IT department. He argued that network filtering was educationally restrictive and very frustrating for him as a boarder:

> Because some sites they block, just, there's no reason why they should be blocked. Like why block a blog site which it's been set up that people in the school will, for their assignments, do blogs on... Like it's understandable that they block game sites and things, but sites which can be educational shouldn't be blocked, in my opinion.

In addition, the computer in his boarding room was quite old. When asked if he used it much he replied:

> Not so much because it's really quite a bad computer, so, as you can imagine, that's so slow. So if it takes half an hour, to turn it on, and then you get into your work and it lags all the time, then... it isn't so easy to type and having it appear a few minutes later or whatever ... and it [network access to Internet] closes at 11 and opens at 6... it is
inconvenient if you've got a lot of work and it suddenly cuts out. It sends all these stupid messages saying “get off your computer”.

Instead he would go to the school library “quite a lot of the time” because “the library computers are better... And it's a better atmosphere to work in than a boarding house.”

The student felt that he was being disadvantaged as a boarder compared to the majority of his classmates who went home at the end of each school day, because they would have “better” computers and “better” access to the Internet when they got home, like his classmate Student01 who did the majority of his Internet searching and project work on his wiki at home.

The PIP wasn’t due until the students returned to school at the beginning of Term 4, so when Student08 went home for the school holidays he did quite a bit of work on his project because he had “decent internet access”. “So it was a lot easier to do it then”, he concluded.

Student08 was interested in testing and trialling Web 2.0 tools in the future. He liked them. But as a boarding student, this could only be achieved in future by devising new ways of working around school-based infrastructure issues. And he believed he could do this, given web proxies were part of his PTT.

The above challenges experienced by the students in this class highlight how technology infrastructure issues can influence students’ use of technologies, no matter how much they value the utility of particular tools. While some students devised workarounds to overcome an infrastructure issue, others simply did not bother. They already had tools and techniques in their PTT which they knew worked within the parameters and restrictions of the school network. It also demonstrates how the full functionality of a Web 2.0 tool, if not available to students on the school network, reduces the students’ capacity to explore the potential application of all features of that Web 2.0 tool.

In summary, students’ own personal suite of tools and techniques will be drawn upon to complete future tasks, unless they are exposed to other tools or techniques that could help them complete a task more efficiently, effectively or creatively, than they would achieve with their existing toolkit. When the functionality of existing tools or techniques was limited, students viewed ease of use, utility and experience as the main criteria in determining whether they would consider using a particular Web 2.0 technology in the future. However, it is important to note that a tool or technique may not be adopted as
part of a students’ PTT when an initial trial or subsequent applications of that tool or technique is a requirement of an inquiry unit.

Technology infrastructure issues, whether in school or at home, influence a student's intention to use a particular technology in the future. Some students devise workarounds to overcome infrastructure issues when working with Web 2.0 technologies at school. Others will revert to existing technology tools and techniques in their toolkit which they know are not affected by infrastructure restrictions. And finally, the full functionality of a Web 2.0 tool, if not available to students on the school network, reduces the students’ capacity to explore the potential application of all features of that Web 2.0 tool.

5.6.2 Teacher and TL views on technology use in the future

5.6.2.1 Impact of technology infrastructure issues on future use

The teacher and TL identified technology infrastructure issues as a major factor influencing their views on using Web 2.0 technologies in the future. In fact, in the pre-unit interviews with the teacher and TL, access to the Internet via the school’s network was identified as a concern for both of them regarding “how well the inquiry unit would go”. However, at the beginning of the unit the TL thought she had already made the necessary arrangements with the IT department regarding the provision of student access to the Web 2.0 technologies being used as part of the inquiry unit. As mentioned in Section 5.3.1, the TL had to have sites unblocked to set up the blogs and wikis and thought there would be no problem:

_WordPress, PBwiki was alright, because we’d actually got that unblocked, because we requested it earlier in the year, to use for the staff development day... and the same with Delicious... I actually had to submit the kids’ names in the global studies class for them to be given access to Delicious._

However, the IT department must have only processed staff (not student) access to the WordPress blogging site because, as indicated above, Student08 needed to use web proxies to access his blog. The TL also mentioned that a major server upgrade occurred during the school holidays just before the PIP unit commenced, which she suggested may have been the cause of some changes to students’ permission settings on the school network. However, she did persevere in the first three weeks with encouraging students
to consider using Delicious to support the topic selection and information gathering phases of their project, as she explained:

At one stage I went around to every computer in the classroom and actually uploaded them [Delicious bookmarklet buttons], and I thought, fantastic. But they actually went into a temporary folder... [which] disappears every time you shut down the computer.

This was a disappointing result because the teacher in her interview stated that she liked the functionality of Delicious to store collections of web resources ‘in the cloud’ for her and her students to access from any computer. However, given the reduced functionality of Delicious for students via the school network, she could see students may not feel it was worth the effort.

The teacher saw the wiki as a useful tool for those students having trouble accessing the school’s intranet from home. She liked the fact her students could access their project work “from anywhere, using any computer... That’s what’s good about it”, and she was already thinking about utilising wikis to support her Year 9 and 10 Global Studies units in the following year that involved group-based projects.

Another issue for the TL as the instructional partner with technology expertise was the lack of technology support she received from the IT department which ultimately reduced her capacity to support the technology needs of the teacher and students, as she explained:

I think the stumbling block was the lack of technology support – you know, when we came back and we tried to get that [PIP unit] all started, they upgraded the server, and then the kids couldn’t get in, and then they couldn’t put the buttons on the computers. So, I think once you make it too hard, they’re just not going to go with it.

This lack of technology support was a source of frustration for the TL who wanted to see students’ inquiry experiences enhanced by using the Web 2.0 tools, and she understood why some students made the decision to not use some of the tools made available to them, as stated in her overall conclusion of the unit’s success:

You’ve got to ensure that the technology structure at the school will support whatever you want to do with it. There wasn’t a great enough need for some of them [the students] to overcome the technology difficulties.
For both the teacher and the TL, technology infrastructure issues were viewed as part of the technological and educational environment within which they had to navigate on a daily basis. This certainly influenced their willingness to trial Web 2.0 technologies in the future.

5.6.2.2 Integration of Web 2.0 technologies in inquiry units

The findings reported in Section 5.6.1 along with the technology infrastructure issues examined above, have identified a number of issues teachers and TLs need to be cognisant of when designing an inquiry-based unit of work that integrates Web 2.0 technologies. For example, based on students’ preference for tools that are easy to use, have utility, and those they have previously had some success with, a teacher and TL need to carefully consider what additional functionality a new Web 2.0 tool brings to students’ inquiry experience. This approach was articulated by the TL:

*When you start thinking about how can this be applied in the classroom... you have to also think, is it actually offering anything that is not already being achieved by what is currently there? So, it actually has to value add, I think... before people will embrace it.*

Teachers and TLs must also build a technology testing phase into the unit planning process to ensure that both teacher and student permission levels on the school network are configured by the IT department to allow access to the full functionality of the Web 2.0 tools to be used. As explained by the TL:

*The primary concern would have to be that the IT structure is not supporting the most efficient use of the technology – you know, at the moment the problems with the server, so that sites are blocked, etcetera. A lot of the sites where you actually have to set up the blogs and wikis have been blocked, so it’s been a matter of trying to get those sites unblocked.*

However, the experience of the TL in this study demonstrates that organising such permissions at the outset is not enough, given that changes and upgrades can be made to a school network throughout the term. Therefore, as part of the implementation phase of a unit, the status of students’ access must be monitored throughout the life of an inquiry unit.

In addition, when planning for the integration of Web 2.0 technologies in an inquiry unit, the teacher and TL need to collect data on the level of PC and Internet access the students
during out-of-school hours, i.e., at home, in the boarding house. For example, in the interviews, students with limited technology infrastructure at home explained how they tried to use their time effectively on the computers during their Global Studies periods. This raises equity as a potential problem when a Web 2.0 technology is being used as the compulsory ‘thinking’ and/or publishing space for an inquiry unit. This is particularly important when a teacher or TL mandates homework tasks that require students to either spend considerable time on a computer to complete it, or requires students to have ready access to the Internet to conduct information searches, or complete publishing or communication tasks using Web 2.0 spaces. So if a class includes one or more students with limited access to PC and Internet time at home, the unit design must include provisions to ensure these students can complete assigned tasks on a PC either within class time, or within school hours via other means such as school library or IT lab access.

Furthermore, the teacher in this study concluded for future PIP units she would prefer students be given more choice with regard to using technologies to support inquiry projects. Thus acknowledging the existence of students’ own personal collection of tools and techniques as part of the unit design:

*So, next year I would keep the wiki for the group projects, definitely, and I have group projects in year 9, and I’ll use wikis for them, but for the PIP, I’ll say, look if you want to have a wiki as a way to organise, then go for it, but if you’d rather use a blog, or use a Word document or a piece of paper, then that’s fine as well.*

Thus, the teacher’s intention was to build even greater choice into the design of the PIP unit for Global Studies students in the future, in an attempt to overcome some of the technology infrastructure issues faced by her class this time round.

### 5.6.2.3 Provision of Web 2.0 technology instructional support

Based on their experiences in this study, the teacher and TL identified a number of ways they could provide instructional support in future, as well as some challenges they needed to address in the future with regard to providing instructional support. For example, as reported previously, a number of students made comments about difficulties accessing websites via the school network and having “decent Internet access” at home, which resulted in them conducting quite a lot of their project work out of class time, particularly for web searching tasks. While this reduced opportunities for the teacher and TL to
provide students with face-to-face instructional support, particularly in the topic selection/refining and information gathering phases of the inquiry process, the TL demonstrated a number of ways that she could connect with the students in their Web 2.0 spaces out of class time (as per Sections 5.3 and 5.5).

A number of students also responded positively to this online interaction with the TL, as noted by the teacher in her evaluation:

*The wiki I thought was really effective... very early on when students were looking for resources, or even trying to define their topic, I noticed that Mrs [TL] had gone in and used the comment section in the wiki to just say something to the kids, or say, good on you, or here’s this resource... And I think that hooked Student09 in, because she could see that it was another place for her to potentially engage with someone, even though it was her wiki space, Mrs [TL] could come in and provide support, and that’s recorded in her space.*

The teacher saw how well some students responded to the record of conversation being developed in their Web 2.0 space, particularly the wiki. This also informed the teacher of the types of instructional support the TL was providing her students. The teacher had also activated the email notification alert on students’ wikis which meant that she received updates of the frequency and type of activity completed by students in class and during out-of-class time:

*The other thing that’s interesting is, you know how you get the email notifications when they [students] do anything, I’d go back to my computer at the end of a global studies lesson and then, it’d be full!*

Again, this provided her with a way of monitoring student progress, although she preferred to provide face-to-face advice during class time when possible.

As noted in Section 5.5.2.9 findings, within a blended classroom environment, the teacher and TL needed to learn which mode – either face-to-face or online – is the most appropriate mode for a particular intervention. For example, as part of the design of the inquiry unit, the TL was responsible for teaching the second lesson where she introduced the Web 2.0 technologies that were being made available to the students. She then supported this with the creation of a Global Studies wiki space that provided step-by-step instructions on how to create a wiki, blog and Delicious account. This resulted in her receiving a number of questions from students on how to create new pages on the wiki,
or how to use Delicious to collect web resources. In terms of technology support, early in the unit she noted “they’re definitely coming to me for that”. As for the provision of instructional support of Web 2.0 technologies, particularly when trialling new tools as part of an inquiry unit, the TL concluded:

*Teachers are busy people and really, if they’ve got someone else who can support them in adding that extra layer into the classroom, then they don’t need to be experts themselves.*

This reflects the findings in Section 5.5 on the expertise each member brings to a learning team. The provision of instructional support about Web 2.0 technologies, and via Web 2.0 spaces, by the TL in this study demonstrates the valuable contribution a TL can bring to an individual student’s learning team as well as supporting the teacher as an instructional partner.

5.6.3 Summary of participants’ views on future technology use

In summary, technology infrastructure issues influenced the teacher and TL’s views on using Web 2.0 technologies in the future. Students’ levels of computer and Internet access during out-of-school hours need to be considered by the teacher and TL when planning the integration of Web 2.0 technologies in an inquiry unit to ensure equity of access for all students. The teacher and TL saw the wiki as one tool that helped students overcome problems accessing the school intranet when working from home.

A technology testing phase must be built into the unit planning process to ensure that both teacher and student permission levels on the school network provides them with access to the full functionality of the Web 2.0 tools to be used. In addition, the status of students’ access must be monitored throughout the life of an inquiry unit to ensure the full functionality of Web 2.0 tools is available at all times.

The TL demonstrated a number of ways she could provide instructional support via students' Web 2.0 spaces during out-of-class time. This also informed the teacher of the types of instructional support the TL was providing her students. However, in this study, lack of technology support from the IT department reduced the TL’s capacity to support the technology needs of the teacher and her students.
5.7 Summary

This chapter has discussed in detail under six major areas the key findings of the study presented in this thesis. These included findings regarding students’ general approaches to study when researching assignments, how they invested their time during class versus working on school assignments out of class time (including in the school library and at home), the problems and frustrations they generally experienced when working on project-based assignments, the types of help they sought from their teachers and the TL, and the previous experiences they had with using Web 2.0 technologies for school and personal use.

This chapter also presented findings with regard to students’ approaches to technology use. Participants in this study demonstrated the application of a set of seven criteria in determining whether to use or not use specific technologies. These included accessibility, ease of use, familiarity, utility, time, return on investment and experience. Findings also showed how the breadth of student’s set of criteria (either broad or limited) could influence their willingness to trial new technologies. In addition, three mental models of technology were identified in participants’ conceptual development of technology, namely, that of vagueness, technicality, and enrichment. This study found that students can benefit from reflecting on their use of technologies by way of discussion with other people (identified as technology informants), which could contribute to the development of their mental models of technologies. It also showed with some intervention, students’ mental models could move from vagueness to gaining a greater understanding of the technicalities of technologies, which in turn could strengthen their mental model to see potential enrichment gained by using technologies in their learning.

A key finding presented in this chapter was the concept of an individual’s personal technology toolkit as an important element of a student’s approach to technology use. It presented this toolkit as a student’s tools of choice, i.e., the tools and techniques they preferred to use to fulfil a specific functionality when undertaking a particular task. The student experiences in this study has highlighted that the simplicity or complexity of a task can determine which mix of tools and techniques are seen to have the best utility, based on students’ desire for efficiency, effectiveness, or creativity. It has also shown how the existence of a student’s PTT can influence their interest in, and/or willingness to adopt, new technologies to complete tasks as part of an inquiry project.
Another key finding presented in this chapter was the identification of specific functionalities of Web 2.0 technologies with regard to supporting students’ inquiry learning experience. The seven broad functions were information collection and repository, communication, project management, data collection and analysis, knowledge construction, publishing, and self-reflection. This study found that students’ use of the breadth of functionality of a Web 2.0 tool was influenced by their set of criteria determining technology use, the development of their mental model of that tool, discussions with and support of the technology informants in their learning team, and what tools and techniques already exist in their PTT. These findings have also highlighted students’ technology experience as a very complex layer of the inquiry process.

The results of students’ ASSIST scores were also examined to explore the impact of approaches to learning on students’ use of Web 2.0 technologies. While analysis of students’ technology use as deep, strategic or surface did not identify distinct patterns or trends within each style, a number of relationships between students’ technology use and some of the defining features within the deep and strategic approaches were identified, which does suggest that distinct patterns or trends could be identified in a study using a larger sample size.

The concept of a learning team approach was also identified as an important finding. Throughout the inquiry unit, students demonstrated a capacity to manage who were part of their support network, and determine the nature of people’s involvement, whether they were the teacher, TL, classmates, other students, or family members. In addition, eight different types of instructional intervention were identified while using Web 2.0 technologies. These included assistance with topic selection, technology support, resource support, focus formulation, inquiry process, research process, project management, and knowledge construction aspects of the inquiry learning experience. The emergence of an individual student’s learning team as a broader unit of instructional and moral support, along with the eight types of intervention, provided an alternate lens to explore the nature and dynamics of collaborative instructional partnerships within a blended learning environment using Web 2.0 technologies.
This chapter concluded with an exploration of student, teacher and TL views on the future use of Web 2.0 technologies to support learning and teaching in the future. This study found that students’ views on future use of technologies were determined by the combination of their application of one or more of the seven criteria used to determine technology use, the nature of their existing PTT, and technology infrastructure issues at school and in the home. Key issues impacting on the teacher and TL’s views on the future use of technologies when designing inquiry units included technology infrastructure issues experienced by themselves and by their students (at school and in the home), and the need to build a technology testing phase into the unit planning process to ensure that both teacher and student permission levels on the school network were configured to allow access to the full functionality of the Web 2.0 tools being used. This study also highlighted the increasing complexity experienced by teachers and TLs within a blended classroom environment, where they needed to work out which mode – either face-to-face or online – was the most appropriate mode for a particular instructional intervention. It also demonstrated the contribution a TL can bring to students’ learning teams, and in supporting the teacher as an instructional partner when using Web 2.0 technologies. The findings presented in this chapter are discussed in light of related research along with their implications for professional practice and future research in the next chapter, Chapter 6.
Chapter 6 Discussion and conclusion

The key research question for the study presented in this thesis asked, “How can Web 2.0 technologies be used to support student learning through a guided inquiry process?” To assist in answering this question, the following five focus questions were used to scaffold the exploration of this study:

1. How can Web 2.0 technologies be used to support students in the process of completing a project-based assignment?
2. How do learning styles affect students’ use of Web 2.0 technologies while they are in the process of completing a project-based assignment?
3. What types of instructional intervention within a guided inquiry framework can be provided by the teacher librarian and class teacher when students are using Web 2.0 technologies as learning environments?
4. What kind of ‘online dynamics’ among students, teachers and teacher librarians exist in Web 2.0 learning environments, and how does this influence students’ learning?
5. How do teacher, teacher librarian and student experiences with Web 2.0 technologies influence their views on using these in the future to support students’ learning?

This chapter discusses the findings presented in Chapter 5 within the context of the research literature to answer each of the above research questions. It also discusses the implications of the findings in relation to the design of curriculum units and project-based assignments where teachers/TLs intend to integrate Web 2.0 technologies to support students’ inquiry learning experience. In addition, it presents a theoretical framework and scaffolds to inform ways that teachers/TLs might introduce new technologies to students to assist in the development of their mental models of technologies, and in further developing their personal technology toolkit while completing inquiry-based learning tasks.

Chapter 6 consists of four discussion sections, with each section specifically addressing one or more of the focus questions:
6.1 Using Web 2.0 technologies to support inquiry learning (Q1);
6.2 Learning styles and Web 2.0 technologies (Q2);
6.3 Instruction and engagement in the blended classroom (Qs 3, 4); and
6.4 Personal construction and students' technology use (Q5).

At the end of each section recommendations are made for professional practice and further research. This is followed by a fifth section (6.5) which discusses the limitations of the study. The sixth and final section (6.6) presents the conclusion for the thesis.

### 6.1 Using Web 2.0 technologies to support inquiry learning

The first focus question asked, “How can Web 2.0 technologies be used to support students in the process of completing a project-based assignment?” Addressing this question required an exploration of the use of Web 2.0 technologies by the class with their teacher and TL, which provided an insight into the breadth of functionality of Web 2.0 technologies and the potential scope of students’ use of these technologies while completing an inquiry project. Analysis of students’ blog, wiki and social bookmarking spaces, along with web calendar and online survey tools, identified seven broad functions these types of technologies can provide to assist with a student’s inquiry learning experience. These functions are:

- information collection and repository;
- communication;
- project management;
- data collection and analysis;
- knowledge construction;
- publishing; and
- self-reflection.

Section 6.1.1 below presents a technology functionality matrix based on these seven that can be used by teachers/TLs to explore the integration of technologies when designing curriculum units, particularly with regard to matching the features and functionality of tools with specific learning tasks. Section 6.1.2 then examines the use of Web 2.0
technologies to support the project management needs of students undertaking inquiry-based learning tasks.

6.1.1 Technology functionality matrix

Section 5.3 in the findings chapter provided a detailed analysis of the features of each Web 2.0 technology used in this study and the nature of their functionality. A summary of the seven broad functions across the range of Web 2.0 tools is presented in Table 6.1. It is proposed that these can inform the development of a functionality matrix to assist teachers in evaluating and selecting potential technology tools for classroom use.

Table 6.1 Summary of types of tools and breadth of functionality evident in the study

<table>
<thead>
<tr>
<th>Types of tools</th>
<th>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiki</td>
<td>Information collection and repository</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
</tr>
<tr>
<td></td>
<td>Project management</td>
</tr>
<tr>
<td></td>
<td>Data and collection analysis</td>
</tr>
<tr>
<td></td>
<td>Knowledge construction</td>
</tr>
<tr>
<td></td>
<td>Publishing</td>
</tr>
<tr>
<td></td>
<td>Self-reflection</td>
</tr>
<tr>
<td>Blog</td>
<td>Information collection and repository</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
</tr>
<tr>
<td></td>
<td>Project management</td>
</tr>
<tr>
<td></td>
<td>Knowledge construction</td>
</tr>
<tr>
<td></td>
<td>Publishing</td>
</tr>
<tr>
<td></td>
<td>Self-reflection</td>
</tr>
<tr>
<td>Social bookmarking</td>
<td>Information collection and repository</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
</tr>
<tr>
<td></td>
<td>Project management</td>
</tr>
<tr>
<td></td>
<td>Publishing</td>
</tr>
<tr>
<td>Web calendar</td>
<td>Project management</td>
</tr>
<tr>
<td></td>
<td>Self-reflection</td>
</tr>
<tr>
<td>Online survey</td>
<td>Data and collection analysis</td>
</tr>
</tbody>
</table>

Overall, students’ use of wiki features in this study highlighted the most breadth in terms of functionality of a single tool (with examples of all seven broad functions utilised by
one or more students). Six out of the seven broad functions were utilised within blogs, with four broad functions used within social bookmarking tools throughout students’ inquiry learning experience. While the above summary and detailed analysis of functionality in Table 5.8 in Chapter 5 identifies how the seven broad functions were applied to the Web 2.0 technologies examined in this thesis, these seven broad functions could also be provided by other technologies, such as software programs like Microsoft’s Office suite or Adobe’s creative and publishing suite, or to iOS or Android mobile apps.

While the existing framework as presented in Table 5.8 is not exhaustive (given it only represents those functions used by the class in this study), these seven broad functions could be used by teachers to discuss the complexities associated with social networking tools with students, i.e., with many of these tools having more than one function. This framework can therefore help teachers articulate the complexity of specific technology tools with regard to breadth of functionality and utility; however, it does require further development and refinement to be used in practice.

Thus, the following matrix has been developed to clearly define the specific functionalities of each Web 2.0 technology in supporting an inquiry learning experience. Within the context of this thesis, functionality is defined as the quality of being suited to serve a purpose well. Therefore the specific types of functions that each Web 2.0 technology can potentially “serve” or provide students and teachers, while undertaking an inquiry learning task, are presented in Table 6.2 as a Technology Functionality Matrix.

As noted previously, the participants in this study did not fully explore some of the features of each Web 2.0 technology. Based on the researcher’s analysis of the features of each of the five Web 2.0 technologies, and reports of usage in the wider literature (based on those examined in Section 2.4), the potential functionality of some of these technologies has been expanded in the development of this matrix. For example, in Table 6.1 we can see that the online survey tool was only used by students to fulfil the data collection and analysis function, whereas in Table 6.2 additional features of the online survey tool are identified to demonstrate its potential in fulfilling project management and publishing functions. Likewise, the social bookmarking tool which was used by participants to fulfil aspects of information collection and repository, communication,
<table>
<thead>
<tr>
<th>CATEGORY OF FUNCTIONALITY</th>
<th>Wiki</th>
<th>Blog</th>
<th>Social bookmarking</th>
<th>Online survey</th>
<th>Web calendar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information collection and</td>
<td>store documents &amp; upload files</td>
<td>store documents &amp; upload files</td>
<td>• capture bibliographic data of sources including title, URL, annotations and</td>
<td>• use tagging feature to direct resource sharing to an individual or group</td>
<td></td>
</tr>
<tr>
<td>repository</td>
<td>record information from sources</td>
<td>record information from sources</td>
<td>subject headings/ tags</td>
<td>• use annotations field to leave messages or instructions for individuals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>collect useful quotes</td>
<td>collect useful quotes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>capture bibliographic data of sources</td>
<td>capture bibliographic data of sources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>record brainstorming of ideas</td>
<td>record brainstorming of ideas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>'copy &amp; paste' digital full text &amp; images</td>
<td>'copy &amp; paste' of digital full text &amp; images</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>insert and view multimedia files</td>
<td>insert and view multimedia files</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>create separate pages for sub-topics</td>
<td>create separate pages for sub-topics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>instigate and maintain asynchronous conversation via Comments feature</td>
<td>instigate and maintain asynchronous conversation via Comments feature</td>
<td>• build a collection of digital resources on specific topics and sub-topics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• capture a record of conversation with date and time of each</td>
<td>• capture a record of conversation with date and time of each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>comment automatically recorded</td>
<td>comment automatically recorded</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Wiki</td>
<td>Functionality of Technology Tool Functions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>------</td>
<td>------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Calendar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online Survey</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blog</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specific Technology Tool Functions

- Use survey to collect feedback from users and analyze the results.
- Use tools to process data and generate reports.
- Use digital resources to create interactive content.
- Use calendars and blogs to manage projects.

- Support ongoing workshops, member advice, and development.
- Create a project plan with timelines and responsibilities.
- Join and participate in online communities.
- Develop project plans with timelines and responsibilities.
- Use surveys to collect feedback from users and analyze the results.
- Use tools to process data and generate reports.
- Use digital resources to create interactive content.
- Use calendars and blogs to manage projects.
<table>
<thead>
<tr>
<th>CATEGORY OF FUNCTIONALITY</th>
<th>Wiki</th>
<th>Blog</th>
<th>Social bookmarking</th>
<th>Online survey</th>
<th>Web calendar</th>
</tr>
</thead>
</table>
| Data collection and analysis | • create a page to design survey and interview questions  
• upload audio files of interview data, record transcripts of interview data, and record notes of focus group interviews  
• store the analysis and compilation of survey data collected from print-based survey forms | | | • use data collection parameters to collect survey responses within a specific time period  
• use analysis features to automatically calculate quantitative and qualitative data  
• use graphic-based reporting features to automatically create data charts of results  
• use exporting feature to download, save and edit quantitative data  
• use exporting feature to download and save qualitative data for analyses | | |
<table>
<thead>
<tr>
<th>Blog</th>
<th>Wiki</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publish</td>
<td>Knowledge</td>
</tr>
</tbody>
</table>

### Publishing
- Create separate pages for...
- Use headings and navigation links to...
- Read about the creation of...
- Understand and develop the...
- Encourage student thinking and...
- Monitor the knowledge...
- Promote discussion between...
- Develop the knowledge...
- Support learning to...
- Use the blog to create separate pages for...
- Use navigation links to...

### Knowledge
- Encourage student thinking and...
- Develop the knowledge...
- Support learning to...
- Use the blog to create separate pages for...
- Use navigation links to...

### Content
- Develop the knowledge...
- Support learning to...
- Use the blog to create separate pages for...
- Use navigation links to...

<table>
<thead>
<tr>
<th>Web Calendar</th>
<th>Online Survey</th>
<th>Bookmarking</th>
<th>Social Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category: TOOL FUNCTIONS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CATEGORY OF FUNCTIONALITY</td>
<td>Wiki</td>
<td>Blog</td>
<td>Social bookmarking</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>
| Self-reflection           | • create a separate page for students to record their feelings throughout the inquiry process, identifying problems and examples of troubleshooting/solving these  
• use the Comments feature to provide affective support, critical feedback and instructional intervention at the point of need | • create a separate page or use blogroll with ‘reflection’ tag for students to record their feelings throughout the inquiry process, identifying problems and examples of troubleshooting/solving these  
• use the Comments feature to provide affective support, critical feedback and instructional intervention at the point of need |                   |              | • use web calendar features to maintain a learning log with entries recording student reflections of their learning experience throughout the unit  
• insert web calendar as a plug-in to a wiki, blog, website, or other Web 2.0 space used to support project work |
project management and publishing. Table 6.2 also shows how social bookmarking has potential to fulfil the knowledge construction functionality by using the annotations feature to record critical evaluation of individual sources, and to brainstorm ideas or take notes as a result of reading an individual source.

Furthermore, given few students used the blog to support their inquiry learning experience, the researcher has included additional features of the blogging tool to demonstrate the potential application of a blog to fulfil the six functions of information collection and repository, communication, project management, knowledge construction, publishing and self-reflection in a more comprehensive fashion. This shows how a blogging tool has comparably similar functionality and utility to a wiki, which could assist a teacher or student in determining which of the two tools could best suit their needs to complete a particular task, or allay concerns of the breadth of functionality of a blogging tool if they do not have ready access to a wiki platform. Therefore, the Technology Functionality Matrix provides guidance for teachers in designing inquiry learning tasks, and guidance for students in completing inquiry learning tasks, when using one or more Web 2.0 technologies.

The Technology Functionality Matrix also provides a framework for teachers to help them articulate the potential functionality of new Web 2.0 tools when introducing them to a class. Teachers can employ the matrix to discuss how the features and functionality of a Web 2.0 technology can meet the specific needs of an individual or group of students when embarking on a new inquiry project. This supports a constructivist approach to building on previous knowledge or experience, and relates to the implications for personal construction and students’ technology use which is explored in detail in Section 6.4. It could also help to address some of the challenges teachers face with students who are sceptical of teacher-led technology innovation as per findings presented in Section 5.2.3.

Findings from other studies of Web 2.0 technology functionality confirm some of the findings presented in Chapter 5 and contents of the Technology Functionality matrix presented above. For example, with regard to the information collection and repository function, Schaffert et al. (2006) found wikis allow teachers and students to work closely together on a topic, collecting and sharing information on a topic, regardless of the whereabouts of students and teachers. This feature of remotely accessing the wiki as a
central storage place from any computer, whether in school or at home, was highly valued by some of the students, as presented in Section 5.2.1.1 on accessibility as a criteria determining technology use and Section 5.3.1.1 on the collection and repository function of the wiki.

Similar to the harvesting behaviour identified in Section 5.3.1.1, Engstrom and Jewett’s (2005) study of 400 middle school students undertaking an inquiry project found that students primarily used their wiki to collect information with little application of critical thinking to content posted. Grant’s (2006) observation of Year 9 ICT students’ use of a wiki also found that students’ focus was principally on the selection and collection of content to be stored, rather than focusing on the development of their ideas. As first time users of a wiki, these students did not see the potential of the wiki as a knowledge construction tool, which led to Grant’s recommendation that teachers need to explicitly teach the features and potential functionality of new technologies being introduced to students as online learning spaces. This supports the need for teachers to employ a scaffold such as the Technology Functionality Matrix presented in this chapter to assist in the explicit teaching of the features and functionality of specific technologies to support student learning.

