The development of pre-service teachers’ schema for teaching students with diverse learning needs

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A thesis submitted to Charles Sturt University in fulfilment of the requirements for the degree of Doctor of Philosophy
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## Glossary

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<th>Definition</th>
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<tr>
<td>AITSL</td>
<td>Australian Institute for Teaching and School Leadership</td>
</tr>
<tr>
<td>ANOVA</td>
<td>analysis of variance</td>
</tr>
<tr>
<td>BAM</td>
<td>behavioural-analytic method</td>
</tr>
<tr>
<td>CEC</td>
<td>Council for Exceptional Children</td>
</tr>
<tr>
<td>CI</td>
<td>confidence interval</td>
</tr>
<tr>
<td>GPE</td>
<td>general physical education</td>
</tr>
<tr>
<td>H0</td>
<td>research hypothesis</td>
</tr>
<tr>
<td>H1</td>
<td>null hypothesis</td>
</tr>
<tr>
<td>IEP</td>
<td>individual education plan</td>
</tr>
<tr>
<td>LEA</td>
<td>local educational authority</td>
</tr>
<tr>
<td>$\eta^2$</td>
<td>eta-squared</td>
</tr>
<tr>
<td>NCATE</td>
<td>National Council for the Accreditation of Teacher Education</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>PSTs</td>
<td>pre-service teachers</td>
</tr>
<tr>
<td>REF</td>
<td>response evaluation framework</td>
</tr>
<tr>
<td>REGWQ</td>
<td>Ryan-Einot-Gabriel-Welsch and Quiot test</td>
</tr>
<tr>
<td>RTI</td>
<td>response to intervention</td>
</tr>
<tr>
<td>SDL</td>
<td>schema development level</td>
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<tr>
<td>SOLO</td>
<td>Structure of the Observed Learning Outcome</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for the Social Sciences</td>
</tr>
<tr>
<td>STS</td>
<td>schema for teaching scale</td>
</tr>
<tr>
<td>UDL</td>
<td>universal design for learning</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
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Dedication

This work is dedicated to my parents, Kevin (RIP) and Ann (RIP) who lit the flame of ‘needing to know’. Also to my family, both immediate and extended, in particular my wife Dianne, and children Rachel, Caleb and Liam. You have walked this journey too, for longer than we care to remember.
Certificate of Authorship

I, Gregory Kevin Auhl, 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 anywhere else 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, Library Services, or nominee, for the care, loan and reproduction of theses.

Signature:

Date:
Acknowledgements

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Abstract

This research seeks to extend knowledge and understanding of how teacher-preparation courses impact the cognition of pre-service teachers for teaching students with diverse learning needs in mainstream classrooms. The research examines the extent to which a professional schema for practice develops as a result of pre-service teacher participation in a program of professional preparation. A number of theoretical perspectives were used to frame the research. Schema theory, along with theories of complexity, self-organising systems and communities of practice were used to provide a structure around which the investigation developed. Research on successful self-organising systems shows the centrality and importance of a shared schema, allowing agents within a given system or community of practice to work together in meaningful ways (Bain, 2007; Gell-Mann, 1994). The research sought to determine the extent to which pre-service teachers build such a schema over time, and graduate with an entry-level schema for working with students who have a range of learning needs.

Three separate, yet linked, studies were employed to investigate schema development in pre-service teachers. Study 1 developed and validated an instrument to measure pre-service teacher schema. Study 2 employed the instrument in a cohort design to investigate the evolution of pre-service teacher schema from initial enrolment in a pre-service teacher-preparation program through to the end of undergraduate education studies. Finally, Study 3 employed the instrument within a quasi-experimental design to determine any differences in schema development between pre-service teachers in teacher-preparation programs at three New South Wales (Australia) universities.

Two comparison groups were also included in Study 3 to further explore the effects of a teacher-education program on pre-service teachers. These comparison groups were drawn from final-year students in exercise physiology and a cohort of graduates from a recently completed Master of Inclusive Education.

The results from Study 1 showed that an instrument was able to be developed to measure schema, where it existed. Study 2 results indicated that schema development as pre-service teachers progress through their program was inconsistent, year-on-year. Little schema development was apparent until the end of the third year of progression, with growth apparent for that cohort dissipating by the end of the final year. Study 3 showed that none of the programs from which participants were drawn showed
development of a functional schema for practice. The master’s degree comparison group indicated schema development at a functional level, while the exercise physiology reflected that of the undergraduate teacher-preparation graduates. Consistent across all cohorts was an absence of professional pattern language at a level that would be expected to support professional, practice-based conversations.

These results are discussed in relation to the nature of teacher preparation and its impact on the cognition of graduates, self-organising systems and communities of practice in educational settings.
Part 1:  Introduction to the thesis

Part 1 of this research provides an overall introduction to the pre-service training of teachers, schema development and measurement, and the studies conducted for this thesis.

Part 2 of this thesis consists of a literature review presented in four chapters. The assumptions underpinning this review are outlined in the following section.

Finally, Part 3 outlines the methodology (Chapter 6), presents the results (Chapter 7) and discusses the results (Chapter 8) of the three studies conducted for this research.

Chapter 1:  Introduction

Over the last decade there has been a growing emphasis, locally and internationally, on the ‘professionalism’ of teachers and in finding ways to enhance the quality the teaching and learning that occurs in schools. This emphasis has been fuelled by a number of sources, including public management and accountability perspectives (Hamilton, 2005, p. 287; Schwandt, 2005, p. 314), professional practice perspectives (Kemmis & Wilkinson, 1998; Schwandt, 2005) and the desire both from within and outside of the teaching community to develop better approaches to teaching, and to examine the efficacy of those methodologies (Craven et al., 2014; Eltis, 2003).

The concerns about teacher professionalism and quality, and whether a consistent schema for practice exists, have stimulated an extensive examination of the field including work in the areas of teacher preparation, effectiveness and professional practice (Antil, Jenkins, Wayne & Vadasy, 1998; Darling-Hammond, 2000, 2006a, 2006b; Fullan, 1992, 1999; Goodlad, 1994; Lortie, 1975; McLaughlin & Talbert, 2001). In addition, numerous reports have been completed over the last decade investigating the quality of teacher-preparation programs, as described by Levine (2006). These reports have questioned the consistency and efficacy of teacher-education programs; the quality of the institutions offering them; and the low admission standards required, particularly in programs aimed at preparing elementary teachers for their practice, and whether those graduates are ready for work in the field (Center For Education, 2010; Levine, 2006).
1.1 Assumptions in the thesis

The expectation that graduates from pre-service teacher (PST) preparation programs should have a schema for practice stands at the confluence of a number of assumptions described in detail in the literature review and drawn together in the methodology. The first of these assumptions is that there exists a substantive body of knowledge describing what constitutes effective teaching practice, and in particular effective inclusive teaching practice from which a schema could or should be derived. While for some in the field, the existence of a body of effective teaching practice is self-evident, for others this is contested. Further, the research on teaching practice shows high degrees of variability in the implementation of effective practices even within single schools, let alone at scale across different sites. The literature focusing on this is described in Chapter 2, which makes the case for this practice as a cornerstone of schema development and the present research.

The second assumption is that the existence of standards and their use translates the body of effective practice into sets of expectations for the design of programs, and what graduates should achieve. These expectations contribute to processes of accreditation for both graduates and the programs themselves, further instantiating the expectation that graduates should have a schema for practice reflecting the standards and the effective teaching practice that underpins them. This body of knowledge is examined in Chapter 3.

A fundamental premise, and the third assumption of the thesis, is that teacher-preparation programs have an impact on PST cognition, and this in turn impacts on teacher behaviours. The impact is described in Chapter 4 of the literature review, in particular from the perspective of schema development. Chapter 4 explores the theoretical underpinnings of schema at both the individual and organisational level to examine what is required to be a professional within a community of practice having its own underlying professional requirements.

The final chapter of the literature review is based on the assumption that it is possible to measure an individual’s schema for practice in a given area. It examines practical issues associated with the measurement of schema, and approaches to instrument development enhancing validity and reliability.
Collectively, these chapters build an evidence base for this research and the expectation that graduates should have developed a schema for practice that is measurable, reflective of the wider organisational schema of the profession and reflective of the substantive literature representing best practice in the field.

1.2 Accreditation standards

One response to concerns about teacher quality and professionalism on both national and international levels has been the development of professional teaching standards (National Board for Professional Teaching Standards, 1987; National Council for Accreditation of Teacher Education, 2008; New South Wales Institute of Teachers, 2005; Training and Development Agency for Schools, 2008), and new requirements from teacher-preparation courses (Australian Institute for Teaching and School Leadership (AITSL), 2011). These standards aim to provide a structured approach to building teacher capacity, guiding both what is required of graduates and what needs to be embedded within their preparation programs. Standards bring an extant definition and framework to influence the thinking, professional skills and knowledge of PSTs. Defining what teachers should know and be able to do as graduates of standards-based teacher-preparation programs, also makes possible the identification of those key elements of a schema for practice arising from their participation.

Accreditation standards draw heavily on a well-established body of literature related to effective teaching practice (Fraser, Walberg, Welch & Hattie, 1987; Hattie, 2003, 2009; Marzano, 1998, 2000). What is clear from this significant and longitudinal literature is there exists a substantial baseline of research about the professional body of practice underpinning teaching as a profession. While this research has provided an empirical foundation for effective practices and preparation standards, translating this knowledge into classrooms has continued to provide challenges for teachers, schools and systems. Despite what is known about effective teaching and attempts to encapsulate that knowledge into professional standards, there remains extensive contestation in the field about the role of research and the nature of practice (Schalock, Schalock & Ayres, 2006). At this time, the profession has struggled to implement known evidence-based practice at scale (Bain & Drengenberg, 2016), with positive experiences of students within classrooms being described as idiosyncratic, rather than routine (McLaughlin & Talbert, 2001).
1.3 Inclusion

Ensuring the capability of graduate teachers as effective practitioners has become even more compelling given the substantial increase in the number of students with disabilities receiving instruction within the context of mainstream classes (Dempsey & Arthur-Kelly, 2007). As the inclusion of students with disabilities has evolved and become more visible in education systems internationally, so, too, has the need to ensure that all teachers are prepared to meet the aforementioned challenge. Kirch, Bagerhuff, Cowan and Wheatly (2007, p. 673) describe how “one goal of many teacher-education programs is to provide coursework and field experiences to introduce future educators to diverse student populations and provide a framework for accommodating a range of learning styles”. These authors suggest that for many practitioners, that goal remains largely unrealised.

Research into approaches to teaching student populations with a broad range of learning needs and characteristics has served to both highlight what is required for effective practice within these classrooms, as well as to inform the teaching standards identified above. This research has also highlighted how the skills identified in the literature for classroom practice in a general sense are also prominent in the literature describing effective inclusive teaching practice (Jordan, Schwartz & McGhie-Richmond, 2009).

For many teachers, meeting the educational needs of students with a diversity of learning needs, along with “those with significant behaviour problems” in regular classrooms is seen as being “without doubt one of the most confronting” educational changes with which they have had to deal (Dempsey & Arthur-Kelly, 2007, p. 30). Whitworth (1999, p. 3) describes the “preparation teachers receive at the pre-service level” as being “one of the greatest barriers” to achieving the goal of inclusion in schools. These issues call for a careful and considered examination of PST education and its ability to fully prepare graduates of teacher-education programs for professional practice.

While a number of studies have investigated a variety of factors that contribute to the effectiveness of teacher-preparation programs, including subject matter preparation (Darling-Hammond, 2000; Goldhaber & Brewer, 2000); quantum of practice teaching (Grossman & Richert, 1988); and certification/application of standards (Darling-Hammond, 2000; Grossman, 1989), there are significant gaps and a noticeable dearth of studies explicitly related to the translation of PST learning into practice (Wilson, Floden
& Ferrini-Mundy, 2002), a circumstance that is described by Lancaster (2016) as not having changed markedly since the Wilson et al. (2002) meta-analysis.

A need exists at this time to understand more completely the way teacher-preparation programs shape the development of PSTs. This understanding includes the way programs impact on the cognition of PSTs and whether they produce a more complete and reflective schematic framework for professional practice. Such an understanding can assist researchers to understand and interrogate the effects of teacher preparation on the way PSTs construct a personal framework or schema for the exercise of their professional practice. In addition, it can help in more fully understanding the aspects of program design that contribute to that schema, teacher practice and ultimately student learning.

1.4 Teacher cognition

Existing research about teacher cognition in all stages of career development is limited and presents contradictory findings. Studies have indicated that, for PSTs, cognitive change, in terms of a deep understanding about how students in classrooms learn, and ways to structure effective lessons for them, can be determined to have taken place as a result of teacher-preparation programs (Adams & Krockover, 1997; Grossman & Richert, 1988). The indicated cognitive change, however, can be inconsistent across subjects and courses studied. Adams and Krockover (1997) researched the cognition of graduate science teachers, finding some indication of an ability for pre-service courses to influence cognition. Results, however, were inconsistent and effects small. Grossman and Richert (1988) found cognition of PSTs, again from the perspective of a broad and deep understanding of the requirement of effective practice, was enhanced moderately by engaging with their courses. This change, however, was described by the authors as an unintended result of such engagement and for many of the PSTs involved, little overall development was apparent. It also needs to be recognised that the predominance of research in the area relies on self-report and inferential measures, with limited evidence derived from validated objective measurement.

The relatively modest effects, contradictory findings, lack of objective measurement and overall limited research in the area of PST cognition indicates a need for a deeper and more complete understanding of the effects of teacher preparation on what teachers think about their practice, what they know, and believe they are able to do (Elmore, 2002; Swanson, 2006). Overall, and as noted previously, while there exists a body of
research on the instrumental practice of teaching such as planning lessons, asking questions, classroom management, pedagogical approaches and the like, questions as to the effects of teacher preparation on the thinking that precedes the use of these approaches by PSTs remain largely unanswered.

1.5 Schema theory

In trying to understand the impact of teacher-preparation programs on the cognition of graduates, this thesis employed schema theory, as described by Marshall (1995), to determine the extent to which graduates of teacher-education programs had developed a schema for teaching the diversity of learners represented in mainstream classrooms. Within the literature, the terms schema and schemata are frequently used synonymously; however, for this research the terms are used such that schemas are constructed of individual schemata, each of which contributes to bigger picture understanding.