The affordances of the communication features of wikis in supporting inquiry learning has also been identified in other studies, particularly with regard to the functionality of a wiki in leveraging instructional intervention between teachers and students. For example, Todd and Dadlani (2014) found the use of a wiki site allowed the teacher and TL to converse online with the students, provide feedback on students’ progress and reflections, and provide instruction for students’ at the point of need. Zorko’s (2009) study highlighted the value a group of undergraduate students placed on the wiki because it provided them greater access to their instructors using the Comments feature. This record of conversation also becomes valuable in supporting students’ reflective practice (which is discussed in more detail later in this section). While the studies by Ayers (2011) and McGrail and McGrail (2014) found the communication functionality of the Comments feature of the wiki was valued by students because it allowed them to gain feedback from an authentic audience who engaged in their ideas and motivated them to continue with their writing.
As noted in Section 2.4 of the literature review, there are fewer studies in the use of social bookmarking tools, particularly with school students. The information collection and communication functionalities of Delicious and Diigo have been realised by university lecturers and students to support their work (Gunawardena et al., 2009; Cox, Taha, & Wood, 2014; Wood et al. 2014). Within the school context, Diigo was successfully used by Grade 5 students as an information collection tool to identify, categorise, and save bibliographic data and URLs for sources, and as a project management tool to help save students’ time when needing to find existing sources during knowledge construction and publishing phases (Anderson, Mitchell, Thompson, & Trefz, 2014). The teacher of Anderson et al.’s case study also instructed the students on the use of Diigo as a knowledge construction tool using the highlighting and annotation features of this social bookmarking platform to take notes of ideas as they emerged and rework saved quotes into paraphrased sections as part of the drafting phase of the writing project. Similar results were found with a pre-service teacher course where groups of 5 and 6 students were encouraged to collaborate on inquiry topics using Diigo as the group’s ‘think space’ (Li, Pow, & Cheung, 2015). The researchers concluded this social bookmarking environment was found to be conducive to fostering high-level cognitive and metacognitive activities, particularly in the use of the text highlighting feature of Diigo which leveraged learners’ comprehension ability and provided “the necessary anchors and scaffolds for learners to engage in meaning negotiations and knowledge building” (p. 11). The findings from this and Anderson et al.’s study on the knowledge construction functionality of Diigo supports the features and functions of social bookmarking proposed in the Technology Functionality Matrix (Table 6.2).

Other studies have also found wikis useful as a knowledge construction tool where knowledge is created and shared by learners and their teachers (Fountain, 2005; Gunawardena et al., 2009). The process of knowledge construction collaboratively with others using a wiki supports constructivist approaches to learning design and has been examined by a number of researchers (Engstrom & Jewett, 2005; Boulos, Maramba, & Wheeler, 2006; Notari, 2006; Todd & Dadlani, 2014). Yukawa’s (2005) use of wikis in narrative analysis showed how text (knowledge construction) and “online talk” (asynchronous communication using the Comments feature) constructs a more holistic view of a student’s learning experience involving cognition, interaction, and support for their affective needs. Likewise, Hsu, Ching, and Grabowski’s (2013) analysis of blogging
studies found a “positive impact on learning with additional affective benefits when learners used blogs to share learning progress and achievement with peers” (p. 750). For example, students using blogs to post and respond to each other’s writing experience can increase motivation (Taylor, 2012), and can alleviate self-doubt and help students become more confident in their learning (Ladyshewsky & Gardner, 2008). These studies show the power of a Web 2.0 tool with features that combine knowledge construction, publishing and communication functionalities.

On the other hand, some studies have found that students do not feel comfortable using the wiki as a knowledge construction tool because they do not want to make their thinking visible to others (Lin & Kelsey, 2009). In fact the actions of the students in Lin and Kelsey’s study were similar to findings of the Year 10 Global Studies students’ behaviour in this study, where some students felt uncomfortable sharing their thinking process with peers through the wiki, or did not want the teacher to be able to monitor the development of their ideas into a final published piece. As a result, students preferred to use Microsoft Word as their ‘thinking space’, which allowed them to hide their thinking from being visible.

Teachers have also reported the value of the Comments feature in a blog or wiki in providing feedback for students on specifics pages of their wiki or specific entries on their blog. As identified by the TL of the class in Section 5.3.2, the communications functionality of Web 2.0 tools provides a permanent record of conversation between members of a student’s learning team. Atkins et al. (2014) advise this is why teachers prefer to use wikis for writing instruction because they can provide feedback specifically for the student as author of each wiki page, which the student can then refer to while making revisions per page. This view is also supported by Assaf et al. (2014).

Furthermore, teachers particularly value the knowledge construction functionality of wikis because of the history feature that saves each version of a wiki page. A number of studies in both school and university settings have found educators’ preference to use a wiki to support students’ completion of inquiry learning, writing tasks and group work, because it allows them to what knowledge construction in action, and monitor individual student’s contributions to group-based knowledge construction tasks (Engstrom & Jewett, 2005; Elgort, Smith, & Toland, 2008; Zorko, 2009; Hsu, Ching, & Grabowski, 2013;
Assaf et al., 2014; Atkins et al., 2014). Teachers also find the convenience of the wiki in reducing the chance of students losing drafts of their work (Atkins et al., 2014).

Other studies confirm the project management functionality of wikis, with Schaffert et al. (2006) and Chao (2007) identifying the wiki as an effective tool to support project planning and documentation, along with Naish (2006) who found the wiki providing a platform for clear team direction compared to the use and management of individual email messages to support group projects. The use of project management functionality to support inquiry learning is discussed further in the next section (6.1.2).

The self-reflection functionality of wikis has also been identified by Chen et al. (2005), Fountain (2005) and Gunawardena et al. (2009) who found wikis enable students to reflect upon their learning, thus gaining a greater understand of their own learning processes. In addition, Assaf et al. (2014) recommend teachers be involved in this reflective process where teachers and students reflect on wiki page revisions using the History feature of wikis, where the teacher can discuss the revision process in more detail, pointing out specific improvements and the overall quality of text written by a student. Gunawardena et al. (2009), Ladyshewsky and Gardner (2008), and McGrail and McGrail (2014) have also observe the value of blogging in supporting student metacognition, with Xie, Ke and Sharma’s (2008) study finding a significant increase in students’ level of reflective thinking over a period of time.

In terms of studies specifically identifying sets of functionalities of social media platforms or technologies in general, the focus has been more on the collaborative, participatory, social networking nature of these technologies rather than functionalities in terms of learning, or more specifically inquiry learning. For example, Friedman and Friedman (2013) identified communication, collaboration, community, creativity and convergence as the unique attributes of social media platforms in terms of functionality. Zorko’s (2009) review of the literature presents a list of six functions a wiki provides for educators, including storing different types of digital information, sharing information, monitoring students’ group or individual progress, promoting democratic participation, empowering students, and interacting socially and collaborating. While Reynolds (2016) has proposed a digital literacy framework of six stages including create, manage, publish, socialise, research and surf/play that identifies the features of a range of Web 2.0
technologies such as wikis, blogs, social bookmarking, YouTube and Google Docs, just to name a few; however, this experience is within the context of student game design.

While educators acknowledge the supportive functions of Web 2.0 technology in fostering student learning such as engagement, encouragement of autonomy, intentionality, reflection, and community (Chen, Lambert, & Guidry, 2010; Dunlap & Lowenthal, 2011), no other study identified in the review of the literature undertaken for this research has developed a matrix of functionality based on features across a number of Web 2.0 technologies within the context of individual students’ inquiry experience as presented in this thesis.

Future research could explore how this matrix can be expanded based on features and functions of a range of other social networking tools, software programs or mobile apps, to address more comprehensively the seven broad functions identified in this study. Alternatively, further research on technology functionality may identify additional functions based on inquiry learning experiences, or other types of learning experiences such as collaborative learning, problem-based learning or design thinking.

No matter what technologies are available to teachers, TLs and students, the findings presented in this thesis demonstrate functionality as central to effective application of a technology to support student learning. As Assaf et al. (2014) advise upon presenting the outcomes of their action research:

> In each of these cases we had to consider the best tool for the particular needs of our students. Choosing online tools can be an overwhelming process for educators – there are so many and new ones are being developed at a dizzying pace, but taking the time to experiment with tools and match functionality with instructional goals can ensure a smooth and meaningful experience. (p. 473).

To conclude, the Technology Functionality Matrix presented in this section can be used as a starting point for educators interested in trialling one or more of the five Web 2.0 tools examined in this thesis. This matrix has scope to evolve based on empirical evidence from future studies and documented outcomes of teacher practice in the future.
6.1.2 Project management and Web 2.0 for inquiry

Findings in Chapter 5 highlighted that project management was one aspect of the inquiry project that students clearly struggled with and needed greater assistance with. Recently, project management has been espoused as an essential life skill for 21st century learners (Byrne, 2010; Trilling, 2014; Stanley, 2016), however, the teaching of any project management knowledge or skills principally occurs within computing technology or design and technology curricula in Australia (ACARA, 2016).

Classroom observations and interviews with the students, teacher and TL in this study highlighted the lack of explicit teaching in terms of a project management process as part of the inquiry project. While information process models such as the NSWDET (2007) Information Process or Kuhlthau’s (2004) Information Search Process are often used to scaffold students’ completion of inquiry-based projects, these lack an organisational dimension that is critical to the success of students’ inquiry learning experience, i.e., an explicitly customised project management plan and process to support specific design and organisational requirements of their proposed project. One of the challenges for teachers/TLs is that the planning phase in project management requires an investment of time, which needs to be explicitly built into the design of the inquiry unit.

While a number of students in the class developed a research plan, these principally articulated the data collection requirements of their project. The techniques employed to analyse the data and the proposed time this should take was not included in these plans, nor was the writing up phase of their primary research, nor the integration of information collected from secondary sources with their findings. Therefore, it is not surprising that these students could not plan their time, or even have an idea of the estimated time it would take to complete these aspects of their project. While students commented on their lack of time management skills, they did not actually have a project plan that ‘mapped’ tasks with time estimates, therefore they had no scaffold to help them effectively manage their time.

It is well known in the field of project management that complex projects require careful planning and scheduling to successfully manage each stage within a project. This mapping of tasks and times into a project schedule is often presented in diagrammatical formats such as a milestones and activity chart, commonly known as a Gantt chart (White
& Fortune, 2002). However, none of the students in this study used such a tool to plan and monitor each of the tasks they needed to complete. Such a chart would have helped the students identify each task (and even sub-tasks) to be undertaken and how each of these was to be carried out, in what order and with time estimates (in terms of hours, days or weeks). In other words, a schedule was needed that lists more than a few dates as deadlines. This would have also helped the students to identify which tasks needed to be completed before another task could be started, i.e., tasks that are sequential, as well as identifying parallel tasks that could be done simultaneously, in part or as a whole.

A chart such as this would have helped the students develop a mental model of what the overall project would look like with a combination of sequential, and overlapping or parallel tasks. It would have assisted the students in constructing a more realistic picture of the time they had available to them and the estimated time their proposed project would take. It would have also provided a formal platform on which to base instructional intervention between the students, and the teacher and/or TL as required. For example, such a chart could identify a student’s inability to complete more than one or two forms of data collection within the project timeframe. Or it could identify a student’s unrealistic estimation of time to complete the writing up phase, or even identify the non-inclusion of the writing up phase as part of their project management plan, which has been identified in other studies as being problematic for secondary students undertaking inquiry projects (Kuhlthau, 2004; Sadeh & Zion, 2012). The experiences of the students observed in this study demonstrate that students completing inquiry learning projects require both knowledge and skills in project management, and that this be supported by a simple yet effective project management methodology.

Project management is defined by the Project Management Institute (PMI, 2013) as “the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements” (p. 5). PMI employs a project management process involving the five process groups of Initiating, Planning, Executing, Monitoring and Controlling, and Closing from the beginning to end of a project (as illustrated in Figure 6.1), with the implementation of each process group ensuring “the effective flow of the project throughout its life cycle” (p. 47).
As presented in Section 5.3.3, all students struggled at some point with managing the variety of elements required by the PIP, and as evidenced in Section 5.5.2.7, the TL made comments on students’ wiki or blog prompting or reminding them of pending deadlines and submission dates as outlined in the PIP booklet. However, as articulated by the students and TL, the primary focus of their efforts was on time management rather than task management. Studies in students’ completion of inquiry- and project-based learning tasks shows that students can often generate project plans and carry out individual project steps, however, they struggle with managing their time “due to the absence of a more systematic approach to carrying out the project” (Helic et al., 2005, p. 449). It is therefore recommended that teachers/TLs re-examine the design and implementation of inquiry units using a project management lens to strengthen student and teacher efforts on task management, in addition to time management (which up till now is where emphasis is most commonly placed from student and teacher perspectives).

A project management lens can encourage students and teachers to focus on task management (within a timely fashion). While the findings of Helic et al. (2005) show that students can develop a project plan, what appears to be missing is an understanding that project plans change within the life cycle of a project. In other words, it is unrealistic to expect the original version of a project plan to remain relevant throughout the life of the project without requiring some adjustments. Helic et al. concluded that teachers need to help “learners to better anticipate the complexity of particular project steps, thus
resulting in an early adjustment of the project plan and better project management” (p. 449).

According to the PMI (2013), projects by nature have the potential to change, therefore it is important to view the development of the project management plan as “an iterative activity”, that is “progressively elaborated throughout the project’s life cycle” (p. 6). In other words, a person managing a project must understand that their plan is not static; it will evolve as one progresses through the project life cycle, adding more detailed and specific information, and making more accurate estimates of task completion within the project life cycle as it becomes available. The PMI refers to this approach as “progressive elaboration” (p. 6), which is one element of project management that could be integrated more explicitly within information process or inquiry process models.

Figure 6.1 shows the integrative nature of five categories of project management process groups as espoused by PMI (2013). These include:

- the Initiating Process Group – processes performed to define a new project or a new phase of an existing project by obtaining authorisation to start the project or phase;
- the Planning Process Group – processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve;
- the Executing Process Group – processes performed to complete the work defined in the project management plan to satisfy the project specifications;
- the Monitoring and Controlling Process Group – processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes; and
- the Closing Process Group – processes performed to finalise all activities across all Process Groups to formally close the project or phase.

Based on the experiences of the students, teacher and TL as documented in Chapter 5, it is proposed that the Planning, Executing, and Monitoring and Controlling processes of project management are particularly relevant to the design and
implementation of inquiry- and project-based learning tasks. The nature of, and techniques within, these three processes can assist in guiding students through a far more explicit inquiry experience with task management as the focus, along with developing an understanding of when to expect the implementation of process group techniques throughout the life cycle of a project.

It is important to understand, however, while the commencement of the process groups is sequential in nature, starting with initiating, followed by planning, executing, monitoring and controlling, and concluding with closing, there is significant overlap across and interaction between these process groups. The sequencing of, and interaction between, each process group is presented in Figure 6.2 (as defined by the Project Management Institute, 2013), which illustrates project management process interaction and the percentage of time each process group is estimated to be active throughout a project’s life cycle. For example, the process of initiating, planning, and monitoring and controlling all commence at the start of a project, with executing beginning in the first 5-10% of the life cycle of the project. Of particular note is the expectation that:

(a) the initiating process commences at the very beginning of the project and remains active into approximately the 30% mark of the project life cycle;

(b) the planning process commences at the very beginning of the project and remains active throughout the first 80% of a project’s life cycle, and it peaks in activity around the 35-40% mark of the project, after the initiating process concludes;

(c) the executing process commences approximately 5% into a project’s life cycle and concludes when the project is more than 90% complete, increasing in activity about 45% into a project life cycle when planning activity starts to reduce (note this is where their activity intersects), and executing processes peak around 60% of a project’s life cycle;

(d) the monitoring and controlling process commences at the start of a project and is active for the entire project’s life cycle, peaking at 50% in a project’s life and concluding at the finish of a project; and

(e) the closing process commences around the time the planning process peaks at 35-40% into a project, and it remains active for the remainder of a project’s life, peaking around the 80-85% mark of the life cycle.
Figure 6.2 Project management process interaction and percentage of time each group is active throughout project life cycle
The implementation of activities and techniques within each of the above five process groups is designed to provide a clearly articulated, task-focused process for managing a project. The challenge for teachers/TLs is aligning a project management process with an existing information process or inquiry process model. While the Year 10 students in this study did not explicitly follow all phases of an information process to complete their PIP, a number of instructional interventions provided by the TL throughout the project using Web 2.0 technologies (as presented in Section 5.5.2) relate to some phases of Kuhlthau’s (2004) Information Search Process (ISP) and the PMI’s (2013) project management (PM) process. As a result, Figure 6.3 has been developed to illustrate what a project management process might look like when aligned with an information process model. This specifically applies a project management lens to the seven phases of Kuhlthau’s (2004) Information Search Process throughout the life cycle of a project. This diagram highlights some key interactions between the two processes, including:

(a) The Initiation phase of the ISP, where students prepare for the decision of selecting a topic for an inquiry project, coincides with the initiating process of PM where individuals or a group work together to define a new project;

(b) The intersection between the reduction of initiating activities and an increase in planning activities of PM (approximately at the 15% mark of the project life cycle), coincides with the end of the ISP Initiation phase;

(c) The level of planning in PM continues to increase through the Selection phase of the ISP where students identify and select a general topic to be investigated and determine the approach to be pursued. This is where students are weighing prospective topics against personal interest, assignment requirements, information available and time allotted, and often discuss the possibilities of topic selection with others;

(d) The PM planning process peaks in the middle of the ISP phase of Exploration, which is identified by Kuhlthau (2004) as the most
Figure 6.3: Applying a project management lens to Kuhlthau’s (2004) ISP model throughout a project’s life cycle.
difficult phase in the process for many students who feel confused, frustrated and sense doubt about making a decision on the specific focus of their topic. This is also where PM’s executing and monitoring and controlling processes begin to increase and intersect to ensure the momentum of a project’s ‘flow’ does not falter but continues;

(e) Focus formulation is the fourth phase of the ISP, which is considered the turning point for many students undertaking a project because they need to make a final decision about the specific topic or aspect(s) of a topic to investigate in greater depth as the focus of their project. This is where the level of PM executing activity increases, with the primary focus being to complete the work defined in the project management plan to satisfy the project specifications. This is also the halfway point (between the 45-55% mark) of a project’s life cycle;

(f) As students move from Focus formulation to the Collection phase, the executing processes of PM peak and the levels of planning, and monitoring and controlling begin to decrease and intersect. This is where students undertake very targeted information gathering that defines, extends and supports the project’s specific focus to inform the development of new understandings, i.e., knowledge construction. At approximately 60% into the project life cycle, students’ project plans should have been revised to accommodate any changes that need to be made to ensure the momentum of the project’s flow is maintained to move the student through knowledge construction towards the Presentation phase;

(g) The Presentation phase of the ISP is known as the ‘culmination point’ of the inquiry process (Kuhlthau, 2004), where they conclude searching for new information and focus on synthesising their findings in preparation for presentation to others (usually in the form of a product, e.g., project report, artefact, oral presentation, model or prototype). The PM planning activities conclude (at around the 80% mark of the project’s life cycle), and executing processes come to a close by the end of the Presentation phase; and

(h) The final ISP phase of Assessment begins around the 95% mark of the project life cycle, particularly where reflection and self-assessment tasks are built into the design of the inquiry project. This coincides with the monitoring and controlling, and closing processes coming to an end at the 100% mark of the project life cycle. For the majority of school-based projects there is usually a
formal assessment process involved upon completion of a project. This is why the Assessment phase of the ISP in Figure 6.3 goes beyond the life of the project (denoted by Finish at the 100% mark).

Throughout a project’s life cycle where a project management lens is applied to an information process model, a teacher/TL has multiple points where instructional scaffolds can be used to assist students develop PM skills and understandings as part of their inquiry project. These scaffolds could draw upon a range of tools and techniques from project management theory and practices, as well as tasks, strategies and interventions articulated within the phases of an information process such as the ISP.

From the few studies examining the outcomes of teaching project management to school students, no studies have layered the two processes together as presenting in Figure 6.3. The main findings of a program that explicitly taught project management include an increase in the academic performance of primary age students, particularly with regard to organisational skills, time management, task completion, teamwork, and responsibility (PM4Life, 2005). Hoyet’s (2004) study which involved teaching Year 9 students collaborative and project management skills, found increased cooperation, positive interdependence, and individual accountability in her students. Across the 49 students involved in the project, Hoyet found an overall increase in the quality of students’ work, with analysis of students’ project grades before and after the PM training showing an increase from 31% of students receiving an A to 67% receiving an A, and 47% of students receiving a B reduced to 33%. Previous to the PM training, 22% of the students had received a C grade; however after students completed the PM project, no grades lower than a B- were awarded across the cohort. Students’ journal entries highlighted how the PM training helped them to organise tasks, establish a working schedule, and work efficiently “instead of spending days without a clear plan as they had in the past” (p. 12). Overall, the students also “expressed enthusiasm about their increased understanding of both the way to work together successfully and the importance of learning these skills for school projects and future jobs” (p. 2).

Sadeh and Zion’s (2012) observation of over 300 Year 12 Biology students completion of open inquiry versus guided inquiry projects, found that open inquiry students invested
more time in practical work and in the preparatory stages of choosing a subject, formulating questions, and planning their project. Student responses about coping with change throughout the life cycle of the project indicated that open inquiry students were required to take more initiative, and cooperate more with their project partners (be they students, teachers, or lab assistants) to achieve project outcomes. This suggests that open inquiry tasks place greater project management demands on students, thus the need for explicit instruction of PM knowledge, processes, and skills.

In addition, Web 2.0 technologies can be employed to support students’ journey through the PM and inquiry processes. The features and functionality of Web 2.0 technologies used by participants in this study to support project management tasks while detailed in Section 5.3.3, have been expanded upon in the Technology Functionality Matrix presented in Table 6.2. All five of the technologies used by students in this study, including wikis, blogs, social bookmarking, online survey, and web calendar tools, have features supporting a range of project management functions. However, Web 2.0 tools that also provide features to support the functionalities of information collection and repository, communication, data collection and analysis, knowledge construction, publishing, and/or self-reflection, all have the potential to support students’ project management experiences. For example, as a result of their analysis of the student experience during a project-based learning task, Helic et al. (2005) advise that if web-based tools are intended to support PBL, at a minimum they need to incorporate project management and data analysis functionality, as well as communication features for teachers to provide feedback to students throughout the length of the project.

Fountain (2005) suggests several applications of a wiki in project integration work, including managing a long-term design process, problem solving, permitting constructive critique of pedagogical projects, allowing commentaries/critiques on project integration work, and cross class/course projects. Schaffert et al. (2006) suggest ways in which wikis can be useful in project knowledge management, including brainstorming and exchange of ideas, coordination of activities, coordination and records of meetings, and serving as a notepad for common information items.
Chen et al. (2005) discuss the benefits of wikis in their design engineering group project, including enabling students to gather, organise, and share writing, photos, videos, presentations, and other digital creations. Chao’s (2007) observation of software engineering students using a wiki to create a group diary of individual and team activities, found that the groups began to use the wiki for project management activities not anticipated by the instructor, including project planning, project tracking and progress reports, and publication of group output such as test cases, defect tracking, client notes, and user documentation. Todd and Dadlani’s (2014) observation of Year 9 students in two English classes using a wiki for a collaborative research task found it “enabled the students to discuss their research topics, establish working relationships, plan and manage the tasks, collect information sources, and work together through the process of co-constructing their products, which included a class presentation, visual display, and annotated bibliography” (p. 4).

There are now many technology tools available to support the creation and generation of project management schedules and charts, and facilitation of project management teams. For example, Google Docs has a Gantt chart gadget called ‘Project Plan Gantt Chart’ that generates charts from project management data stored as spreadsheet (http://tinyurl.com/project-gantt-chart). Google also supports a range of project management tools in its apps library called G Suite Marketplace, such as Kambanchi for G Suite (http://www.kanbanchi.com/), Wrike (https://www.wrike.com/google-apps/) and Smartsheet (https://www.smartsheet.com/). Zoho Projects (https://projects.zoho.com/) is a Web 2.0 project management and planning environment, which can also be integrated with Google apps, and includes a range of features to support the management of a project including project tasks and milestones which can be viewed as a Gantt chart, a web calendar, a document repository, and an in-built wiki tool, and a number of other features that support group collaboration within a project. In addition, many of these tools also provide mobile access to individual and team project spaces via iOS and Android apps.

Based on the range of Web 2.0 functionalities as presented in Table 5.8, the features of Zoho Projects, Kambanchi and Wrike could accommodate all seven functions to varying degrees, based on the scope and design of a student’s inquiry project. These are certainly appropriate platforms to support an inquiry unit where the development of students’
project management skills and understandings is explicitly built into the learning design and curriculum outcomes.

While time management has been identified as a critical factor in students’ inquiry experiences (Kuhlthau, 2004; Zach, 2005; Savolainen, 2006), the findings from the study presented in this thesis has identified project management knowledge, processes and skills as one way of assisting students to better manage their time by shifting the focus of managing projects from that of solely time management to that of task management. Within the context of inquiry learning and information seeking research, there has been little mention of project management as a critical component of students’ project experiences. This highlights the need for further research to be undertaken that examines the student experience using information process models through a project management lens as identified in Figure 6.3. This could include the mapping of students’ thoughts, actions and feelings (as espoused by Kuhlthau in her ISP) throughout students’ engagement with a project management process which is integrated with an existing information process or inquiry process model.

While the findings in this study has identified a range of functionalities of Web 2.0 technologies to support the project management process, further research could observe how students’ project management experience enhances the implementation of an information process model such as the NSWDET (2007) Information Process or Kuhlthau’s (2004) ISP in greater detail, to scaffold students’ completion of inquiry-based projects. Given there is little empirical evidence to date of the impact of explicitly teaching project management knowledge, processes and skills across a range of curriculum areas, further research needs to be undertaken into how PM can be taught in subjects that require students to explore their worlds as inquirers, e.g., in science, geography, history, global studies, and interdisciplinary courses such as those taught as part of International Baccalaureate (IB) programs. This study has highlighted project management as an important component of inquiry that as yet, has not been fully explored by researchers or practitioners. Adding to this, the potential of Web 2.0 technologies in supporting the project management process as part of school curricula, there is considerable leverage for future researchers to explore how project management, and new and emerging technologies, can further support student inquiry.
6.1.3 Summary of how Web 2.0 technologies support inquiry

The findings in Chapter 5 and discussion in this section (6.1) have identified a number of ways that Web 2.0 technologies can be used to support students in the process of completing a project-based assignment (thus answering the first research question of this study). These have been presented across the seven broad functionalities of Web 2.0 tools, including information collection and repository, communication, project management, data collection and analysis, knowledge construction, publishing, and self-reflection. While the functionality of wikis, blogs, social bookmarking, online survey and web calendars have been examined in this thesis, there is considerable scope for further research to examine features and functions identified in the Technology Functionality Matrix (Table 6.2) with other Web 2.0 tools, as well as desktop, mobile and cloud-based applications. This matrix that can be used by teachers/TLs to explore the integration of technologies when designing curriculum units, particularly with regard to matching the features and functionality of tools with specific learning tasks.

Observation of participants in this study, along with findings from other studies examined in Section 6.1.2, have highlighted time- and task management-related problems, demands and issues faced by students, teachers and TLs throughout open-ended inquiry learning experiences. The author of this thesis has proposed the explicit teaching of project management knowledge, processes and skills with students to assist students in managing their projects more efficiently and effectively. Project management has recently become more predominant in the literature as an essential life skill for 21st century learners and a highly valued skill in the workplace (Byrne, 2010; Trilling, 2014; Stanley, 2016). It is therefore proposed that authors of information process and inquiry models consider making PM processes and techniques a more explicit dimension of their model to assist students become better task managers, as well as time managers, of inquiry projects. Likewise, teachers/TLs need to develop knowledge and skills in PM, and become more proactive in seeking opportunities across curriculum areas to design inquiry units that integrate PM knowledge and skill outcomes, and explicitly teach PM as an explicit dimension of inquiry- and project-based learning. The findings of this study have also highlighted for teachers/TLs the potential of Web 2.0 technology features and functionalities in supporting project management processes when designing and teaching inquiry units.
6.2 Learning styles and Web 2.0 technologies

The second focus question of this study asked, “How do learning styles affect students’ use of Web 2.0 technologies while they are in the process of completing a project-based assignment?”. As presented in Section 5.4, the analysis of students’ technology use as deep, strategic or surface learners did not identify distinct patterns or trends within each style. Given the small sample used in this study, the ASSIST scores were used primarily as a means of profiling each student in terms of their predominant approach to study. However, a number of relationships between students’ technology use and some of the defining features within the deep and strategic approaches did emerge, which suggests that distinct patterns or trends could be identified with a much larger sample in further studies. This is supported by the results of Heinström and Sormunen’s (2016) study of senior secondary Finnish students, who found students with a combination of a deep and a strategic approach seemed better equipped for the demands of inquiry-based learning tasks.

Entwistle (2007) advises that “everyone has the basic mental processes” used across all three approaches, and it is up to individual students to decide “how learning tasks are tackled” (p. 133). This was demonstrated with Student06 whose results showed no single tendency towards any of the three broad approaches, although he did receive the highest score in the class on the surface scale. Furthermore, Entwistle reports that results from multiple studies using the ASSIST measure identifies students who are strategic as having the ability to determine whether they will adopt a deep or surface learning approach to complete a specific assessment task, with the choice of approach used being influenced by their motivation to gain the best mark (based on investment of effort required). This is similar to students’ approaches to technology in Chapter 5 with regard to applying the return on investment (ROI) criterion when faced with the choice of using a particular technology, i.e., students weighed up how much effort trialling a new technology was worth based on the perceived value or ROI in helping them complete their project more efficiently, effectively or creatively (see Section 5.2.1.6).

In his meta-analysis of a number of ASSIST studies, Entwistle (2007) also concluded that a student’s “previous success in using one or other approach will… lead to its subsequent use, and can build towards its more habitual use” (p. 133). This reflects the findings
presented in Sections 5.2.1.7 and 5.6.1.1 regarding students’ approaches to technology use where students’ previous experience with successfully using a technology could lead to subsequent use of that technology, and with “habitual use” that technology tool or technique could become part of a students’ PTT as presented in Section 5.2.4.

The breadth of students’ criteria in determining technology use (as presented in Section 5.2.1.8) could also be examined within the context of deep, strategic or surface learners. In this study, familiarity, ease of use, utility and experience were cited by students as the four main criteria determining technology use, with the criterion of time identified as a strong inhibitor to a student trialling a new technology. In one case a student’s critical evaluation of new technologies was based on a restricted set of criteria such as familiarity and time pressures (only), which limited their exposure to, and exploration of, the potential application of a new technology. On the other hand, some students demonstrated the application of a far broader set of criteria when deciding what suite of tools they would use to complete their inquiry project. It was also found that the breadth of an individual’s set of criteria for determining technology use could also be influenced by how they conceptualised the value or impact of technologies in facilitating their learning. Thus, breadth of criteria provides another dimension to further investigate how students’ predominant learning style may influence their approach to technology use.

One key finding of this study was that no matter what a student’s predominant learning style was, all of the students were prepared to trial the use of a wiki to support their inquiry project at the beginning of the PIP unit. While comparative analysis of students’ predominant styles and their use of Web 2.0 technologies did not elicit distinct patterns or trends within each style, it does raise questions that could be investigated in future studies. For example, of the two students who employed the largest suite of technology tools to complete their project (which consisted of 10 tools), one rated predominantly as a deep learner with the other student rated as strategic. A comparative study using a much larger sample may find students using a larger suite of tools completing an inquiry project are predominantly deep learners, or alternatively might provide stronger evidence of the absence of a clear relations. Given that students employing a deep approach have a tendency to form their own personal understanding of the topic they are investigating, and to show active engagement and interest in what they are studying (Entwistle & Tait,
1990; McCune & Entwistle, 2000), future studies may find deep learners also tend to be more engaged and willing to use a range of technologies to help them achieve their project goals. Deep learners also try to see the purpose of learning within a wider context than the immediate task at hand and this could be explored within the context of students’ mental models of technology. Based on the findings presented in Section 5.2.2, one could question whether deep learners tend to have developed a mental model between technicality and enrichment, while surface learners tend to have vague mental models of technology. For example, in this study, those students who demonstrated an ‘enriched’ view of technology, made decisions about using a technology which was situated within a broader context of application and use, i.e., beyond the needs or demands of the immediate project. This represents the transformational aspects of a deep approach.