The concept of schemata was first proposed within the fields of psychology and education in the 1930s by the British psychologist, Frederic Bartlett. Bartlett’s (1932) ideas proposed that memory was “organised around schemas containing summaries of familiar stories or situations” (Marshall, 1995, p. 10). These schemas were activated when some aspect of a new situation resonated with existing schemata. Schemas were built by repeated interaction with the same or similar situations. Schema theory explained how complex knowledge structures could be stored and later activated from the memory to allow responses to both every day and novel situations. Development of Bartlett’s early work did not, however, eventuate until the 1970s through the work of Minsky (1975), Schank (1977) and Winograd (1972), while in 1980 Rumelhart consolidated schema theory as an “explicitly psychological theory of the mental representation of complex knowledge” (Brewer, 1985, p. 23).

Marshall’s (1995) work builds on that of early researchers in cognitive psychology and the concept of a schema such as Wiener (1948), Miller (1956), Neisser (1967), Minsky (1975) and Rumelhart (1980), among others. Marshall (1995, p. 39) describes a schema as “a vehicle of memory, allowing organisation of an individual’s similar experiences” in a way that “assists their day to day activities and develops from an individual’s experiences and guides the individual’s responses to the environment”. Schemas can also exist on an organisational level. In practice fields, such a schema refers to “a commonly held set of professional understandings, beliefs and actions” (Bain, 2007,
p. 44) within the particular field. In the case of teachers, these understandings, beliefs and actions would refer to the processes involved in teaching and learning.

The concept of a schema in psychology is important in that it describes the manner in which an individual’s cognition is organised and activated. Individuals develop schemas through their interactions with their environment. The development of these structures then allows the individual to respond appropriately to known situations without impacting on working memory. The working memory indicated is then available for attending to novel situations (Kirschner, Sweller & Clark, 2006; Paas, van Gog & Sweller, 2010; Sweller, 1988, 1994).

Schema theory has been applied in a number of contexts to help in understanding cognitive processes. Seel, Darabi and Nelson (2006), investigated the development of a schema for problem solving within a group of engineering students in a United States (US) university. Wulf (1991) and Marshall (1995) both describe the use of schema theory in the instruction of students, although in widely disparate areas. In investigating motor learning in children, Wulf found that variable practice assisted children in developing a schema for throwing which was able to be utilised by participants in a novel situation. Marshall researched problem solving in arithmetic, finding that a structured approach to teaching a problem-solving methodology allowed students to better understand both the problem and their approach to it.

Other researchers have also used schema theory in a variety of instructional contexts. Meade, Cubey, Hendricks and Wilie (1995) investigated the effects of schema-based instruction on preschool children in a variety of carer placements, finding that explicit schema-based instruction improved children’s outcomes in several major competency areas (e.g. intrapersonal skills), while Timperley and Robinson (2001) investigated ways of achieving school improvement through attempting to challenge and change teachers’ schema about the causes of low academic achievement. These authors found that it was possible to challenge and change beliefs about “the causes of low academic achievement from external factors … to internal factors such as the contribution of their own teaching practices” (Timperley & Robinson, 2001, p. 1).

For the purposes of this research, the concept of a schema is applied to engagement with a program of study, whereby PSTs should have developed a schema for practice both on a personal/professional level and in a manner that resonates with the schema for practice for the profession more widely. This would imply the individual practicing in a manner
consistent with the evidence and underpinnings of the field. According to Marshall (1995), a schema is comprised of four levels of knowledge – identification knowledge, elaboration knowledge, planning knowledge and execution knowledge. Using Marshall’s (1995) framework, early-career teaching professionals can be seen to require knowledge related to the identification of professional practice, the elaboration of that knowledge as it relates to the content and pedagogy of teaching, knowledge required to plan for the enactment of professional practice and knowledge required for the execution of those professional plans in classroom settings. With teaching increasingly described as a collaborative exercise, a schema for practice on both an individual level and for the profession are important considerations for this research.

1.6 Schema in collaborative systems

The role of a schema is also important when considering teaching as a collaborative enterprise. A schema based on shared understanding of practice and a common lexicon permit teachers to collaborate, working together to develop strategies and solve problems. A professional teacher-preparation program would be expected to provide teachers with the knowledge, skills and professional language required for entry-level classroom practice, enabling them to become functioning members of a learning community or system that is a school. Such learning communities are characterised by their collaborative endeavour in an area of common interest, where a “commonly held set of professional understandings, beliefs and actions about teaching and learning” (Bain, 2007, p. 44), known as a schema, are evident.

Research on communities of practice and self-organising systems both indicate that teachers need a shared schema and accompanying professional pattern language to become functioning members of the community (Bain, 2007; Bain, Lancaster & Zundans, 2009; Wenger & Snyder, 2000). Common language is essential to allow members within the community to collaborate with each other effectively, as it defines the “dimensions of practice” (Bain, 2007, p. 46) within a particular community. Possession of these characteristics allows practitioners to engage mutually with others within the enterprise of the community with a common understanding of purpose.

What remains unclear at this time is whether teachers graduate from their preparation programs with the kind of schema and professional pattern language required to enter the profession and to fully engage with it at both a local and wider level. It is unclear whether graduate teachers have developed a full entry-level understanding of the
requirements of their future professional practice, and an associated ability to use the professional pattern language of the field. While such an entry-level understanding would be expected to build in scope and sophistication as a practitioner gains experience, it would also seem reasonable that teacher-preparation programs would be formulated to build an understanding at the level indicated by the relevant standards that apply to a given jurisdiction. This is particularly so with respect to meeting the needs of diverse student populations and in particular, the inclusion of students with disabilities into regular classrooms. At the same time, some researchers (Eraut, 2000; Coburn, 2006) suggest that the assumption that this language actually develops may be erroneous.

Given its importance to collaboration and professional understanding, the concept of a schema is an equally compelling construct when applied to individual preparedness for teaching as well as agency in collaborative groups. Schemas develop from repetition of activities and contain “a specific sequence of events in a well-understood context” (Marshall, 1995, p. 19). These self-repeating patterns are also typical of successful complex systems, where Waldrop (1993, cited in Bain, 2007, p. 50) describes them as characteristic of such systems within their organisational structure.

When part of a successful self-organising system, the development of the type of schema described above becomes imperative for the system to maintain the degree of responsiveness necessary for ongoing viability. Further, it is essential that agents within such a system share that schema in order to function successfully within it and contribute positively to the overall enterprise. As such, establishing whether teachers develop a schema as a result of their preparation is a critical prerequisite for allowing graduates to exert their agency in collaborative communities and systems.

1.7 Measuring a schema

The ability to measure a schema is a complex task, requiring the collection and analysis of data often revolving around higher-order thinking and interconnectedness between numerous pieces of information. Marshall (1995) describes interviews and thinking aloud as one approach, but also indicates that this can be problematic, as she describes how individuals are not always sure of how they are approaching a particular problem in terms of their cognitive processes. A number of other authors describe various ways of measuring schema, such as analysis of skill development or ability in computer-based simulations (Seel et al., 2006; Wulf, 1991). Schmidt, Joiner, Young & Telch (1995)
describe the preliminary validation of a questionnaire used to determine a measure of a number of schemas relevant to identifying personality disorders. Rodebaugh (2009) developed an instrument that aimed to measure a schema that would be self-predictive of problematic social anxiety. Marshall (1995) outlines an approach to determining levels of schema development involving direct observation of behaviours; however, the author describes this as challenging due to the resource intensive nature of her approach. All of these methods involve an assessment of the ability of an individual to exhibit a particular skill or aspect of knowledge after immersion in some form of training. A number of these assessments involve individual responses to scenario-based problem-solving exercises. The approach indicated involves presenting written scenarios to learners in the context of authentic professional problems. Application of skills and knowledge is then applied to the situation and responses determined.

With the complexity of the task of measuring a schema referred to above, a number of considerations need to be addressed in adopting a scenario-based approach. First, any instrument used must be representative of the construct of the schema. Second, it must explore the extent to which learners have developed and can instantiate the schemas resulting from instruction (Marshall, 1995). Third, the instrument must be sufficiently open ended so as to allow for individualisation of responses as “no two individuals will form identical schemas” (Marshall, 1995, p. 267).

Goldfried and D’Zurilla (1969) describe a scenario-based instrument design framework for examining situations where a behavioural response to a given situation is necessary. Their behavioural-analytic method (BAM) provides a framework around which an appropriate instrument can be developed to address the construct of schema development for teaching diverse learning populations.

Goldfried and D’Zurilla’s (1969) framework consists of five discrete steps focused on enhancing the validity of the measure being developed. These steps are a situational analysis, response enumeration, response evaluation, development of measuring instrument and evaluation of the measure. The situational analysis ensures that what is described in the measure is authentic to what respondents will experience within the environment relevant to the scenario. Response enumeration involves an evaluation of the possible responses to the scenario, and preliminary evaluation as to the possible effectiveness of these. This builds into the response evaluation stage, which involves judgements being made by experts as to the efficacy of responses within the
environment, and what is likely to be most effective in addressing the situation. Following these steps is the development of the measure – including the criteria for scoring the measure (Step 4) and evaluation of the measure (Step 5). The evaluation of the measure is focussed on ensuring that validity and reliability measures both reflect authenticity for the context described.

Implementing the BAM in this manner provides a situation/scenario allowing an investigation of responses to a problem-solving situation in the field of education to be measured. In this thesis, the response is employed to demonstrate an understanding of the scenario provided and formulate a coherent plan of action to address it. Such scenario-based assessments have a number of parallels in other professional fields, such as software development (Folmer, van Gurp & Bosch, 2003), geology (Klügel, Mualchin & Panza, 2006) and nurse education (Shepherd, Kelly, Skene & White, 2007).

The SOLO taxonomy is built on a hierarchical categorisation of written responses based on degree of sophistication. It “was developed to evaluate, qualitatively, how students structure or organise learning outcomes or products” (Brownlee, 2001, p. 284) and ranks responses within a five-level hierarchical structure. Biggs and Collis’s (1982) structure consists of the stages of *pre-structural*, where an individual shows no knowledge or understanding of a concept or situation; *uni-structural*, where an individual shows only one relevant concept; *multi-structural*, where a number of relevant concepts are seen in an individual’s response; *relational*, where these relevant concepts are linked together; and *extended abstract*, where the capacity to generalise related ideas to different situations can be seen.

Marshall’s (1995) levels of knowledge within schema development can be seen to have close connections to Biggs and Collis’s (1982) levels within the SOLO taxonomy and these two concepts can be synthesised to determine a schema development level (SDL) for final-year PSTs. While this will be fleshed out further in the work following, such connectedness provides an opportunity to use the SOLO taxonomy (Biggs & Collis, 1982) to analyse responses to an open-ended scenario-based problem, focussed on professional problem solving, to determine a level of schema development for teaching in classrooms consisting of students with diverse learning needs.
The levels of complexity within SOLO can be used as indicators of the level of
development of schema knowledge for an individual around a given construct. A
schema for teaching students with diverse learning needs provides the construct, while
the different knowledge levels of Marshall’s (1995) structure are used as the lens
through which responses are viewed. The different levels of schema development are
seen as analogous to the different levels within the SOLO taxonomy. The overall
instrument development process seeks to operationalise the construct of a schema for
teaching students with diverse needs. Achieving this goal is dependent on developing a
scenario that represents authentic practice and a measure that accurately represents the
construct.

1.8 Assumptions and the studies

As described earlier, the current research focusses on teacher cognition and specifically
the schema development of PSTs in relation to effective practice for inclusive
classrooms. The research is predicated on the assumptions described. These
assumptions are elaborated fully in Part 2, the literature review. As such, the research is
derived from a thesis that given the existence of multi-year, standards-based teacher-
preparation programs based upon the extant body of professional practice in the field,
students on graduation from those programs should possess a schema for practice
capable of guiding teaching in inclusive classrooms. Further, their schemas should
develop year-over-year as students progress in their programs, and should also be
distinguished from the schema (about teaching in inclusive classrooms) of graduates
from another field of study.

The research involved three related studies, presented in Part 3 over three chapters.
Study 1 developed and validated an instrument to measure schema development with
respect to meeting the needs of a diversity of learners, in particular those with
disabilities, in mainstream classrooms. Study 2 involved the use of a cohort design to
address two important aspects of PST schema: The first of these is the base level of
schema knowledge about teaching possessed by students prior to their participation in a
PST preparation program, and the second is the way that knowledge develops as
students progress through their course. Study 2 also served to provide further validation
information about the instrument by indicating that the schema of PSTs was measurable
and sensitive to change as they moved through their course of study. Study 3 used the
instrument to investigate schema development in final-year PSTs from three New South
Wales (NSW) university providers and two comparison groups. These comparison groups were pre-practice students in the final year of an exercise physiology program and a cohort of experienced graduate teachers who had recently completed a Master of Inclusive Education. Specifically the research will:

1. Apply schema theory and the SOLO taxonomy to the development and validation of an instrument for determining the knowledge forms/levels of final-year undergraduate education students for teaching students with disabilities.

2. Establish whether those knowledge forms/levels cohere as a schema for professional practice in graduates of a PST preparation program, with particular reference to meeting the needs of students with disabilities.

3. Help in understanding the way PSTs build a cognitive framework for their professional practice over time.

4. Establish whether that professional practice schema can be applied to the resolution of a complex classroom problem-solving task.

5. Establish any differences in schema development between graduates of different university settings/programs in relation to schema development and applied problem-solving.
Part 2: Review of the literature

Section 2 examines multiple bodies of literature that relate to the research. It is structured around four chapters, each of which has two areas of focus. The first chapter of the review (Chapter 2) interrogates literature around the characteristics of effective teaching practices as well as the characteristics of these practices in inclusive settings. Chapter 3 explores how teaching standards place a framework around these characteristics and describes the current state of teacher-preparation programs as to how they embed the requirements of teaching standards in their courses. Chapter 4 explores teacher preparation as the embodiment of the teacher effectiveness literature. It investigates the cognitive impact of teacher-preparation programs and how this impact can be described from several theoretical perspectives on both an individual and an organisational level. Finally, Chapter 5 chapter examines the literature associated with the measurement of a schema as an individual cognitive construct and the literature on the development and validation of instruments that can be used to measure schema development.