Strategic learners, on the other hand, tend to try to find the right conditions to support their studies, and tend to try to manage their time and effort effectively to achieve the highest possible grade (Tait, Entwistle, & McCune, 1998; Entwistle & Peterson, 2004; Entwistle, 2007). Results of study approaches by Vermetten et al. (2002) which introduced students to learning tasks with scaffolds to support deep learning (tasks that produced ‘friction’) found that the students who were predominantly strategic in their approach (i.e., self-regulating their learning) tended to avoid using the scaffolds provided. This reaction by strategic students towards scaffolds, is similar to two of the students in the Global Studies class, who tried to minimise the use of Web 2.0 technologies (including their wiki) as a scaffold to support their inquiry project. Heinström and Sormunen’s (2016) investigation of senior school students found that students with a strategic approach had difficulty publishing their text on Wikipedia and a class wiki. Findings from this study (see Sections 5.3.3 and 6.1.2) have highlighted the importance of project management knowledge, processes and skills being explicitly taught as part of inquiry- and project-based learning, and how Web 2.0 technologies can be used to support project management. This raises the question as to possible links between strategic learners’ willingness to engage with new technologies, particularly if they feature project management functionality, that can help them to be better organised, and manage their time and effort more effectively than non-technology solutions or techniques.
One key finding from Heinström and Todd’s (2006) study in the secondary school context was that students’ tendencies to experience different feelings and difficulties while searching for, and processing information were dependent on their study approaches, thus, empirical evidence of a link between secondary school students’ study approaches and information behaviour. A number of findings from the study presented in this thesis could be used to build on the findings of Heinström and Todd, and Heinström and Sormunen (2016), particularly with regard to secondary school students’ approaches to technology. For example, the findings with regard to students’ Web 2.0 technology experiences could be used to design a survey instrument that collects more detailed information about students’ approaches to technology, in addition to the questions asked in the second part of the student questionnaire (see Appendix B.2). One point of investigation could involve students being asked to identify which of the seven evaluation criteria they apply when making a decision whether to use or not use a particular technology, as presented in Section 5.2.1. Questions about students’ willingness to use specific technologies based on the seven broad functions of Web 2.0 technologies (as per the Technology Functionality Matrix in Section 6.1) could also be compared to students identified as predominantly deep, strategic or surface learners. Furthermore, a list of statements representing the characteristics of the mental models of vague, technicality and enrichment could be developed, the results of which could then be compared to students’ ASSIST scores.

While questionnaires containing the above items would lend themselves to surveying larger samples in an attempt to identify possible relationships between a student’s predominant approach to study and their approaches to technology use as described above, this study also provides a model for presenting profiles of types of learners as information and technology users in the vignettes published as ‘cases in point’. For example, the profile featured in CIP 5.1 (in Section 5.2.1.4) illustrates the strategic approach employed by a student who applied familiarity, ease of use and utility as the main criteria underpinning her decisions regarding technology use whereas, CIP 5.2 (in Section 5.2.4) profiles a student who predominantly employed a deep approach to technology use which also reflects the characteristics of a student whose mental model represents that of enrichment. This style of reporting of ‘student voice’ further builds on
profiling of students as deep, strategic and surface information users and inquirers as presented by Heinström and Todd (2006).

6.2.1 Summary of learning styles and Web 2.0 technologies

In summary, given the basic premise behind learning styles is that individual students prefer to learn in their own way (Cassidy, 2004; Entwistle, 2007), the examination of learning styles in this study has raised more questions, than provided answers. That said, the above discussion does introduce potential ways of further investigating the relationship between students’ approaches to study and students’ approaches to technology use, based on the seven criteria for determining technology use, the seven functionalities of Web 2.0 technologies, and the three mental models of technology, all identified as a result of the present study. Therefore, the findings in Chapter 5 and discussion in this section (6.2) have identified the possible existence of relationships between learning styles and students’ use of Web 2.0 technologies (thus addressing the second research question of the study), and provides three different aspects of students’ approaches to technology use that can be used to garner further insights into the nature and extent of these relationships in future studies. Results of further research on these relationships will help teachers be cognisant of the range of ways their students prefer to learn with technologies, and adopt teaching approaches or create learning environments that are compatible with students’ intentions when approaching a learning task that involves technology use.

6.3 Instruction and engagement in the blended classroom

“I think if you’re going to use an interactive technology, then you need to interact.”

Quote from the TL participant

The third and fourth focus questions used to guide the study asked, “What types of instructional intervention within a guided inquiry framework can be provided by the teacher librarian and class teacher when students are using Web 2.0 technologies as learning environments?” (Q3), and “What kind of ‘online dynamics’ among students, teachers and teacher librarians exist in Web 2.0 learning environments, and how does this
influence students’ learning?” (Q4). Overall, the findings highlighted that a classroom using Web 2.0 technologies cannot be examined solely as an online learning space, because part of the learning environment that students and teachers are working in remains a face-to-face classroom. Therefore, an exploration of students’ and teachers’ inquiry- and technology-related experiences must be considered within the context of a blended learning environment, i.e., where face-to-face learning experiences are integrated with online learning experiences using a range of technology platforms, whether they be a learning management system, web-conferencing system, or Web 2.0, cloud-based and mobile platforms, or a combination of these (Ultranet & Digital Learning Branch DEECD, 2012). Ultimately the aim of blended learning in schools is to provide technology tools, online collaborative spaces, and digital resources in a way that “enhances the physical classroom” (p. 34). The online learning component of a blended classroom also provides students “with some element of… control over time, place, path, and/or pace” (Horn & Staker, 2011, p. 3).

One of the aims of this study was to explore the different types of instructional intervention that teachers and TLs can provide students within Web 2.0 learning spaces created to support inquiry learning. As a result of observing the class online, eight types of instructional intervention were identified, including topic selection, technology support, resource support, focus formulation, inquiry process, research process, project management, and knowledge construction (as presented in Section 5.5.2). The implications of these for practice and recommendations for further research is discussed in the next section (6.3.1).

In addition, with this new blending of online and face-to-face learning spaces, comes a shift in the roles of teachers as designers and facilitators of blended learning experiences, and in the roles of students as learners who ‘inhabit’ blended classroom spaces as part of their learning experiences. The introduction of online learning spaces means that teachers and students find different ways to communicate, interact and engage with each other. For the purposes of this study, these online interactions and relationships are referred to as ‘online dynamics’. This study also identified the different types of expertise that individual members brought to a student’s learning team, and how students manage roles
and relationships within their own learning team. The implications of these are discussed in detail in the second part of this section (6.3.2).

6.3.1 Instructional intervention using Web 2.0 technologies

Observation of students’ Web 2.0 spaces during class time and out-of-class time identified a number of ways instruction can be provided by a teacher and TL. Although the majority of assistance in students’ Web 2.0 spaces was provided by the TL in this study, teachers could provide some of this instruction based on their interest and expertise in maximising the potential of the features and functionalities that Web 2.0 technologies offer inquiry-based learning. Implications of the eight types of instructional intervention for teacher/TL practice are explored here within the context of Vygostsky’s notion of intervention, with particular reference made to his concept of the Zone of Proximal Development (ZPD), which was presented in Chapter 3, Section 3.1.3.3 as part of the theoretical framework underpinning the study.

Vygotsky's (1978) ZPD is a conceptual framework that can inform the nature and timing of teachers’ instructional support for their students when designing whole curriculum units, or even individual learning tasks. Basically a ZPD approach is designed to identify a “zone” where intervention would be most useful or helpful for a learner when encountering new information, skills or understandings (p. 86). This involves determining “actual development” versus “potential development”, where the level of actual development is the level of development that a learner has already reached where he/she is capable of solving problems independently, whereas the level of potential development is the level of development that a learner is capable of achieving with the support of others. This reflects the constructivist view of learning as a social process where the development of students’ higher order thinking skills are supported to construct knowledge (Bruner & Rieber, 2004; Kuhlthau, 2004; Pritchard & Woollard, 2010). Kuhlthau built “zones of intervention” into her Information Search Process as a way of flagging those aspects of particular phases of the ISP where a student “can do with guidance and assistance what he or she cannot do alone or can do only with great difficulty” (p. 202). The intention is that by providing an intervention when a student is in this zone, they are able to move through to the next phase of the information process.
Conversely, if a teacher/TL introduces an intervention outside a student’s ZPD, it can be viewed as either intrusive or overwhelming by a student. Kuhlthau argues intervention outside a student’s zone of potential development is both “inefficient and unnecessary” (p. 202). Therefore, identifying students’ ZPD requires a diagnostic process on behalf of the teacher/TL, and an increase in a student’s level of uncertainty at points throughout their inquiry experience is identified as central to diagnoses.

Findings presented in Section 5.3, particularly with regard to the communication functions of Web 2.0 technologies, demonstrated how the TL monitored students’ wikis and blogs to diagnose potential zones of intervention. Often these involved students leaving comments on their wiki or blog about being frustrated, or angry, or stressed about a particular incident or challenge they encountered on the day, which the TL often responded to with both instructional and affective support (see Section 5.3.2). Sometimes the TL would also follow up with a comment on a student’s wiki or blog as a result of her diagnosing a student’s potential zone during class time, and where she felt there was some value in documenting this support in a student’s online space so they had a permanent record of this conversation. Students could revisit these as required, thus helping build students’ confidence throughout the inquiry experience.

Individuals require scaffolding to support new learning. Scaffolding is a way of operationalising Vygotsky’s ZPD (Wells, 1999). Within the context of the present study, the Web 2.0 technologies provided a platform for observing and recording the application of scaffolding in operation. Some scaffolding is planned, with interventions principally being planned by a teacher where they expect or anticipate instructional support will need to be given as a means to assist student progress to meet a learning outcome (Kuhlthau, 2004; Pritchard & Woollard, 2010). The teacher feedback on the three project progress reports used in the design of the PIP unit in this study is one example of planned interventions. Alternately, some scaffolding is opportunistic. This second type of intervention is ‘ad hoc’, and more difficult to plan because it is dependent upon the teacher being “in the right place at the right time” to provide the support a learner or group of learners may need (Pritchard & Woollard, p. 38).
Of the eight types of instructional intervention identified in this study, six of these specifically relate to instructional support that is articulated in information process models such as Kuhlthau’s (2004) ISP. These include topic selection, resource support, focus formulation, research process, knowledge construction, and inquiry process. For example, with regard to topic selection, the wikis and blogs were used by students to brainstorm ideas about potential topics, and the teacher/TL could monitor students’ progress in the initiation and exploration phases of their PIP. While the teacher in this study preferred face-to-face discussions with students regarding topic selection, she used student wikis and blogs as a platform for discussion when conducting individual consultations with students during class time. The teacher also referred to students’ wikis in class when discussing their progress in collection and analysing data for their project, i.e., research process support. These examples illustrate how Web 2.0 technologies can support the blended classroom.

The TL’s use of class and student Delicious spaces illustrated the potential of social bookmarking tools in providing resource support and targeted resource-based interventions throughout the inquiry process, particular in the earlier phases where students were exploring possible topics and building background knowledge to make an informed decision as they moved towards formulating the specific focus of their project (see Sections 5.3.1.3 and 5.5.2.3). The TL also used the Comments feature in student wikis and blogs to advise students of specific resources she had located on their topic, made suggestions regarding places to search for information including the library catalogue and the library’s full-text databases, gave advice regarding specific keywords, subject headings and phrases to locate relevant information, or gave instructions on how to accurately record bibliographic details of sources used. This advice was often provided on wiki pages where students were harvesting online information as they found it (presented in Section 5.3.1.1). These are examples of opportunistic interventions. At times she also reminded students to revisit the PIP unit documentation which included scaffolds such as advice of how to evaluate resources, particularly with regard to critically evaluating websites. These are examples of scaffolds supporting planned interventions.

The Web 2.0 spaces allowed the TL to provide resource-based interventions during out-of-class time when the TL was working from the library or after hours, which highlights
the benefits of using Web 2.0 spaces to create a blended classroom environment. This shows opportunities for instructional intervention by a TL are expanded as the nature of blended classrooms shift learning support to any time, any place, and any pace (Horn & Staker, 2011). As presented in Sections 5.3 and 5.5.2, students valued this ‘just in time’ support given they were able to access their Web 2.0 spaces out of class time, while working on their projects at home or in the boarding house, and this support was documented as a permanent record of conversation in their online project space.

While Kuhlthau’s (2004) ISP was not explicitly used as the information process scaffold in the design of the PIP unit in this study, focus formulation did emerge as a significant milestone in students’ inquiry experiences, and reflected the actions, thoughts and feelings of students reported in Kuhlthau’s ISP. Furthermore, findings from other studies identify formulating a focus as a critical point in students’ information experience (Fister, 1992; Tallman, 1998; Gordon, 1999; Fitzgerald, 2007; Tanni & Sormunen, 2008). While the TL provided focus formulation support in students’ Web 2.0 spaces in similar ways to that of topic selection, a lot of focus formulation intervention occurred as a result of students uploading their first and second progress reports to their wiki or blog, i.e., scaffolds for planned interventions. The TL, therefore, used the Comments feature in the wikis and blog to provide feedback based on the ideas, issues and concerns raised by each student in their progress reports (examples presented in Section 5.3.2). The TL in this study found Web 2.0 spaces gave her far more opportunity, than in previous classes, to provide this type of instructional intervention, and these were highly valued by the teacher.

Overall, Web 2.0 spaces provide teachers/TLs with a platform for both planned and opportunistic interventions throughout the inquiry learning process. Often for the TL, these were mainly in the form of prompts to remind students of particular stages of the project they needed to work through, for example, posting comments to remind students to complete and upload progress report, or referring students to specific sections in the PIP booklet that provided advice on how to tackle different aspects of the project. She also employed the technique of dropping by a student’s Web 2.0 space to try to maintain her relationship with that student. There are, however, two implications to note regarding this approach. Firstly, in a blended learning context where an online component is added
to the face-to-face classroom, teachers/TLs will find greater demands on their time in terms of monitoring student progress and providing interventions, particularly opportunistic interventions, as these can increase as a result of increased monitoring of student progress during out-of-class time. Therefore, teachers/TLs need to find ways to manage this increase in monitoring and instructing students online, within the context of their daily or weekly teaching workload. And secondly, teachers/TLs may find an increase in students’ expectations about their availability out of class time (including at night and on weekends). It is, therefore, important for teachers/TLs to clearly articulate the extent of their availability in a blended classroom, i.e., what is considered a reasonable level of online presence and engagement, out of class time, to support students’ inquiry experiences.

Findings in Section 5.3.5 demonstrated the history feature of the wiki as a particularly useful diagnostic tool for teacher/TLs to monitor the development of students’ ideas, their collection of relevant information, and how they tackle the writing up phase of their project. In other words, the wiki is a powerful online platform for observing a student’s knowledge construction process (as presented in Sections 5.5.3 and 5.5.2.8). One lesson learned from the teacher and TL participants in this study, was the scheduling of the latter part of the PIP, which meant that the majority of students were undertaking knowledge construction and presentation/publishing tasks during the school holiday period. This meant there was little time for the teacher or TL to fully explore the potential of the wiki as a platform for either planned or opportunistic interventions to support students throughout the knowledge construction phase of inquiry. Thus, an implication for practitioners who intend to integrate Web 2.0 technologies into inquiry units, is to ensure the scheduling of the later phases of students’ projects occur within term time. This is supported by a number of studies that have identified the writing up phase as being problematic for secondary students undertaking inquiry projects, in terms of not leaving adequate time at the end of the project to cope with the higher-order thinking demands of the knowledge construction phase (Kuhlthau, 2004; Helic et al., 2005; Sadeh & Zion, 2012).

The remaining two types of instructional intervention identified in this study were technology support and project management support. The experiences of the teacher/TL
in this study highlighted when introducing new technology tools to students in a blended classroom, the majority of technology support in the very early stages of a curriculum unit will be provided in face-to-face mode. Usually this will involve planned interventions, where the teacher/TL scaffold step-by-step processes to help students set up their Web 2.0 spaces. This is the most efficient and effective way of establishing students’ online presence. Scaffolds might also include “walk through” demonstrations of creating Web 2.0 spaces which include guidelines regarding digital citizenship issues of account security, access across devices, online safety, and ethical protocols and practices while inhabiting their online spaces.

The TL in this study played a lead role as technology instructor and facilitator, which was negotiated with the teacher when designing the inquiry unit. This allowed planned interventions to be more streamlined, because students understood this to be part of the TL’s role as instructional partner. As a result of observing students’ use of their online spaces, the TL needed to develop additional scaffolds which included advice on how to use the navigation feature of the wiki once students had created multiple wiki pages, advice about the features of social bookmarking tools such as the tagging features in Delicious, guidance in using the history feature of the wiki to manage revisions and deletions, and advice on layout and design of wiki pages. Once students’ online spaces were established, the TL shifted some of her instruction to individual’s Web 2.0 spaces, which in the main were opportunistic interventions where she would troubleshoot students’ technical problems at the point of need. Often these were as a result of monitoring students’ online spaces during out-of-class time, by looking for student comments about frustrations or issues they were experiencing, or identifying where students might improve or enhance their Web 2.0 space by tapping into additional features of the tool that they had not yet trialed, or were not aware of.

An implication of trialling a new technology in the blended classroom, is that some interventions that are opportunistic in the first instance may lead to teachers/TLs developing planned interventions for units in the future that will use that technology. Where a technology is new to the students, the planned interventions might address some foundational aspects as presented above. Alternately, where students have previously used a particular technology in class, a planned intervention may be designed to reinforce
“the basics”, or it might build on and extend students’ use of the features and functionality of a tool.

Project management support is the final type of instructional intervention identified in the findings of this study. While project management within the context of inquiry, and the potential application of Web 2.0 technologies to support project management processes, has been discussed in detail in Section 6.1.2, the instructional support provided by teachers/TLs is addressed here. There were no planned interventions regarding project management support designed as part of the PIP unit in this study, and as presented in Section 5.3.3, all students struggled at some point with managing the variety of elements required by this inquiry unit. While students were required to complete three progress reports throughout the inquiry experience, these did not provide the same PM scaffolding recommended in 6.1.2, because the majority of prompts by the TL in students’ wikis and blogs were focused on time management and deadlines, rather than task management. Therefore, some planned interventions that teachers/TLs might build into the inquiry experience could include a project plan template which requires students to monitor and review the plan at regular intervals throughout the inquiry experience.

Further research could explore the different types of planned and opportunistic interventions that occur with a group of secondary students undertaking an inquiry unit that uses Kuhlthau’s (2004) ISP model with a project management lens as presented in Figure 6.3 (Section 6.1.2). Teacher and TL practitioners could also identify additional types of PM-related interventions upon implementing an inquiry process that integrates an information process model with a project management model (as per Figure 6.3). Further investigation of Web 2.0 technologies in supporting PM interventions could also be undertaken by researchers or practitioners.

The above discussion shows the potential of Web 2.0 technologies in supporting eight different types of instructional intervention in a blended classroom. It also identifies some of the issues teachers/TLs need to consider when managing the demands of instructional support between face-to-face and online classroom spaces. Vygotsky’s ZPD has been explored in terms of diagnosing students’ zones, designing scaffolds to support planned interventions, and providing examples of what opportunistic interventions look like, and
how they materialise, in Web 2.0 spaces. These online spaces also capture a permanent record of conversation between students and teachers/TLs, which practitioners can use as evidence of the nature and timing of the instructions provided, and how these influence decisions made by students throughout the inquiry experience. In addition, given Web 2.0 spaces capture student and teacher actions and interactions, these become a rich source of data for researchers wanting to investigate the information, technology, and teaching and learning experiences that occur within a blended classroom environment.

This study highlights the advantage of using Web 2.0 technologies to support instructional interventions, in that interventions can be recorded on students’ blog, wiki, social bookmarking, or web calendar spaces. This also contributes to the collection of data that can be used to inform the evaluation of an inquiry unit, as well as being used for action research or evidence-based practice purposes by the teacher and TL. While little research has been undertaken in the secondary school context, a number of studies in higher education have investigated how online learning spaces can be used to provide scaffolding in individual student’s and student groups’ ZPD (Hung, 2001; Hung & Chen, 2001; Dyke et al., 2007; van Harmelen, 2008; Chandra & Chalmers, 2010).

Therefore, the findings of the study presented in this thesis are significant because they provide practitioners and researchers with a range of intervention types within Web 2.0 learning environments that can be targeted as either planned or opportunistic, depending on the design of an inquiry unit, that may employ an information process such as Kuhlthau’s (2004) ISP and/or a project management process as defined by PMI (2013). These findings present an application of Vygotsky’s ZPD theory as a lens to further explore the provision of online scaffolding using Web 2.0 technologies to assist students’ progress through their inquiry experience.

6.3.2 Learning teams in the blended classroom

Social constructionists view knowledge as a social product, and learning as a social process, where “knowledge is created by learners in the context of, and as a result of social interaction” (van Harmelen 2008, p. 36). Crotty (2003) defines constructionism as “the collective generation [and transmission] of meaning” (p. 58), which is socially
constructed as a result of interaction between people and their world. In the context of this study, a student’s “world” consisted of the face-to-face classroom and physical school precinct (and for some, the boarding house), the school’s technology infrastructure and learning management system, the Web 2.0 spaces created to support the inquiry unit, the home environment, and the people a student interacted with throughout the life of the project.

The interactions between students, teacher and TL in the blended classroom environment observed in this study, were informed by Berger and Luckmann’s (1967) Social Construction Theory (SCT) which examines the methods that members of a society use to create, or construct reality. Hence from an individual’s perspective, when they interact with others, they do so with the understanding that their respective perceptions of reality are related and, as they act upon this understanding, their “common sense” of reality is reinforced (p. 37). To achieve this, people need to negotiate with each other regarding the meaning of the information provided within an interaction or encounter. Thus, an assumption underpinning this study was that Web 2.0 technologies, such as social bookmarking platforms, blogs and wikis, are not only personal tools that can support inquiry learning, they provide a platform for communication and collaboration between members of learning teams. These technologies are viewed as creating online learning environments that have the power to facilitate learning conversations between students and teachers, and enhance student engagement in the learning process.

Berger and Luckmann (1967) argued these kind of conversations or “reciprocal” interactions lead to institutionalisation and, in the process of this institutionalisation, meaning is embedded in society (p. 72). Individuals’ conceptions (and beliefs), of what reality is, becomes embedded in the institutional fabric of society. Thus reality is socially constructed. Berger and Luckmann proposed society as both an “objective reality” and as a “subjective reality”. Objective reality is based on the development of social processes which create customs, habits and beliefs that support and reinforce institutions, which can be passed from generation to generation. They refer to this as a social, “objective world” (p. 77).
Within the context of SCT, the constructions of the teacher and TL in this study were important, because they were viewed as the facilitators of the learning process by way of conversations with the students (both face-to-face and online), placing an emphasis on helping students build independence in their use of information and technologies to inform their learning. It is also used as a lens to examine how individuals (students, teacher and TL) develop shared meanings about the rules, protocols, expectations and practices within the classroom and Web 2.0 spaces (objective reality), and provides a framework for exploring the relationships and dynamics within each learning team as students’ developed their own subjective reality.

Due to the ethnographic nature of this study, conversations and interactions were examined from the student perspective as they negotiated with information, technology, processes and procedures, and with members of their learning team, family and peers, thus exploring how reality was socially constructed within the Global Studies class as a blended classroom (objective reality), and how subjective reality of students was constructed within their learning team throughout the inquiry experience.

Based on the literature regarding teachers and TLs working together as instructional partners to support inquiry (as presented in Section 2.5), an assumption of this study was that the teacher and TL would work collaboratively to support students’ inquiry experience. Given students were undertaking a PIP, a further assumption was that the teacher and TL would work together as a learning team for each student to customise the inquiry experience based on the student’s individual needs. Of particular note, however, was the emergence of a broader membership within each learning team, where students’ drew upon the knowledge, expertise, skills, opinions and affective support of others in their world (other than the teacher and TL), such as other teachers, family and friends, and outside experts, to assist in them in their inquiry experience.

Thus, just as each student made their own decisions about using, or not using, the technologies available to them, i.e., they applied one or more of seven criteria to determine technology use, they also demonstrated a capacity to ‘manage’ who were part of their learning team, and determine the nature of these people’s involvement in their inquiry experience. As described in Section 5.5, from the beginning of the inquiry unit,
the researcher observed communications and behaviours of students that either
encouraged or distanced interactions with those around them, i.e., they shaped the nature
of input from individuals, whether it be the teacher, TL, classmates, family and friends,
or outside experts. This demonstrates how a student’s subjective reality is developed
within a socially constructed domain, such as the blended classroom, or even at a micro-
level, an inquiry unit.

For example, through the lens of SCT, the design of the PIP unit provided an objective
reality, which consisted of particular rules, protocols, expectations and practices. These
included guidelines, scaffolds and expected outcomes of the PIP unit; the expectation that
students would use Web 2.0 technologies to undertake their project; the expectation that
individual students were to negotiate directly with the teacher for topic approval; the
expectation that students would work with the TL to set up their Web 2.0 spaces; and the
expectation that students would be taking charge of their inquiry experience as an
independent learner (with assistance, as required). In other words, the teacher and TL
had created a socially constructed domain (objective reality) that students were to operate
within.

Based on the second part of Berger and Luckmann’s (1967) SCT, an individual needs to
“go out and learn” in society as a socially constructed domain (p. 78). This requires a
process of socialisation where an individual learns how to participate in the institutional
structures of society (its objective reality), and when an individual becomes “successfully
socialised”, this results in “the establishment of a high degree of symmetry between
objective and subjective reality… as well as identity” (p. 183). Conversations between
individuals, and communication within a group, organisation or society assists in the
maintenance of an individual’s subjective reality. Within the context of this study,
students became the centre of their own learning teams, and were proactive in creating
and maintaining their relationship with individuals they wished to have on their team.
The selection of their team members was based on what the student perceived to be the
expertise and potential contributions each member could make to support their inquiry
experience.
As a result of the findings (in Section 5.5.1.1), the nature of what constitutes expertise from the perspective of students is defined as the knowledge, skills and experience (KSE) of learning team members that matches the information, technology and learning needs of a student. In other words, ‘expertise’ is contextual; it is based on the interests, beliefs, expectations and needs as perceived by an individual student. As a result, the expertise of the teacher or TL may be viewed differently from student to student, based on their subjective reality. This study has identified five types of expertise that are valued by students when undertaking inquiry using technologies: disciplinary expertise, curriculum expertise, process expertise, technological expertise, and production expertise.

Disciplinary expertise includes knowledge, skills, and experiences (KSE) in the discipline or disciplines in which a student’s inquiry topic resides. While one may assume the teacher as the main disciplinary expert in a student’s learning team, the findings of this study showed that inquiry topics explored by students can often be multi-disciplinary or interdisciplinary, so a student may seek the KSE of other people, in addition to the teacher. The TL, teachers of other subjects in the school, and outside experts beyond the school or student’s personal network were also used by some students for disciplinary expertise. For example, Student01 worked closely with the TL in refining his original topic of computer addiction to the issue of ‘World Of Warcraft Gold Farming’, because the TL’s knowledge and interest in computing and technology-related issues. Given the teacher, in this instance, had difficulty in understanding some of the ideas raised by Student01 when negotiating his topic with her, the student could have become frustrated and decided to explore a topic that his teacher had greater knowledge in. In this case, the TL’s disciplinary KSE led to her becoming a critical member of Student01’s learning team, where she worked with him to refine his topic to a point where they worked together as a team to negotiate the approval of his topic with the teacher. Therefore, an implication for teachers, particularly when designing an interdisciplinary unit, is acknowledging that they may not have the disciplinary expertise to help some of their students formulating the focus of their specific inquiry topic. Thus, it is important for teachers to work with students to seek out other disciplinary expertise as required.

Also of note here is the potential richness of disciplinary expertise that a teacher-TL partnership can provide for students undertaking inquiry. For example, in this study, the
teacher brought knowledge of global studies and international relations, geography and society and culture, and commerce, legal studies and history to the class, while the TL brought KSE in legal studies, English, music, resourcing and information seeking, information ethics, and ICTs. This highlights the disciplinary benefits for teachers in collaborating with teachers from other disciplines, in addition to the TL (who as a qualified teacher, has interest and expertise in one or more disciplines).

Within students’ learning team, the teacher is often the key member with curriculum expertise, which includes KSE of the curriculum in terms of unit outcomes, expectations of the inquiry unit, and assessment requirements. If, however, the TL has been involved in the design of the unit, they can also bring curriculum expertise to a learning team. Process expertise includes KSE of inquiry processes, research processes, information processes, and knowledge construction processes. Studies in teacher-TL partnerships show process expertise of the TL is often one area where they provide a significant contribution to the collaborative partnership (as discussed in Section 2.5 of the literature review). Note, as a result of project management implications as discussed in Section 6.1.2 and 6.3.1, project management KSE could also be included in process expertise.

Technological expertise includes KSE in a range of technology tools and techniques. While a teacher or TL may have some technological expertise, there are often other teachers or ICT facilitators in a school community who may also be able to contribute specialised technology KSE to a learning team. Students can also have technology KSE that could be used to support other students’ learning teams. An implication for teachers is that they need to proactively seek out the ‘best fit’ for them and their students regarding the technology expertise required to support successful inquiry experiences for all.

A number of students sought production expertise from people in their learning team. This involved KSE in crafting a final product and/or artefacts to best represent the student’s learning, as well as matching these to the assessment requirements. The majority of students in this study did tap into the teacher’s KSE, specifically with regard to their projects meeting the assessment criteria of the PIP unit, with some asking the teacher to review a draft of their essay or report. In terms of production expertise, however, few students used the teacher or TL to help them develop project artefacts using
Powerpoint slides, Photostory, or other presentation software. This was where students tapped into the expertise of family, friends or classmates to provide advice on the production of their project. Family and friends were also used as proof readers in the production process. While a teacher may not have some of the production KSE that students need to complete their project (especially if it involves technological KSE), it is important for the teacher to, again, work with individual students to actively seek outside expertise to support students’ needs.

The above discussion highlights how students build their learning team based on the types of expertise individuals can contribute to achieve the outcomes of their inquiry task. That said, the roles the teacher and TL played within a student’s team at the beginning of the inquiry unit in this study was also influenced by the relationship that existed between the student and teacher, or student and TL, as a result of contact they had in previous classes, school terms and years. Thus, the students, teacher and TL came to the inquiry unit and blended classroom as a socially constructed domain, with each of them contributing to the objective reality in some way. In addition, some of the teacher’s and TL’s roles had been negotiated as part of the design of the inquiry unit, i.e., the teacher as the discipline expert and manager of the class, and the TL as the information and technology specialist. So the students also came to the inquiry unit and blended classroom as an objective reality which had been socially constructed by the teacher and TL prior to their involvement.

Within the context of each student’s subjective reality, the involvement of team members was largely determined by the expertise the student believed each member had that was going to help meet their unique needs. Another factor that also influenced some students’ interaction with team members was the expectation that the PIP unit was primarily an “independent research project” (as articulated by the teacher). Some students (Student02 in particular) interpreted “independence” as needing to demonstrate they did not need help in completing their PIP. This resulted in some students not drawing upon members of their learning team for assistance as much as they could or should have throughout the life of the project. An implication for teachers/TLs here is the need to make explicit to students at the commencement of an inquiry unit that formal and informal “help” structures are in place throughout the inquiry experience (in the form of planned and opportunistic interventions as per 6.3.1), and there is an expectation that students use
these as required. In other words, teachers/TLs need to build explicit rules of engagement into a socially constructed domain to ensure all students engage with these rules as part of their subjective reality. This also means teachers and TLs need to work more diagnostically (with students’ zones), which requires significant and continual dialogue to occur between each other regarding the progress and experiences of each student.

As students consciously managed the different role(s) of learning team members throughout the inquiry experience, this management of people’s contributions and interactions determined the development of ‘relationship dynamics’ between the student and teacher, the student and TL, and the teacher and TL, and other members (if at all). For example, some students worked very closely with the teacher as the core member of their learning team, encouraging little interaction with or engagement of the TL, while others worked more closely with the TL than the teacher as a core member of their team, due to the students’ views on what each member could do to assist them with their project. A full description of the nature of roles and relationships was presented in Section 5.5.1.2.

Thus, the study shows that by Year 10, students are able to shape the nature of input from individuals within their learning team, even when instructional roles of the TL and teacher are formally integrated into the design of an inquiry unit. In this way they are able to influence the role of, and relationship dynamic they have with, the teacher and the TL, as well as other members. This demonstrates how students can manipulate their learning team to accommodate the development of their own subjective reality within the parameters of the blended classroom (as objective reality). According to Berger and Luckmann (1967), this process supports the development of one’s personal “identity” (pp. 195), and ultimately an individual’s sense of belonging within the socially constructed world. Further research could explore at what age school students have the capacity to independently shape and manage the relationship dynamics with their own learning teams within socially constructed domains such as a blended classroom or inquiry unit experience.
6.3.3 Summary of instruction and engagement in the blended classroom

An assumption of this study was that instructional intervention is an important dimension of the inquiry learning experience and that Web 2.0 technologies have the potential to assist with the provision of instructional support in a number of ways. Section 6.3.1 presented eight types of instructional intervention provided by teachers/TLs in students’ Web 2.0 spaces, including topic selection, resource support, focus formulation, inquiry process, research process, knowledge construction, technology support, and project management. It is important to note that in a blended classroom environment these ‘supports’ can be provided face-to-face as well as online via students’ Web 2.0 spaces. Ultimately this means that teachers/TLs need to learn which mode – either face-to-face or online – will be the most appropriate mode for a particular intervention. Vygotsky’s (1978) Zone of Proximal Development and Kuhlthau’s (2004) zones of intervention are used as a framework for diagnosing instructional interventions, and Pritchard and Woollard’s (2010) treatment of scaffolding (as a way of operationalising Vygotsky’s ZPD) has been used to inform the design of both planned and opportunistic instructional interventions.

Section 6.3.2 has discussed the nature of students’ learning teams in terms of membership, roles and relationships, and how students by Year 10 have the capacity to independently construct and maintain a learning team that draws upon a mix of teachers, TLs, classmates, family, friends, and outside experts based on the expertise they bring to the students’ inquiry experience. Implications of five types of expertise of learning team members are explored, including disciplinary, curriculum, process, technological, and production expertise. Berger and Luckmann’s (1967) Social Construction Theory has been used to explore the relationships of teachers, TLs, and students in the blended classroom as a socially constructed domain (objective reality), and examine how students make sense of their world (development of subjective reality) with the help of their learning teams throughout the inquiry experience.
6.4 Personal construction and students' technology use

The final focus question asked, “How do teacher, teacher librarian and student experiences with Web 2.0 technologies influence their views on using these in the future to support students’ learning?” The following sections answer this question, with the first two parts (Sections 6.4.1 and 6.4.2) exploring this question within the context of students, and the third part addressing this question from the perspectives of teachers and TLs and presenting implications for practice (6.4.3), followed by the implications of the theory of personal construction of technology use for future research (6.4.4).

6.4.1 Process of personal construction and students’ technology use

Section 5.2.4 within the findings presented the concept of a personal technology toolkit where each student, as a technology user, possesses his/her own toolkit that he/she uses on a regular basis to complete specific tasks, whether for personal or school use. It was also demonstrated that this toolkit consists of a collection of ‘preferred’ technology tools resulting from the process of a student trialling, evaluating and ultimately selecting each tool to be added to his/her toolkit as the preferred tool to complete a particular task or tasks.

A student’s PTT is not a static collection of technology tools and techniques. It is a collection of tools and techniques that is dynamic and constantly evolving as the student is either: (a) exposed to a new technology that can help them complete a task more effectively, efficiently or creatively than they could achieve with their existing toolkit, or (b) if the student is required to complete a task that requires a tool or technique they currently do not possess within their toolkit. Thus, the student is involved in a continual process of customisation of their PTT. This requires him/her to make decisions regarding the choice of an existing tool or technique versus new tools or techniques available to them to complete a particular task. This decision making process is informed by a set of Criteria Determining Technology Use (CDTU) (identified in Section 5.2.1), and influenced by a combination of the factors (outlined in Section 5.2.2, 5.2.3 and 5.6.1.3), that could potentially affect their choice of using an existing tool or technique over a new tool or technique to complete the task, or vice versa.
As presented in Section 3.1.3.1, Kelly’s (1963) Personal Construct Theory (PCT) provides a framework for understanding how students are actively involved in making sense of new information they encounter in relationship to what they already know, resulting in new learning. Specifically relevant to the findings in this study is the application of Kelly’s theory and a number of his corollaries to gain insights into the decisions made by students whether to use or not use particular technologies to complete tasks throughout the inquiry learning process.

Kelly postulates that an individual interprets the world through mental “constructs” or patterns which they create, and when they encounter a new experience, they attempt to fit these “constructs” over the new experience. Previous experiences helps an individual to hypothesise about a new experience and, upon reflection, they then formulate expectations about what they may encounter. These hypotheses become an individual’s personal constructs which can either be reinforced by some new experiences, or challenged by new encounters. This is how we develop understanding and ultimately, learn. This process of personal construction was demonstrated as students explained the reasons why they chose to use or not use a specific technology to complete a particular task for their PIP. In fact, the set of CDTU articulated by the students represent personal ‘constructs’ of technology use and adoption. This demonstrates students’ capacity to personally construct their own technological environment by drawing upon their PTT, or adding to and refining their PTT, to support school curriculum and personal learning needs. This process of personal construction is an integral part of student development as an independent learner.

The central focus of constructivist learning theory is that “learning happens in contexts and that learners form much of what they learn and understand as a function of their experiences in situation” (Abbas, Lai-Mei, & Ismail, 2013, p. 49). Within an increasingly digitally driven world, it is important that students develop skills and understandings in effectively evaluating and using new and emerging technologies as part of their development as independent, lifelong learners. Given the environment we now live in is a very complex and dynamic one, particularly in terms of technological innovation and evolution, building students’ capacity as critical, creative and adaptive users of technology has become an essential outcome of schooling today.
A significant amount of students’ use of technology, however, is occurring outside the school precinct and hours of the school day. This has resulted in students developing their own views on the use, value and potential application of technology for both school and personal use. The findings presented in Section 5.2.1 identified accessibility, ease of use, familiarity, utility, time pressures, return on investment, and previous experience as seven criteria students may apply when determining whether to use a technology. This set of seven criteria, from here on is referred to as CDTU, i.e., criteria determining technology use.

Because constructivist approaches to inquiry-based teaching and learning often place students in an open-ended learning environment, students are encouraged to draw upon their own experience and constructs to inform decisions made. Each of the CDTU are applied based on the constructs that a student draws upon when ‘personally constructing’ within their technological world. It is therefore, important for teachers and Tls to understand what constructs inform students’ decision making when selecting what they consider to be an appropriate technology, or the “best tool for the job” – in other words, which criteria are meaningful to them and why, and how these are utilised, becomes part of the personal construction process.

Fundamentally, the findings centreing on the PTT show how students make sense of, and navigate, the blended learning environment, and reflect the process of personal construction as espoused by Kelly’s (1963; 1970) PCT. The findings provide an empirical basis for proposing a theory of the personal construction of technology use. This theorising draws upon the work of Kelly because the findings are consistent with core principles that make up Kelly’s PCT.

There are, however, additional factors that contribute to the context in which students function when making decisions about using technologies to support their learning. The first factor involves the context of the blended classroom as a socially constructed domain (objective reality), which is informed by Berger and Luckmann’s (1967) Social Construction Theory (SCT) as discussed in Section 6.3.2. As a student’s learning team functions within the blended classroom, the conversations and interactions between the student and members of their learning team helps the student make sense of this socially
constructed domain as they develop their own subjective reality, i.e., how they learn to fit into, and function effectively within, this socially constructed domain.

A second contextual factor is the instructional interventions (both planned and opportunistic) provided by the teacher and TL within the blended classroom (as part of the socially constructed domain) which are instigated upon determining a student’s zone of intervention. The nature of these are informed by Vygotsky’s (1978) Zone of Proximal Development (ZPD) and Kuhlthau’s (2004) zones of intervention, where teachers and TLs design interventions to assist students in developing their own subjective reality – making sense of their world – within the blended classroom and an inquiry unit as a socially constructed domain.

Furthermore, while a student uses their learning team as a vehicle to function within the context of a socially constructed domain, and as they begin to make sense of ‘this world’, the development of the student’s subjective reality becomes their own individual personally constructed domain. What happens within these two domains, and the relationship between these two domains, is presented by the author of this thesis as a theory of Personal Construction of Technology Use.

6.4.2 A theory of personal construction of technology use

This thesis posits a theory of personal construction of technology use by high school students. The Personal Construction of Technology Use (PCTU) theory comprises two domains as discussed above, i.e., the blended classroom and an inquiry unit as a socially constructed domain, and the student experience as a personally constructed domain. Each domain consists of a set of dimensions and processes that contribute to the construction of that domain. The theory explores these domains, dimensions and processes from the perspective of the student, i.e., the theory is presented as a student-centric model of inquiry learning within the blended classroom environment.

The next two sections provide detail of the above domains, dimensions and processes of the Personal Construction of Technology Use theory. These include 6.4.2.1 The Blended Classroom as a Socially Constructed Domain, and 6.4.2.2 The Student Experience as a
Personally Constructed Domain. This is followed by a third and final section (6.4.2.3) which presents the development of a student’s personal technology toolkit as an outcome of the PCTU process.

6.4.2.1 The blended classroom as a socially constructed domain

According to the PCTU theory, the context within which an individual student undertakes an inquiry project using technologies occurs within a blended classroom, which represents a socially constructed domain. This domain comprises five dimensions as social constructs, including a specific learning area or subject, a group of students as a class, the teaching team, the inquiry unit, and new technologies. Each of these dimensions contribute to the context which a student ‘inhabits’ while undertaking an inquiry project experience using technologies. As introduced in Section 6.4.2, students need to learn how to fit into, and function effectively, within the blended classroom, and they do this by engaging with each of the dimensions within this socially constructed domain.

Figure 6.4 illustrates each of the five dimensions that contribute to the blended classroom. Given each of these dimensions are socially constructed, as per Berger and Luckmann’s (1967) SCT, they are drawn as square shapes and arrow using straight lines, because they represent structures that exist beyond the control of an individual student. They are institutional, educational and technological structures that have been created by others and are imposed on the student. In other words, this is the learning context within which a student is required to function.

Therefore, the blended classroom as a socially constructed domain consists a class of students from a year level who are enrolled in a specific subject. For example, a Year 10 Global Studies class, as examined in this study. The year level of a class of students brings with it certain expectations and protocols, e.g., by Year 10 there is an expectation that students have the capacity to undertake independent inquiry projects and exhibit some of the skills and attributes of an ‘independent learner’. In addition, the learning area or subject consists of content knowledge, cognitive processes, and skills and behaviours that represent that of the discipline within which the subject sits. For example, the subjects of Biology and Chemistry sit within the discipline of Science, while the elective subject of Global Studies is more interdisciplinary in nature, in that it sits within the
learning area of Humanities and Social Sciences but draws from disciplines such as Geography, History, Economics, Law and Political Science. Hence, an expectation of the Global Studies curriculum is that students engage with global issues through the lenses of the above disciplines, each of which have been socially constructed through the centuries by humankind, where experts in the field have built a core set of knowledge and skills underpinning disciplinary thinking.

Figure 6.4 Dimensions of the blended classroom as a socially constructed domain
The teaching team of a blended classroom is also socially constructed in that the membership of a particular teaching team has been composed by design. In other words, the class teacher has sought a collaborative partnership with other teaching experts to support the needs of his or her students while undertaking a specific curriculum unit or task. Here there is an expectation that each member of the teaching team bring with them a set of knowledge, skills and expertise (KSE) to support the design of a specific curriculum unit. In the case of the Global Studies class observed in this study, while the teacher was seen as the discipline expert, she partnered with the TL as an information, inquiry learning and technology expert. So the composition of the teaching team is socially constructed to best meet the KSE demands of a curriculum unit and the perceived needs of students in the class. In other year level and subject contexts, a class teacher might draw upon the KSE of the school’s Learning Technology facilitator, or Literacy teacher, or English as a Second Language (ESL) teacher, or Learning Difficulties teacher, based on the individual needs of students in their class and requirements of the curriculum unit.

The fifth and final dimension of a blended classroom is the new technologies dimension. This is depicted in the form of an arrow that enters the blended classroom from outside the school-based (institutional) parameters of the learning environment, i.e., they are injected into a classroom setting to support the needs and/or outcomes of the other four dimensions. New technologies are also socially constructed, in that the design of each technology is based on the norms, protocols, features, and functionality of the technology team that has produced it. Some of the norms, protocols, features, and functionality of a specific technology tool is based on the type of tool it is. For example, there are particular norms, protocols, features, and functionality of a wiki tool that are different to those of a social bookmarking tool, or a blogging or online survey platform. When one or more of these tools are integrated into a curriculum unit, students and their learning team are required to work within the parameters of these technologies. These can influence the way teachers and students use these tools to support teaching and learning. In other words, as they trial a new technology, individual teachers and students need to become familiar with the way the tool works within the context of the learning tasks they undertake as part of a curriculum unit – they need to learn how to fit into, and function
effectively, within the predetermined parameters (social constructs) of that new technology.

Thus, each of the above dimensions contribute to shaping the learning context of a blended classroom environment, and influence how teachers and students function within this environment as a socially constructed domain. The challenge for individuals, therefore, is to make sense of the world of the blended classroom, and work out ways they can best fit. This requires individuals to undergo a process of personal construction to develop what Berger and Luckmann (1967) refer to as one’s “subjective reality” (p. 166). The second domain of the PCTU theory examines dimensions and processes involving this phenomenon of personal construction from the perspective of the student.

6.4.2.2 The student experience as a personally constructed domain

As stated above, for a student to function effectively within a blended classroom environment and engage with a specific learning experience such as an inquiry unit, they need to undergo a process of personal construction to help them make sense of the socially constructed domain which they are expected to inhabit. But before we can examine a student’s experience within the socially constructed domain, we must first understand what a personally constructed domain looks like, and how the dimensions and processes of personal construction contribute to the development of an individual’s personally constructed domain.

Figure 6.5 illustrates the four dimensions of the personally constructed domain of a student. These include a student’s learning team, their mental model of technology, the set of criteria (CDTU) they apply to make decisions whether to use technologies to support their learning, and the nature of their PTT. Given each of these dimensions are personally constructed, as per Kelly’s (1963) PCT, these are drawn as circular shapes, because they represent the student-centric nature of this domain. The dimensions are presented as a series of layers influencing a student’s personal construction of technology use, with broader influence occurring at the outer layer working in concentric layers to the centre of influence, which is the PTT.
The outer dimension of the personally constructed domain is the student’s individual learning team. The relationship between the teacher/TL as the teaching team of the PIP versus the emergence a student’s learning team was discussed in detail in Section 6.3.2. It is important to note here that the teacher/TL as the formal teaching team is a dimension of the socially constructed domain as illustrated in Figure 6.4. However, the teacher and TL are also elements within the learning team dimension, based on the fact that each student customised the membership of their learning team based on the knowledge, expertise, skills, opinions and affective support of others in their world to assist them in their inquiry experience. While these teams included a mix of other teachers, family and friends, and outside experts, each student had a preference for how much input and assistance they sought from the teacher and TL.
While the nature of, and dynamic within, students’ learning teams is presented in detail in Sections 5.2.3, 5.5 and 6.3.2, it is important to reinforce here within the context of the PCTU theory that students independently construct and maintain their own learning team based on the expertise students believe each member can bring to the team to assist them in completing an inquiry project. The types of expertise brought to the learning team by members includes disciplinary, curriculum, process, technological, and/or production expertise.

Members of a student’s learning team can also contribute to or influence the development of the student’s mental model of technology. This is the second dimension of a student’s personally constructed domain. The findings in Section 5.2.2 demonstrated how mental models of technologies can influence a student’s decision to use or not use a particular technology. This is reflected in the constructivist view of learning as a process of personal construction where “learning occurs when a learner actively builds meaningful cognitive representations”, i.e., builds mental models (Mayer, 2003, p.141).

Geroski (2000) states that mental models “often have an amazingly powerful effect on how people think about particular phenomena, an effect that is sometimes stimulating and sometimes limiting” (p. 604). In other words, mental models can contribute to, or significantly influence, the nature of an individual’s approach to technology use. The three mental models of vagueness, technicality and enrichment were identified in the present study towards technology (see 5.2.2 for detailed treatment of these). For example, a mental model that is based on vague understandings of the features and functionality of a particular technology can inhibit a student’s willingness to use it, or explore its potential application because their decision is not fully informed. Conceptual vagueness was particularly evident with those students who applied a very limited set of CDTU when exposed to a new technology, or where a student expressed that they “couldn’t be bothered” considering to trial a new technology. Therefore, a lack of willingness to engage with a new technology can influence further development of a student’s mental model of technology.

A mental model that focuses primarily on the technical aspects of a technology can range from a developing understanding of that technology to quite a sophisticated
understanding of a technology, based on the level of technical detail a student articulates. This demonstrates a more informed decision making process than those with conceptual vagueness. In comparison, a student’s mental model that is based on enrichment demonstrates a far more sophisticated understanding of a technology, because it moves beyond the technical features and functionality of tools to a deeper understanding of the utility and value of the technology. This understanding is informed by critical and creative thinking and one’s capacity to see a tool’s potential.

The third dimension involves the set of CDTU a student used when he/she is introduced to a new technology, and they need to make a decision as to whether they will trial or use that technology to complete a particular task or tasks. The seven criteria of accessibility, ease of use, familiarity, utility, time pressures, return on investment, and previous experience are defined and discussed in detail in Section 5.2.1. Of particular relevance within the context of this second domain is that some students employ a broad set of CDTU, while other students default to two or three criteria, i.e., a restricted set, which can limit the chances of a student trialling a new technology. The set of CDTU articulated by a student represents their own personal ‘construct’ of technology use. No matter how broad or restricted a student’s set of CDTU is, it demonstrates their capacity to personally construct their own technological environment (whether extensive or limited) to support school curriculum and personal learning needs. The influence of a student’s CDTU is explored in greater detail in the next section (6.4.2.3) where these underpin a process of evaluation employed by students when making decisions about technology use.

The fourth and final dimension of a student’s personally constructed domain is their PTT. This is the inner circle of a student’s domain that represents those technologies and techniques he/she has adopted as their preferred technological suite, i.e., their ‘default’ set of tools and techniques to meet their learning and personal needs. The nature of a PTT is reported in detail in Section 5.2.4 and is introduced within the context of personal construction in Section 6.4.1. It is also presented later in Section 6.4.2.4 as an outcome of the PCTU experience.

In order to further understand a student’s PCTU, however, we need to examine the relationship between the two inner dimensions of the personally constructed domain.
This is explored as an evaluation process student’s undergo when exposed to new technologies, and compare the potential of new technologies with the content and application of technologies and techniques in their PTT.

### 6.4.2.3 Technology evaluation as a process of personal construction

The relationship between the inner dimensions of a student’s personally constructed domain is presented as a fundamental process in the Personal Construction of Technology Use theory. This involves the breadth of the set of CDTU a student employs to evaluate the tools and techniques within their PTT versus new tools and techniques they are exposed to. This process is represented in Figure 6.6 as two blue circular arrows to illustrate the iterative nature of Technology Evaluation as a process of personal construction, when a student is forced to make sense of the new technologies which are imposed upon them from the socially constructed domain (represented by the orange arrow).

As shown in Section 5.2, some students used a restricted set of CDTU to inform their decision making, while others drew upon a broader set of criteria to evaluate the learning context to determine their use of technologies. The challenge for teachers and TLs is to assist students in making the most informed decision (as possible or practicable) when faced with the choice of using one or more technologies to support their learning, whether these are from the PTT or technologies that are new to them.

The PCTU theory also proposes a set of seven Technology Evaluation principles that explain the personal construction process experienced by a student when faced with the choice of using one or more technologies to support their learning. Seven of Kelly’s (1970) eleven personal construct corollaries have been adapted to create this set of Technology Evaluation principles which provide a framework for examining students’ decision making process when evaluating the technologies available to them within the context of an inquiry unit. These principles were informed by Kelly’s corollaries of construction, individuality, organisation, dichotomy, choice, range and experience.

Table 6.3 presents a summary of the seven Technology Evaluation principles proposed by the researcher of this thesis with Kelly’s (1970) corresponding corollaries (italicised)
to illustrate their genesis as informants of the personal construction process in students’ technology use, presented as the PCTU Theory. This is followed by a detailed explanation of each principle which draws upon each of the CDTU to highlight the relationship of the CDTU and the process of technology evaluation.

Figure 6.6 Technology evaluation as a process of personal construction
Table 6.3 Comparative table of Kelly’s PCT corollaries and Hay’s Technology Evaluation principles

<table>
<thead>
<tr>
<th>Kelly’s Personal Construct Theory corollaries</th>
<th>Hay’s Technology Evaluation principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>A person anticipates events by construing their replications.</td>
</tr>
<tr>
<td></td>
<td>A student anticipates the potential application of a technology based on his/her previous use of it.</td>
</tr>
<tr>
<td>Individuality</td>
<td>Persons differ from each other in their constructions of events.</td>
</tr>
<tr>
<td></td>
<td>Students differ from each other in their constructions of technologies.</td>
</tr>
<tr>
<td>Organisation</td>
<td>Each person characteristically evolves, for his convenience in anticipating events, a construction system embracing ordinal relationships between constructs.</td>
</tr>
<tr>
<td></td>
<td>A student’s decision to use technologies characteristically evolves, and is based on the relationships or links she/he makes between constructs.</td>
</tr>
<tr>
<td>Dichotomy</td>
<td>A person’s construction system is composed of a finite number of dichotomous constructs.</td>
</tr>
<tr>
<td></td>
<td>A student’s decision to use a particular technology is often based on the application of criterion with opposing properties.</td>
</tr>
<tr>
<td>Choice</td>
<td>A person chooses for himself that alternative in a dichotomized construct through which he anticipates the greater possibility for the elaboration of his system.</td>
</tr>
<tr>
<td></td>
<td>The opportunity for a student to make choices based on a dichotomised construct can help him/her broaden or refine their set of criteria, and develop their ability to apply criteria.</td>
</tr>
<tr>
<td>Range</td>
<td>A construct is convenient for the anticipation of a finite range of events only.</td>
</tr>
<tr>
<td></td>
<td>The set of criteria a student uses to evaluate technologies is finite in its application.</td>
</tr>
<tr>
<td>Experience</td>
<td>A person’s construction system varies as he successively construes the replications of events.</td>
</tr>
<tr>
<td></td>
<td>A student learns how to effectively evaluate and use technologies when she/he successively evaluates and uses these.</td>
</tr>
</tbody>
</table>

The proposed framework of seven Technology Evaluation principles is presented in detail below. Each principle begins with a guiding statement (presented in *italics*) which summarises the essence of the principle, followed by an explanation of how each principle influences students’ decision making regarding technology use based on the original premise published by Kelly (1970).
**Principle of construction**

*A student anticipates the potential application of a technology based on his/her previous use of it.*

Students anticipate how a particular technology is going to meet their needs in completing a particular task based on the outcome(s) of previous occurrences using that technology. Criterion such as accessibility, familiarity, ease of use, utility, ROI and previous experience may contribute to a student’s construct of a technology. No occurrence or replication of its use will be exactly the same. However, the similarity of its application across occurrences gives the student confidence that the technology is the most appropriate tool to achieve task completion. Furthermore, Kelly (1970) states that “same construction that serves to infer their similarity must serve also to differentiate them from others” (p. 11). Therefore, the student’s ‘construct’ based on one or more criteria may also be used as a point of comparison to evaluate a new technology.

**Principle of individuality**

*Students differ from each other in their constructions of technologies.*

Students are going to evaluate a particular technology based on their own set of criteria. This means that some students will apply only one or possibly two criteria when evaluating a particular technology, while other students will employ a more detailed set of criteria. Each set of criteria used by a student will be created to meet their needs at a particular time based on the technology or technologies available, as well as the specific learning context which can be influenced by environmental factors (e.g., working from home, school, boarding room); affective factors (i.e., how they are feeling at the time); and interpersonal factors (i.e., those people whose sphere of influence is impacting on the student). This reflects Kelly’s (1970) view that individuals create “systems” based on objects, information and people when constructing meaning, and no two individuals “put their construction systems together in terms of the same logical relationships” (p. 12).

**Principle of organisation**

*A student’s decision to use technologies characteristically evolves, and is based on the relationships or links she/he makes between constructs.*

The relationships or links a student makes between CDTU and factors influencing technology use usually conform to some kind of order, i.e., they are based on a logic that a student normally applies to make sense of these relationships. This means that students
approach evaluation of technologies in different ways, and it is important that the decision making process they use conforms to their understanding of these relationships, otherwise they will become confused or frustrated with not being able to make sense with their decision making. Kelly (1970) refers to these approaches as “avenues of inference and movement” that allow a student to resolve “contradictions and conflicts that inevitably arise” (p. 12). This organisation of one’s personal construct is particularly important when students are introduced to the challenge of understanding a new technology before being able to effectively apply their set of CDTU.

**Principle of dichotomy**

* A student’s decision to use a particular technology is often based on the application of criterion with opposing properties.

This principle shows how students distinguish between the elements of a criterion when using it to evaluate a technology. Kelly (1970) argues that construing is bipolar, i.e., personal constructs have opposites. In other words, if a student uses the criterion familiarity, they actually divide this into the two criteria of, “I am familiar with this technology” versus “I am not familiar with this technology”, to inform their decision. If a student uses the criterion ease of use, they are actually assessing whether the technology is either “easy to use” or “difficult to use”. Likewise, with successful use, a student may have also had previous experience with a technology that proved “unsuccessful” in meeting their needs. Alternatively, when a student considers ROI, they are trying to determine whether the effort and time they need to invest to use a particular technology is either “worth it” or “not worth it”. Kelly believed that a person’s construction system is “composed of a finite number of dichotomous constructs” (p. 12). Constructs that are presented in ‘black and white’ terms provide students with a means for being decisive in their decision making, which in turn supports them affectively in terms of feeling confident in their decision to use or not use a technology. This also relates to the next principle, Choice.

**Principle of choice**

* The opportunity for a student to make choices based on a dichotomised construct can help him/her broaden or refine their set of criteria, and develop their ability to apply criteria.
Kelly (1970) believed that choice develops the usefulness of one’s personal construction system. In his words “when a man makes a choice, what he does is align himself in terms of his constructs” (p. 16). Thus, this principle represents the control and empowerment a student can feel as a result of having a clearly defined set of parameters from which to make choices as part of the decision making process when using technology. When a student makes such a choice, this has the potential to expand his or her understanding of the nature of each CDTU and the effective application of these, no matter whether that choice ends up being the “right one” or “wrong one” to complete a particular task. Ultimately, they have learned as a result of experiencing the implications of applying the criteria, and will be able to use this new learning to inform the application of the criteria for making decisions in the future.

**Principle of range**

*The set of criteria a student uses to evaluate technologies is finite in its application.*

While the range of criteria (seven in total) identified collectively by the students in this study worked for them in evaluating which technologies to use for their PIP, these criteria may have a finite range of applicability or usefulness in terms of applying it to other technologies and emerging technologies in the future, or applying it to learning contexts other than inquiry. In other words, the usefulness of each criterion is limited. Kelly (1970) refers to this as a construct’s ‘range of convenience’ (p. 17). Therefore, a student must be mindful of not restricting themselves to a specific set of criteria. Teachers and TLs can use range of convenience as a vehicle for working with individual students to expand their set of criteria for determining technology use, as required. This also relates to the next principle, Experience.

**Principle of experience**

*A student learns how to effectively evaluate and use technologies when she/he successively evaluates and uses these.*

As students test and trial new technologies, and test and trial the application of their set of criteria, what they learn builds their experience as technology evaluators and technology users. Kelly (1970) views the gaining of experience when one “concedes a discrepancy between what he was and what he is” (p. 18). This implies one’s capacity to reflect on one’s own learning as part of this experience-building process. Kelly viewed a “unit of experience” as a “cycle embracing five phases: anticipation, investment,
encounter, confirmation or disconfirmation, and constructive revision”, followed by “new anticipations, as the first phase of a subsequent experiential cycle gets underway” (p. 18-19). This aptly describes the process students undergo as they encounter learning tasks that require technological support. Students need to be given the opportunity to reflect on how they have applied certain criteria to determine technology use within their own learning context as outlined under the Individuality principle. This builds experience. In fact, students’ understanding of, and engagement across, each of the above six principles contribute to the development of this seventh and final principle.

The above principles provide an insight into the parameters within which the process of personal construction of technology use occurs with students. The study presented in this thesis, however, has shown that while students can critically evaluate their own context regarding technology use (with some having a limited set of criteria), they often have difficulty clearly articulating the decision making process they employ to determine whether to use or not use a particular technology. This is supported by the results of an online survey of over 500 senior secondary school students regarding their expectations and use of technologies by Ipsos MORI (2007), who found that while the majority of students spoke about technology as aiding their life (both at school and personally), there “appears to be certain boundaries for its use which they, although they may not be able to express it, are aware of and these help to shape their uptake and interest in its use”. (p.10). The Technology Evaluation process and principles and Criteria Determining Technology Use presented here as part of PCTU Theory, provide teachers and students with a common language to use when discussing what parameters or “boundaries” they establish which shapes their mental model of technology, their interest in trialing new technologies, and how these contribute to the development of their own PTT, which is presented in the following section as an outcome of the PCTU experience.

6.4.2.4 Personal technology toolkit as an outcome of the PCTU experience

The above three sections have outlined the key components – the domains, dimensions, processes and principles – of a student’s personal construction of technology use experience, and the very centre of this construction experience is a student’s PTT. Figure 6.7 illustrates what these look like when all components are brought together as whole. This figure presents how a student’s PTT is situated within the personally constructed
domain, and how this domain then sits within the blended classroom as a socially constructed domain. In other words, a student’s PTT is an outcome of the PCTU experience.