The first body of literature focusses on the characteristics of effective teaching, and their relationship to student learning, particularly in the context of teacher professionalism, in order to establish a baseline for the identification of the characteristics of effective teaching practice. This baseline is important for this research as it provides a description of the skills and understandings teachers require to be effective classroom practitioners and acts as a cornerstone of a schema for practice, specifically addressing the first assumption described in the introduction (see Section 1.1). The exploration is then extended into literature about effective teaching practice in inclusive settings, to further highlight the characteristics and requirements of successful inclusive classrooms. The student composition within Australian classrooms is becoming increasingly diverse. One of the reasons for this is that students with disabilities who were previously educated in more restrictive environments are now taught in inclusive settings (Dempsey & Arthur-Kelly, 2007). For the purposes of this research, inclusive education is focussed specifically on the education of students with disabilities in mainstream classrooms.

The next chapter of the review explores the evolution of teaching standards and teacher ‘certification’ as extant frameworks embodying the professional knowledge, practice and engagement required of a teaching graduate to ensure that the characteristics of
teacher effectiveness described earlier are able to be translated into practice. This chapter addresses the second assumption, described previously in Section 1.1. As a result of the increased diversity in classrooms, the requirements of graduate teachers in contemporary schools have expanded significantly, while at the same time, have rarely been under closer scrutiny. Standards represent an instrumental approach serving as both a professional expression of teacher capacity at various levels (in the case of the Australian context these are described as graduate, proficient, highly accomplished and lead) as well as a political expression providing a structure within which governments can influence teachers and teacher education. An examination of the literature around teacher-preparation programs will then highlight that, over the last two decades, numerous government investigations into teaching and teacher education, and significant research have focussed attention not just on the supposed quality of teacher education graduates, but also on the programs preparing them for practice. The standards are intended to provide university teacher-education providers with what is required to be developed within their programs, while at the same time providing graduates, schools and school systems, and the wider community with a framework to ensure that what is known about teacher effectiveness is translated into practice. Framing standards in this manner ensures that what is described in the literature about the characteristics of effective teaching is reflected in the preparation of practitioners.

The third major body of literature examines research on how our understandings about teacher effectiveness, embodied in standards and teacher-preparation programs, impact on the cognition of PSTs. It will examine the literature showing the relationship between what teachers think, and what they do, showing that how they practice is predicated on a number of variables contributing to their cognition about teaching practice and addresses the third assumption described earlier in Section 1.1. To be effective in guiding practice, standards cannot exist as a disparate checklist of items, but rather as an inter-related schema informing appropriate professional responses to classroom situations. Translating the requirements of teaching standards into practice in inclusive classrooms requires significant cognitive load. Meeting the requirements of standards in this holistic way demands complex cognitive structures to help reduce this load. These structures, or schema, reduce the cognitive load by allowing individuals to bring into play processes allowing them to recognise similarities to scenarios previously encountered and to bring into play skills, knowledge and practices that have previously
proven to be successful. This literature will establish what is currently understood about schema development on an individual level.

While historically teaching has been described as a private practice autonomously constructed by individual practitioners, more contemporary views challenge this perception, emphasising the importance of collaboration within a community of practice. This collaboration is particularly important in inclusive education, as professionals from different fields work together to meet the needs of children. The literature pertaining to the concept of a schema as an organisational phenomenon will also be explored within this body of literature. If teachers are graduating from university preparation courses bounded by teaching standards that are based in research about effective practice, it stands to reason that there would be a high degree of consistency in their individual schemas about classroom practice, as they have been exposed to the same learning experiences throughout their program. Such a schema for practice is represented within complexity theory generally, and in particular within self-organising systems theory. It would also allow the development of the type of practice communities described in the literature around communities of practice, with a common domain of interest and a consistent repertoire, implying not only commonly held understandings, but also a commonly held language about transactions within the practice. These communities also provide the critical spaces necessary for the levels of collaboration required to advance the field.

Effective communities of practice develop a shared repertoire, or ways of conducting the work of the community – the practice – with a common understanding of that work and the language used to describe it. This understanding could be considered to be a shared schema. Similarly, self-organising systems have a common schema for practice as a characteristic, where agents within the system can work together with a common understanding of the nature of the work, communicated through a shared and common professional language. These theoretical perspectives will help to frame the research in exploring the schema development of PSTs.

The final chapter of this review will examine the literature pertaining to measurement of schema, and the different approaches used by researchers in gauging schema development. It will explore approaches to authentic situations and scenarios as the basis of determining the degree to which individuals have developed both a discrete as well as a consistent professional schema for practice. It will further examine approaches
to instrument development, the type of instruments used to measure a schema and
disciplined approaches in developing these instruments to enhance their validity and
reliability, thus addressing the assumption that schema can be measured This section of
the literature review is crucial in informing a methodological approach to measuring
schema to be determined, and thus allowing the research questions to be addressed.

In summary, Section 2 will describe the literature about effective teaching; particularly
that focussed on the education of students with disabilities. It will describe how that
literature has been distilled into teaching standards, and how these standards help to
focus the efforts of teacher-education providers in developing their programs. The
cognitive load associated with meeting the requirements of teaching standards
necessitates cognitive changes occurring in PSTs, allowing the connections between
individual aspects of a schema to be developed and a coherent, complete schema for
practice to be formed. This schema is described on both an individual and
organisational level. The literature on schema development describes it as a measurable
construct, hence PST development of a schema as they progress through their course of
study ought to be measurable. The literature on instrument development has shown that
using a disciplined approach to design enhances the effectiveness of these measures. In
combination, the various bodies of literature examined provide the context for this
research. These bodies of literature describe what would constitute effective practice
and how this is encapsulated within standards. They further describe how university
preparation programs embed these standards within their preparation programs and the
cognitive impact that these programs can have in helping PSTs to develop a schema on
both an individual and organisational level. It is the measurement of this schema that is
central to this research in investigating the level at which teacher-preparation programs
do, in fact, impact on the schema of PSTs.

The combination of these bodies of literature serve to establish a framework that allows
a methodology to be developed to determine whether the cognitive changes described
and schema development expected were instantiated.
Chapter 2: Effective teaching and effective inclusive teaching

In recent times, there has been a growing opinion, both locally and internationally, about the professionalism of teachers and the perceived deficits of practitioners. This perception is despite a significant body of knowledge about the characteristics of both effective teaching and effective inclusive teaching. Finding ways to enhance the quality of the teaching and learning that occurs in schools has become a major focus of government education initiatives. As described in the introduction (see Section 1.1), several perspectives have informed this focus, including public management and accountability perspectives (Hamilton, 2005; Schandt, 2005), professional practice perspectives (Kemmis & Wilkinson, 1998; Schandt, 2005) and a wider community aspiration to implement more effective approaches to teaching, and to examine the effectiveness of those approaches (Craven et al., 2014; Eltis, 2003; Ingvarson et al., 2014).

Ongoing research over an extended timeframe has indicated that what teachers do and how they do it has a significant effect on student learning (Brophy & Good, 1986; Gage & Needels, 1989; Hattie, 2003, 2009, 2012; Rosenshine & Stevens, 1986). Rosenshine (1996, p. 199) describes this research into teacher effects as “an important body of research” that allowed the identification of significant teacher behaviours likely to result in enhanced student outcomes. Despite this research, there has remained an ongoing criticism of the effectiveness of instruction in many classrooms, with further studies indicating that these positive teacher effects were more the exception than the norm in most settings (Goodlad, 1984; McLaughlin & Talbert, 2001). Bain (2007, p. 2) describes how this research indicates that “students and parents cannot expect those effects as a routine outcome of their educational experience”. Instead, the effects exist as characteristics of individuals rather than of schools or of systems. In a study of teaching practice in US high schools, McLaughlin and Talbert (2001) found that in most of the settings they examined, teachers were left to construct their practice as an individual “in keeping with norms of professional autonomy in American education” (p. 2).

The isolated approach to classroom practice described has frequently come under scrutiny and been criticised, with a number of authors, and a significant body of research into effective practice, indicating that it does not best serve the needs of
students (Slavin, 1993; Thousand & Villa, 2000). With classroom diversity increasing significantly in terms of representation of students with disabilities in mainstream classes (Dempsey & Arthur-Kelly, 2007), teachers need to develop the collaborative skills allowing them to work with others to better meet the needs of their students (Ashman & Elkins, 2012; Bal, Kozleski, Schrader, Rodriguez & Pelton, 2014; Friend & Cook, 2012; Tomlinson, 2005). This development of collaborative skills is particularly important for the development of inclusive classrooms where students with diverse learning needs are represented. While the development of this collaboration is not seen as being without some challenges (Alexander, 2001; Forlin, 1998), it has evolved as a significant expectation of professional practice.

Hattie (2009) argues that, despite all the research that has been completed within education over the last century, “the practice of teaching has changed little”, that the collaboration referred to above is not common among teachers and that “the self-contained classroom with one teacher” (p. 5) remains as the most common model within schools. Hattie’s research resonates with the work of a number of earlier researchers (Goodlad, 1984; McLaughlin & Talbert, 2001). These studies indicate that “any schema for teaching and learning is much more likely to be represented in the many schemata of individual teachers” (Bain, 2007, p. 46), rather than in a commonly shared coherent school level understanding. At the heart of much of what is delivered in classrooms is still the type of autonomous practice described by authors such as Hattie (2009) and Bain (2007).

The autonomous approach to practice described in the literature continues to be a challenge to the professional status of teaching and education. Bain and Drengenberg (2016) emphasise the importance of understanding context when exploring data aimed at improving practice. These authors build on the work of Bowker and Star (2000) in defining context as “the way normal work is transacted to produce an expected or intended outcome” (Bain & Drengenberg, 2016, p. 18). This normal way that work is transacted is built on three features – comparability, visibility and professional control. Comparability is described as “the use of evidence-based approaches across multiple settings and individuals”, visibility as “a visible work process that makes the use of the evidence-based work demonstrable in ways that can differentiate among more or less effective practices” and professional control as having “a managed professional process that makes both the standardisation and differentiation of practice possible while retaining a degree of professional flexibility and autonomy” (Bain & Drengenberg,
Bain and Drengenberg (2016) contend that it is the combination of these features that creates a professional context where “working in a particular way or to a professional standard can be expected to yield a successful outcome” (p. 18). Further, these authors argue that the certainty provided in such a context allows for the expectation of an effect that can be attributed to a particular process having been implemented. This also means “that expertise extends beyond the idiosyncratic and private practice of the individual, toward the expertise of an entire profession at scale”, leading to a situation where “the same practices, standards and outcomes can be expected from one situation to another” (p. 18).

Within this situation, the evolution of teaching standards, based in what research has informed as effective teaching practices, can be seen as a move to both enhance practice and move teaching toward a greater level of professionalism. Comparability is provided by the use of effective teaching literature, and this is made visible through teaching standards used as the basis for both teacher and program accreditation. It is within this context, both nationally and internationally, that the literature reviewed in the chapter is framed.

2.1 Approach to reviewing the literature

Several readily accessible research platforms were used to search the literature in each of the fields described above. As well, the researcher was aware, from both previous study and from staying up-to-date in employment, of a number of texts and journals providing material in the relevant areas.

EBSCOhost (Education) was the major vehicle implemented for this review. This platform packages a number of EBSCOhost databases, put together by the researcher’s library, with a focus on education and other related areas. The databases represented within the platform are:

- Academic Search Complete
- Education research Complete
- ERIC
- Psychology and Behavioural Sciences Collection
- SocINDEX with Full Text

This database was supplemented with use of Google Scholar and Taylor & Francis Online.
Relevant studies from the early 1970s to the present were located, with only studies from peer-reviewed journals and relevant book sources being included. Some seminal works in each area prior to this timeframe were also included because they had contributed significantly to work within the field.

### 2.2 Teacher effectiveness

For the first section of this review, seminal works included some large-scale studies and meta-analyses (Fraser et al., 1987; Hattie, 2003, 2009; Marzano, 1998, 2000) examined prior to access of the data-bases. Descriptors used for this section began with a focus on the literature related to teacher effectiveness and teacher professionalism. These areas were explored both alone and in the context of school reform and school improvement. From the perspective of teaching diverse learners, the descriptor inclusion proved far too broad, providing 166,161 references between 2000 and 2015. Narrowing this focus by using descriptors such as teaching diverse populations, teaching students with disabilities and pre-service teacher preparation in combination, provided a broad body of literature in the domain suitable for examination. Further exploration included searching for the major features of inclusive classrooms and the major concerns/challenges reported by teachers about inclusion.

In his 2009 book Visible Learning, Hattie describes how, while “there is so much known about what makes a difference in the classroom … rarely is it used by teachers, and rarely does it lead to policy changes that affect the nature of teaching”. Hattie’s observation is reminiscent of Marzano (1998, p. 7) who, over a decade earlier, observed that “after decades of studies on instruction, educational researchers have concluded that practitioners simply have not benefited from the knowledge that has accumulated from those … because the research has not been presented in such a way as to be readily interpretable in terms of classroom practice”. The body of research into effects on student learning indicates that the effectiveness of schools can, in general terms, be considered to be impacted by three variables: those impacting at school level, impacts from teacher effectiveness and impacts related to the student (Marzano, 2000). Research has continually indicated that the single greatest influence on student learning (apart from individual student characteristics, which Marzano describes as accounting for about 50% of the variance in student achievement) is teachers and the way they teach, accounting for about 30% of the variance (Hattie, 2003, p. 1). Given this level of impact, a major assumption of this research is that the professional practice of teaching
makes a difference to student learning and, further, how teachers develop a schema for that practice is important in terms of assisting them to respond appropriately to differing classroom scenarios. This section will investigate what the extensive research referred to by Hattie (2009) tells us about the knowledge that has accumulated related to teacher impacts on student learning.

Following the finding of the Coleman report (1966) that schooling had little impact on achievement, numerous discrete studies were implemented aiming to explore more deeply those factors that did have an apparent impact on student learning outcomes. In exploring these factors, Brophy and Good (1986) found that there were a variety of factors that they described as teacher behaviours that were positive influences on student achievement. Their research, considered to be foundational in the field, indicates that factors such as the quantity and pacing of instruction, approaches to conveying information and questioning and how instructors reacted to respondents were all important considerations. Each of these areas was further broken down. For example, quantity and pacing of instruction included aspects such as opportunity to learn/content covered, expectations and classroom-management skills.

In an attempt to distil the numerous discrete investigations outlined above into consistent indicators of what ‘worked’ within classrooms, a number of researchers conducted broad-scale meta-analysis and reviews of existing research. While much of this research investigated school effectiveness more broadly, it also delved into teacher behaviours and characteristics that were identified as having an impact on student outcomes.

A study by Fraser et al. (1987) undertook a wide-ranging analysis of what was termed educational productivity research, including detail of the factors that influenced learning. This research extended these general features by further exploration of their application with the field of science education. These authors found that the factors identified could be grouped into three broad areas: aptitudinal, instructional and environmental factors. From the perspective of classroom practices impacting learning, there were two broad categories of characteristics related to the instructor and those related to the type of instruction. These broad factors had a 0.44 and 0.47 effect size respectively. There were a significant number of more explicit characteristics within these broader categories (Fraser et al., 1987, identified 20 with an effect size over 0.2)
that were considered to have a large effect. These included reinforcement (1.17), questions (0.34), cues and feedback (0.97) and cooperative programs (0.76).

Marzano (1998) undertook a study where he described the domain of interest as “the effect of classroom instructional techniques” (p. 66). For his study, instructional techniques were described as “an alterable behaviour on the part of teachers or students” (p. 66), thus deliberately excluding a variety of factors (such as demographic variables) that were not alterable. The study covered eight moderator variables: intended user of technique, specificity of instructional techniques, grade level of subject, student ability, duration of treatment, specificity (reactivity) of dependent measure, methodological quality and types of publication. Beginning with the studies included in the Fraser et al. (1987) analysis, Marzano identified those he deemed as being specifically related to alterable behaviours, added more recent analyses, and added further from a hand search of several research-based journals. Marzano found an overall effect size of 0.65 from the studies included in his analysis. Similarly to the Fraser et al. study, Marzano found questions (0.93), cues and feedback (1.13) and cooperative programs (0.78), among others, to have strong effects.

A further analysis by Marzano (2000) reports results within three categories: school level, teacher level and student level variables. Marzano (p. 39) describes these categories as appearing to be “implicit or explicit in a variety of studies”, including well-known analyses such as Carroll (1963), Cotton (1995), and Scheerens and Bosker (1997). In this study, while acknowledging the difficulty in separating out teacher effects from school effects, Marzano (2000) describes how “evidence supports the assertion that the effects of teachers far exceed the independent effect of schools” (p. 60), a conclusion confirmed by Hattie (2003). In his 2000 study, Marzano describes how “lists of teacher-level variables abound in the research literature” (p. 62); however, despite this, three categories can be used as organisational tools: instruction, curriculum design and classroom management. From the perspective of instruction, characteristics such as the use of advance organisers, feedback clarity of presentation and questioning are highlighted from both qualitative and quantitative studies as being of importance for student achievement. For curriculum design, “the order and pacing of instructional activities” (Marzano, p. 63) is the major focus, as without this, the coherence of instruction falters. From the perspective of classroom management, Marzano (p. 65) describes these sets of characteristics as those “designed to minimise disruptions or distractions to the learning process and maximise the effectiveness of interactions
between teachers and students, and students and students”. Variables such as procedures and rules around seat work, group work and discipline are identified as having positive impact.

In his 2009 synthesis, Hattie examines the evidence presented from over 800 meta-analyses related to student achievement. Hattie (2009) organises his work based on six factors, all of which can be seen to have considerable similarities to the organisational structures of previous work: the child, the home, the school, the curricula, the teacher and the approaches to teaching. Hattie’s six factors are then further explicated into different characteristics. One of the characteristics of the factor ‘the child’ for example, is the child’s prior knowledge of learning. From the perspectives of characteristics pertaining to the teacher, and to approaches to teaching, Hattie’s findings reflect those of previous studies. Some of the larger effect sizes reported in his study related to teacher quality included teachers who had experienced microteaching in their undergraduate courses (0.88), teacher-student relationships (on a variety of variables such as empathy) (0.72) and teacher clarity (0.75). An interesting finding from this work, given recent emphases, was that teacher subject matter knowledge rated poorly (0.09) in its contribution to student learning outcomes in comparison to other variables. From the perspective of approaches to teaching, the findings from this study were broadly consistent with earlier work, showing, for example effect sizes of 0.46 for questioning (a little lower than previously, albeit from a broader sample), 0.73 for feedback and a range of 0.41 to 0.54 for differing approaches to cooperative programs.

What these studies show consistently, and over a significant period of time, is that what happens within the classroom and how teachers design and deliver instruction is crucial to promoting student achievement of intended learning outcomes. The research makes it clear that what teachers do makes a difference – particularly in relation to their approaches to instruction, the way in which their curriculum is designed and the ways in which they manage the classroom environment. These factors are all foundational to schema development and hence foundational for this research. That there is a deep knowledge base is clear; however, the implementation of factors drawn from that knowledge base is much more an individual phenomenon than the result of any planned and structured approach to adoption.

This section has described what the literature articulates about effective teaching practice. In the next section, this review will be expanded to draw on the literature about
what constitutes the translation of effective teaching into inclusive settings and the characteristics of effective teaching in such settings.

2.3 Teaching diverse populations

This section of the literature review extends the research on effective teaching practice to include a consideration of how this practice is expressed in inclusive settings. It will describe the key features identified for inclusive classrooms in terms of three areas: the teaching skills required (including effective teaching practice, classroom management, and collaboration skills); the classroom context necessary for effective inclusion to create a positive learning environment; and the attitudes and dispositions necessary for inclusive practice. Effective teaching skills and practices encompass a number of aspects that are crucial for classroom practice in inclusive environments. The ability to differentiate materials and approaches on multiple levels, the ability to manage the classroom environment allowing those differentiated materials to be delivered effectively, and the capacity to collaborate and communicate with other professionals, both from teaching as well as non-teaching backgrounds, is essential. Equally important is the ability to create positive learning environments by the simultaneous engagement of these skills to allow constant monitoring of the classroom. The impact of teachers’ self-efficacy on the development and use of these skills is also an important factor in determining their attitudes toward inclusive practice; hence the likelihood of their being able to create inclusive environments. An understanding of the key features of inclusive classrooms is central to graduates’ schema development for teaching in an inclusive environment, including what they should know and be able to do as graduates in the field.

2.3.1 Effective teaching skills and practices

Teachers in contemporary classrooms can expect to have students with a diverse range of needs in their care. For many teachers, this diversity will include students with a diagnosed disability (Foreman & Arthur-Kelly, 2014). As a result, there is a need for teachers to be well prepared for teaching student populations with a broad range of learning needs and characteristics. Teaching students with disabilities has become a focus of contemporary research in the field (Johnson & Hawkins, 2008; Kirch et al. 2007; Whitworth, 1999).
It is perhaps not surprising that many of the skills described for effective teaching practice also appear in the literature describing effective inclusive teaching. Given the demands associated with successfully meeting the needs of diverse learners in mainstream settings, a strong mastery of the knowledge and practices characterising effective practice sets the foundation for inclusive practice. The skills of decision-making about appropriate choice of content and aligning pedagogical approaches to student needs (Ashman & Elkins, 2012; Foreman & Arthur-Kelly, 2014; Quaglia, 2015; Tomlinson, 2005; Washington & Matlock, 2013) appears frequently, along with effective instruction, the ability to make necessary adjustments to meet student need and flexibility (Ashman & Elkins, 2012; Florian & Black-Hawkins, 2011; Foreman & Arthur-Kelly, 2014; Tomlinson, 2005).

Jordan et al. (2009) examined the literature and findings emerging from almost two decades of a research program into inclusion (the Supporting Effective Teaching – SET project) in which they had been involved. The researchers found strong evidence to show that “effective teaching skills are effective for all students, both with and without special education needs” (p. 535). These researchers identified a number of skills as being essential for inclusive settings. Five of the major areas described are also strongly represented in the literature about effective teaching, including:

- the development of learning tasks creating high levels of student engagement
- the capacity to differentiate and scaffold learning based on student’s current levels of mastery
- effective classroom and time management skills
- encouraging cognitive engagement with higher-order thinking skills
- having high levels of expectation about student success.

Their study challenged a number of beliefs among practitioners, including that “teaching students with special needs requires specialised teaching skills” (p. 535), proposing a model that “the school norm (the expectations of the principal and staff) about inclusion in the school, individual teachers’ beliefs about their roles and responsibilities for including children with special education needs, and the teachers’ sense of teaching efficacy predict teaching practices, which in turn predict student outcomes” (p. 536). Similarly, Hattie (2012) describes the five major characteristics of effective teachers as those who:

- identify the most important ways to represent subject knowledge
- create an optimal classroom climate for learning
monitor learning and provide feedback

believe all students can reach the success criteria

have an influence on students beyond immediate test results.

Hattie (2012) notes, however, that the influence of these factors is enormously variable as they are often not implemented effectively within classrooms.

Florian and Black-Hawkins (2011) investigated the knowledge and skills needed for teachers to be inclusive in their practice. Inclusive practice was described by these authors as using inclusive pedagogy. They participated in informal conversations, conducted observations of the classrooms and interviewed 11 classroom teachers over a six-month timeframe. Data collection took place in two schools, purposively chosen “because both were highly inclusive in terms of their intake and also because the staff in both had strongly articulated their support of inclusive policies and practices” (p. 815). They found that effective inclusive pedagogy involved a “shift in pedagogical thinking”. This shift moved from teachers “thinking from an approach that works for most learners existing alongside something ‘additional’ or ‘different’ for those (some) who experience difficulties, towards one that involves providing rich learning opportunities that are sufficiently made available for everyone, so that all learners are able to participate in classroom life” (p. 819).

One approach to implementing this shift in thinking described by Florian and Black-Hawkins (2011), and thus meeting diverse needs within inclusive classrooms, is known as universal design for learning (UDL). UDL is defined by the Higher Education Opportunity Act 2008 (US) as a scientifically valid framework for guiding educational practice that provides flexibility in the presentation of information, and in the ways students respond; reduces barriers by providing appropriate accommodations, supports and challenges; and maintains high expectations for all students. UDL is generally framed around three principles: providing multiple means of representation, providing multiple means of action and expression, and providing multiple means of engagement. It promotes approaches such as the use of advance organisers, clear presentation through multiple modalities, timely and rich feedback, and the careful design of the order and pace of instruction as important characteristics. Each of these aspects of effective teaching was also identified by Marzano (2000) and Hattie (2009) in their large-scale meta-analyses of effective teaching practices. As such, UDL encapsulates a number of effective teaching practices by focussing on designing learning experiences
that allow for individual learning differences, and flexibly using instructional methods, materials and assessments (Rose & Meyer, 2002). This flexibility allows differentiation of instruction to take place at the design stage of preparation, building supports in as necessary for diverse learners. Pisha and Coyne (2001) describe UDL as an appropriate way of delivering accessible curriculum in inclusive classrooms for a variety of learners without individual students feeling stigmatised or isolated.

A recent study by Quaglia (2015) proposes that careful initial course design and a UDL approach helps to build many of the characteristics of effective teaching into curricula at the planning stage, thus making it unnecessary to “retrofit a curriculum with individual disability accommodations” (p. 2). In describing approaches to college music teaching and the growing diversity of participants in these courses, Quaglia (p. 2) suggests that UDL “is a robust and flexible framework for addressing learner variability”. Further, Quaglia suggests that planning and designing curricula to allow a greater level of access to learners who are in the margins (defined by the author as learners with disabilities, gifted and talented and students having English as a further language, among others) is also of benefit to other learners, as different and more flexible approaches to both learning and assessment are adopted.

Emerging from the literature on inclusive classrooms, then, is the importance of using effective teaching approaches for inclusive teaching. These teaching practices resonate with the body of literature described earlier about characteristics of effective teaching. These practices include aspects such as knowing content and how to adjust teaching for the differential needs of learners, pedagogy (including design and delivery), and the ability to be flexible in accommodating the needs of all learners by differentiation of classroom materials and approaches – all foundational to standards and the skills required of graduate-level teachers. The ability to differentiate and the related skills of effective classroom management appear as frequent themes in the literature, and are described in the following sub-sections.

2.3.1.1 Differentiation within the classroom

The ability to effectively differentiate instruction emerges from the literature as a significant skill required of teachers in inclusive classrooms (Foreman & Arthur-Kelly, 2014; Mastropieri & Scruggs, 2014; Tomlinson, 2005) and is built on a foundation of effective practice (Weston & Bain, 2014). Differentiation not only enhances student
access to the curriculum, but has also been shown to enhance student educational outcomes (Mastropieri et al., 2006).

A study by Mastropieri et al. (2006) investigated quantitative outcomes associated with peer tutoring using differentiated activities compared to traditional teacher-directed instruction for students with mild disabilities in inclusive 8th grade science classes. Their investigation involved 13 classes and a total of 213 students, 44 of whom were classified with disabilities. Over a 12-week period, one group of students was engaged in units of differentiated, peer-mediated, hands-on instruction, while the control group was exposed to traditional science instruction. The results from the study show a statistically significant difference for the group receiving differentiated instruction on both post-tests and on state-level high-stakes testing, for all students. The researchers describe their results as particularly significant in science, where there is a history of students with disabilities experiencing difficulties due to aspects of content such as vocabulary and the reading level of many texts.