Figure 6.7 The social and personal constructs of a blended classroom

While the concept of the PTT for school age students was developed by the author during the data analysis phase of the research presented in this thesis, the label “technology toolkit” has been used by other authors to describe a number of different concepts. For
example, Oliver and Conole (1998) introduced the concept of a “toolkit” for teaching practitioners in higher education to assist academics evaluate communication and information technologies to support tertiary teaching. More recently, Booth (2011) referred to a “technology toolkit approach” as a model for evaluating the affordances of social, information, and communication technologies (SICTs) to support teaching in higher education.

Underpinning Booth’s evaluative model is the assumption that “every social, information, and communication technology has pedagogical potential” (p.72), and academics, academic librarians and instructional designers need to evaluate each SICT based on a set of ten affordances that support the pedagogical potential of a technology. These affordances are identified as properties of technology tools that are useful in determining how a particular technology might be used to support the outcomes of instructional design. While Oliver and Conole’s and Booth’s models provide educators with an approach to evaluating technologies for curriculum integration, they do not examine personal technology adoption and use from the perspective of a student as explored in this thesis with the concept of the PTT.

The concept of a toolkit of assistive technologies to support the learning needs of students with disabilities has also been published in the research literature since 2000. This has involved the identification of a collection of technology devices that have broad applicability to students with mild disabilities in the classroom (Edyburn, 2000). This type of toolkit was designed as a teaching and learning kit for the special classroom where teachers can provide ready access to a range of assistive technologies as part of the classroom’s collection of resources, as opposed to technology allocation based on the evaluation of individual student’s needs (Edyburn, 2000; Parette & Wojcik, 2004). Furthermore, Puckett (2004) identified a range of software, equipment, and strategies as a “toolkit” to support students with mild disabilities in general education standards in Maths and English, while Fonner and Marfilius (2005) proposed a technology toolkit of equipment and software to support literacy instruction for students with severe disabilities. Judge (2006) argues this toolkit approach of “equipping classrooms with an assortment of assistive technology tools… affords opportunities for a serendipitous approach to technology integration” in a special needs classroom (p.18).
Likewise, the label of “technology toolkit” has been used by mathematics educators and researchers in the exploration of the appropriate mathematics and statistics-based computer programs and applications to support the teaching of mathematics in schools and universities (Hovorka, Schlegelmilch, & Fowler, 2003; Heid, 2005). Within these contexts, the development of a toolkit is the collection of technology tools and programs identified and rated by education professionals regarding what tools they think are required to support the teaching in special education and mathematics classrooms. The concept is not related to the development of a student’s PTT based on a student’s own personal preference for and use of a suite of technology tools and techniques, and does not acknowledge a relationship between students’ mental models and their approach to technology use based on the existence of their PTT. Thus the concept of the PTT as described in this thesis provides educators with a new lens in which to explore students’ potential use of technologies from the perspective of the individual student, as opposed to the above pedagogical and instructional design approaches to technology integration in the classroom.

Somewhat closer to the concept of a student’s PTT is that of the personal learning environment or PLE. A PLE includes those “tools, communities, and services that constitute the individual educational platforms learners use to direct their own learning and pursue educational goals” (EDUCAUSE, 2009). This is in contrast to the technology infrastructure hosted by educational institutions such as learning management systems (LMSs) or virtual learning environments (VLEs). The idea of teaching students the knowledge, skills and attributes to become independent learners by building their capacity to “learn how to learn” underpins the concept of the PLE. It “recognises the role of the individual in organising their own learning”, and that “learning will take place in different contexts and situations and will not be provided by a single learning provider” (Attwell 2007, p.2). In other words, it acknowledges the existence of personal learning, and workplace or school-based learning within one holistic learning environment, rather than treating these as discrete and separate learning places, occurrences and experiences. It encapsulates the learning environment a student develops and maintains throughout their school life to function effectively in an increasingly complex informational and technological world.
The PCTU Theory which has been developed as a result of observing students within the secondary school context in this study, provides an explanation of how students’ experiences with Web 2.0 technologies influence their views on using these technologies in the future to support learning, thus answering the fifth and final focus question of this study. By way of understanding students’ approaches to technology use, it provides educators with a model that articulates one way of interpreting students’ information, technology and inquiry learning experiences in a blended classroom environment. The implications of PCTU theory for practice and future research are discussed in the following section.

6.4.3 Implications of the PCTU Theory

This section presents a number of implications of the proposed PCTU Theory within the context of professional practice for teachers and TLs. This is followed by a section on the implications of the PCTU Theory for researchers, and identifies ways components of the PCTU Theory could be examined in future studies, thus building on the findings and theory resultant from the present study.

6.4.3.1 Implications for professional practice

The PCTU Theory has implications for scaffolding student knowledge and skills regarding the evaluation and use of technologies. The findings presented in Section 5.2.1 and the proposed Technology Evaluation process and principles in Section 6.4.2.3 show that in order for students to develop the capacity to effectively evaluate technologies to help them select the most appropriate tool or technique to complete a particular task, they need to draw upon of a broad range of criteria that can assist them in achieving this. The Technology Evaluation process and principles highlight the complexities involved in helping students develop a functional set of CDTU that both encourages them to explore new technologies, as well as being open to the expansion of their existing set of criteria. While observation of students’ use of other technologies may identify criteria in addition to the seven CDTU found in this study (further discussion regarding this is presented in Section 6.4.3.2), it is important to note from a professional practice perspective, that working with a larger set of CDTU beyond the seven identified here could become somewhat complex and unwieldy when working with students.
The adaptation of Kelly’s (1970) personal construct corollaries shows that technology evaluation and use is unique to each individual student, and their exposure to learning with and through technology is a *meaning making* experience for each student in terms of their personal needs and preferences, learning context, and satisfaction and effectiveness as a technology user. Teachers and TLs need to gain an understanding of the personal construction process experienced by students as part of the Technology Evaluation process to diagnose students’ needs with regard to the technology decision making, and in helping students develop greater independence and confidence in utilising a range of criteria to make the most informed decision to complete a particular task.

As stated in Section 6.4.2.3, under the principle of Range, the set of criteria a student uses to evaluate technologies is finite in its application due to the fact that the scope of each criterion is defined. This means that students need to be mindful of not restricting themselves to a single criterion or a small set of criteria. This provides teachers/TLs with an opportunity to work on broadening an individual student’s set of CDTU if it is limited to a small subset of the seven criteria of accessibility, ease of use, familiarity, utility, time pressures, return on investment, and experience. For example, time pressures or lack of familiarity as a student’s main criteria, may limit their pursuit of a technology or technique that has considerable utility or ROI in helping them achieve a specific learning goal. The seven CDTU provides teachers and students with a common language on which to base such discussions.

Furthermore, research shows that young people are often persuaded to use or adopt certain technologies as a result of their friends’ adoption and use of the technology (Ipsos MORI, 2007; Margolis, Estrella, Goode, Holme, & Nao, 2008; Committee of Inquiry into the Changing Learner Experience, 2009; Warschauer & Matuchniak, 2010), and family support (Barron, Martin, Takeuchi, & Fithian, 2009; Warschauer & Matuchniak, 2010). In fact, findings presented in Section 5.2.3 identified a range of technology informants influencing students’ decisions to use specific technologies while completing learning tasks and for personal use, including classmates, friends, family members, teachers and the TL. However, students’ reflection on potential technology informants did reveal a complex tension between their level of tolerance, interest and willingness with regard to adopting a new technology when it was introduced to them by a teacher compared to a
friend or family member, with some students being sceptical of the faddism of technology, when they found a number of teacher wishing to trial a particular technology. Therefore, teacher-led technology innovation could be best introduced by appealing to individual students’ set of CDTU and mental model of technologies, and by showing how a new technology might to be a ‘good fit’ for inclusion in a student’s PTT. Again, the Technology Evaluation Principles proposed in this thesis could be used by teachers and TLs to gain a deeper understanding of the personal construction process of individual students’ approaches to technology use to support their learning.

While the Technology Evaluation process and principles highlight the complexity behind students’ decision making regarding technology use based on their CDTU, it also informs our understanding of the development of student’s mental models of technologies which is explored in detail in Section 6.4.2.2 as part of the personal construction process. The findings presented in Section 5.2.2 provides examples of a students’ lack of a mental model in terms of the features or functionality of specific Web 2.0 technologies. While teachers/TLs can provide students with step-by-step instructions on how to set up a Web 2.0 space as part of the instructional process, students also need instruction that goes beyond the technical ‘how’ type help. In other words, to help them develop a mental model of a particular technology they also need to be instructed on ‘why’ certain features should be enabled or disabled, and/or ‘why’ a setting needs to be selected as private instead of public.

In addition, the exit interviews with students in this study highlighted how some students benefited from reflecting on their use of technologies, particularly when discussing them with another person. Such reflection can contribute to the development of a student’s mental model of technology throughout the life cycle of an inquiry project. These sorts of conversations can help contribute to the development of students’ mental models and can assist them in using Web 2.0 technologies safely and appropriately for the immediate purpose, as well as develop a sound understanding of the implications of selecting, e.g., privacy settings in future use when working on these sorts of technologies independently, whether for school or personal use. Teachers/TLs could design instructional scaffolds to support this as part of the design of a set of planned interventions within an inquiry unit.
A mental model of technology as a “time sucker” (as perceived by the teacher in this study) could potentially influence whether teachers decide to trial or integrate technologies into curriculum units, thus becoming a barrier to their willingness to trial technologies in their teaching. This has implications for TLs, Learning Technology facilitators or ICT champions in schools who have responsibility for working with teachers to integrate ICTs into the curriculum. Thus, the categories of three mental models identified in this thesis – vagueness, technicality and engagement – can be used to inform how technology leaders or facilitators in schools shape their conversations with teachers. In fact, these models could inform the development of some professional learning scaffolds when working with teachers, particularly those who seem reluctant to trial new technologies as part of their teaching practice.

The study by Ipsos MORI (2007) found that young people “are not constantly seeking new types of technology in their school lives (as they are at home), they are pragmatic in their approach to technology and take it in their stride” (p.15). This reflects the findings of the present study, and does have implications for teachers when introducing new technologies to students in a blended classroom. For example, within the context of the PCTU Theory and PTT, it is important for teachers to understand what technologies students bring with them to a new learning experience such as an inquiry unit, as this can influence their preference for technology tools and/or technology functionality when completing learning tasks. Therefore, teachers need to not only acknowledge the existence of a student’s PTT as part of the learning process, they need to accommodate the development and refinement of students’ PTTs when designing curriculum units. One way of finding out what technologies constitute a students’ set of preferred tools is to implement a survey at the beginning of a new school year as a way of profiling the PTT of each student in their class. These PTT profiles could also be shared with other teachers of students enrolled in a particular year or grade level. As a result of these profile, teachers/TLs can be more informed about the potential utility of new technologies they wish to introduce in specific curriculum units each term in the school year. In other words, teachers need to be able to explain to students’ the how and why of introducing a new technology based on students’ PTT.
As stated in Section 5.2.4, the term ‘personal toolkit’ implies a level of critical evaluation, personal ownership and explicit preference in adopting and using those technologies that individual students have in their toolkits; therefore teachers/TLs need to respect student preference and gain an understanding of the reasons behind student choice in adopting or eliminating a particular technology. For example, if a teacher directs a class to use blogger.com as the blogging tool to be used for a particular curriculum unit, and a number of students already have their own blog that they have set up and have used for a number of learning tasks for other subjects, such as wordpress.com or edublogs.com, is it unreasonable to expect those students to create another blog to undertake the task? In a blended classroom environment that accommodates the existence of students’ PTT, it would be considered reasonable to allow those students to continue using their existing blog, i.e., blogging tool of choice, to complete the task. Furthermore, student preference to use standard software programs to support their learning such as Microsoft Word and PowerPoint has been confirmed by studies in school education (see, for example Gu, Zhu, & Guo, 2013) and higher education (Conole, de Laat, Dillon, & Darby, 2006). This supports the desire of some students to keep it simple, especially when faced with a complex inquiry project.

Schools also need to reconceptualise the mapping of ICT integration in schools – moving beyond the curriculum planning, and assessment and reporting levels – to include students taking responsibility for their own mapping in terms of the development of their PTT. This requires teachers to revisit the concept of developing students as independent learners within the blended classroom. When looking at the development of an individual student’s PTT, this requires some level of student input at the curriculum planning stage to ensure that students’ technology needs and preferences are considered. This could be in terms of providing students with opportunities to utilise tools from their personal toolkit, as well as having students working with teachers/TLs to diagnose possible gaps in, or areas for developing or building, their PTT. This shifts curriculum into a new zone of personalisation and customisation, where diagnosis becomes a point of intervention at the curriculum planning level to support student’s PTT. This will become increasingly important as more school education systems introduce 1:1 laptop computing and the use of mobile devices.
As schools and universities encounter a greater transformation of traditional classrooms to blended classroom environments, to the point where the latter becomes the norm, it is important for educators to understand how young people’s preference for, and use of, technologies shape the way they respond when confronted with new technologies to support learning tasks. Such an understanding will help educators engage in an informed debate about future developments in pedagogy and curriculum that maximise affordances of the blended classroom. The PCTU Theory provides educators with a framework for exploring the ways their students make decisions about using technologies, and the ways they can design learning tasks and provide instructional support to assist students in engaging with new and emerging technologies, and thus has considerable implications for professional practice.

6.4.3.2 Implications for future research

Future studies could explore high school students’ evaluation and use of technologies other than those examined in this study, as well as technologies that have emerged since this study was conducted. For example, studies could explore collaborative tools such as Google Docs and Zoho, or curation tools such as ScoopIt! and Pinterest, or using mobile technologies such as iPhones and android phones, or touch tablets such as iPads.

While the set of seven CDTU were identified collectively by the students in this study (accessibility, ease of use, familiarity, utility, time pressures, return on investment, and experience), and because of the unique inquiry learning context observed as the basis of this study, it is important to acknowledge the possible existence of more criteria than the seven identified in Section 5.2.1. The Technology Evaluation process and seven principles of the PCTU Theory can accommodate an expansion of CDTU beyond the seven identified in this study, because these principles help define the personal construction process with regard to technology evaluation, no matter the nature of a criterion, or breadth of criteria available.

Of the seven criteria identified as CDTU, however, all except for return on investment (ROI) have been clearly identified in other studies identified in this researcher’s review of empirical literature. For example, Warschauer and Matuchniak (2010) concluded that a students’ access to a home computer can result in greater familiarity with software
which in turn can increase the effectiveness of computer use for completing school assignments, does support two of the criteria identified by the present study, i.e., accessibility and familiarity. These two criteria were also identified by Bulman and Fairlie (2015) in their review of the impacts of technology on educational outcomes. Within the context of IT professionals and administrative staff in a business setting, an individual’s familiarity with technology was linked to individual beliefs about usefulness and ease of use of technology (Burton-Jones & Hubona, 2005), which relates to the criteria of familiarity, utility, and ease of use in the set of CDTU. The main factors influencing health professionals’ adoption of technology have been identified as perceived usefulness, ease of use, lack of familiarity, time constraints, compatibility (or lack of fit between an ICT and work practices), and design and technical concerns (Gagnon et al., 2012). The latter two factors could be represented in the utility criterion of CDTU.

Furthermore, Helsper and Eynon’s (2009) study of Internet use across different age groups in Britain identified experience and breadth of use as two criteria of technology use, where experience was defined as years of using the Internet, and breadth of use referred to the number of different online activities a person undertakes while connected to the Internet. They claimed that “the higher the number of different activities a person undertakes the more the Internet is integrated into the person’s everyday life” (p. 511). Within the context of the present study, breadth of use could fit within the scope of the criterion of experience; however, future research of school students’ technology experiences could explore the possibility of breadth of use being added to the CDTU as the eight criterion, and compatibility (or alternatively lack of fit) and/or design and technical concerns, could be explored as the ninth and tenth criterion.

In addition, further research could be conducted to explore how teachers and TJs integrate the proposed framework of seven Technology Evaluation principles in the curriculum as a scaffold for teaching technology evaluation and use. Students’ use of these principles to help them understand their own development as effective technology evaluators could also be investigated, as well as their broadening of an existing set of CDTU, or further expansion or consolidation of their PTT.
Future research could further explore the phenomenon of mental models of technologies as constructed by teachers, TLs and students as they engage with new and emerging technologies. This study has identified the three mental models of vagueness, technicality and engagement, and identified the existence of a process of conceptual understanding with regard to technology use. A lack of student engagement as a result of vague mental models needs to be explored further, and the framework of seven Technology Evaluation Principles presented in the previous section (6.4.2.3) could be applied in future studies to diagnose student engagement regarding technology use. For example, one or more of these principles may be identified as critical factors in contributing to student engagement as an effective technology evaluator. Alternatively, the nature of the seven principles of Construction, Individuality, Organisation, Dichotomy, Choice, Range, and Experience could be explored specifically in relation to the affective dimensions of personal construction informed by the emotions identified by Kelly (1963; 1970), or the affective domain across the phases of the Information Search Process by Kuhlthau (1993), or Guided Inquiry Design model by Kuhlthau, Maniotes and Caspari (2012).

Furthermore, conceptual vagueness could be examined within the context of the information behaviour theory of satisficing as presented by Simon (1967) where he argued motivation and emotion “are major influences on the course of cognitive behavior” (p.29), and ultimately learning through goal completion. (A full examination of satisficing is presented in Section 2.3.2.4 of the literature review). He identified satisficing as one of five affective procedures humans use to manage goal completion, where satisficing represents the behaviour of an individual when they estimate that they have achieved a particular task “well enough” (p.32). In other words, “to satisfice” is a “terminating action when a satisfactory situation has been achieved” (p.39). This relates to the findings in Section 5.2.1 where students applied a set of criteria to determine whether they chose to use or not use a particular technology. In fact, any single criterion or combination of the criteria of accessibility, ease of use, familiarity, utility, time, return on investment, and experience could influence students’ learning behaviour in terms of satisficing.

Future research could examine the relationship between students’ learning styles as deep, strategic and surface learners with the mental models of vagueness, technicality and
enrichment as identified in this thesis. Furthermore, research could compare the processes used by deep and strategic learners when provided with the choice as to what technologies they draw upon from the PTT to support an inquiry project.

In addition to the student experience, further research could explore teachers’ mental models of technologies. This could identify more types of mental models other than the three identified by the present study. Furthermore, studies could examine the influence of teachers’ mental models on the development of their students’ mental models. For example, within the context of the PCTU’s blended classroom (as illustrated in Figure 6.7), the teaching team is identified as a dimension of the socially constructed domain, which therefore acknowledges their ability to influence a students’ personally constructed domain. Research exploring the nature of blended classrooms based on teachers’ mental models could contribute further to our understanding of the two domain in the PCTU Theory.

Finally, the findings, implications and recommendations presented by the researcher of this study lend themselves to be explored in other learning contexts, such as primary school classrooms and primary school libraries, students’ use of technologies to support learning in technical education and tertiary education sectors, as well as other adult learning contexts such as community colleges, professional development in the workplace, or educational technology programs for seniors. The concept of the personal technology toolkit is potentially universal (beyond educational settings) and therefore could be examined across a range of learning and workplace contexts where individuals are required to develop knowledge and skills in using existing technologies available to them, and/or explore the potential of new and emerging technologies to refine and expand the tools and techniques of their PTT.

6.5 Limitations of the study

The contributions of the research need to be considered within the context of the following limitations. The limitations of the study are related to the small sample size, and the school context on which the study was based. The first limitation was the small sample size and the challenges this presented in obtaining definitive results relating to
whether a student’s learning style could influence their use of technology to support their learning. The small sample size means that the results of this study are not generalizable; therefore further research using larger sample sizes is required to confirm or disconfirm the findings, particularly those regarding students’ approaches to study and technology use, based on learning styles. While the findings provided limited evidence to support this assumption, the study’s use of mixed methods ethnography does provide future researchers with a theoretical framework and methodology to further investigate the impact of learning styles on students’ approaches to technology use.

A second limitation was the nature of the unique school and curriculum context within which the study explored the inquiry experiences of a group of students and their teacher and TL. The inquiry experience was situated within the context of a Global Studies subject which was an elective subject for students enrolled in Years 9-10. It was a NSW Board of Studies’ School Developed Board Endorsed Course (SDBEC) program (Board of Studies NSW, 2011) where the majority of learning in the subject involved students working on in-depth research projects, both individually and in groups. To gain entry into the Global Studies elective in this school, students were required to nominate their interest in taking the subject, and then undertake an interview with one of the Global Studies teachers to determine their capacity to cope with the demands of the ‘independent learning approach’ employed by the subject. This selection process for gaining entry into the subject is not a common procedure in other schools; however, this school’s process was designed to minimise the attrition of enrolments in the elective due to students’ inability to cope with the independent learning demands of the subject. This meant that the majority of students in this class understood the expectations of the elective and were highly motivated to undertake independent inquiry projects that were to be sustained for up to one term in duration.

This contributes to the uniqueness of the inquiry experience under investigation, compared for example, to the expectations and demands of independent inquiry in mainstream curriculum areas, such as Maths, English, History or Science. The age of students in this class (15 and 16 years old) is another specific aspect of the context of the investigation that would need to be considered in any application of the findings to another context. For example, studies exploring inquiry- and technology-based
experiences of students in Year 7 (13 and 14 years old) could identify other criteria
determining technology use, or the younger students may not exhibit the same behaviours
in trying to control the nature of their learning team or parameters of their inquiry
experience, or their attitude to technologies may identify other types of mental models
not observed in the present study.

Another specific aspect of the context that may limit application to other contexts was
that all students in this class had access to a computer and the Internet in their home (all
of which subscribed to a broadband Internet service), whereas other studies may include
participants without computer and Internet at home, which could influence students’
attitudes towards and behaviour using technologies at school to support their learning.
Another aspect of the context was the role of the TL, who worked in a team of TLs in
the school, with each TL being assigned responsibility for collaborating with teachers of
specific curriculum areas and year levels. Thus, the time this TL was able to dedicate to
students and the teacher in face-to-face classroom as well as in the class and students’
Web 2.0 spaces during and after school hours, could be different to that of a sole TL
working in a large secondary school where the TL: student and TL: teacher ratio was
much higher. Furthermore, the study was investigated within an Australian school
context, where there has been greater opportunities for teachers to include inquiry
experiences within the school curriculum, compared to other countries whose curriculum
may have less emphasis on content and skill outcomes being taught through inquiry.

A final limitation is that the study has not drawn upon the body of theory from information
systems research relating to technology acceptance. This body of theory is largely used
in quantitative studies with very large samples within business and workplace contexts
that have had primarily positivist or predictive underpinnings (Silva, 2007), not largely
used in interpretivist qualitative studies. Even though theoretical models such as the
Technology Acceptance Model (TAM) has been applied in school and higher education
contexts (see for example, Teo, Lee, Chai, & Wong, 2009), this has generally been in
very large survey research studies focusing on the likelihood of predicting use or non-use
of technology for learning, not for studies involving in-depth understandings of the nature
of technology use. Future research could explore the alignment of CDTU and other
PCTU dimensions influencing students’ technology use with these models, such as TAM

6.6 Conclusion

We need to understand learners in order to teach them well… change must be based on empirical evidence and not rhetoric.

(Helsper & Eynon, 2009, p. 518)

As a result of critically analysing claims in the literature about digital natives, Bennett, Maton and Kervin (2008) called for “considered and rigorous investigation that includes the perspectives of young people and their teachers, and genuinely seeks to understand the situation” with regard to students’ interest in and use of technologies (p. 784). The study presented in this thesis answers this call.

In the past decade, a number of survey-based studies have examined students’ ownership and levels of use of technologies (including Web 2.0), particularly within the tertiary context (Garcia & Qin, 2007; Kennedy et al., 2007; Corrin, Lockyer, & Bennett, 2010). However, given the complexity and diversity of new technologies available to society, we need to understand the “how” and “why” of young people’s use of new technologies to support formal and informal learning settings (Livingstone & Helsper, 2007; Hargittai & Hinnart, 2008), and this often requires exploratory studies to inform the development of survey research that subsequently draws upon larger populations to identify significant trends, issues and practices that could then become generalisable.

While much has been written by teaching practitioners about their everyday experiences using Web 2.0 technologies with their students, empirical evidence is still needed to help build theory of “what this learning looks like” and “how students behave” within different contexts, to inform further research as well as professional practice. In-depth research into students’ approaches to technology use such as the research undertaken within this study can help gain a greater understanding of how technology can effectively support teaching and learning in education, in both the compulsory schooling and higher education contexts. The major findings of this study and key conclusions presented in this thesis have contributed to this research agenda in eight specific ways. The findings
within these eight areas have underpinned the development of a new theory called the Personal Construction of Technology Use (PCTU) Theory which is the major contribution of this research. The eight specific contributions are summarised in the following paragraphs, followed by a summary of the contribution made by the development of the PCTU Theory.

Firstly, the study identified seven broad functions that Web 2.0 technologies can provide, in particular with regard to wikis, blogs, social bookmarking platforms, and online survey and web calendaring tools. These seven functions were information collection and repository, communication, project management, data collection and analysis, knowledge construction, publishing and self-reflection. Within the context of this study, functionality was defined as the quality of being suited to serve a purpose well, and as a result of the findings the author devised a Technology Functionality Matrix describing the specific types of functions that each Web 2.0 technology can potentially serve inquiry learners and their teachers. While the matrix only identifies the features and functionality of the five Web 2.0 tools which were within the scope of this study, future research could explore how it could be expanded based on a range of other social networking tools, software programs or mobile apps. The matrix can also be used as a starting point for educators interested in trialling one or more of the five Web 2.0 tools examined in this thesis. Therefore, the matrix has scope to evolve based on empirical evidence from future studies and documented outcomes of teacher practice in the future.

Secondly, the study has identified a number of elements that contribute to students’ approaches to technology use and decisions about which technologies to use. A key finding was that when students are introduced to new technologies to complete a specific learning task, they may frequently instead choose to use other technologies they are already familiar with. The study highlighted the complex suite of technologies individual students can bring to an inquiry experience, in addition to those introduced by their teacher. It also demonstrated students’ ability to customise a suite of technologies to help them to complete an inquiry project. This involved students employing a decision-making process that used a set of criteria to determine whether they would use, or would not use, a specific technology as part of their inquiry experience. These became known as ‘criteria for determining technology use’ (CDTU), which students applied when
critically evaluating those technologies that were available to them. Each student had their own set of criteria, based on the seven CDTU identified in this study. These were accessibility, ease of use, familiarity, utility, time, return on investment, and experience. Students often identified more than one criterion in determining their use of a particular technology. Some students employed a restricted set of CDTU which limited their exposure to the potential application of new technologies at their disposal, while others demonstrated the application of a far broader set of criteria which demonstrated an interest in and willingness to explore the features and functionality of new tools.

Thirdly, the study discovered that individuals’ conceptions or ‘mental models’ of technologies can influence the way they approach the use of technologies. The three mental models of vagueness, technicality and enrichment were identified, and a process of conceptual development was also found to occur when students’ or teachers’ mental models transition from vagueness to technicality, or technicality to enrichment. It was also found that mental models of others can influence the mental model of a student, thus potentially shaping their approach to technology use. The people within a student’s sphere of influence acted as technology informants (classmates, teachers, TLs, family or friends), where students tapped into their opinions about, expertise in, and preferences for technologies, which in turn could influence the student’s decision to use a particular technology.

Fourthly, the concept of a student’s personal technology toolkit was identified as a key element impacting on a student’s approach to technology use. A student’s PTT represents those technologies that they have adopted as their preferred or default suite of tools and techniques to meet their learning and personal needs. Therefore, when a student is introduced to a new technology to complete a learning task, they will evaluate the learning and technology context within which they find themselves by applying one or more CDTU to decide whether to trial or not trial the new technology. In other words, when students are given a choice to use technologies to support their learning, they will draw upon their own personal suite of tools and techniques to complete learning tasks, unless they are exposed to other tools or techniques that could help them complete a task more efficiently, effectively or creatively than they would achieve with their existing toolkit.
It is important for teachers and TLs to acknowledge the existence of a student’s PTT as part of a blended classroom environment. They need to understand what technologies students’ already use and how they use them, to inform the design of inquiry units where the use of specific technologies are a requirement of the learning experience. The concept is potentially universal (beyond educational settings) and, therefore has scope to be examined across a range of other learning and workplace contexts where individuals are required to develop knowledge and skills in using existing technologies available to them, and/or explore the potential of new and emerging technologies to refine and expand the tools and techniques of their PTT.

This study (among others) has highlighted students’ difficulties with time issues when managing the variety of elements required by an independent inquiry project. However, another finding of this study was that participants’ focus on time management as the issue masked the actual source of the problem which was that of task management. It was, therefore, concluded that students’ lack of project management knowledge, processes and skills was a factor that inhibited their progress throughout the inquiry experience. Therefore, the fifth contribution of this study is the development of a project management framework that combines an information process model with project management processes, to highlight those aspects of the student inquiry experience where project management scaffolding could assist with students’ planning and management of project tasks. Students’ use of Web 2.0 technologies in this study has also shown the ways these tools can help students manage their inquiry projects better, especially when working from a number of computers in school and at home. It also demonstrated how Web 2.0 technologies can provide a platform for teachers and TLs to monitor students’ management of the project process during class and out-of-class time. Therefore, features and functionality of Web 2.0 technologies to support student’s project management needs has been included in the Technology Functionality Matrix to assist teachers and TLs in identifying potential tools to meet students’ task management and time management needs.

A sixth contribution of this study was the concept of a students’ learning team, which was actually shaped by students themselves, to provide them with instructional and moral support as they completed their inquiry project. The study showed how students (by Year
have the capacity to independently construct and maintain their own learning team that draws upon a mix of teachers, TLs, classmates, family, friends, and outside experts, based on the expertise the student perceives they bring to the inquiry experience. Five types of expertise members can bring to a learning team were identified and these were disciplinary, curriculum, process, technological, and production expertise. It also highlighted how students managed their the learning team, not just in terms of membership but also the roles of each member and the relationships between each member and the student. In other words, each student had a preference for how much input and assistance they sought from learning team members, including that of their teacher and the TL.

The seventh contribution of this study was the identification of the potential of Web 2.0 technologies as a platform to support instructional intervention, both planned and opportunistic. Eight types of instructional intervention have been identified to inform teachers and TLs use of Web 2.0 technologies, specifically topic selection, technology support, resource support, focus formulation, inquiry process, research process, project management, and knowledge construction. Within a blended classroom environment, it is important to note that these types of interventions can be provided in the face-to-face classroom, as well as in students’ Web 2.0 spaces. Therefore, teachers and TLs need to make decisions about which mode – either face-to-face or online – are the most appropriate mode for a particular intervention.

The eighth contribution of this study was the identification of additional factors impacting on students and teachers use of Web 2.0 technologies in the blended classroom environment. A major concern for students is the technology infrastructure issues they face, whether in school or at home. Students in this study showed how they devised workarounds to overcome infrastructure issues, particularly when working with Web 2.0 technologies at school where school networking configurations include the use of Internet filtering and web proxies. Some students, when faced with these issues, however, will revert to existing technology tools and techniques in their PTT which they know are not affected by infrastructure restrictions. It was also found when the full functionality of a Web 2.0 tool was not available to students on the school network, this reduces students’
capacity to explore the potential application of all features of that Web 2.0 tool, which therefore influences their willingness to trial it or adopt it as part of their PTT.