In a report developed to “gather and synthesise findings from a review of projects that made successful use of differentiated instructional approaches to improve student learning” (McQuarrie, McRae & Stack-Cutler, 2008, p. 31), the researchers reviewed 25 Alberta Initiative for School Improvement projects that had been identified as having a positive impact on student learning. These represented all grade levels from Kindergarten through to Year 12. Projects chosen for inclusion were those described as demonstrating promising practices by seeking school improvement through differentiated instruction, using approaches to differentiation that had been shown in previous projects to have statistically significant effect sizes based on standardised tests or provincial achievement tests. In completing their synthesis, the researchers examined annual reports from the projects over a three-year period, conducted a focus group session with representatives from 18 of the projects and contacted and interviewed representatives from the remainder via telephone. In terms of strategies used by participants, the five most commonly employed were flexible grouping, learning styles/profiles, alternative assessment approaches, use of reading buddies and the use of independent study projects. From the perspective of pedagogies and learning supports that demonstrably enhanced student outcomes, the researchers report six key findings:

1. Effective differentiation begins with and is shaped by ongoing assessment for learning activities.
2. Differentiated instruction enhances student self-confidence and engagement.
3. Differentiated instruction helps students become more self-directed and meta-cognitive as learners.

4. Technology, when used appropriately, enhances the ability to differentiate instruction and engage students.

5. Differentiated instructional practices enhance the ability to reach all learners.

6. Students who are more at risk or have higher needs receive more benefits from differentiated (targeted) and intensive support (McQuarrie, McRae & Stack-Cutler, 2008, p. 6).

The project further explored supports found to be effective in facilitating moves toward school-wide use of differentiation. Prominent among these were time for professional dialogue around differentiation, along with working toward developing a common understanding of differentiation and related terms (i.e. a professional pattern language). Common professional learning experiences, including peer modelling, mentoring and coaching was also a high priority emerging from the study.

The implications of these findings for graduates of teacher-preparation programs are clear. One of the vital skills required of them within contemporary classrooms is the ability to differentiate learning experiences to meet the needs of the diversity of students likely to be represented within them. The capacity to manage this within the classroom environment, with different students and groups working at different rates and in different ways, has significant implications for classroom-management skills as a further necessary requisite. This is described in the next section.

2.3.1.2 Classroom-management skills in inclusive settings

Effective classroom-management skills are essential in the implementation of inclusive classrooms. While the capacity to differentiate at multiple levels is crucial, the delivery of differentiated learning can only take place in environments where the teacher has a clear understanding of how to manage the multiple activities that may be taking place at any one time. Ashman and Elkins (2012) suggest that aspects including knowledge of curriculum areas, having a range of teaching strategies and having a range of learning activities to ensure that all students are catered for are all important precursors to effective classroom management. Ashman and Elkins (2012) go so far as to suggest that where problem behaviours do occur, teachers should always examine their own practice to ensure that “their teaching and learning strategies aren’t the cause of the problem” (p. 152). These authors advise that aspects such as having clear classroom requirements,
consistency and persistence and use of a range of management strategies are also important in managing the complex interactions required of inclusive settings.

Research on effective teaching and learning has consistently shown the importance of the role of the teacher in supporting effective learning outcomes. Classroom management was described by Hattie (2009, p. 102) as having an effect size in the medium/high level of Hattie’s “zone of desired effects”. While in his meta-analysis, Hattie suggests caution in the use of descriptors such as small, medium or large effect sizes, he does, indicate that for the purposes of his work, an effect size of “d = 0.2 was small, d = 0.4 for medium, and d = 0.6 for large when judging educational outcomes” (p. 9). Hattie’s zone of desired effects is considered to be anything with a medium or higher effect size. Hattie’s finding is consistent with the work done by previous researchers such as Fraser et al. (1987) and Marzano (2000) described earlier. This research has shown that well-managed classrooms are vital in supporting the educational outcomes for students (Ashman & Elkins, 2012; Foreman & Arthur-Kelly, 2014; Jones & Jones, 2012).

For the purposes of the current research, and emerging from the literature, it is important to recognise that classroom management refers widely to the processes and actions used to keep the classroom organised, to keep lessons running smoothly and to keep students engaged in the lesson, thus supporting both academic and social-emotional learning (Evertson & Weinstein, 2011). While a part of classroom-management skills includes managing what may be perceived as problematic behaviour, this is not the sole focus. Ashman and Elkins (2012, p. 130) describe how the increased enrolment of children with disabilities in mainstream settings, including those with behavioural/emotional disorders inevitably means that “for an increasing number of students, inappropriate classroom behaviour, physical aggression, verbal aggression … and difficulties in following directions are common”. This means that addressing such behaviours is something for which teachers must be prepared. Implementation of strategies described in the introduction (see Section 1.1) is seen by Ashman and Elkins (2012) as a significant step in preventing disruptive behaviour in the first instance. While the terminology around definitions with respect to classroom management is often contested, the implications as to the need for teachers to have well-developed skills in classroom management are, however, clear, regardless of the perceived underlying source of behavioural issues (Conway, 2006; Sawyer, 2009).
Given the importance associated with classroom-management skills, and the recognition of their importance within numerous texts associated with inclusive teaching (Ashman & Elkins, 2012; Foreman & Arthur-Kelly, 2014; Mastropieri & Scruggs, 2014), Korpershoek, Harms, deBoer, van Kuijk and Doolaard (2014) and Yamani (2014) describe it as surprising that there is limited empirical research specifically focussed on the requirements of classroom management in inclusive settings. In a large-scale meta-analysis of the effects of classroom-management strategies and existing management programs on the academic, behavioural, emotional and motivational outcomes of students, Korpershoek et al. (2014) examined a number of previous analyses, as well as online databases to identify studies where the effectiveness of classroom-management programs was investigated. These researchers limited studies to those that were whole-class focussed and that were either experimental or quasi-experimental designs. One of their major findings was that the strongest effects were found for programs targeting social-emotional growth, a finding they describe as “especially relevant given the recent educational trend toward more inclusive classrooms” (p. 47). They did, however, comment that their literature search “did not find well-designed experimental studies in which the effectiveness of CMS [classroom-management skills] was investigated in inclusive classrooms” (p. 49).

A study by Yamani (2014) aimed to investigate classroom-management practices in inclusive classrooms. Yamani’s study gathered data from what the researcher describes as informal interviews conducted with two participants teaching in elementary schools in Canada. The participants varied in terms of experience within the classroom as well as educational background in inclusive education. An interview guide was developed by the researcher that focussed on their background, classroom-management practices and their perspectives as to the benefits and challenges with the implementation of classroom-management practices in inclusive classrooms. Yamani reported five themes emerging from her study: practices to establish early in the school year, including the setup of the classroom; establishment of rules and procedures for discussions; management of transitions and use of ‘community spaces’ within the classroom; the benefits and challenges of inclusive classrooms, with factors including benefits for both students and teachers; approaches to managing behaviour, such as using positive reinforcement to help minimise unwanted behaviours, being aware of behaviours as responses to stimuli and having the established routines described earlier; the impact of prior experience and additional training, with both aspects being described as helpful in
teaching in inclusive classrooms; and effective use of the resources available within the environment, such as special education resource teachers, teacher assistants, engaging with parents and using colleagues as supports. This last point is taken up in the following section on the necessity for collaboration in inclusive settings. Yamani, however, also recognised the limitations of her study, particularly with respect to the small sample size limiting any scope for her findings to be able to be widely generalised.

In describing research-based practices on effective classroom management in inclusive settings, Soodak (2003) framed her exploration around both school-level and classroom-level features. Soodak examined the literature through the concept of community building, exploring how teachers create a sense of community within their classrooms, as well as how they create safe and responsive learning environments. Soodak found that management strategies that facilitate friendships and collaboration among staff, students and parents, and that foster approaches to positive behaviour management, were all well represented within the literature.

The importance of skills of effective classroom management emerging from the previous examination of the literature on effective teaching practices (Fraser et al., 1987, p. 150) indicates that environmental factors have a significant influence on learning. The environmental factors identified include the home environment; the classroom or school environment; the peer group environment outside the school; and the mass media environment, especially “the amount of leisure-time television viewing”. While these environmental factors are important determinants of successful student outcomes, Fraser et al. (1987) describe “the psychological morale or climate of the classroom group” as being strongly predictive of “end-of-course measures of affective, behavioural and cognitive learning” (p. 161), especially when compared to other environmental aspects such as the influence of the peer group outside of school.

Within inclusive education, a number of cognitive and meta-cognitive strategies are also promoted as being useful in supporting the behaviour of students experiencing difficulties in that area (Menzies, Lane & Lee, 2009). Implementation of these strategies has the capacity to assist teachers with, and exert an influence upon, classroom management. Included in these are self-monitoring, self-evaluation, self-instruction and goal setting, all of which are described as being of particular use for students who have emotional and behavioural disorders (Menzies et al., 2009; Vanderbilt, 2005). Self-
monitoring is described by Hattie (2009, p. 190) as “observing and tracking one’s own performance and outcomes, often recording them.” Described as encouraging strategic and reflective thinking, such processes have a typical effect size in the high range of desired effects. Meta-cognitive strategies are described by Fountas and Pinnell (2000) as thinking about thinking, and being aware of themselves and their surroundings. These strategies, as a part of the repertoire of strategic and reflective skills, are particularly important, having an effect size in the high range of desired effects (Hattie, 2009, p. 155). While not specifically teaching strategies, a knowledge of these strategies, and an ability to appropriately instruct students in their use, is an important tool in helping to manage a classroom and create a positive learning environment, as students learn to take responsibility for the monitoring and management of their own behaviour.

What emerges from this literature on the knowledge and application of effective classroom-management skills in inclusive settings is their importance not only in creating supportive classroom environments, but also, hence, in supporting students in achieving educational outcomes. As such, these skills in inclusive classrooms are significant supports in helping teachers create environments where all students can learn (Jones & Jones, 2015) - vital inclusions in teaching standards and schema development at graduate level, and in programs of initial teacher education.

2.3.1.3 Collaboration and communication skills

Just as skills of collaboration and communication have become increasingly valued within society, so they have become increasingly necessary within schools, generally, and within inclusive education in particular (Dettmer, Knackendoffel & Thurston, 2013; Friend & Cook, 2012). Inclusive education practitioners are now required not only to program for the educational needs of students with disabilities within their classrooms, but also to coordinate the development of individual education plans (IEPs) involving parents, other teachers, teachers’ aides and external professionals, such as speech and occupational therapists (Brownell, Hirsch & Seo, 2004). The development and implementation of IEPs requires well-developed communication skills, with Buzzo (2004) describing effective interpersonal communication skills as the building block needed for effective collaboration. Friend and Cook (2012) and Dettmer et al. (2013) both caution, however, that effective interpersonal communication skills need to be learned, rehearsed and practised, not (despite popular perception) being inherently developed as a part of normal maturation. Further, the development and implementation
of IEPs for students requires the use of a common professional language, referred to by Smethurst (1997) as pattern language, to allow problem solving, the development of outcomes, and approaches to management of student needs to be determined.

Bain et al. (2009) investigated the use of pattern language and its development with PSTs. These researchers used classroom communities of practice and an embedded design approach to determine whether PSTs increased frequency and complexity of pattern language as their course progressed. Embedded design involves using repeated patterns in the design and delivery of the learning experiences within a course. With a cohort of 54 PSTs over a 13-week timeframe, they found that both frequency and sophistication of pattern language use increased within the timeframe of the study.

Hamilton-Jones and Vail (2013) conducted a qualitative case study to investigate pre-service special educators’ perspectives about collaborating with general educators in school settings. In the context of special educators’ professional standards having explicit requirements for “adept collaboration and co-teaching skills” (p. 56), including professional language and communication skills, these researchers used a grounded theory approach involving document analysis (assignment work from 12 participants) and interviews (from five participants) to explore pre-service special educator perspectives about collaboration. Their findings indicate that having participated in coursework in collaboration helped participants to feel better prepared to undertake and more confident in understanding future collaborative endeavours.

A review of the literature on collaboration in special education (Hernandez, 2013) found four “interrelated factors and ingredients that have been identified as important in the development of collaborative skills” (p. 486). These characteristics include perspectives, attitudes, and preparation; professional efficacy; interpersonal skill capacity; and contextual setting/organisational capacity. Hernandez (2013, p. 487) describes how the last three of these are particularly important “once teachers enter the schools” but also that even prior to this, their “notions regarding their role as an educator … impacts on how they enter into collaborative relationships”. Given the necessity of an ability to collaborate effectively as a prerequisite for effective inclusive practice, these studies are important in showing that both the skills and the language required to engage with others in a collaborative fashion are capable of being taught – and learned.

Hernandez’s (2013) review of collaboration also describes a number of challenges to collaboration arising not only with educators but with other professionals. Many of
these challenges focus on the lack of clarity about the concept and process of collaboration (Bauer, Iyer, Boon & Fore, 2010), while other concerns are often expressed about the time and effort required to establish and maintain effective collaboration – that it does not come naturally (Dettmer et al., 2013; Friend, 2000; Friend & Cook, 2012). In their description of ways to enhance collaboration between classroom teachers and speech-language pathologists, Bauer et al. (2010) emphasise that collaboration is not a process implemented for its own sake, but rather a process aimed at accomplishing a goal, and that collaboration is centred on trust, respect and a mutual commitment to the outcomes of the collaboration.

Of greater concern in terms of challenges to collaboration is the perspective from some, including teachers, that working independently is a preferable mode to engaging in collaborative processes. Troen and Boles (2011) describe how the “cultural norm of teacher autonomy” (p. 1) can, in itself be an obstacle, where teachers neither wish to take individual leadership roles, nor to accept the guidance of others who may step forward. These authors describe an expectation within the profession that graduates arrive “knowing everything they need to know in order to be good teachers” creating a climate where they are afraid to admit that “there is a problem or condition they can’t solve by themselves” (p. 1). Teacher teams are described by Troen and Boles (2011) as “being able to accomplish low-level tasks such as organising field trips” but while they “may have energy and enthusiasm, team members typically lack the skills, tools and support structures that would allow them to orchestrate significant pedagogical and curriculum changes through the collaborative work of the team” (p. 1). Likewise, a study on the collaboration between speech-language therapists collaborating with classroom teachers by Ritzman, Sanger and Coufal (2006) examined the characteristics of collaboration that resulted in successful classroom-based service delivery. These researchers conducted observations and interviews with one participant who had been purposively sampled for her representation as an effective classroom practitioner. They found that, while there was widespread acknowledgement that collaboration between professionals resulted in better outcomes for students, the majority of interventions still involved operating in traditional one-on-one mode.