This research has drawn upon theory and practice across the three broad areas of information behaviour and use, teaching and learning, and technology use and adoption. The context has also been viewed through a theoretical lens comprising Personal Construct Theory (Kelly, 1963), Social Construction Theory (Berger & Luckmann, 1967), and Vygotsky’s (1978) Zone of Proximal Development. The combination of the above contextual influences has resulted in the author of this thesis proposing a new theory – the Personal Construction of Technology Use (PCTU) Theory – which is the major contribution of this study to research and professional practice. This theory provides an explanation of how students’ experiences with Web 2.0 technologies influence their views on using these technologies to support learning, and shows how the blended classroom as a socially constructed domain, as well as students’ learning teams, mental models, set of CDTU and development of their PTT, contribute to students’ process of personal construction as they navigate our technologically-driven world. The domains, dimensions, processes and principles of the PCTU Theory provides a set of propositions for further empirical investigation within each, or across the fields, of information behaviour and use, teaching and learning, technology use and adoption, and constructivist learning theory. It also provides educators with a model that articulates one way of interpreting students’ information, technology and inquiry learning experiences in a blended classroom environment.

The findings of this study have highlighted technology use at the level of individual student experience. Very early in the data collection phase of this study, within the everyday chaos of an inquiry classroom, the researcher observed one of the students standing up from his computer terminal and yelling across the room to the teacher, “Do we have to use a wiki, Miss?” The findings and conclusions of this study provide a basis to allow teachers and TLs to answer this question in an empirically informed way.
References


Board of Studies NSW. (2011). Global Studies syllabus. Sydney, Board of Studies NSW.


Church, A. P. (2005). Virtual school libraries – the time is now! *MultiMedia & Internet@Schools, 12,* 8-12.


Goodall, H. L. (2000). Writing the new ethnography. Lanham, MD: AltaMira.


http://leadcommission.org/sites/default/files/The%20Rise%20of%20K-12%20Blended%20Learning_0.pdf


Hsu, Y.-C., Ching, Y.-H, & Grabowski, B. L. (2013). Web 2.0 applications and practices for learning through collaboration. In M. Spector, M.D. Merrill, J. Elen, & M.J. Bishop (Eds.), Handbook of Research on Educational Communications and Technology (pp. 747-758). New York: Springer.


Change’, National Communication Association (NCA) 95th Annual Convention, Chicago Hilton & Towers, Chicago, IL.


Sheerman, A., Little, J., & Breward, N. (2011). iInquire... iLearn... iCreate... iShare: Guided Inquiry at Broughton Anglican College. *Scan*, 30(1), 4-5.


Appendices
Appendix A
Ethics in Human Research Committee (EHRC)
Approval letter, participants information sheets
and consent forms
16 April 2007

Ms Lyn Hay
School of Information Studies
WAGGA CAMPUS

Dear Ms Hay,

Thank you for the additional information forwarded in response to a request from the Ethics in Human Research Committee.

The Committee has now approved your proposal entitled “Using Web 2.0 technologies to support student learning through the guided inquiry process”. The protocol number issued with respect to the project is 2007/079. Please be sure to quote this number when responding to any request made by the Committee.

You must notify the Committee immediately should your research differ in any way from that proposed.

You are also required to complete a Progress Report form, which can be downloaded from www.csu.edu.au/research/forms/ehre_annrep.doc, and return it on completion of your research or by 16/04/2008 if your research has not been completed by that date.

Please don’t hesitate to contact the Executive Officer telephone (02) 6338 4628 or email ethics@csu.edu.au if you have any enquiries about this matter.

Yours sincerely,

Julie Hicks
Executive Officer
Ethics in Human Research Committee

Cc Ms K Williamson
Information Sheet for Teacher

Using Web2.0 Technologies to Support Student Learning Research Project

Dear Ms ___________,

Thank you for agreeing to be involved as a participant in my doctoral research project, and nominating one of your classes to form the basis of the study. As you know from preliminary discussions with myself as researcher and your teacher librarian, the research project intends to explore the use of Web2.0 technologies to support students’ completion of project-based assignments, and how the teacher librarian and class teacher can harness Web2.0 tools to support students’ learning. The study has been approved by Charles Sturt University’s Ethics in Human Research Committee (protocol number 2007/079), and the Headmaster of ________ College, Dr ____________________________.

Your involvement in this study is by way of:

(a) consenting to be interviewed in Term 3 of this year, before your students’ project work begins and upon completion of the student project, to gain your perceptions on students’ use of Web2.0 tools when completing assignment work. These interviews will take approximately 30 minutes of your time and be audio-taped;

(b) allowing the students in your class in Term 3 before commencing their project work to complete a student learning styles questionnaire (based on Entwistle & Tait’s 1997 Approaches and Study Skills Inventory for Students tool) along with some questions about students’ levels of Internet access and use at home, previous experience with Web2.0 tools, and types of school library help sought when completing project-based assignments;

(c) providing access to your class during Term 3 while students are working on a project-based assignment which integrates the use of blog, wiki and social bookmarking tools, and allowing me as researcher to be present in your classroom or the library (at agreed times), or online in students’ Web2.0 spaces, while the students work on their projects. I will observe the students working on their projects and also observe instructions and guidance given by you and the teacher librarian to each student;

(d) allowing me to view emails that contain questions and responses made between yourself, the teacher librarian and each student throughout the duration of the time the students are working on their projects; and finally

(e) allowing me to conduct individual interviews with each student upon completion of their project for approximately 15-20 minutes during normal class time.
Outcomes of this project will help inform the teacher librarianship profession about the potential use and value of Web2.0 technologies in supporting student learning through the guided inquiry process. This will also assist in identifying types of instructional intervention that teachers and TLs may provide using Web2.0 technologies at the point-of-need for students, both in normal class time and beyond the confines of school time and space. This project will also provide the teaching profession with a deeper understanding of the benefits, issues and processes involved with integrating Web2.0 technologies into the curriculum and how these impact on students’ learning and teachers’ practice.

Those of your students who participate in this study will benefit in terms of skill development in using Web2.0 technologies to support their learning. It is also hoped that you and your TL will benefit in terms of further developing your relationship as a collaborative teaching team. This could include gaining insights into effective assignment design which integrates Web2.0 tools, taking into account students’ learning styles using Web2.0 technologies, as well as being provided with a rich description and analyses of your teaching practice. A report of the research results will be made available in your school library upon submission of my doctoral thesis for examination.

No identifying details that can be linked to individual students, yourself as teacher or the TL will be included in any publications resulting from this research. Your participation and the participation of your students in this study is voluntary and there will be no penalty for refusing to participate.

You will find a consent form attached to this information sheet. After giving this project some thought, please sign and return the consent form to me. Please feel free to contact me via email lhay@csu.edu.au or by phone on (02) 69332808 if you have any questions regarding this research.

Kind regards,

Lyn Hay
Lecturer in Teacher Librarianship
School of Information Studies
Charles Sturt University

NOTE: Charles Sturt University’s Ethics in Human Research Committee has approved this project. If you have any complaints or reservations about the ethical conduct of this project, you may contact the Committee through the Executive Officer:

The Executive Officer
Ethics in Human Research Committee
Academic Secretariat
Charles Sturt University
Private Mail Bag 29
Bathurst NSW 2795
Tel: (02) 6338 4628
Fax: (02) 6338 4194

Any issues you raise will be treated in confidence and investigated fully and you will be informed of the outcome.
Information Sheet for Teacher Librarian

Using Web2.0 Technologies to Support Student Learning Research Project

Dear Mrs ____________,

Thank you for agreeing to be involved as a participant in my doctoral research project. As you know from preliminary discussions with myself as researcher and your nominated class teacher, this research project intends to explore the use of Web2.0 technologies to support students’ completion of project-based assignments, and how the teacher librarian and class teacher can harness Web2.0 tools to support students’ learning. This study has been approved by Charles Sturt University’s Ethics in Human Research Committee (protocol number 2007/1079), and the Headmaster of ____________ College, Dr ______________.

Your involvement in this study is by way of:

(a) consenting to be interviewed in Term 3 of this year, before students’ project work begins and upon completion of the student project, to gain your perceptions on students’ use of Web2.0 tools when completing assignment work. These interviews will take approximately 30 minutes of your time and be audio-taped;

(b) allowing me as researcher to be present in the school library while the students work on their project, and observe instructions and guidance given by you to both the teacher and students;

(c) allowing me to view your advice to students via their Web2.0 spaces; and finally

(d) allowing me to view emails that contain questions and responses made between yourself, the teacher and each student throughout the duration of the time the students are working on their projects.

Outcomes of this project will help inform the teacher librarianship profession about the potential use and value of Web2.0 technologies in supporting student learning through the guided inquiry process. This will also assist in identifying types of instructional intervention that TLs and teachers may provide using Web2.0 technologies at the point-of-need for students, during normal school hours as well as beyond the confines of school time and space. This study will also provide the teaching profession with a deeper understanding of the benefits, issues and processes involved with integrating Web2.0 technologies into the curriculum and how these impact on students’ learning and teachers’ practice.
Those students who participate in this study will benefit in terms of skill development in using Web2.0 technologies to support their learning, and it is hoped that you as TL and the classroom teacher will benefit in terms of further developing your relationship as a collaborative teaching team. This could include gaining insights into effective assignment design which integrates Web2.0 tools, taking into account students’ learning styles using Web2.0 technologies, as well as being provided with a rich description and analyses of your teaching practice as an information specialist. A report of the research results will be made available in your school library upon submission of my doctoral thesis for examination.

No identifying details that can be linked to individual students, yourself as TL or the teacher will be included in any publications resulting from this research. Your participation in this study is voluntary and there will be no penalty for refusing to participate.

You will find a consent form attached to this information sheet. After giving this project some thought, please sign and return the consent form to me. Please feel free to contact me via email lhay@csu.edu.au or by phone on (02) 69332808 if you have any questions regarding this research.

Kind regards,

[Signature]

Lyn Hay
Lecturer in Teacher Librarianship
School of Information Studies
Charles Sturt University

NOTE: Charles Sturt University’s Ethics in Human Research Committee has approved this project. If you have any complaints or reservations about the ethical conduct of this project, you may contact the Committee through the Executive Officer:

The Executive Officer
Ethics in Human Research Committee
Academic Secretariat
Charles Sturt University
Private Mail Bag 29
Bathurst, NSW 2795
Tel: (02) 6338 4626
Fax: (02) 6338 4184

Any issues you raise will be treated in confidence and investigated fully and you will be informed of the outcome.
Teacher & Teacher Librarian Consent Form

Using Web2.0 Technologies to Support Student Learning Research Project

Principal Investigator:

Lyn Hay
Lecturer in Teacher Librarianship
School of Information Studies
Ph.: (02) 69332808
Fax: (02) 69332733
Mobile: 0412034595
Email: lhay@csu.edu.au

I, ........................................................................................................... , consent to participate in the research project titled Using Web2.0 Technologies To Support Student Learning Through The Guided Inquiry Process.

I understand that I am free to withdraw my participation in the research at any time and that, if that happens, there will be no penalty or discriminatory treatment.

The purpose of the research has been explained to me and I have read and understood the information sheet provided.

I permit the investigator to tape record my interviews as part of this project.

I understand that any information or personal details gathered in the course of this research are confidential and that names of individuals and any other identifying information will not be used or published without written permission.

Charles Sturt University’s Ethics in Human Research Committee has approved this study. I understand that if I have any complaints or concerns about this research I can contact:

Executive Officer
Ethics in Human Research Committee
The Grange
Charles Sturt University
Bathurst NSW 2795
Ph: (02) 6338 4428
Fax: (02) 6338 4194

Signed by: ...............................................................

Date ............................................................
Information Sheet for Parents and Students

Using Web2.0 Technologies to Support Student Learning Research Project

Dear Parent and Student,

I am a Lecturer at Charles Sturt University in the School of Information Studies working in the area of school libraries and student learning. I am currently conducting research as part of my doctoral studies which explores the use of Web2.0 technologies to support students’ completion of project-based assignments, and how the teacher librarian and class teacher can harness Web2.0 tools to support student learning.

This study has been approved by Charles Sturt University’s Ethics in Human Research Committee (protocol number 2007/079), and the Headmaster of ___________ College. Dr ___________ in consultation with teacher librarian, Mrs ___________ has nominated the Year 10 Global Studies class to become participants in the research project and I would like your son or daughter to participate.

Students will be asked to complete a questionnaire in early Term 3 of this year, before they begin their Term 3 project work. This questionnaire will ask students to comment on the ways they approach their learning at school, their level of Internet access and use at home, previous experience with Web2.0 tools, and types of school library assistance they have been given when completing project-based assignments. This questionnaire will be completed during normal class time.

As the researcher I will be present in this class (at times) during Term 3 while students are working on a project-based assignment which integrates the use of blog, wiki and social bookmarking tools. I will observe the students working on their projects at various times in the classroom and the school library, and observe the instructions and guidance given by the teacher and the teacher librarian to each student. I will also view work that is collected and generated by students online in each of their Web2.0 spaces and view emails that contain questions and responses made between the teacher, the teacher librarian and each student throughout the duration of the time the students are working on their project.

Students will also be interviewed upon completion of their projects for approximately 15-20 minutes during normal class time. Interviews will be audio-taped. Any disruptions to their school day will be kept to a minimum.

Outcomes of this project will help inform the teacher librarianship and teaching professions about the potential use and value of Web2.0 technologies to support student learning involving completion of project-style assignments. The study will also identify the types of instructional
support that teachers and teacher librarians may provide using Web2.0 technologies at the point-of-need for students, both in normal class time and beyond the confines of school time and space. It will also provide the teaching profession with a deeper understanding of the benefits, issues and processes involved with integrating Web2.0 technologies into the curriculum and how these impact on students’ learning and teachers’ practice.

Students who participate in this study will also benefit in terms of skill development in using Web2.0 technologies to support their learning, and gain greater insight as to how they learn as when working on project-style assignments. A report of the research results will be made available in your school library upon submission of my doctoral thesis for examination.

The contents of students’ project work, and student survey results and responses to interview questions will remain anonymous. No identifying details that can be linked to individual students will be included in any publications resulting from this research. Student participation is voluntary and there will be no penalty for refusing to participate, but I would greatly appreciate cooperation from as many students in this class as possible. The more students I am able to observe and talk to, the more valuable and useful will be the results.

I have provided students with a consent form to complete and submit to indicate their willingness to participate. Parents will find a parent consent form attached to this information sheet. After giving the project some thought, please sign and return the consent form with your son or daughter. Non-participation or withdrawal from this study will not adversely affect a student’s relationship with either their teacher, the teacher librarian or the College.

Please feel free to contact me via email lhay@csu.edu.au or by phone on (02) 69332808 if you have any questions regarding this research.

Kind regards,

Lyn Hay
Lecturer in Teacher Librarianship
School of Information Studies
Charles Sturt University

NOTE: Charles Sturt University’s Ethics in Human Research Committee has approved this project. If you have any complaints or reservations about the ethical conduct of this project, you may contact the Committee through the Executive Officer:

The Executive Officer
Ethics in Human Research Committee
Academic Secretariat
Charles Sturt University
Private Mail Bag 29
Bathurst NSW 2795
Tel: (02) 6338 4628
Fax: (02) 6338 4194

Any issues you raise will be treated in confidence and investigated fully and you will be informed of the outcome.
Parent Consent Form

Using Web2.0 Technologies to Support Student Learning Research Project

Principal Investigator:
Lyn Hay
Lecturer in Teacher Librarianship
School of Information Studies
Ph: (02) 69332808
Fax: (02) 69332733
Mobile: 0412034595
Email: lhay@csu.edu.au

I, .................................................................................................................., consent to my
son/daughter’s participation in the research project titled Using Web2.0 Technologies To Support

I understand that he or she is free to withdraw his or her participation from the research at any
time and that, if that happens, there will be no penalty or discriminatory treatment.

The purpose of the research has been explained to me and I have read and understood the
information sheet provided.

I permit the investigator to tape record my son or daughter’s interview as part of this project.

I understand that any information or personal details gathered in the course of this research are
confidential and that names of individuals and any other identifying information will not be used
or published without written permission.

Charles Sturt University’s Ethics in Human Research Committee has approved this study. I
understand that if I have any complaints or concerns about this research I can contact:

Executive Officer
Ethics in Human Research Committee
The Grange
Charles Sturt University
Bathurst NSW 2795
Phone: (02) 6338 4428
Fax: (02) 6338 4194

Signed by: ...........................................................................................................

Date ........................................................................................................
Student Consent Form

Using Web2.0 Technologies to Support Student Learning Research Project

Principal Investigator:

Lyn Hay
Lecturer in Teacher Librarianship
School of Information Studies
Ph: (02) 69332808
Fax: (02) 69332733
Mobile: 0412034595
Email: lhay@csu.edu.au

I, ........................................................................................................... consent to my participation in the research project titled Using Web2.0 Technologies To Support Student Learning Through The Guided Inquiry Process.

I understand that I am free to withdraw my participation from this research project at any time and that, if that happens, there will be no penalty or discriminatory treatment.

The purpose of the research has been explained to me and I have read and understood the information sheet provided.

I permit the investigator to tape record my interview as part of this project.

I understand that any information or personal details gathered in the course of this research are confidential and that names of individuals and any other identifying information will not be used or published without written permission.

Charles Sturt University’s Ethics in Human Research Committee has approved this study. I understand that if I have any complaints or concerns about this research I can contact:

Executive Officer
Ethics in Human Research Committee
The Grange
Charles Sturt University
Bathurst NSW 2795
Phone: (02) 6338 4628
Fax: (02) 6338 4194

Signed by: ..........................................................................................

Date ............................................................................................

413
Appendix B

Online student questionnaire design
B.1: Schedule of original versus revised ASSIST items in the student questionnaire

Revision schedule of the 52 ASSIST statements

Note the majority of statements are from the original ASSIST inventory. Those statements in red italics denote statements that were revised to meet the age of student participants and the language of the school context (with the original statement following in parentheses).

1. I manage to find conditions for studying which allow me to get on with my work easily.

2. *When working on an assignment, I’m keeping in mind how best to impress the teacher.*
   (When working on an assignment, I’m keeping in mind how best to impress the marker.)

3. Often I find myself wondering whether the work I am doing here is really worthwhile.

4. I usually set out to understand for myself the meaning of what we have to learn.

5. I organise my study time carefully to make the best use of it.

6. I find I have to concentrate on just memorising a good deal of what I have to learn.

7. I go over the work I’ve done carefully to check the reasoning and that it makes sense.

8. Often I feel I’m drowning in the sheer amount of material we’re having to cope with.

9. I look at the evidence carefully and try to reach my own conclusion about what I’m studying.

10. *It’s important for me to feel that I’m doing as well as I really can on my subjects at school.*
    (It’s important to me to feel that I’m doing as well as I really can on the courses here.)

11. I try to relate ideas I come across to those in other topics or other subjects whenever possible.

12. I tend to read very little beyond what is actually required to pass.

13. *Regularly I find myself thinking about ideas discussed in class when I’m doing other things.*
    (Regularly I find myself thinking about ideas from lectures when I’m doing other things.)

14. I think I’m quite systematic and organised when it comes to revising for exams.
15. I look carefully at teachers' comments on my school work to see how to get higher marks next time.  
   (I look carefully at tutors' comments on course work to see how to get higher marks next time.)

16. There's not much work in this subject that I find interesting or relevant.  
   (There's not much of the work here that I find interesting or relevant.)

17. When I read an article or book, I try to find out for myself exactly what the author means.  
   (When I'm reading an article or book, I try to find out for myself exactly what the author means.)

18. I'm pretty good at getting down to work whenever I need to.

19. Much of what I'm studying makes little sense: it's like unrelated bits and pieces.

20. I think about what I want to get out of this subject to keep my studying well focused.  
   (I think about what I want to get out of this course to keep my studying well focused.)

21. When I'm working on a new topic, I try to see in my own mind how all the ideas fit together.

22. I often worry about whether I'll ever be able to cope with the work properly.

23. Often I find myself questioning things I hear in class or read in books.  
   (Often I find myself questioning things I hear in lectures or read in books.)

24. I feel that I'm getting on well, and this helps me put more effort into the work.

25. I concentrate on learning just those bits of information I have to know to pass.

26. I find that studying academic topics can be quite exciting at times.

27. I'm good at following up some of the reading suggested by my teachers or teacher librarians.  
   (I'm good at following up some of the reading suggested by lecturers or tutors.)

28. I keep in mind who is going to mark an assignment and what they're likely to be looking for.

29. When I look back, I sometimes wonder why I ever decided to do this subject.

30. When I am reading, I stop from time to time to reflect on what I am trying to learn from it.
31. I work steadily through the term, rather than leave it all until the last minute.
   (I work steadily through the term or semester, rather than leave it all until the
   last minute.)

32. I'm not really sure what's important in class so I try to get down all I can. (I'm not
   really sure what's important in lectures, so I try to get down all I can.)

33. Ideas in books or articles for this subject often set me off on long chains of thought of my
   own. (Ideas in course books or articles often set me off on long chains of thought of my
   own.)

34. Before starting work on an assignment or exam question, I think first how best to
   tackle it.

35. I often seem to panic if I get behind with my work.

36. When I read, I examine the details carefully to see how they fit in with what's
   being said.

37. I put a lot of effort into studying because I’m determined to do well.

38. I gear my studying closely to just what seems to be required for assignments and
   exams.

39. Some of the ideas I come across in this subject I find really gripping. (Some of the ideas I come across on the course I find really gripping.)

40. I usually plan out my week's work in advance in my head or by writing it down.
   (I usually plan out my week's work in advance, either on paper or in my head.)

41. I keep an eye open for what teachers seem to think is important and concentrate on that.
   (I keep an eye open for what lecturers seem to think is important and concentrate
   on that.)

42. I'm not really interested in this subject, but I have to take it for other reasons.
   (I'm not really interested in this course, but I have to take it for other reasons.)

43. Before tackling a problem or assignment, I first try to work out what lies behind it.

44. I generally make good use of my time during the day.

45. I often have trouble in making sense of the things I have to remember.

46. I like to play around with ideas of my own even if they don't get me very far.
47. *When I finish a piece of work, I check it through to see if it really meets the requirements.*
   (When I have finished a piece of work, I check it through to see if it really meets the requirements.)

48. Often I lie awake worrying about work I think I won’t be able to do.

49. It’s important for me to be able to follow the argument, or to see the reason behind things.

50. I don’t find it at all difficult to motivate myself.

51. I like to be told precisely what to do in essays or other assignments.

52. I sometimes get ‘hooked’ on academic topics and feel I would like to keep on studying them.
B.2: Screenshots of online student questionnaire as viewed by student participants in Zoomerang

Part A: Your research style and approach to studying

Each person tends to have a preferred way of doing research. No one style is necessarily better than the other, as the same outcome can be reached by different strategies. We would like to find out how you usually do your research and approach your studies, by asking you to respond to each of the following statements.

Please work through these statements, giving your immediate response. To help you choose your answer, please think in terms of your approaches to research and study for this Global Studies class.

Note: you cannot submit this survey page until all statements have been answered.

1. Please type your first name here, eg. Ben, Sarah

2. Please indicate whether you agree or disagree with each of these comments about studying.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I manage to find conditions for studying which allow me to get on with my work easily.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>When working on an assignment, I'm keeping in mind how best to impress the teacher.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Often I find myself wondering whether the work I am doing here is really worthwhile.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>I usually set out to understand for myself the meaning of what we have to learn.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>I organise my study time carefully to make the best use of it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>I find I have to concentrate on just memorising a good deal of what I have to learn.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>I go over the work I've done carefully to check the reasoning and that it makes sense.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Often I feel I'm drowning in the sheer amount of material we're having to cope with.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>I look at the evidence carefully and try to reach my own conclusion about what I'm studying.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
10. It's important for me to feel that I'm doing as well as I really can on my subjects at school.

11. I try to relate ideas I come across to those in other topics or other subjects whenever possible.

---

### Please indicate whether you agree or disagree with each of these comments about studying:

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.</td>
<td>I tend to read very little beyond what is actually required to pass.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>Regularly I find myself thinking about ideas discussed in class when I'm doing other things.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>I think I'm quite systematic and organised when it comes to revising for exams.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>I look carefully at teachers' comments on my school work to see how to get higher marks next time.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>16.</td>
<td>There's not much work in this subject that I find interesting or relevant.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>17.</td>
<td>When I read an article or book, I try to find out for myself exactly what the author means.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>18.</td>
<td>I'm pretty good at getting down to work whenever I need to.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>19.</td>
<td>Much of what I'm studying makes little sense: it's like unrelated bits and pieces.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>20.</td>
<td>I think about what I want to get out of this class, to keep my studying well focused.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>21.</td>
<td>When I'm working on a new topic, I try to see in my own mind how all the ideas fit together.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>22.</td>
<td>I often worry about whether I'll ever be able to cope with the work properly.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

---

### Please indicate whether you agree or disagree with each of these comments about studying:

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strongly agree</td>
<td>Agree</td>
<td>Disagree</td>
<td>Strongly disagree</td>
</tr>
<tr>
<td>---</td>
<td>----------------</td>
<td>-------</td>
<td>----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>23.</td>
<td>Often I find myself questioning things I hear in class or read in books.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>I feel that I’m getting on well, and this helps me put more effort into the work.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>I concentrate on learning just those bits of information I have to know to pass.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>I find that studying academic topics can be quite exciting at times.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>I’m good at following up some of the reading suggested by my teachers or teacher librarians.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>I keep in mind who is going to mark an assignment and what they’re likely to be looking for.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>When I look back, I sometimes wonder why I ever decided to do this subject.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td>When I am reading, I stop from time to time to reflect on what I am trying to learn from it.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>I work steadily through the term, rather than leave it all until the last minute.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32.</td>
<td>I’m not really sure what’s important in class so I try to get down all I can.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Please indicate whether you agree or disagree with each of these comments about studying:

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.</td>
<td>Ideas in books or articles for this subject often set me off on long chains of thought of my own.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34.</td>
<td>Before starting work on an assignment or exam question, I think first how best to tackle it.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35.</td>
<td>I often seem to panic if I get behind with my work.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36.</td>
<td>When I read, I examine the details carefully to see how they fit in with what’s being said.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37.</td>
<td>I put a lot of effort into studying because I’m determined to do well.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
38. I gear my studying closely to just what seems to be required for assignments and exams.

39. Some of the ideas I come across in this subject I find really gripping.

40. I usually plan out my week's work in advance in my head or by writing it down.

41. I keep an eye open for what teachers seem to think is important and concentrate on that.

42. I'm not really interested in this subject, but I have to take it for other reasons.

---

6 Please indicate whether you agree or disagree with each of these comments about studying:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>43. Before tackling a problem or assignment, I first try to work out what lies behind it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44. I generally make good use of my time during the day.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45. I often have trouble in making sense of the things I have to remember.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46. I like to play around with ideas of my own even if they don't get me very far.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47. When I finish a piece of work, I check it through to see if it really meets the requirements.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48. Often I lie awake worrying about work I think I won't be able to do.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49. It's important for me to be able to follow the argument, or to see the reason behind things.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50. I don't find it at all difficult to motivate myself.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51. I like to be told precisely what to do in essays or other assignments.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52. I sometimes get 'hooked' on academic topics and feel I would like to keep on studying them.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Thank you for completing Part A of this survey.

Don't forget to come back to complete Part B later!
Part B: Some background information about you and researching assignments

Please answer each of the questions below as best as you can.

Note: you cannot submit this survey page until all questions have been answered.

1. Please type your first name here, e.g. Ben, Sarah

2. Please select your age (in years):

The next two questions ask you about the type of computer & Internet access at home.

Please select an answer that best describes what you use at home to complete assignments and homework.

3. When working on assignments and schoolwork at home, the computer I use most is:
   - One which all members of my family share
   - One that I share with my brothers & sisters
   - A desktop computer which only I use
   - A laptop computer which only I use
   - Other, please specify

4. What type of Internet access do you have at home? Please select the one that best describes what you have at home:
   - Dial up access for a single user
   - Broadband access for a single user
   - Broadband access for multiple users
   - Wireless broadband for a single user
   - Wireless broadband for multiple users
   - Other, please specify
5. When researching for school assignments, do you complete most of your research in class, or the school library or at home? Provide a percentage for each (note all 3 percentages must add up to 100%).

The percentage of research completed across these are:

% in class
% in the school library
% at home

6. What are the main problems or frustrations you have when working on school projects and assignments? Please write these in the box below:

7. When working on projects and assignments in the school library, what tasks do you ask a teacher/librarian to help you with? Please write these in the box below:

8. When working on projects and assignments in the school library, what tasks do you ask your teacher to help you with? Please write these in the box below:

9. This question consists of six statements, each of which is designed to find out whether you have ever used blogs, wikis or social bookmarking tools likeDel.icio.us for either personal use or to complete school work.

Please select an answer for each of the six statements below:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have used blogs for school-related purposes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I have used blogs for my own personal use (other than school work)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I have used wikis for school-related purposes</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I have used wikis for my own personal use (other than school work)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I have used a social bookmarking website for school-related purposes</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
I have used a social bookmarking website for my own personal use (other than school work)

10 If you answered ‘Yes’ to any part of Question 5, briefly explain how you have used these to complete your school work, and why you have liked or disliked using these to complete school work:

Thank you for taking the time to complete Part B of this survey.

Good luck with your Global Studies project in Term 3!!
Appendix C
Example of field notes/memoing
Classroom observation schedule/memo – Wednesday 22 August Period 3

Teacher is attending a Year 12 Legal Studies consultation for the day so TL has agreed to take the class herself rather than have a different teacher take an 'extra'. Each student is sitting at a PC but turned to face front of classroom. I sit in the back left hand corner in front of a PC.

TL gives a rundown of what students should have completed and what they need to complete by the end of this week (which is 2 ½ weeks into their PIP timeline). She writes this checklist up on the whiteboard:

1. Complete learning survey
2. Create wiki, blog, delicio.us accounts
3. Complete the PMI task (from their GS Project Workbook p.7 - Plus-Minus-Interesting exercise on their proposed topic or topics if they are still undecided)
4. Complete journal entries in wiki or blog
5. Complete Progress Report 1 - upload to wiki or blog from Snoopy docs (this is the name of the server where digital files to support classwork is stored at the school)
6. Identify your critical friend and inform teacher
7. Complete Research Plan (copy from Snoopy, complete and upload to wiki or blog)

S05: Opens his wikispace and opens Google search. He begins a search on 'Emirates' and clicks on the first entry which is a Google-sponsored link (a commercial online airfares website). He ends up clicking on a Qantas link and goes to a webpage on Qantas's security measures. He copies the whole page of text, goes to his wikispace, creates a new page based on the pasting of this content - he calls the new page 'Airline Safety Info - From all parts of the globe'. He continues to search other websites of commercial airlines, eg. British Airways, and continues to copy and paste content from webpages from a range of airlines into his wiki page.

TL asks me what students have not completed the learning survey yet. I go online and check the Zoomerang survey and provide her with a list:

Part A Survey – S11, S12
Part B Survey - S11, S12, S04

TL goes to speak to each of these students individually about completing the survey before getting into their wiki or blog.

TL talks to S01 about his topic on computer addiction - he is struggling with this topic because he needs to bring in an international dimension to his project (a requirement of this PIP) and he thinks he will try to look at his topic within the context of China. He explains about people in China playing online games to earn points which they can then 'sell' these points to other online gamers for money. TL asks him to explain how his topic has 'international impact'. He explains that these online gamers who buy the points can come from anywhere else in the world. TL asks him to try to write up his topic idea in preparation for the teacher to consider whether this will meet the criteria of the PIP.