A study by Conderman and Johnson-Rodriguez (2009) investigated the perceptions of beginning teachers trained in both general education and special education about the development of their skills in collaboration. These researchers developed a survey asking participants to rate the importance of 20 skills related to inclusion and
collaboration on a four-point Likert scale from 1 (not important) to 4 (very important). Conderman and Johnson-Rodriguez’ (2009) study also included five open-ended survey questions about their preparation program, current position and intentions for future employment. Described by the researchers as a pilot study, their original random sample of 100 participants from the State of Illinois teacher directory resulted in a response rate of 46%. Findings indicate that “beginning teachers felt well prepared for and value working with children and families of diversity” (p. 240). Participants also commented on the importance of field experiences and working with experienced teachers as being important in helping their understanding of how to approach teaching inclusively. The major area in which respondents felt least prepared, however, was in working with other staff, including both professional and paraprofessional staff, and in co-teaching within inclusive classrooms. Open-ended survey responses highlighted areas including lack of adequate preparation for collaboration and the challenges of interpersonal relationships in collaborative engagements as key issues.

From the perspective of collaboration as a key challenge to inclusion, a study by Florian (2012) reported on an investigation into the professional development needs of teacher educators in ensuring that the requirements of the standards for initial teacher education in Scotland were able to be met by graduates. In her research, Florian describes how traditional approaches to teacher preparation were no longer adequate, requiring a “new curricular approach” to prepare teachers “who would meet the SITE [standards for initial teacher education] requirements in inclusive education” (p. 277). This approach was described as necessary because of the time constraints within teacher-preparation programs placing limits on what could reasonably be delivered in helping PST mastery of necessary skills. Smith and Tyler (2011) report similar findings about the lack of preparedness reported by teachers in working effectively with students in inclusive settings. They further identify the difficulties of preparation programs keeping up-to-date, and issues of an ongoing lack of professional development for educators in promoting the use of online materials, both within the classroom and for use within teacher-preparation programs. They describe how, given that “teacher effectiveness is strongly linked to student outcomes, these perceptions of inadequacy are clearly problematic” (p. 323), hence requiring improved teacher preparation.

Cowan, Swearer-Napolitano and Sheridan (2004) describe the importance of home-school collaboration for successful student outcomes. The factors identified in their study as impacting on such collaborations include legislative imperatives, such as the
Individuals with Disabilities Education Act 1990 (US); home and family related factors, such as how the family has interacted with the school in the past, and family culture, beliefs and expectations; school related factors, such as individual school personnel and their beliefs, values and expectations; and community-related factors, such as the relationship the school has, over time, established within its community. These factors intersect in a complex relationship that can, at times, result in situations where parental voice is devalued and schools become “disconnected from the reality of students’ home lives” (McKenna & Millen, 2013, p. 9). Saltmarsh, Barr and Chapman (2015), while recognising the importance of such collaborations, caution against an assumption that the skills required to engage with collaborative processes are universally and thoroughly taught within initial teacher-education programs in the Australian context. In a study involving interviews with 35 teacher educators from 15 universities across all states of Australia, these researchers conducted semi-structured interviews – informed by program and course documentation – focussing on the degree to which such skills were embedded within the courses. These researchers examined courses in four domains: foundational units specifically referring to parents and families, stand-alone units in special interest areas such as teaching Indigenous students, stand-alone units specifically focussed on parent/community engagement, and practicum. While enshrined as a graduate standard within the Australian Professional Standards for Teachers (AITSL, 2012), these researchers found that all participating sites offered some input; however, found “only two universities in which PSTs were likely to encounter issues specifically pertaining to parent-school engagement in all four domains” (p. 74).

Emerging from the literature reviewed here is the clear requirement for PSTs to be well prepared in skills of collaboration and communication by their preparation programs to assist in their development of practice-based schema. While the literature describing the need for, and importance of, collaboration to maximise learning outcomes in inclusive classrooms is clear, what also emerges is the perception of a lack of preparedness for the demands of collaboration and for the skills required. This lack of preparedness is reflected in wider research on teacher-preparation which “continues to find that teachers feel unprepared to teach special needs students with disabilities in general classrooms” (Faragher & Clarke, 2016, p. 132). Troen and Boles’ (2011) study raises further concerns that, despite a significant body of evidence about the benefits of collaboration,
some practitioners from both teaching and other backgrounds still envisage operating autonomously as a preferable option.

### 2.3.1.4 Monitoring student progress and providing feedback

The capacity of teachers to effectively monitor student outcomes associated with their learning, and the provision of feedback to students, parents and other stakeholders, has been identified as a key determinant of student progress and a factor clearly associated with effective teaching (Hattie, 2009; 2012). For students with disabilities, whose academic progress frequently occurs in smaller steps, the monitoring of progress toward meeting outcomes is crucial (Howell & Nolet, 2000). One approach to this monitoring is using a framework of response to intervention (RTI), with curriculum-based measures as a means of determining the effectiveness (or otherwise) of particular interventions. Howell and Nolet describe such measures as “collecting and evaluating student performance using the student’s own curriculum materials” by employing regular “short, direct measures” (p. 105) as an appropriate way of monitoring student progress toward achieving long-term goals.

RTI uses a tiered approach to identifying the needs of lower achieving pupils (Gorard, Siddiqui & Huat See, 2014). An RTI approach utilises whole-class teaching (Tier 1) followed by small group instruction (Tier 2) for students who are measured as not progressing appropriately. Tier 3 involves one-to-one tutoring for students who are still not making progress within small groups. Regular monitoring of progress to examine the efficacy of interventions, using curriculum-based measures, is an essential part of this procedure (Gorard, Siddiqui & Huat See, 2014).

A study by Bourke, Mentis and Todd (2011) examined the assessment practices of teachers for students with disabilities described as requiring high or very high support needs. The study collected quantitative data through the completion of a survey/questionnaire to investigate the rationale behind teachers’ assessment choices with regard to type of assessment used as well as the purposes of assessment. The researchers received 964 completed questionnaires from both primary and secondary school sectors. Follow-up interviews were conducted at three schools sites to “gather case study examples that illustrated the implications for teachers using narrative assessment” (p. 411). These researchers found that the primary purpose of assessment was to support student learning, although reporting to parents and supporting applications for additional funding were also frequently cited responses. A variety of
assessment approaches were reported, including standardised and specific teacher-developed instruments. Examples of student work, observations and anecdotal records were reported as being of more use, however, than standardised psychometric approaches. Such assessment types are more clearly able to be reflective of the differentiated programs of individual students and their achievement of individualised learning outcomes, thus better able to inform future learning. Howell and Nolet (2000) describe how effective instruction facilitated expected progress for learners. For students with disabilities, such effective instruction often focused on interventions in their day-to-day program, facilitating learning and the meeting of outcomes. Frequent examination of the efficacy of such interventions, using the approach of curriculum-based evaluation, is important in determining whether interventions should be maintained or discontinued. Howell and Nolet (2000) propose that “some evaluations occur for reasons that originate inside the classroom, whereas others occur for outside reasons” (p. 14). Such an approach to the implementation of assessment has been clearly linked to enhanced student progress (Howell & Nolet, 2000).

Consistent with the findings above, Bourke and Mentis (2014) highlight two major purposes of assessment: to describe, analyse and facilitate learning, and to measure learning outcomes. Given these purposes, the authors describe how a wider variety of assessment approaches than may be regularly used within classrooms lend themselves well to both purposes. In a national survey of 964 regular education teachers in New Zealand who were asked about their assessment practices for assessing students with high needs in inclusive settings, 24 differing modes were identified. When these were then linked to the major purposes of assessment, most teachers identified wanting to help students with the next stage of their learning. Associated with this was the need to know where students were currently situated to inform future teaching. The provision of information to parents was seen as an important factor; however, so was the role of accountability to the student, with “self-determination and self-regulation through assessment” being identified as powerful drivers in helping students with disabilities “identify their goals and aspirations” (p. 392).

These studies highlight the skill of being able to develop and apply a variety of assessment types, in particular curriculum-based assessment, for often diverse purposes, as being fundamental to effective inclusive teaching. The nature of inclusive settings encompasses students working at different points within the curriculum, thus the ability to effectively monitor individual performance is paramount. Factors emerging from the
literature in this dimension indicate that the primary purposes for assessing students with disabilities is to both determine progress, but more importantly to inform ongoing teaching and what is needed to continue to allow students to make progress. The implications for graduate-level PSTs implied by these requirements are that they have the capacity to engage knowledge and understanding about curriculum, assessment and reporting in designing learning experiences within their class. Further, these learning experiences, along with the assessment types and approaches, need to be differentiated at multiple levels to ensure that the needs of all learners, including students with disabilities, can be met.

2.3.1.5 Communication with parents and caregivers

 Provision of information to parents and caregivers was also a frequent theme in the literature describing the purposes of assessment. In providing this feedback, the maintenance of positive relationships between the school and the parent/caregiver is important for ongoing progress. Meeting legislative and system requirements, while mentioned within the literature, was not deemed as being an important primary purpose. The ability to use assessment for the purposes of informing learning, reporting on progress (both formally and informally) and maintaining a positive relationship with parents and caregivers all feature prominently in the literature about effective teaching practices in inclusive settings, hence are important in framing this current research.

 An important part of providing feedback to parents and caregivers is the maintenance of positive relationships between the home and the school. A body of research has developed over time indicating the importance of parental/caregiver involvement to student outcomes (Fan & Williams, 2009; Park & Halloway, 2013). For students with disabilities, this relationship can be fundamental to the success of an inclusive placement. Despite this, schools sometimes resist accepting parents as legitimate partners in the educational process. In describing the elements necessary for inclusive education, Mastropieri and Scruggs (2014) highlight that good inclusive practice is concerned with the involvement of parents and wider communities in the education of students with disabilities.

 Emerging from this literature is the clear requirement for PSTs graduating from courses of initial teacher preparation to be skilled in diverse areas if they are to be effective practitioners. Among other characteristics, they need to display the ability to determine the needs of a diversity of learners and design activities to instruct these learners at
multiple levels; they need to be skilled communicators, with the capacity to effectively manage the learning environment; they need to be able to collaborate with professionals from both within and outside of teaching, as well as parents/caregivers; they need to be skilled in the design and implementation of assessment processes, often for multiple purposes; and they need to have the capacity to provide feedback as to the outcomes of assessment to students and parents/caregivers.

2.3.2 Creating positive learning environments

An important aspect of effective inclusive practice is for practitioners to be able to implement the complex array of skills described above to create an environment that is conducive to learning. One of the major characteristics described for successful inclusive environments is that they show an appreciation for, and acceptance of, student difference at a system, school and classroom level (Ashman & Elkins, 2012; Foreman & Arthur-Kelly, 2014; Tomlinson, 2005). Booth and Ainscow (2002) propose a model of an inclusive learning and teaching environment at school level as having three characteristics: the extent to which it operates as an inclusive learning culture, the extent to which it has inclusive policies, and the extent to which it has inclusive practices. At the classroom level, these practices are driven by teachers who have positive attitudes, high expectations of all learners and who promote a sense of community and social acceptance (Ashman & Elkins, 2012; Foreman & Arthur-Kelly, 2014; Tomlinson, 2005; Washington & Matlock, 2013).

An in-depth study of how one teacher managed an inclusive learning setting (Flem, Moen & Gudmundsdottir, 2007) examined the participant’s efforts in facilitating a good learning environment for all the students in her classroom. The researchers in this study gathered data through observations, video recordings and interviews to explore inclusive practice. The participant was identified through purposive sampling and had 20 years of teaching experience. Her class consisted of 23 students, with three having identified special needs. The researchers found themes in three main areas: cognitive processes, where instruction was clear, modelled and scaffolded, with constant feedback processes; social learning processes, with “clear rules and procedures for how the pupils should behave both in the listening-corner and when they were working in groups” (p. 92); and collaboration processes, where there is a need for the classroom teacher to “cooperate with and be supported by other persons” (p. 93).
In a study examining the effective characteristics of inclusive classrooms for students with moderate to severe disabilities, Downing and Peckham-Hardin (2007) interviewed parents, teachers and para-educators at three schools that promoted themselves as inclusive. All three settings educated students of all abilities in chronologically age-appropriate classrooms. A total of 58 participants were interviewed consisting of 18 parents, 17 general education and six special education teachers and 17 para-educators. Students ranged in age from preschool to middle school. Open-ended questions were asked in a semi-structured interview approach. When asked about the characteristics of a high quality educational program for students with moderate to severe disabilities, participants cited being placed with typical peers, and being in a positive and caring environment as two of the major characteristics. Having the capacity to implement the school’s positive behaviour support model to managing behaviour was also mentioned by participants as an important skill for teachers in addressing behavioural issues within the classroom and maintaining a learning environment that catered for all students.

In drawing on the literature describing the requirements for creating positive learning environments, Bucholz and Scheffler (2009) describe how “the classroom environment can either improve or impede a student’s ability to learn and feel safe and comfortable as a member of the class” (p. 1). The capacity to create such an environment depends in large part on the use of effective teaching skills in establishing classroom procedures, implementing classroom strategies and in classroom design. In terms of classroom procedures, these authors advocate for ensuring that classroom management becomes a collaborative approach, with rules for transitions and different work areas negotiated at class level; for classroom strategies, they suggest encouraging students to advocate for their own needs and those of classmates, as well as teaching communication skills such as active listening to facilitate collaboration; while for classroom design, having an organised, but warm environment is encouraged. While requiring significant skills in managing these processes, Bucholz and Scheffler emphasise that such skills are readily transferable across contexts and can lead to significant student gains. Further, they argue that they are not “just for students with disabilities” (p. 10), but are important in building the classroom as a supportive and effective learning community.

The creation of learning environments that are conducive to learning for a diverse student population necessitates bringing the skills of effective teaching practice into classrooms in a manner that is accepting of all students and encouraging of their aptitude. This requires not only the development of an array of effective teaching skills,
management skills and collaborative skills, reflective of a graduate-level schema for practice, but also requires teachers to have a positive attitude and disposition toward the right of all students to a place within the inclusive classroom. These attitudes and dispositions, as represented within the literature, are discussed in the next section.

2.3.3 Attitudes and dispositions

From the perspective of creating positive classroom environments, the attitudes and dispositions of teachers have frequently been cited as having an important influence (Ashman & Elkins, 2012; Boyle, Topping & Jindal-Snape, 2013; Foreman & Arthur-Kelly, 2014; Mastropieri & Scruggs, 2014), with some research indicating that attitudes of teachers can be as important as resource allocation (Boyle et al., 2012). In a wide-ranging review of research related to teacher attitudes towards mainstreaming, integration and inclusion, Avramidis and Norwich (2002) examined the findings from the international literature and found a wide variety in teacher perspectives. Their study included an examination of databases, reference lists from relevant texts, literature reviews, relevant reports and a hand search of a number of international journals for articles related to the three terms. The variety in attitudes had a number of sources, including geographical location of the study; nature and severity of the disability; teacher variables such as gender, age, teaching experience and grade level taught; and training and any previous contact with people with disabilities. Environmental issues were also important in helping determine teacher attitudes, with availability of resource personnel and clear support from leadership being seen as influential. Overall, these researchers found that teachers were generally positive toward inclusion. Teachers from countries having strong pro-inclusion legislation held more favourable attitudes, while those from countries with sophisticated segregated educational provisions, less so (p. 132).

Studies of the attitudes of PSTs show that the perspectives held by practitioners can begin early. A study of 135 secondary PSTs who were completing their preparation courses at a large United Kingdom (UK) provider (Avramidis, Bayliss & Burden, 2000) found that, while participants felt positively about the concept of inclusive education and their ability to meet the needs of students, this self-perceived level of competence deteriorated according to the degree of disability of the children involved. The researchers also found that attitudes toward children with emotional or behavioural issues were less positive than was the case for other disabilities. In their study described
earlier, Jordan et al., (2009) found that the beliefs and attitudes of teachers were vital if they were to become effective inclusive teachers. Describing how PSTs enter their initial period of preparation with “beliefs about teaching and learning that are intransigent and hard to change” (p. 540), the authors suggest that PSTs need experiences structured into their preparation to help them recognise and confront firmly held beliefs.

Farrell, Dyson, Polat, Hutcheson and Gallannaugh (2007) conducted a study designed to investigate the impact of inclusion at local educational authority (LEA) and school level in the UK. Data were collected from the National Pupil Database, which holds information such as results in national high-stakes assessments as well as indices of inclusivity at both school and LEA levels. While no evidence of any relationship between inclusion and attainment was found at LEA level, a slight negative effect was found at school level. The researchers describe this effect as being greater than would be expected from lowered average scores deemed as an inevitable consequence of higher representation of students with disability; however, it was very small in comparison to the impact of other indices such as the proportion of students qualifying for free school meals – used as a measure of socio-economic status in the UK. The study, however, also described teaching children with special educational needs as placing “considerable demands on schools and teachers” (p. 177). This demand was particularly so in terms of the resources that both schools and individuals could provide to meet identified needs and that it took little to disturb the delicate balance between resources available and demands made, including issues such as teacher skills and support personnel. These issues were described in a context of concern about “the presence of pupils whose behaviour disrupts lessons” (p. 177) as being potential sources of anxiety for teachers, sources of impact on the learning of other children, and hence impacting teacher attitudes.

As well as expressing concerns about the adequacy of preparation programs, teachers cite lack of support mechanisms, including support personnel, time and resources as areas of challenge to them, and having an impact on their disposition toward inclusive classrooms. In a study by Monsen, Ewing and Kwoka (2014) that investigated the relationships between teachers’ attitudes toward inclusion, support provision and learning environment, 95 teachers completed questionnaires on attitudes to inclusion, classroom learning environment, support and stress, while 2,514 pupils completed a questionnaire on the classroom learning environment. Background demographics were
collected for teacher participants and responses to items on five scale areas were requested on an eight-point Likert scale: the Teacher Attitude to Inclusion Scale; Willingness to Include; Adequacy of Support; Health/stress; and My Class Inventory as an indicator of classroom environment. Among other findings, these researchers found a clear correlation between the level of internal and external support provided to classroom teachers and their attitude toward inclusion. Lack of support mechanisms lead “to non-inclusive classroom environments and negative attitudes towards including pupils with SEN [special educational needs]” (p. 124).

The literature on teaching attitudes has some significant implications for teacher preparation and for graduate teachers. Given the strongly held beliefs of PSTs, the variety of variables identified as potentially impacting on these beliefs and the relationship between these beliefs/attitudes and the ability of teachers to implement learning experiences within the classroom, including notions of self-efficacy, teacher-preparation courses must not only address existing understandings, ensuring new schemas reflecting best practice are constructed, but also ensure that new perceptions, coupled with skill development, form a part of programs. This is considered further in the next section.

2.3.3.1 Attitudes, dispositions and self-efficacy

Closely connected to attitudes and dispositions is the concept of self-efficacy. Bandura (1994) describes self-efficacy in terms of individuals’ beliefs about their capacity to influence and have an impact on situations that affect their lives. Given there is evidence of some correlation between teacher self-efficacy and attitudes toward inclusive education (Weisel & Dror, 2006), as well as evidence of a relationship between self-efficacy and skill development (Soto & Goetz, 1998) consideration of this relationship is warranted. At the same time, some caution is necessary, with Chan (2008, p. 182) describing how “despite general acknowledgement of the importance of studying teacher efficacy, there is no consensus view of the meanings and measures of the construct”. Further, there is a need to distinguish between what Tshannen-Moran, Woolfolk Hoy and Hoy (1998) describe as a general collective teacher efficacy, referring to teachers’ beliefs in the ability of the field to impact on student outcomes, and personal self-efficacy, referring to an individual’s beliefs about their own capacity to have such an impact. This distinction is further described by Hoy and Spero (2005),
who describe how, while teachers may feel comfortable that the profession should have particular capacities, they may not feel so comfortable on an individual level.

Studies of teacher self-efficacy indicate the complex relationship between an individual’s self-beliefs and behaviours. Holzberger, Phillip and Kunter (2013) implemented a longitudinal study examining the relationship between instructional quality and self-efficacy. Data were collected from 155 German secondary mathematics teachers and 3,483 Year 9 students. These researchers found that not only was there a correlation between self-efficacy and instructional quality, but also that self-efficacy was further enhanced by positive classroom experiences.

A study of teacher self-efficacy in inclusive settings explored what teachers expect of themselves in three dimensions (instruction, behaviour management and collaboration). The study drew on participants from three countries, China, Finland and South Africa (Malinen et al., 2013). The countries chosen were reported as representing different histories, culture, sizes and approaches to inclusive education, hence there were variations in results, as would be expected given that self-efficacy is context specific (Tschannen-Moran & Woolfolk Hoy, 2007). The Chinese sample consisted of 451 primary and middle-school teachers from Beijing, 855 Finnish teachers from primary, lower secondary and unified comprehensive schools, with the South African sample including 605 responses from primary and secondary contexts. Each participant completed a questionnaire – the Teacher Self-Efficacy for Inclusive Practices scale, divided in three sub-scales on efficacy in instruction, in managing behaviour and in collaboration. These researchers found that having had experience in inclusive settings was the major consistent factor across cultures in determining whether teachers had positive expectations of their ability, or not. Further, efficacy in collaboration was seen to strongly predict overall attitudes toward inclusion, and teacher’s self-perceived ability within inclusive environments.

Lancaster and Bain (2007) explored the impact on self-efficacy for teaching students with disabilities of PSTs having completed a course covering materials relevant to inclusive education. The study involved 125 participants from two different programs (one a Bachelor’s degree in primary education, the other a Bachelor’s degree in early childhood education) completing the same core of academic work, but differing field-based experiences. One group was involved, after additional training, in a one-on-one mentoring program. The second group was involved in additional input on areas
including literacy and numeracy, and assistive technology prior to participating in an in class experience in inclusive classrooms, while the third group (the early childhood cohort) completed additional work in a number of areas, such as early intervention and transition skills, before making a group presentation. A pre-test/post-test was implemented measuring self-efficacy on each occasion (before and after the experience) using the Self-Efficacy toward Future Interactions with People with Disabilities scale. These researchers found a statistically significant difference for the occasion of testing, with all groups showing gains. There was, however, no statistically significant difference between the levels of the dependent variable. Lancaster and Bain’s (2007) study demonstrated that the self-efficacy of PSTs with respect to their future work in inclusive classrooms can be impacted positively by engagement with course materials during their preparation.

In a study of Turkish English as a foreign language teachers, Yilmaz (2011) investigated the relationship between the teachers’ self-perceived proficiency in the content of their material and their perceptions of teaching efficacy. The study involved 54 teachers completing a three-part questionnaire with the first part focusing on perceived self-efficacy, the second on self-reported English proficiency, and the third on pedagogical strategies for teaching the content. The study found a positive correlation between the “teachers’ self-reported perceptions of classroom management, instructional strategies, and their self-reported English proficiency in listening and writing skills” (p. 98). Yilmaz concludes from the findings that there is an important link between teachers’ self-efficacy and the type of classroom climate and learning experiences they created and that “self-evaluation made on the basis of their teaching competence has a considerable impact on classroom practices in regard to teachers’ efforts and targets, and the challenges they set for themselves and for their students” (p. 99).

Flores (2015, p. 4) describes how “a growing body of scholarship suggests that pre-service teachers’ efficacy may be significantly influenced by their teacher preparation program and field experiences.” In a quantitative study of elementary science teaching involving 30 PSTs, she examined the self-efficacy and outcome expectancy within a science methods course with an embedded teaching practice component. Data were gathered using the Science Teaching Efficacy Belief Instrument-Preservice, Form B, an instrument the researcher describes as being well established and having been used in numerous studies. A pre-test/post-test design was implemented, and Flores found that
both general teaching efficacy and personal science teaching efficacy showed statistically significant increases, a result she concluded was due to “mastery experiences and successful performance” (p. 13) during the duration of the course.

These studies highlight the complex inter-relationship between teacher skills, attitudes and dispositions and their links to self-efficacy. The attitude of teachers toward inclusion is described in the literature as an important determinant of the success of inclusive placements. These attitudes have, however, also been linked to the self-efficacy of both teachers and PSTs. Further, the literature describes a link between self-efficacy and instructional quality. For PSTs, the research shows both the importance of mastering the skills of effective teaching, but also that self-efficacy can be enhanced through focussed instruction on skill development (Flores, 2015; Lancaster & Bain, 2007; Yilmaz, 2011).

2.3.3.2 Placement of students

Another factor having an impact on the attitudes of teachers toward inclusive classrooms concerns the effect of the placement on both the student(s) with disabilities and their non-disabled peers, with questions as to both the degree of benefit for students with disabilities as well as the perceived negative impact on students without disabilities. Matzen, Ryndak and Nakao (2010) studied the experiences of three middle-school students with disabilities and the teams responsible for their education during the first year of the students receiving general-education services, with placement in a regular class. Semi-structured interviews were conducted with general and special education teachers as well as parents or guardians for each student about the student background, schooling experiences, skills, hopes and aspirations and their experiences/perspectives about the home/school relationship. Observations were also carried out in both segregated and general-education contexts. Despite reporting some issues associated with philosophical differences and some difficulties with the level of collaboration required, these researchers also reported improvements in student performance over the duration of the school year, and data that indicated “students received more instruction, experienced less down time and engaged in fewer problem behaviours in the general education setting” (Matzen et al., 2010, p. 287).

In investigating the outcomes in post-secondary educational settings for students with learning disabilities or emotional-behaviour disorders who had experienced an inclusive high-school placement, Rojewski, Lee and Gregg (2015, p. 210) found that there was a
positive and “direct causal link between inclusion and postsecondary education.” This link was described as extending the results of past studies, which had been only descriptive or correlational. For their study, these researchers analysed data from a stratified random sample of 500 school districts and 40 special schools in the US derived from the National Longitudinal Transition Study. The study represented 780 students with learning disabilities and 580 with emotional-behavioural disorders. The findings from this literature linking positive student outcomes to inclusive placement creates an imperative for PSTs to have mastered the skills of effective inclusive teaching, as well as to have developed a positive disposition toward inclusive classrooms prior to graduation.

Similarly, a number of studies have sought to determine any impact evident on students without disabilities in inclusive classrooms. Dessemontet and Bless (2013) investigated the effect on students without disabilities, who were rated as low, average and high achieving, of having students with intellectual disabilities included (with support) in general classrooms. A quasi-experimental pre-test/post-test study was conducted in the second year of primary education in Switzerland. An experimental group consisted of 20 classes from three Swiss provinces that included children with intellectual disabilities, while the control group consisted of 30 classes, chosen at random, where there were no students with intellectual disabilities. Teachers of the classes concerned had an ‘opt out’ option and a 93% participation rate was reported. Children from each group were matched for a number of criteria (gender, socio-economic status, mother tongue, age, IQ, and academic achievement) at the pre-test (low, average, high) and paired. The final sample, after a small dropout rate, consisted of 202 pairs (404 students). The researchers in the study found there were no significant differences apparent in the progress of students from any of the groups examined (low, average or high-achieving students). This led them to conclude “that the inclusion of children with ID [intellectual disability] in primary regular education classrooms with support is not detrimental to the academic progress of students without disability” (p. 29).

Important in these considerations is the relationship between the beliefs of teachers and PSTs and their attitudes and dispositions toward inclusive classrooms. Given the relationship between positive outcomes in inclusive settings and attitudes and dispositions, there is a need for initial teacher-preparation programs to address such beliefs prior to graduation.
While the acceptance of systems and schools and the attitudes and dispositions of teachers are well represented as important factors in creating positive inclusive experiences, as this section has described, it is also clear that these are impacted significantly by the experiences of teachers. Studies describing the challenges experienced by teachers are described in the following section. A consideration of these challenges is important for this research as, in impacting on the attitudes and dispositions of teachers, these challenges are also those experienced by PSTs in the context of their practicum placement. Given the entrenched beliefs about teaching held by PSTs, as described in the literature, these challenges have the potential to impact significantly on those in the process of completing their courses of study.