TL then moves to talk to S03 across the room (he is one of the two students who are about 2 weeks behind the others due to the GS Inter-School presentations).

S10 is sitting next to S01 and S11 and tells them he still doesn't have a topic.

S11 searches for an idea for a topic using Google - he is behind in his PIP project because he spent the first week with S03 working on a presentation for the GS inter-school presentations. S11 hasn't created his wiki yet and he tells S01 and S10 that he doesn't want to create his wiki until he picks a topic.

S02 (across the room) works on her wiki.

S05 continues to populate his wiki with 'copy & paste' - there is no record of the source of each of his copied sections, including text, graphics, airline logos.

S06 sits in front of the PC staring at the screen. He has been doing this since class began.
S03 searches Google trying to come up with ideas for his topic.

S10 opens the PMI file from Snoopy

S02 asks TL for help with her wiki. She explains she has created a blog for her journal and a wiki to publish her project. But she is having trouble navigating the blog. TL looks at both the blog and wiki and realises S02 has created a 'commercial wiki' using pb.wiki rather than an educational wiki and instructs her to create an educational one and copy and paste the contents into the educational one.

S07 is working on the Word doc template for her research plan. TL works with her on the wording of her research question - a whole discussion occurs on the implications of S07 using the term 'effectiveness' in her research question. S07 is thinking deeply about the formulation of her research question, she wants to ‘get it right’.

S06 is sitting next to S07 and TL turns to S06: "What are you working on?"

S06: Tribalism
TL: What is your question?
S06: Don’t know yet.
TL: Where have you been searching?
S06: Google, the Internet and stuff.
TL: Have you looked at the library databases?
S06: No, how do you do that?
TL: Why not try EBSCOHost... what search terms have you used so far?
S06: Tribalism
TL: What other terms?
S06: Youth gangs
TL shows him how to complete a search using the search phrase 'youth gangs' and they find an article on ethnic youth gangs in New Zealand.

TL: You can email these articles to your email account

S06: No, I'll just put it in my wiki.

S06 copies and pastes the article into his wiki.

TL talks to S05 about his topic – they talk about the TL’s experience at Heathrow airport. S05 talks about his experience in Vienna, and also how he has found a website where cabin crew share information and talk about their experiences.

TL asks S05, “Show me cabincrew.com”

S05 has already made an account to try to find people to interview. He shows the TL the Australian and NZ forum on this website.

S10 has managed to complete a part of his PMI.

TL talks to S08 – he is looking at newspapers – “To what extent are newspapers influenced by… politics… and business”. The TL asks him about his use of the term “To what extent…”. She asks, “Does this mean that you are going to measure something? How are you going to measure it?”

S08 talks about using content analysis to examine newspapers, “The SMH has this many articles on George Bush, eg, & the Guardian has only 5, the NY Times has 15.” The TL suggests ‘importance’ as a measure in terms of where in the newspaper are the articles located, eg, front page vs a few pages inside. S08’s topic (because he is doing newspapers) has him doing a lot of web-surfing and browsing on websites of newspapers – he is finding some websites require payment to gain access to the articles he wants to view.

TL asks S11 how he is going with his topic, “I’m doing an assignment on Australia’s foreign policy in America – looking at foreign aid given to Nauru. The TL shows S11 how to create a wiki. S11 is reading about Nauru on Wikipedia.
S04 says, “I’m filling out my Progress report but I haven’t really done so much, so it is difficult to fill it out.”

S06 is back to searching on the web, this time using ‘youth gangs’ as his search phrase in Google.

S10 asks, “How do you log off a wiki?”

Bell rings...

---

**Observation memo:**

In this class the TL showed how she could support the students with:

- setting up/using Web 2.0 technologies
- how to refine topics and try to develop a specific research question for students’ PIPs, eg. S07, S08, S01
- instruction regarding use of appropriate search terms for student searches
- instruction regarding use of EBSCOhost full-text database for published journal articles (encouraging use of authoritative information as part of their finding information phase)

In this class, the TL shows how she can act as a conduit between the student and teacher, eg. S01 example.

**Student behaviours:**

- Some struggling with topic selection, refinement - S10, S12 seem to be very passive in terms of topic selection, they are not actively searching for information to help inform the selection of a topic - out of all the students in the class, these two seem to be doing nothing but talking to each other and others during class time - they are not ‘on task’ or engaged at all by the process.
• Some struggling with setting up Web 2.0 technologies to create online learning space - mental models of technology, eg, S02 not being aware of the difference between a commercial or an educational wiki; S11 doesn’t want to ‘deal with the technology’ until he has decided on his topic.

• Note, all students’ first port-of-call is Google when starting to search for information on their topic

• Note, students seem to be using their wiki space as a place to copy and paste content from websites and journal articles – few of them are recording where each of the sections of pasted content has come from. S05’s behaviour reminds me of someone ‘harvesting’ – he is really ‘on task’ as he searches different sites and collects (copies and pastes) the content he has found – he takes the lot – text, graphics – he ‘transports’ the information to his online space – it is becoming a big storehouse of pasted content – the wiki is acting like an ‘information repository’; S06 is another example of this.

Question: is the wiki or blog ‘encouraging’ plagiarism with this copy/pasting activity??

• Some students are not ‘on task’, eg, S06 just staring at the screen – he obviously needs more scaffolding to help him define/refine his topic and to help him search for information.

• Students are experiencing time management problems – some not using their class time as effectively as they could, others not on task and falling behind the proposed project timeline (as per checklist presented by the TL at the beginning of the class).

This observation has captured some good examples of students’ topic formulation, eg, S01, S07, S08.
Appendix D
Teacher and TL interview question schedules
Semi-structured Interview 1: Questions for Teacher

Demographic/Background Questions:

1. How many years have you been a teacher? + qualification, eg. BAdipEd, BEd + MEd (include initial teaching qualification plus any further tertiary education incl. current study if any)

2. How many years have you been teaching at this school?

3. While teaching at this school, how many times per year would you collaborate with a TL on resource-based units of work? (eg. twice a year with 3 of your classes)

4. When completing your teacher training and/or further tertiary studies in education, did you ever complete subjects that focused on how to design and support resource-based learning, and did you ever complete subjects that exposed you to the potential role of the TL as a teacher’s collaborative planning and teaching partner?

5. When teaching at previous schools, were you involved in collaborative planning and teaching activities with the TL? If yes, for how many years has this been a regular part of your teaching practice?

Interview Questions:

Firstly, I’d like to ask you some questions about how you view the role of the school library and teacher librarian in supporting you as the teacher when working with your classes on assignments and/or research-based projects:

1. What role do you see the school library and teacher librarian in supporting you as a teacher when planning and/or designing assignments?

2. What role do you see the school library and teacher librarian in supporting you as a teacher in implementing assignments?

3. I notice in the Year 10 Global Studies workbook for this Term 3 PIP project that you recommend that students use the 6-stage Information process of Defining, Locating, Selecting etc as an approach to help them work through their research project.

   a. Who first introduced you to this process, and when was this?

   b. Is this a process that you use with your classes all the time, and if so, how successful do you think this process is in helping student manage their research better?
I’d now like to ask you some questions about using technology:

4. What types of technologies and software programs do you use on a daily or weekly basis to communicate with others, whether for work or personal use? Eg. email, chat, instant messaging, Internet phone calls (Skype) via your laptop, or sms or web searching via your mobile.

5. Besides communicating with your students face-to-face during class time, what other ways do you communicate with your students, eg. can they or do you encourage them to email you with questions? Do you use any other technologies to support communication with your student out-of-class time?

6. What drives your adoption of using new technologies? eg. a personal friend, the teacher whose desk is next to yours in your staffroom, or an ICT teacher at this school, or a TL, or students, or any others. Can you give me some examples of times when you have adopted new technologies?

7. When trialing the use of a new technology or program, does your personal use of these drive the use of these in your teaching, or would you first trial something in your teaching which you then might pick up and use for personal use?

8. Can you please tell me what Web2.0 technologies you have used in the past, and explain how you encourage and integrate the use of these within your classes (if any)?

9. Do you have any issues or concerns about the use of the selected Web2.0 technologies (blogs, wikis, del.icio.us) with this Year 10 Global Studies project in Term 3?

10. What is your understanding of the guided inquiry process, and how do you see this helping your students successfully complete their Year 10 Global Studies project in Term 3?

11. Is there anything else you wish to share with me about this Year 10 Global Studies project in Term 3, eg. in terms of the technologies used, the assignment design, allocation of roles of the teacher and TL when working with this class, etc?
Semi-structured Interview 1: Questions for Teacher Librarian

Demographic/Background Questions:

1. How many years have you been a teacher and/or TL? + qualification, eg. BAdDipEd with TL specialisation, BEd + GradDipEd/TL or MEdTL (include initial teaching qualification plus any further tertiary education incl. current study if any, incl any technology training or courses)

2. How many years have you been a TL at this school?

3. How many teachers are at this school, and how many of them are you assigned to collaborate with?

4. Has the school library developed a collaborative planning and teaching program at this school? Describe the nature of this program and what percentage of teachers in the school do you work with on a regular basis as a collaborative planning/teaching partner.

5. Of the percentage of teachers that you work with, on average how many times per year would you collaborate with them on resource-based units of work? (eg. for secondary teachers, twice a year with 3 of their classes)

Interview Questions:

Firstly, I’d like to ask you some questions about how you view the role of the school library and teacher librarian in supporting teachers when working with their classes on assignments and/or research-based projects:

1. What is the role of the school library and your role as teacher librarian in supporting teachers when planning assignments?
   
   On average, what percentage of assignments that are set by teachers have involved your expertise as TL in the assignment design or preparation for assignment work?

2. On average, what percentage of assignments that are set by teachers have involved your expertise as TL in the implementation/teaching of assignment work?

I’d now like to ask you some questions about using technology:

3. What types of technologies and software programs do you use on a daily or weekly basis to communicate with others, whether for work or personal use? Eg. email, chat, instant messaging, Internet phone calls (Skype) via your laptop, or sms or web searching via your mobile.

4. Besides communicating with students face-to-face in the library throughout the school day, what other ways do you communicate with students, eg. can they
or do you encourage them to email you with questions? Do you use any other technologies to support communication with students during school time and out-of-school time?

5. What drives your adoption of using new technologies? E.g., a personal friend, the teacher whose desk is next to yours in your staffroom, or an ICT teacher at this school, or a TL, or students, or any others. Can you give me some examples of times when you have adopted new technologies?

6. When trialling the use of a new technology or program, does your personal use of these drive the use of these in your teaching, or would you first trial something in your teaching which you then might pick up and use for personal use?

7. How do you promote the use of Web2.0 technologies when working with teachers and students on assignments, or in the classroom? Identify the Web2.0 technologies you have used in the past, and explain how you encourage and integrate the use of these with teachers and students?

8. Do you have any issues or concerns about the use of the selected Web2.0 technologies with this Year 10 Global Studies project in Term 3?

9. What is your understanding of the guided inquiry process, and how do you plan to implement this as part of this Year 10 Global Studies project in Term 3?

10. Is there anything else you wish to share with me about this Year 10 Global Studies project in Term 3, e.g., in terms of the technologies used, the assignment design, allocation of roles of the teacher and TL when working with this class, etc?
Semi-structured Interview 2: Questions for Teacher & TL

Questions to use as starting point

1. Overall, how did you think the students performed in the completion of their Personal Interest Projects (PIPs)?

2. What about the project process as outlined in the Global Studies booklet? Do you think students referred to this as they completed each stage of their project?

3. How did you use the project reports in monitoring the progress and learning of each student? Would you use these again in future projects?

4. Some students developed a log with some detail of their journey and others didn’t— what are your thoughts on this?

5. I’m interested in getting your views on the value (or not) of the wikis and blogs in supporting the students’ projects:
   (a) What did these achieve, how did they contribute to the students’ projects or supporting your students’ learning?
   (b) What did you learn from different students’ use of their wiki space or blog?

6. What about the potential use of del.icio.us?

7. Would you use any of these Web2.0 tools again, and if so, how would you use them?

8. What are your views on the impact of the marking criteria on students efforts with regard to the progress reports and learning log?

9. I would now like to explore the different ways you supported the students through their project:
   (a) what were the critical points along the way you saw you needed to invest a lot of time/effort/energy in supporting students?
   (b) Were there times along the way you think you needed to provide more support, and what type(s) of help would they be?

10. I’d now like to explore how you and the TL/you and the teacher worked as a team in supporting the students in their projects:
    (a) What worked well?
    (b) What didn’t work or was problematic?
    (c) What did you learn about working with TL name as the TL/TL name as the teacher?
    (d) Did you learn anything about yourself as a teaching partner?

11. What would you do differently next year with the design of the Global Studies PIP?

Additional questions for TL:

Comments on using the technology to collaborate online
What did you learn about the Guided Inquiry process?
Appendix E
Student interview question schedule
Semi-Structured Exit Interview Questions for Students

xxx, thank you for agreeing to talk to me briefly about your Global Studies project.

I would like to ask you a few questions about what you experienced while researching your project, how you used any technologies to help you work on your project, and also explore the kinds of help you needed to complete your project whether it was from your teacher, Ms [T], Mrs [TL] as a teacher librarian, and any others you might have sought out to help you complete your project successfully.

Now before we begin I would just like to say, that what we discuss in this room is completely confidential, and if I refer to anything that we discuss in any form of publication in the future, your identity will not be shown (meaning that I’ll be giving you a different name, like Student A rather than xxx). Also, if at any time I ask you a question that makes you feel uncomfortable or you don’t want to answer then, please just tell me, and we’ll move on.

1. Can we start with your use of the wiki. Besides uploading your project reports on your wiki, what else did you use it for and how useful did you find it as a place to collect and store information, and write up your ideas?

   Would you consider using a wiki to support other projects in the future?

2. What about using a blog? I see you decided to use/not use a blog to support the completion of your project. Why did you decide to use this instead of a wiki? Why did you decide to use a wiki instead of a blog?

   Would you consider using a blog to support other projects in the future?

3. What about using delicious? I see you decided to use/not use delicious? What were your reasons for using/not using delicious?

   [For those who used delicious] Do you think this could be a useful site to use when collecting websites to support other projects in the future?

I’d now like to ask you about the types of assistance you received while completing your project and whether you feel you could have done with more help, or whether the help you got was just what you needed.
4. Let’s start with Mrs [TL]. How did she help you? Did you get any help from her outside your normal Global Studies class time? Where was this and what type of help did she give you?

Can you think of any other ways that Mrs [TL] might have been able to help you?

5. Now what about the kinds of help you received from Mrs [TL]? Was this mainly with helping you refine your topic? Did you ask for her help when trying to write up your report or presentation, as far as making decisions about what to include or not include, or whether or not what you were writing made sense?

6. Now, I notice on the wiki that there is a place where other people can add comments to each page you create in your wiki, like a place to give you regular feedback on what you write in your wiki. Do you think this would have been a good place for Ms [T] to add comments about your progress?

7. Did you use any other people to help you with working on your projects, whether parents, friends, another teacher? What kind of help was that?

8. Did you use any other forms of technology to communicate with others about your project, e.g. email, instant messaging, text messaging on your mobile, etc?

[Also ask about the use of proxies if not raised by the student].

9. I would now like to ask you about how you managed your time while completing this project. Given that most of your class time was dedicated to working on this project last term, how much time did you work on your project in class time, compared to say at home?

10. Is there anything else you would like to add about your PIP project experience?

xxxx, thank you for sharing your feedback on your PIP experience. All the best with future projects.
Appendix F

Daily schedule of data collection period
<table>
<thead>
<tr>
<th></th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td>7</td>
<td>8</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GS class handed out PIP booklet. Teacher explains to class that they will begin inquiry unit later in the week.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASKs student to complete ASSIST questionnaire by end of the week. TL has Skype debrief with researcher, providing a summary of the class activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 6</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researcher observes student Web 2.0 spaces. Teacher conducts roundtable of topic ideas with the class, then T &amp; TL, work with students individually. Teacher/TL debrief after class with researcher.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First half of lesson takes up with 2 of the GS class using the class as their audience to do a total of their GS inter-school presentation. Remainder of time students worked individually.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 6</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researcher observes student Web 2.0 spaces.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researcher observes student Web 2.0 spaces. TL takes class while T is on a PD seminar. Works with individual students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td><strong>Period 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TL takes class on using wiki, blog and social bookmarking tools to support inquiry unit. TL also hands out a referencing guide that TLs give to Yr 11-12 students for those students to use as a guide. Reminds student to complete ASSIST questionnaire by end of the week.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher takes class and outlines requirements of PIP unit. Highlights advice provided in the PIP booklet to help with the inquiry process. Last list of students complete ASSIST questionnaire. TL email summary of class activities to researcher.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td><strong>Period 5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researcher observes student Web 2.0 spaces. The class as a group spend lesson negotiating how PIP project will be assessed. Teacher/TL debrief after class with researcher. Researcher records TL Interview.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td><strong>Period 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TL takes class while T is on a PD seminar. Works with individual students. Researcher observes student Web 2.0 spaces. Researcher records Teacher Interview.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researcher observes student Web 2.0 spaces.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# September

<table>
<thead>
<tr>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td><strong>Period 2</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe student Web 2.0 spaces.&lt;br&gt;T Lia has Skype debrief with researcher, providing a summary of class activities of previous week.</td>
<td><strong>Period 3</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe student Web 2.0 spaces.</td>
<td><strong>Period 4</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe student Web 2.0 spaces.&lt;br&gt;T Lia sent email summary of what she did with the students to the researcher.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td><strong>Period 6</strong>&lt;br&gt;Researchers collect students’ Progress Report 1 &amp; 2 files.&lt;br&gt;Researchers observe students Web 2.0 spaces.</td>
<td><strong>Period 5</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe student Web 2.0 spaces.&lt;br&gt;T Lia sent email summary of what she did with the students to the researcher.</td>
<td><strong>Period 5</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe students Web 2.0 spaces.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td><strong>Period 2</strong>&lt;br&gt;Researchers observe students Web 2.0 spaces.&lt;br&gt;T Lia has Skype debrief with researcher, providing a summary of class activities of previous week.</td>
<td><strong>Period 3</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe students Web 2.0 spaces.</td>
<td><strong>Period 4</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe students Web 2.0 spaces.&lt;br&gt;T Lia sent email summary of what she did with the students to the researcher.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>Researchers observe students Web 2.0 spaces.</td>
<td><strong>Period 6</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe students Web 2.0 spaces.</td>
<td><strong>Period 5</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe students Web 2.0 spaces.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td>Researchers observe students Web 2.0 spaces.</td>
<td><strong>Period 6</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe students Web 2.0 spaces.</td>
<td><strong>Period 5</strong>&lt;br&gt;T Lia working in class with teacher and students.&lt;br&gt;Researchers observe students Web 2.0 spaces.&lt;br&gt;T Lia sent email summary of what she did with the students to the researcher.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mon</td>
<td>Tue</td>
<td>Wed</td>
<td>Thu</td>
<td>Fri</td>
<td>Sat</td>
<td>Sun</td>
</tr>
<tr>
<td>----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Researcher observes student Web 2.0 spaces.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>Period 2</td>
<td>Student PIP reports due</td>
<td></td>
<td>Period 3 Researcher observes student presentations to class.</td>
<td></td>
<td>Period 4 Researcher observes student presentations to class. Teacher/TL debrief after class with researcher.</td>
<td></td>
</tr>
<tr>
<td>Researcher observes student Web 2.0 spaces.</td>
<td></td>
<td></td>
<td>11 has debrief with researcher, providing a summary of Monday's class. and issues re student submissions of PIP reports.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>Researcher collects copies of final student projects, oral presentation artefacts, &amp; Progress Report 3.</td>
<td>Period 6 Researcher observes student presentations to class. Teacher/TL debrief after class with researcher.</td>
<td></td>
<td>Researcher collects remaining copies of final student projects, oral presentation artefacts, &amp; Progress Report 3. Researcher observes student Web 2.0 spaces.</td>
<td></td>
<td>Period 5 Researcher records Student06, Student07, Student08 exit interviews.</td>
<td></td>
</tr>
<tr>
<td>Researcher observes student Web 2.0 spaces.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>30</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period 2 Researcher records Student06, Student10 Student11 exit interviews.</td>
<td>Researcher observes student Web 2.0 spaces.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mon</td>
<td>Tue</td>
<td>Wed</td>
<td>Thu</td>
<td>Fri</td>
<td>Sat</td>
<td>Sun</td>
</tr>
<tr>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
</tr>
</tbody>
</table>

- Researcher collects marked copies of students' assignments.
- Researcher records TL Interview.
- Researcher records Teacher Interview/2.
- Researcher observes student Web 2.0 spaces.
- Researcher observes student Web 2.0 spaces.
Appendix G

Examples of ‘working profile’ for students based on demographic data
Student01 is 16 years old. When working on assignments and schoolwork at home, he uses a desktop computer of which he has sole use and his home Internet access is a broadband connection that allows for multiple users within the household. When researching for school assignments, Student01 estimates that he would normally complete the majority of his assignment at home (75%), with 20% of his assignment being completed during class time and approximately 5% when in the school library.

When working on school projects and assignments, he says that “finding relevant information” is usually the main problem or frustration he experiences. However, when working on these in the school library he stated that he doesn't have much contact with the TL, he would normally check with his teacher to see “if I am heading in the right direction”. This suggests a lack of understanding of the potential of, or previous experience with, the TL’s role in supporting student learning.

When asked about his experience using blogs, wikis or social bookmarking tools for either personal use or to complete school work, he stated that while he hadn’t used blogs for school-related purposes, he has used blogs for his own personal use. He has used wikis for both school work and for personal reasons, and he commented that he “liked using” the wiki he made for a school project. However, he hasn’t used social bookmarking tools (like del.icio.us) ever before.
**Student02**

Student02 is 15 years old. When working on assignments and schoolwork at home, she uses a computer with wireless broadband access which all members of her family share. When working on school assignments, Student02 estimates that she would normally complete the majority of his assignment at home (70%), with 20% of her assignment being completed during class time and approximately 10% when in the school library.

She normally finds “different research applications” and “due dates” to be the most challenging or frustrating things when working on school projects and assignments.

When working on projects and assignments in the school library, the tasks Student02 would ask the TL to help her with include, “things like where the printers are, or how to use the help surveys, find a book etc”, whereas “Depending on what we're working on” she would usually ask help from her teacher about “the task at hand”.

With regard to her experiences using Web 2.0 technologies, she stated that she had used a blog for school work in Global Studies to “show a diary/sequence of events”, uses a blog in MySpace “for personal uses”, and has used a wiki for school work in Global Studies before, but hasn’t ever used social bookmarking tools like del.icio.us.
Appendix H
Coding and scoring schedule for ASSIST data from
student questionnaire
CODING & SCORING SCHEDULE FOR ASSIST DATA

The procedures outlined below are based on the instructions provided by *Scoring Key for the Approaches and Study Skills Inventory for Students (ASSIST)* (Centre for Research on Learning and Instruction, University of Edinburgh, 1997) at http://www.etl.tla.ed.ac.uk/questionnaires/ASSIST.pdf

Students respond to learning inventory items on a 1 - 5 scale (5 high) with the recommendation for students not use the rating ‘Unsure’ (value = 3). The legend to the survey data relating to the ASSIST instrument was converted from:

<table>
<thead>
<tr>
<th>Value</th>
<th>Value Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>2</td>
<td>Agree</td>
</tr>
<tr>
<td>3</td>
<td>Disagree</td>
</tr>
<tr>
<td>4</td>
<td>Strongly disagree</td>
</tr>
</tbody>
</table>

and converted for SPSS to align with ASSIST scoring scale to:

<table>
<thead>
<tr>
<th>Value</th>
<th>Value Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strongly disagree</td>
</tr>
<tr>
<td>2</td>
<td>Disagree</td>
</tr>
<tr>
<td>3</td>
<td>Unsure</td>
</tr>
<tr>
<td>4</td>
<td>Agree</td>
</tr>
<tr>
<td>5</td>
<td>Strongly agree</td>
</tr>
</tbody>
</table>

The above conversion ensured values were consistent with the ASSIST calculation of scores as per the ‘Scoring Key for the Approaches and Study Skills Inventory for Students (ASSIST)’ by Entwistle and Tait (1997).

Sub-scale scores were then formed by adding together the responses on the items in each sub-scale. Each item was set as a variable (e.g., D04 = Deep item 4), and then a sub-scale total was produced by creating a new variable summing the items. For example, Seeking Meaning (SM) = D04 + D17 +D30 + D43. Then the approaches were created in the same way, e.g., Deep Approach (DA) = SM + RI + UE + II, as presented in the schedule (below).

Scores on the three main approaches of deep, strategic and surface were then created by adding together the sub-scale scores which contribute to each approach. Scoring was carried out using SPSS 14.0 for Windows (version 14.0.2).
DEEP APPROACH (DPA)
All statements representing a deep item were coded with a D, e.g., D04= Deep item 4. A deep approach consists of four (4) sub-scales: Seeking Meaning (SM), Relating Ideas (RI), Use of Evidence (UE) and Interest in Ideas (II). Each sub-scale was firstly calculated.

Seeking meaning (SM)
D04. I usually set out to understand for myself the meaning of what we have to learn.
D17. When I read an article or book, I try to find out for myself exactly what the author means.
D30. When I am reading I stop from time to time to reflect on what I am trying to learn from it.
D43. Before tackling a problem or assignment, I first try to work out what lies behind it.
SM = D04 + D17 + D30 + D43
In SPSS, a variable called SM was created, and the sub-scale total per student was created using the ‘Transform’ and ‘Compute’ functions.

Relating ideas (RI)
D11. I try to relate ideas I come across to those in other topics or other courses whenever possible.
D21. When I’m working on a new topic, I try to see in my own mind how all the ideas fit together.
D33. Ideas in books or articles for this subject often set me off on long chains of thought of my own.
D46. I like to play around with ideas of my own even if they don’t get me very far.
RI = D11 + D21 + D33 + D46
In SPSS, a variable called RI was created, and the sub-scale total was added per student.

Use of evidence (UE)
D09. I look at the evidence carefully and try to reach my own conclusion about what I’m studying.
D23. Often I find myself questioning things I hear in class or read in books.
D36. When I read, I examine the details carefully to see how they fit in with what’s being said.
D49. It’s important for me to be able to follow the argument, or to see the reason behind things.
UE = D09 + D23 + D36 + D49
In SPSS, a variable called UE was created, and the sub-scale total was added per student.

Interest in ideas (II) (Related sub-scale)
D13. Regularly I find myself thinking about ideas discussed in class when I’m doing other things.
D26. I find that studying academic topics can be quite exciting at times.
D39. Some of the ideas I come across in this subject I find really gripping.
D52. I sometimes get ‘hooked’ on academic topics and feel I would like to keep on studying them.
II = D13 + D26 + D39 + D52
In SPSS, a variable called II was created, and the sub-scale total was added per student.
To gain a complete Deep Approach score, in SPSS, a variable called DPA was created, and the sub-scale totals were added per student, i.e., DPA = SM + RI + UE + II

**STRATEGIC APPROACH (STA)**

All statements representing a strategic item were coded with an ST, e.g. ST01 = Strategic item 1. A strategic approach consists of five (5) sub-scales: Organised Studying (OS), Time Management (TM), Alertness to Assessment Demands (AA), Achieving (A) and Monitoring effectiveness (ME). Each sub-scale was firstly calculated.

**Organised studying (OS)**

ST01. I manage to find conditions for studying which allow me to get on with my work easily.
ST14. I think I’m quite systematic and organised when it comes to revising for exams.
ST27. I’m good at following up some of the reading suggested by my teachers or teacher librarians.
ST40. I usually plan out my week’s work in advance in my head or by writing it down.

OS = ST01 + ST14 + ST27 + ST40

In SPSS, a variable called OS was created, and the sub-scale total was added per student.

**Time management (TM)**

ST05. I organise my study time carefully to make the best use of it.
ST18. I’m pretty good at getting down to work whenever I need to.
ST31. I work steadily through the term, rather than leave it all until the last minute.
ST44. I generally make good use of my time during the day.

TM = ST05 + ST18 + ST31 + ST44

In SPSS, a variable called TM was created, and the sub-scale total was added per student.

**Alertness to assessment demands (AA)**

ST02. When working on an assignment, I’m keeping in mind how best to impress the teacher.
ST15. I look carefully at teachers’ comments on my school work to see how to get higher marks next time.
ST28. I keep in mind who is going to mark an assignment and what they’re likely to be looking for.
ST41. I keep an eye open for what teachers seem to think is important and concentrate on that.

AA = ST02 + ST15 + ST28 + ST41

In SPSS, a variable called AA was created, and the sub-scale total was added per student.

**Achieving (AC) (Related sub-scale)**

ST10. It’s important for me to feel that I’m doing as well as I really can on my subjects at school.
ST24. I feel that I’m getting on well, and this helps me put more effort into the work.
ST37. I put a lot of effort into studying because I’m determined to do well.
ST50. I don’t find it at all difficult to motivate myself.

AC = ST10 + ST24 + ST37 + ST50

In SPSS, a variable called AC was created, and the sub-scale total was added per student.

**Monitoring effectiveness (ME) (Related sub-scale)**
ST07. I go over the work I’ve done carefully to check the reasoning and that it makes sense.
ST20. I think about what I want to get out of this class, to keep my studying well focused.
ST34. Before starting work on an assignment or exam question, I think first how best to tackle it.
ST47. When I finish a piece of work, I check it through to see if it really meets the requirements.
ME = ST07 + ST20 + ST34 + ST47
In SPSS, a variable called ME was created, and the sub-scale total was added per student.

To gain a complete Strategic Approach score, in SPSS, a variable called STA was created, and the sub-scale totals were added per student, i.e., STA = OS + TM + AA + AC + ME

SURFACE APPROACH (SAA)
All statements representing a surface item were coded with an SA, e.g., SA03= Surface item 3. A surface approach consists of four (4) sub-scales: Lack of Purpose (LP), Unrelated Memorising (UM), Syllabus-boundness (SB) and Fear of Failure (FF). Each sub-scale was firstly calculated.

Lack of purpose (LP)
SA03. Often I find myself wondering whether the work I am doing here is really worthwhile.
SA16. There’s not much work in this subject that I find interesting or relevant.
SA29. When I look back, I sometimes wonder why I ever decided to do this subject.
SA42. I’m not really interested in this subject, but I have to take it for other reasons.
LP = SA03 + SA16 + SA29 + SA42
In SPSS, a variable called LP was created, and the sub-scale total was added per student.

Unrelated memorising (UM)
SA06. I find I have to concentrate on just memorising a good deal of what I have to learn.
SA19. Much of what I’m studying makes little sense: it’s like unrelated bits and pieces.
SA32. I’m not really sure what’s important in class so I try to get down all I can.
SA45. I often have trouble in making sense of the things I have to remember.
UM = SA06 + SA19 + SA32 + SA45
In SPSS, a variable called UM was created, and the sub-scale total was added per student.

Syllabus-boundness (SB)
SA12. I tend to read very little beyond what is actually required to pass.
SA25. I concentrate on learning just those bits of information I have to know to pass.
SA38. I gear my studying closely to just what seems to be required for assignments and exams.
SA51. I like to be told precisely what to do in essays or other assignments.
SB = SA12 + SA25 + SA38 + SA51
In SPSS, a variable called SB was created, and the sub-scale total was added per student.

Fear of failure (FF) (Related sub-scale)
SA08. Often I feel I’m drowning in the sheer amount of material we’re having to cope with.
SA22. I often worry about whether I’ll ever be able to cope with the work properly.
SA35. I often seem to panic if I get behind with my work.
SA48. Often I lie awake worrying about work I think I won’t be able to do.

**FF = SA08 + SA22 + SA35 + SA48**

In SPSS, a variable called FF was created, and the sub-scale total was added per student.

To gain a complete Surface Approach score, in SPSS, a variable called SAA was created, and the sub-scale totals were added per student, i.e., **SAA = LP + UM + SB + FF**
Appendix I

Types of codes with examples
Example I.1: Categories and subcategories as *descriptive* and *pattern* codes

<table>
<thead>
<tr>
<th>Category (descriptive code)</th>
<th>Subcategory (pattern code)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>blog (bg)</strong></td>
<td>Identifies use of the blog, issues or problems with the blog</td>
</tr>
<tr>
<td><strong>blog as a communication tool (bg_com)</strong></td>
<td>Use of the blog as a communication tool between the student, teacher, TL and others</td>
</tr>
<tr>
<td><strong>blog as a knowledge construction tool (bg_kc)</strong></td>
<td>Use of the blog as a knowledge construction (KC) tool, where students document their thinking, develop their ideas.</td>
</tr>
<tr>
<td><strong>blog as a publishing tool (bg_pub)</strong></td>
<td>Students' use of a blog to publish their work for an audience other than themselves. Could include all of their final project as a published piece on the blog or parts of their final project work.</td>
</tr>
<tr>
<td><strong>blog as a tool for self-reflection (bg_sf)</strong></td>
<td>Students' use of the blog as a tool for self-reflection, recording feelings, problems, troubleshooting.</td>
</tr>
<tr>
<td><strong>del.icio.us (social bookmarking tool) (del)</strong></td>
<td>Use of del.icio.us as a web-based bookmarking tool to support students' PIPs</td>
</tr>
<tr>
<td><strong>de.icio.us as a communication tool (del_com)</strong></td>
<td>Use of de.icio.us as a communication tool, resource sharing tool between students, teacher, TL and others</td>
</tr>
<tr>
<td><strong>de.icio.us as a repository tool (del_rep)</strong></td>
<td>Identifies use of de.icio.us as a repository or information collection tool, or storage space for ideas, quotes, bibliographic data for references etc.</td>
</tr>
<tr>
<td><strong>wiki (wk)</strong></td>
<td>Identifies use of the wiki, issues or problems with the wiki.</td>
</tr>
<tr>
<td><strong>wiki as a communication tool (wk_com)</strong></td>
<td>Use of the wiki as a communication tool between the student, teacher, TL and others.</td>
</tr>
<tr>
<td><strong>wiki as a knowledge construction tool (wk_kc)</strong></td>
<td>Use of the wiki as a knowledge construction (KC) tool, where students document their thinking, develop their ideas. Use also when coding wiki pages to identify examples of KC using wiki 'history' function that compares content of pages through revisions.</td>
</tr>
<tr>
<td><strong>wiki as a publishing tool (wk_pub)</strong></td>
<td>Students' use of wiki to publish their work for an audience other than themselves. Could include all of their final project as a published piece on the wiki or parts of their final project work.</td>
</tr>
<tr>
<td><strong>wiki as a repository tool (wk_rep)</strong></td>
<td>Identifies use of the wiki as a repository or information collection tool, or storage space for documents, ideas, quotes, bibliographic references etc.</td>
</tr>
<tr>
<td><strong>wiki as a tool for self-reflection (wk_sf)</strong></td>
<td>Students' use of the wiki as a tool for self-reflection, recording feelings, problems, troubleshooting.</td>
</tr>
<tr>
<td><strong>wiki as a project management tool (wk_pm)</strong></td>
<td>Use of wiki as a project management tool using a calendar plug-in - planning, recording and reflecting on tasks. Used to also record log reflections.</td>
</tr>
<tr>
<td><strong>wiki as a data collection &amp; analysis tool (wk_dca)</strong></td>
<td>Use of wiki to collect data from primary research phase of their project, and use as a platform to analyse data including counts, calculation of percentages, collation of qualitative survey responses, interview responses, etc. Also used as a platform to develop data collection instruments such as surveys, interview questions.</td>
</tr>
</tbody>
</table>
Example 1.2: Subcategories as *in vivo* and *inferential* codes a category

**reasons for choice of ICTs used (ch_ict)**
Identifies reasons why students, teacher & TL select to use specific ICT tools to complete particular tasks. Also includes reasons why they decide not to use a tool.

- **accessibility (ch_ict_acc)**
  Student, teacher and TL decision to use a specific ICT tool (or not) due to levels of access. Incl. accessibility in-school, at home & across other PC points.

- **convenience (ch_ict_conv)**
  Student, teacher and TL decision to use a specific ICT tool because they believe it to be the most convenient tool available to them to complete a task vs not using a tool because of lack of convenience.

- **ease of use (ch_ict_eou)**
  Student, teacher and TL decision to use a specific ICT tool because they find it easy to use (in terms of technical use of the tool) vs not using a tool because they find it difficult to use.

- **familiarity (ch_ict_fam)**
  Student, teacher and TL decision to use a specific ICT tool because they are familiar with using it, or lack of familiarity leads a participant to decide to not use a particular tool.

- **return on investment (ch_ict_roi)**
  Student, teacher and TL decision to use a specific ICT tool because they believe it provides the best value for them in terms of ROI of time, energy etc vs not using a tool because they feel they get no or little ROI as a result of using it.

- **time pressures (ch_ict_tp)**
  Student, teacher and TL decision not to use a specific ICT tool because they feel they have little or no time to invest in using its features, or getting to know a new ICT program. Revert to another tool or non-ICT method to complete the task instead.

- **utility (ch_ict_ut)**
  Student, teacher and TL decision to use a specific ICT tool because they see the utility of it, ie. it is the tool that will best meet their needs, is viewed as most effective and/or efficient to get the job done vs not seeing the utility of a tool.
Example I.3: Axial coding with category, subcategories and dimensions

**ict experience (ictxp)**
Participants’ experiences of using ICTs, incl. previous & successful use, adoption & regularity of use, mental models of ICTs, integration into the curriculum. Create relationship with ‘ict expertise’ as experiences with ICTs contributes to development of one’s expertise in ICT use.

**levels of use (ictxp_lou)**
Examines the different levels and success (or lack of success) participants’ using ICTs, and how these impact on their use and non-use.

- **previous use (ictxp_lou_pu)**
  Identifies examples of participants’ previous experiences with using ICTs, and how these impact on their future use.

- **regular use (ictxp_lou_ru)**
  Identifies when participants’ regularly use an ICT, reasons behind this use, and how these impact on their future or continued use. Also incl. ICT adoption as part of either personal or work toolkit, incl. integrated use within the curriculum.

- **successful use (ictxp_lou_su)**
  Identifies how the levels of success participants’ have using ICTs impact on their future use.

**mental models of ICTs (ictxp_mm)**
Examines participants’ mental models of Internet & Web2.0 technologies and how this impacts on their use (or lack of) and adoption of ICTs.

- **enrichment (ictxp_mm_rich)**
  Examines participants’ mental models of Internet & Web2.0 technologies in terms of them seeing these as enriching or enhancing people’s personal and working lives.

- **technical (ictxp_mm_tech)**
  Examines participants’ mental models of Internet & Web 2.0 technologies which is principally in technical terms.

- **vague (ictxp_mm_vag)**
  Examines participants’ mental models of Internet & Web2.0 technologies, which are principally described or expressed with vagueness, and shows a lack of understanding.
Appendix J
Final version of the coding schedule
affective dimensions of project experience (aff)
Identifies the affective dimensions of participants throughout the completion of students' Personal Interest Projects (PIPs).

levels of focus (aff_foc)
Identifies students' levels of focus and commitment to tasks and processes versus vagueness or lack of focus.

levels of frustration (aff_fru)
Identifies levels of frustration with tasks, people, processes, students' own performance etc.

levels of interest (aff_int)
Identifies the level of interest a student has in the project in general or with specific tasks within the project. Incl. lack of interest, boredom, disconnected, distracted vs highly interested, engaged, 'on task', connected, motivated etc

levels of satisfaction (aff_sat)
Identifies levels of satisfaction with tasks, processes, help provided, project in general. Levels incl. happy, satisfied vs unhappy, dissatisfied, disappointment

levels of uncertainty (aff_unc)
Examines the affective dimension of uncertainty, students' levels of uncertainty versus being confident with their ideas, choices, tasks etc

when using ICT (aff_ict)
The affective dimensions experienced by students, teacher and TL while using ICT, or thinking about using ICTs. Could include fear of 'the new' vs excitement/optimism for new ICTs; or expressions of confidence vs lack of re using ICTs

blog (bg)
Identifies use of the blog, issues or problems with the blog

blog as a communication tool (bg_com)
Use of the blog as a communication tool between the student, teacher, TL and others
blog as a knowledge construction tool (bg_kc)
Use of the blog as a knowledge construction (KC) tool, where students document their thinking, develop their ideas.

blog as a publishing tool (bg_pub)
Students’ use of a blog to publish their work for an audience other than themselves. Could include all of their final project as a published piece on the blog or parts of their final project work.

blog as a tool for self-reflection (bg_sf)
Students’ use of the blog as a tool for self-reflection, recording feelings, problems, troubleshooting.

components of the inquiry learning process (comp_ilp)
Explores key components of the inquiry learning process.

finding relevant information (comp_ilp_find)
Identifies aspects of how students search for information and make decisions about the relevancy and accuracy of the information they find within the inquiry learning process.

copy & paste (comp_ilp_find_c&p)
Identifies where students have copied & pasted full text from electronic resources and stored these ‘chunks of information’, to use to write up their project report.

focus formulation (comp_ilp_ff)
Identifies aspects of how students formulate their focus within the inquiry learning process, incl. narrowing their topic, and developing a specific research question.

knowledge construction (comp_ilp_kc)
Identifies aspects of knowledge construction within the inquiry learning process, incl. dealing with conflicting information, differing opinions, problematic knowledge.

project presentation (comp_ilp_pp)
Identifies aspects of how students present their project as part of the inquiry learning process, includes decisions made regarding the most appropriate form of presentation to use and the processes involved in creating their presentation.
research process (comp_ilp_rp)
Identifies aspects of the research process that may occur within the inquiry learning process, incl. creation of a research process; primary research - research methodology, data collection techniques, data analysis, reporting findings.

topic selection (comp_ilp_ts)
Identifies aspects of topic selection within the inquiry learning process, incl. reasons for choice of topic, motivations, drawing upon previous knowledge and building background knowledge to inform the selection of a topic.

evaluation & reflection (comp_ilp_er)
Identifies aspects those aspects within the inquiry learning process where either students or the teacher or TL evaluate and assess student progress and project reports/documents, as well as students' reflections of their learning throughout the inquiry process (incl. progress reports and learning logs) and teacher/TL reflection on the inquiry process and design of the inquiry unit.

del.icio.us (social bookmarking tool) (del)
Use of del.icio.us as a web-based bookmarking tool to support students’ PIPs

del.icio.us as a communication tool (del_com)
Use of del.icio.us as a communication tool, resource sharing tool between students, teacher, TL and others

del.icio.us as a repository tool (del_rep)
Identifies use of del.icio.us as a repository or information collection tool, or storage space for ideas, quotes, bibliographic data for references etc.

dimensions of inquiry learning process (dim_ilp)
Inquiry learning is examined as both a process and learning experience, includes the notion of an information to knowledge journey, and is a complex mix of inquiry as a learning process, the research process and information processing.

curriculum requirements of an inquiry learning unit of work (dim_ilp_cur)
Examines the curriculum requirements & learning outcomes of an IL unit of work
assessment of project and IL process
(dim_ilp_cur_ass)
Examines aspects of the assessment of students' Personal Interest Project (PIP) & inquiry learning process, incl. how the assessment was developed & its content, assessment process, problems with assessment, and students' understanding of it.

assignment design (dim_ilp_cur_des)
Examines the components of assignment design in creating an IL unit of work

evidence of the IL process
(dim_ilp_cur_evid)
Examines evidence provided by students' of their own personal inquiry learning experience, process, issues, artefacts etc

metacognition and reflection of the IL process (dim_ilp_meta)
Examines student awareness of meeting assessment criteria (also create relationship link to dim_ilp_cur_ass); lessons learned as a result of experiencing IL process; alternative approaches identified by students as a result of hindsight.

pedagogy of inquiry learning
(dim_ilp_ped)
Examines teacher's, TL's & students' understanding of IL (both explicit & implicit), incl. exploring ILP as a 24/7 learning process; examines the language of the ILP as used by participants (ie. consistent & coherent, or lack of, language used re ILP.

structure of the IL process
(dim_ilp_str)
Examines participants' experience of the inquiry learning process and how they cope with it. While it can be a structured process, it can also be an organic process (eg. tensions between project timeline vs actual students' IL experience). Has a relationship with 'pms'.

feedback loop (fbl)
Identifies different aspects of the provision and receipt of feedback between students, teachers and TLs. Relates to all 3 main concepts of ICT & Web 2.0 technologies, learning teams, and inquiry learning. Create r'ship btwn this & dim_ilp.

good example (gex)
Identifies a good example of ICT use, information behaviour or skill, to be used to illustrate examples of effective learning using Web 2.0 tools, that I think could be included in my thesis.
good quote (gq)
Identifies quotes in interviews or recordings of students' orals etc. that can be used in my thesis to illustrate key points, issues, etc.

ict access (ict_acc)
Identifies factors regarding ICT access that acts as either an inhibitor or an enabler to the effective access and use of ICTs to support learning, communication etc. Create relationship between this code and 'ict use' and 'choice of ict's' nodes.

home related issues (ict_acc_hm)
Issues that students experience regarding access to ICTs and the Internet when doing school work from home, incl. PC ownership (refer to PartB survey responses); PC quality in terms of age, speed etc.; & type of Internet access at home, speed, availability.

school network issues (ict_acc_sn)
These incl. different locations (in class, school library, boarding house, remote access) and levels of up-to-dateness of ICTs throughout the school that provide either less or greater access, also filtering issues such as blocked sites & use of proxies.

ict experience (ictxp)
Participants' experiences of using ICTs, incl. previous & successful use, adoption & regularity of use, mental models of ICTs, integration into the curriculum. Create relationship with 'ict expertise' as experiences with ICTs contributes to development of one's expertise in ICT use.

levels of use (ictxp_lou)
Examines the different levels and success (or lack of success) participants' using ICTs, and how these impact on their use and non-use.

previous use (ictxp_lou_pu)
Identifies examples of participants' previous experiences with using ICTs, and how these impact on their future use.

regular use (ictxp_lou_ru)
Identifies when participants’ regularly use an ICT, reasons behind this use, and how these impact on their future or continued use. Also incl. ICT adoption as part of either personal or work toolkit, incl. integrated use within the curriculum.

**Successful use (ictxp_lou_su)**
Identifies how the levels of success participants’ have using ICTs impact on their future use.

**Mental models of ICTs (ictxp_mm)**
Examines participants’ mental models of Internet & Web2.0 technologies and how this impacts on their use (or lack of) and adoption of ICTs.

**Enrichment (ictxp_mm_rich)**
Examines participants’ mental models of Internet & Web2.0 technologies in terms of them seeing these as enriching or enhancing people’s personal and working lives.

**Technical (ictxp_mm_tech)**
Examines participants’ mental models of Internet & Web 2.0 technologies which is principally in technical terms.

**Vague (ictxp_mm_vag)**
Examines participants’ mental models of Internet & Web2.0 technologies, which are principally described or expressed with vagueness, and shows a lack of understanding.

**ICT Leadership (ictlead)**
Examples of students, teacher, TL & others providing leadership in use of ICTs, incl. conducting staff development, modelling, troubleshooting, and being a source of information regarding ICTs. This is an indicator of ICT expertise, so create a relationship between them.

**ICT Training (icttr)**
Identifies the types of training in ICTs students, teacher & TL have received, and examines who has provided them with this.

**Colleagues (icttr_coll)**
How the knowledge and skills of colleagues and class mates has helped inform participants’ ICT expertise.

**Family (icttr_kin)**
How the knowledge and skills of the family members has helped develop participants’ ICT expertise.

**Friends (icttr_fri)**
How the knowledge and skills of the friends has helped develop participants' ICT expertise.

in_house (icttr_inh)
In-house, school-based training participants have completed to develop their ICT expertise.

professional reading (icttr_pr)
How professional reading has contributed to development of participants' ICT expertise.

teacher (icttr_tch)
How the knowledge and skills of the class teacher has contributed to the development of participants' ICT expertise.

teacher librarian (icttr_tl)
How the knowledge and skills of the TL has contributed to the development of participants' ICT expertise.

independent learning (ind)
Concept of independence, incl. conceptions of independent learning and expectations of students as independent learners.

conceptions of independent learning (con_ind)
Includes differing conceptions of independent learning and how these impact on the inquiry learning process and dynamics of learning teams. Examine concept of independence as abandonment vs need for support being viewed as dependence.

expectations of students as independent learners (expect_ind)
Expectations of students as independent learners, incl. expectations of teacher, TL and students of each member of the learning team.

instruction in inquiry learning process (instruct_ilp)
Examines types of instruction the teacher & TL provides students throughout the inquiry learning process, and their management of the process.

formulating a focus (instruct_ilp_ff)
Identifies support in helping students formulate a focus as a type of instruction in the inquiry learning process. Incl. where students seek help from others when T & TL are not available.

ict support (instruct_ilp_ict)
Identifies ICT support as a type of instruction in the inquiry learning process. Incl. where students seek help from others when T & TL are not available.

**knowledge construction** *(instruct_ilp_kc)*

Identifies knowledge construction support as a type of instruction in the inquiry learning process. Incl. where students seek help from others when T & TL are not available.

**project management** *(instruct_ilp_pms)*

Identifies different kinds of help given in supporting students' project management skills, as a type of instruction in the inquiry learning process. Create a relationship between this and 'pms' node.

**resource support** *(instruct_ilp_res)*

Identifies resource support as a type of instruction in the inquiry learning process. Has a relationship with comp_ilp_find code. Incl. where students seek help from others when T & TL are not available.

**topic selection** *(instruct_ilp_ts)*

Identifies support given to student while trying to select a topic for their PIP, as a type of instruction in the inquiry learning process. Incl. where students seek help from others when T & TL are not available.

**management of the IL process** *(instruct_ilp_man)*

Examines the way the teacher & TL manage the inquiry learning process of students, incl. T & TL monitoring student progress for initiating instruction; and tools used to help achieve this, eg. progress reports, wikis, blogs, del.icio.us.

**research process** *(instruct_ilp_rp)*

Incl. aspects of the original research component of the student PIPs, ie. creation of surveys, devising interview questions, and other data collection and analysis.

**learning styles (ls)**

Identifies behaviours which represent different learning styles according to Entwistle et al.'s ASSIST inventory (approaches to learning) & Heinstrom's analysis of deep, strategic & surface learners as information users.

**deep approach** *(ls_dpa)*
strategic approach (ls_sta)

surface approach (ls_saa)

learning teams (lts)
Exames each student with the teacher and TL as a learning team, and explores relationship dynamics, the experience each member brings to the learning team and the roles they play. Create relationship between this and 'instructional leadership' as well as 'ict leadership'.

expertise (lts_expert)
Includes dimensions of participants' expertise that they bring to a learning team. Create relationship with 'learning teams - roles'.

disciplinary knowledge (lts_expert_dk)
Includes the types of disciplinary knowledge teacher & TL bring to the learning team, incl. Global studies/International relations; Legal studies; Geography, economics, history; English; resource-based learning, information processing; info ethics; Educational technologies.

knowledge of curriculum (lts_expert_koc)
Identifies what expertise the teacher & TL bring to the learning team in terms of their knowledge of curriculum, incl. knowledge outcomes, skill outcomes, values outcomes.

knowledge of process (lts_expert_kop)
Identifies what expertise the teacher & TL bring to the learning team in terms of their knowledge of process, incl. research process, information processing, knowledge generation. Create relationship with 'independent learning' node.

pedagogical knowledge (lts_expert_pedk)
Identifies what expertise the teacher & TL bring to the learning team in terms of their pedagogical knowledge, incl. learning through inquiry, learning through information, learning through ICTs, critical thinking, learning styles.

roles within learning teams (lts_roles)
Identifies the different roles the students, teacher, TL and others play within each learning team.

instructional leadership (lts_roles_instruct_lead)
Identifies the instructional leadership roles of students, teacher, TL and others play within each learning team. This may be prescribed by or within the school, library or classroom systems.

negotiated (lts_roles_neg)
Identifies the different roles the students, teacher, TL and others play within each learning team which are negotiated between learning team members. Often informal roles.

prescribed by or within system (lts_roles_sys)
Identifies the different roles the students, teacher, TL and others play within each learning team which are prescribed by or within the school, library or classroom systems. Often formally recognised roles.

points of intervention (poi)
Types or phases of teacher & TL instructional intervention with students. Could also include student or other person providing the assistance. Assistance could also be static, eg. GS workbook instructions or dynamic, eg. intervention at point-of-need.

consolidation (poi_consol)
Types of intervention provided by TL, teacher, student or others to a student when they are trying to consolidate the completion of their PIP, where they are seeking confirmation that what they have done meets assessment criteria, supports closure.

diagnosis (poi_dg)
Examples of diagnosis, where a student's need for intervention is diagnosed by either the teacher, TL or student.

initiation (poi_init)
Examples of initiation, where either a student, teacher or TL initiates some form of instruction to help a student overcome an obstacle, troubleshoot a problem.

project management skills (pms)
Identifies aspects relating to students' project management skills (PMSs), or lack of; students' need for support in developing PMSs - relates specifically in terms of inquiry learning process. Create relationship with 'dimensions of the IL process' node.
organisation (pms_org)
Includes aspects regarding students' skills and strategies to organise themselves or stages within the inquiry learning process to make progress.

word count (pms_org_wc)
Identifies where students refer to the word count of the project as an indicator of progress.

planning (pms_plan)

recording (pms_rec)
Incl. recording of bibliographic data throughout the project for later preparation of compiling a complete bibliography.

time management (pms_tm)
Incl. student use of time, whether effective use or not, during class time on their PIPs, as well as management of their time throughout the whole IL process.

reasons for choice of ICTs used (ch_ict)
Identifies reasons why students, teacher & TL select to use specific ICT tools to complete particular tasks. Also includes reasons why they decide not to use a tool.

accessibility (ch_ict_acc)
Student, teacher and TL decision to use a specific ICT tool (or not) due levels of access. Incl. accessibility in-school, at home & across other PC points.

convenience (ch_ict_conv)
Student, teacher and TL decision to use a specific ICT tool because they believe it to be the most convenient tool available to them to complete a task vs not using a tool because of lack of convenience.

ease of use (ch_ict_eou)
Student, teacher and TL decision to use a specific ICT tool because they find it easy to use (in terms of technical use of the tool) vs not using a tool because they find it difficult to use.

familiarity (ch_ict_fam)
Student, teacher and TL decision to use a specific ICT tool because they are familiar with using it, or lack of familiarity leads a participant to decide to not use a particular tool.

return on investment (ch_ict_roi)
Student, teacher and TL decision to use a specific ICT tool because they believe it provides the best value for them in terms of ROI of time, energy etc vs not using a tool.
because they feel they get no or little ROI as a result of using it.

time pressures (ch_ict_tp)
Student, teacher and TL decision not to use a specific ICT tool because they feel they have little or no time to invest in using its features, or getting to know a new ICT program. Revert to another tool or non-ICT method to complete the task instead.

utility (ch_ict_ut)
Student, teacher and TL decision to use a specific ICT tool because they see the utility of it, ie. it is the tool that will best meet their needs, is viewed as most effective and/or efficient to get the job done vs not seeing the utility of a tool.

relationship dynamics (rd)
Is the concept that includes the categories of building relationships, conceptions (incl misconceptions) about relationships, teams & partnerships; synergies; and systems impacts on relationship dynamics.

building relationships (rd_br)
Includes the different dimensions of building relationships, incl. initiating/creating new relationships; maintaining existing relationships; success (or not) of relationships; rules of engagement within relationships; and boundaries that define relationships.

conceptions about relationships (rd_con)
Different conceptions of relationships, teams, partnerships and dimensions which shape these, incl. different expectations & perceptions, past experiences, different interpretations of an issue/idea/topic, different motivations.

synergies (rd_syn)
Identifies synergies that contribute to relationship dynamics, incl. reciprocity btwn initiator/respondent (incl. relationship to 'feedback loop' code); alignment; willingness to negotiate; levels of trust; & community building.

systems impacts (rd_sys)
Looks at factors such as school structures, school policies, timetabling, in & out of class time that impact on the ability of individuals to develop & maintain relationships. These may act as enablers or inhibitors.

rules of engagement (roe)
Incl. participants understanding of teacher, TL & student roles in the inquiry process. Create relationship with ‘instruction in ILP’ node. Also relates to relationship ‘relationship dynamics’ incl. formal, informal, systemic, negotiated, school/classroom/library cultures.

types of ict tools (tools)
Identifies different types of ICT tools used by participants

email (tools_em)
Refers to participants use of email for communication and transfer of files to/from school & home. Incl. reasons for using this as a preferred ICT tool over other tools available.

instant messaging (tools_im)
Refers to participants use of instant messaging & chat to communicate with others. Incl. reasons for using this as a preferred ICT tool over other tools available.

other Web 2.0 tools (tools_other)
Refers to participants’ use of any Web 2.0 tools other than wikis, blogs & del.icio.us, eg. MySpace, Facebook, Twitter. Incl. discussion of different functionalities, and reasons for using one tool as a preferred ICT tool over other tools available.

presentation software (tools_pres)
Identifies the different types of technologies students used to create presentations to support their PIP reports.

printer (tools_print)
Refers to participants’ choice/preference to print work out for editing purposes or when seeking feedback from others, and reasons for using this method as a preferred ICT strategy.

search engines (tools_se)
Refers to participants use of search engines as an ICT tool. Incl. comments about participants' preferences for particular search engines over other SEs available.

voip (tools_voip)
Refers to participants use of VOIP for communication with others, eg. Skype. Incl. reasons for using this as a preferred ICT tool over other tools available.

Microsoft Office tools (tools_off)
Incl. preference to use Word, Excel and/or Powerpoint as tools to support students’ learning throughout IL process.

web proxies (tools_prx)
Use of web proxies to access blocked sites from the school’s filtering system.

library catalogue/databases (tools_lib)
Use of the library catalogue and/or online indexes & databases as ICT tools. Relate to tools_se

online survey tools (tools_surv)
Use of online survey tools, incl. Reason why this was preferred ICT tools over other tools or methods.

wiki (wk)

wiki as a communication tool (wk_com)
Use of the wiki as a communication tool between the student, teacher, TL and others.

wiki as a knowledge construction tool (wk_kc)
Use of the wiki as a knowledge construction (KC) tool, where students document their thinking, develop their ideas. Use also when coding wiki pages to identify examples of KC using wiki ‘history’ function that compares content of pages through revisions.

wiki as a publishing tool (wk_pub)
Students' use of wiki to publish their work for an audience other than themselves. Could include all of their final project as a published piece on the wiki or parts of their final project work.

wiki as a repository tool (wk_rep)
Identifies use of the wiki as a repository or information collection tool, or storage space.
for documents, ideas, quotes, bibliographic references etc.

**wiki as a tool for self-reflection (wk_sf)**
Students' use of the wiki as a tool for self-reflection, recording feelings, problems, troubleshooting.

**wiki as a project management tool (wk_pm)**
Use of wiki as a project management tool using a calendar plug-in - planning, recording and reflecting on tasks. Used to also record log reflections.

**wiki as a data collection & analysis tool (wk_dca)**
Use of wiki to collect data from primary research phase of their project, and use as a platform to analyse data including counts, calculation of percentages, collation of qualitative survey responses, interview responses, etc. Also used as a platform to develop data collection instruments such as surveys, interview questions.
Appendix K

Example of memo writing as an analytic technique
Memo on independent learning and subcategories

Scope of ‘independent learning’ code: Concept of independence, including conceptions of independent learning and expectations of students as independent learners.

Two subcategories have emerged (so far) from the data:

- conceptions of independent learning (con_ind)
  Includes differing conceptions of independent learning and how these impact on the inquiry learning process and dynamics of learning teams. Examine concept of independence as abandonment vs need for support being viewed as dependence.

- expectations of students as independent learners (expect_ind)
  Expectations of students as independent learners, incl. expectations of teacher, TL and students of each member of the learning team.

Draw upon the literature here regarding different definitions of independent learning. In this study, independent learning was identified on a number of both conceptual and operational levels.

Conceptually, the students, teacher and TL each held their own beliefs and pre-conceived ideas about what ‘independent learning’ meant in terms of:

(a) the ability of the students as overall academically capable Year 10 students who had developed and could exhibit levels of independence in terms of completing this inquiry learning project. Outline this process as described by the teacher in interview 1 and 2.

(b) the selection process employed by the teacher and HSIE faculty in terms of ‘recruiting’ students as suitably ‘qualified’ or able to cope with the ‘independent learning demands’ of the Global Studies curriculum, or subject as one of their electives. This selection process enforced the conception of independent learning within some students as a student’s ability to work independently (interpreted by some as being able to complete their project without requiring assistance or little assistance from the teacher or others, eg. TL, other class mates, family members, friends). Use student02 as a Case in Point for this.
the PIP student handbook provided by the teacher, presented a range of scaffolding in terms of guidelines and steps in the research process and information process that students might draw upon throughout the completion of their PIP. The provision of the handbook as a ‘how to’ guide and collection of advice, ideas, templates and proformas also contributed to this notion of, or expectation of students to work ‘independently’.

the teacher’s conception of independent learning was informed by her own behaviour, skills and understandings as an ‘independent learner’ (recently completing a project-based Masters course) as well as her experiences with Global Studies cohorts of Year 10 students in previous years (which she used as her main point of comparison when reflecting on how this group of Year 10 students were ‘coping’ with the demands of the PIP).

a student’s conception of independent learning is informed by their previous experience(s) in working on ‘independent project’ type tasks, it is informed by what they perceive to be the teacher’s expectations of them as independent learners (but how do they know what this is, if the teacher has not specifically defined what his or her expectations are?), it is informed by any assignment guidelines/handouts etc provided by the teacher, it is informed by what ‘independent learning behaviour(s)’ they observe of other students in their class, it is informed by their own evolving perceptions and beliefs of what they wish to ‘look like’ in terms of an independent learner.

what do students’ ‘independent learning behaviours’ look like? Some examples include:

* Student02 being conscious of not being seen as ‘needing’ or ‘seeking’ too much assistance – she sees this as a sign of weakness as an independent learner

* Student11 not wanting the teacher or TL to ‘monitor’ his progress with his PIP in the wiki. Independent learning behaviour in terms of controlling what work they have done, when and by whom. Also in comparison to student02, student11 did not see his need for teacher assistance and feedback as a sign of ‘weakness’ as an independent learner, in fact he actively sought the teacher’s feedback on his draft report just before the end of Term 3 (in addition, he sought this support out of class time, where he visited her in the staff room asking for her feedback).
* Student03 had a similar conception of independent learning as student11 in terms of not perceiving seeking teacher feedback as a sign of weakness – in fact his conception of independent learning included this feedback loop with the teacher as integral to the independent learning process.

* Some students sought assistance from their classmates before seeking feedback from the teacher – this is another example of students perceiving seeking teacher assistance/feedback as a sign of weakness as an independent learner, or ‘lacking independence’ as a learner.