2.3.4 **Implications for teacher preparation**

For inclusive classrooms to be effective, sufficient support mechanisms need to be put in place and ongoing professional development provided for practitioners (Ashman & Elkins, 2012; Foreman & Arthur-Kelly, 2014). While PSTs in some jurisdictions in Australia (e.g. NSW) are required to complete a discrete academic study in inclusive education prior to employment, this is not universal, and the potential exists for graduates to therefore have little, if any, preparation in this aspect of their practice. While most will have some experience of students with disabilities during their practicum placement, it cannot be assumed that any formal input on effective inclusive teaching practices will have taken place.

In the Australian context, a 2012 report reviewing the implementation of the Disability Standards for Education (2005) (*Report on the Review of Disability Standards for Education 2005, 2012*), a piece of Australian legislation under the *Discrimination Act 1992*, concerning educational opportunities for people with disabilities, recognised that, while adequate resourcing and ongoing professional development were important for successful inclusion, they were not always forthcoming. The report described how “funding and resourcing were raised as issues at every consultation and in the majority of submissions” (p. 49) while the committee was gathering information. One of the recommendations of the report was that resources needed to be allocated to allow the implementation of the standards across all educational sectors, including the training of staff to meet core competencies (p. 70). These core competencies include those reflected in teaching standards, including effective teaching practices, strategies to support
inclusive placements, knowledge of assessment and reporting and the ability to engage in professional collaboration.

A number of Australian studies exemplify the findings of this report. A study by Brown, Packer and Passmore (2013) investigated the classroom environment in early education (both school and preschool settings) for students with visual impairments. For their study, 31 students were recruited from 166 invitations; however, due to a number of factors (such as students not meeting all eligibility criteria and staff members declining school involvement), 20 students participated. A number of different data-collection tools and techniques were used, including demographic information from parents, teacher opinion questionnaires, parent involvement questionnaires, vision aids and equipment availability, teacher training and experience, and quality of inclusive experiences measures. In terms of support provision, these researchers report “widespread inadequacies in the regular classroom environment” (p. 230). They highlight lack of professional development in inclusion, generally and in meeting the needs of students with vision impairments specifically as well as “inadequate specialist input, personnel, planning time, and resources to support staff” (p. 230) as serious issues and challenges to teachers maintaining a positive attitude to inclusion.

In terms of resourcing and professional development, similar results were found in a study by Morris and Sharma (2011), also supporting the findings of the 2012 investigation into the implementation of the Disability Standards (Report on the Review of Disability Standards for Education 2005, 2012). These researchers conducted focus group meetings with seven specialists (itinerant support teacher – vision) in providing vision support for both teachers and students in mainstream classes. Focus group questions were aimed at collecting data from personal experience and the exploration of issues of common concern. Participants were also requested to complete a questionnaire prior to participation, both to assist in preparing participants for the discussion, and as a means of triangulation of data. Morris and Sharma (2011) identify what were described as systemic barriers, including lack of resources and time, as key issues. Further, inadequate training, both pre-service and in-service, were important themes arising from the data.

Reports from international jurisdictions show similar findings. MacBeath, Galton, Steward, MacBeath and Page (2006) visited 20 schools from seven LEAs in the UK to investigate the workloads and resource allocation required for the inclusion of children
with special educational needs. LEAs were chosen so as to represent a range of geographical locations as well as a range of differing policies on inclusion. Each site involved interviews with between five and 10 teachers, a similar number of pupils, up to eight parents, the special educational needs coordinator and the head teacher. Classroom observations were also conducted where the school was conducive to these. In terms of resources and professional development, a number of findings emerged from the report. First, the report found that the resources allocated were insufficient to meet demand, creating unnecessary workloads and stress on teachers. Second, the researchers reported that there was frequently insufficient expertise and lack of professional development allowing teachers to develop the necessary skill-set for effective inclusive practice.

The literature describing the resource and professional development requirements of inclusive classrooms is clear in a number of areas, but in particular is highlighted in the 2012 review of the Australian Disability Standards for Education. The first issue is that resources in terms of both materials, personnel and time are important supports for inclusive classrooms. The second key issue is that ongoing professional development for classroom teachers, beyond anything they may have received at tertiary level, is important in supporting their ability to professionally engage in such contexts. What is also clear is that the provision of these supports rarely meets the demand from both a teacher and child perspective.

Considerations of personal self-efficacy are also important for teachers of inclusive classrooms, as described previously. In reporting educators’ beliefs about inclusion, Forlin (1995) found that increased involvement in decision-making processes was found to have an impact on attitudes and resulted in greater commitment by teachers. The Monsen et al. (2014) study similarly found positive impacts associated with teachers’ beliefs about their classroom environment. These researchers found that “teachers with highly positive attitudes towards inclusion were rated by their pupils as having a significantly greater level of cohesiveness, and significantly less competitiveness and difficulty, in their classroom than teachers who held low or medium attitudes” (p. 123). Engaging PSTs in programs that build both skills and confidence in implementing these skills is an important finding from the literature in this section.

2.3.5 Summary

To be an effective teacher in an inclusive classroom is a complex task. That complexity is based in a solid mastery of what the literature describes in terms of effective teaching
practices, including the ability to choose content and pedagogy aligned to student needs, to effectively deliver instruction at multiple levels, to manage diverse learning environments, to collaborate effectively with a variety of other professional and paraprofessional personnel and to constantly monitor and report on individual student progress. Further, in the implementation of these skills, an effective inclusive educator must display a positive attitude toward teaching all students, and the ability to create classroom environments that facilitate this learning. At the same time, the challenges that may be encountered need to be recognised, including limited experience, limited resources (including personnel), and the impact of personal self-efficacy. All of these issues impact on the cognition of pre-service practitioners and on their development of schema; hence, are intrinsically linked to this current research and its assumptions. Table 2.1 (below) describes some of the key aspects of teaching in diverse settings and how these are included in teaching standards both within Australia and within wider jurisdictions.
<table>
<thead>
<tr>
<th>Key features of inclusive classrooms</th>
<th>Key concerns/areas of challenge</th>
<th>Key graduate standards (AITSL, 2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td>An appreciation and acceptance of student difference/diversity (Ashman &amp; Elkins, 2012; Tomlinson, 2005)</td>
<td>Lack of training/experience in developing inclusive programs (Faragher &amp; Clarke, 2016; Schultz, 1982)</td>
<td>Demonstrate knowledge and understanding of strategies for differentiating teaching to meet the specific learning needs of students across the full range of abilities (Standard 1.5)</td>
</tr>
<tr>
<td>A positive attitude by teachers, promoting a sense of community &amp; social acceptance (Ashman &amp; Elkins, 2012; Tomlinson, 2005)</td>
<td>Lack of adequate support/personnel/time/resources (Alexander, 2001; Forlin, 1998; Kauffman et al., 1988)</td>
<td>Demonstrate broad knowledge and understanding of legislative requirements and teaching strategies that support participation and learning of students with disability (Standard 1.6)</td>
</tr>
<tr>
<td>Appropriate choice of content and pedagogy aligned to student needs (Ashman &amp; Elkins, 2012; Mastropieri &amp; Scraggs, 2003; Tomlinson, 2005)</td>
<td>Little/no control over decision-making processes (Forlin, 1995)</td>
<td>Set learning goals that provide achievable challenges for students of varying abilities and characteristics (Standard 3.1)</td>
</tr>
<tr>
<td>Effective classroom management skills (Ashman &amp; Elkins, 2012; Mastropieri &amp; Scraggs, 2003; Tomlinson, 2005)</td>
<td>Effect of placement on both student with disability and on non-disabled peers (Espiner, Wilton, &amp; Glynn, 1985; Tompkins &amp; Deloney, 1995)</td>
<td>Describe a broad range of strategies for involving parents/carers in the educative process (Standard 3.7)</td>
</tr>
<tr>
<td>Ability to collaborate and opportunities for collaboration (Ashman &amp; Elkins, 2012; Foreman, 2008; Friend &amp; Cook, 2007; Tomlinson, 2005)</td>
<td>Challenges of co-operation &amp; collaboration (Alexander, 2001; Forlin, 1998)</td>
<td>Demonstrate the capacity to organise classroom activities and provide clear directions (Standard 4.2)</td>
</tr>
<tr>
<td>Key features of inclusive classrooms</td>
<td>Key concerns/areas of challenge</td>
<td>Key graduate standards (AITSL, 2011)</td>
</tr>
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<td>-----------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Appropriate support and professional development provision (Ashman &amp; Elkins, 2012; Mastropieri &amp; Scruggs, 2003; Schultz, 1982)</td>
<td>Expectations – self, system, parents (Forlin, 1998)</td>
<td>Demonstrate understanding of assessment strategies, including informal and formal, diagnostic, formative and summative approaches, to assess student learning (Standard 5.1)</td>
</tr>
<tr>
<td>Monitoring of student progress &amp; provision of feedback to students and families (Ayres, Sawyer, &amp; Dinham, 2004; Howell &amp; Nolet, 2000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High expectations of all learners and positive reinforcement (Ayres et al., 2004)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For initial teacher-education programs in higher education institutions, the importance of ensuring a thorough grounding in the required skills is paramount. Similarly, governments have exerted significant influence on initial teacher education through, among other measures, the development of teaching standards. These standards are frequently described at differing levels (e.g. graduate, proficient) indicating that there is broad recognition of the need to further develop skills after graduation. Nonetheless, on graduating from a teacher-preparation program, practitioners need to be able to meet these standards at a fundamental level. The requirements of standards is discussed in the next chapter.
Chapter 3:  Embedding effective practice: Teaching standards, teacher accreditation and teacher preparation

The previous chapter of the literature review examined the research on effective teaching practices and on the implementation of these practices in inclusive settings. This chapter will discuss the development of teaching standards, both in the Australian context and internationally, as a mechanism for translating the research on effective teaching into routine practice. It will, further, examine how these standards are embedded within teacher-preparation programs. For the purposes of this thesis, these considerations are important as teaching standards provide a frame of reference delineating what can reasonably be expected of a graduate from a teacher-preparation program. As such, they serve as a further foundation of schema development, reflecting the curriculum priorities shaping PST experiences.

The translation of research about education into the practice of teaching is frequently described as problematic. A significant body of literature has developed investigating the ‘research-to-practice gap’. While not the focus of this research, this gap between what we know and what is routinely practised represents a significant driver in the evolution of standards, as educational jurisdictions attempt to capture research findings to create a representative framework of requirements. The chapter will investigate how teaching standards embed the research on effective practice, acting as a framework for the design and conduct of teacher-preparation programs, and as a point of reference for the expectations of graduate teachers. Teaching standards have been a major outcome of numerous investigations and reports into teaching and teacher preparation, both nationally and internationally, over the last two decades. Finally, this chapter will examine the relationship of teaching standards to the practice and professionalism of teaching, as it evolves toward greater visibility of what is required from practitioners.

3.1 Research-to-practice gap

The existence of a gap between educational research and the practice of teaching has been the subject of many reports and position papers, but limited empirical research (Grima-Farrell, 2012; Vanderlinde & van Braak, 2010). In studying this phenomenon, these authors found a consistent disconnect between the teaching and research communities, with greater levels of co-operation mooted as one way to help bridge the divide. The ‘gap’ exists within both general and inclusive education, with one of the
commonly proposed reasons being the “separateness of the research and practice communities” (Greenwood & Abbott, 2001, p. 276). Further, Korthagen (2010, p. 407) describes the continued existence of the research-to-practice-divide as “leading to serious doubts concerning the effectiveness of teacher education.”

In a literature review exploring the gap between educational research and practice, Broekkamp and van Hout-Wolters (2007) identify four major contributory concerns. These were divided into two sections: those that were related to the production and distribution of the research; and those that were related to its practicality, usefulness and value. They describe the dissemination of research findings to practitioners as challenging due to the lack of skills on the part of researchers to distribute their work beyond academic journals, coupled with a lack of effective mechanisms to do so. Stevens (2004) further argues that researchers exacerbate the issue because they have a tendency to publish in academic journals with higher ratings, but that practitioners do not read, rather than practitioner journals that are seen by academics as of less value.

From the perspective of practitioners, researchers are often viewed with suspicion as being both disconnected from the practice, as well as being a part of the political landscape constantly pushing for reform (Frederiksen & Beck, 2010). Korthagen (2010) identifies the gap as having three main contributory causes: first, patterns of existing socialisation within schools; second, the complexity of teaching; and third, issues within teacher-preparation programs, including their inability to overcome the previous beliefs of PSTs. Korthagen’s study proposes a “realistic” (p. 414) approach to teacher preparation, with greater connections between institutions and schools, as being one way to address the issue.

Bain and Dreengenberg (2016) contend that an underpinning reason for the research-to-practice-gap can be seen as being the lack of a robust framework for the practice of teaching. These authors draw comparisons with the professional field of nursing, where explicit protocols have been developed for a range of contexts that are based in evidence-based practices. Bain and Dreengenberg (p. 18) contend that these protocols “involve a visible work process that makes standardised judgements of professional quality and the differentiation of practice possible”. Not only is the work process visible, but each step in an intervention is highly explicit, and is “informed by a body of applied and experimental research … data is gathered in all phases of the process, and it is not ‘about’ the activity – it is an intrinsic part of the activity” (p. 19), required to implement a given protocol “not to speculate about what happened” (p. 19).
Bain and Drengenberg further argue that such a robust framework for practice, and the kind of focussed and robust professional standards for practice that exist in other fields – creating a conduit and context for the translation of research into practice – are only beginning to evolve in learning and teaching. They argue that “to respect, care for, and serve the individual well, a profession must be able to standardise – to intervene, monitor, communicate, manage, and report.” Further, “to do these things a profession must have a shared practice; it must be able to compare, make visible and control its professional context” as it is this shared context that “creates a mechanism for collective attention to individual needs” (p. 21).

The long history of research having little impact on the classroom practices of teachers coupled with the lengthy examination of teaching practice and teacher preparation undertaken by various educational jurisdictions has made the establishment of teaching standards an important and almost inevitable step. These standards place an extant framework around practice, in which the research on effective teaching practice can be enabled. Such standards are important for this current research because they allow a description of the skills and knowledge a practitioner should have mastered, at graduate level, prior to working in inclusive classrooms. Standards, as an expression of effective teaching practice, are examined in the next section.

### 3.2 Teaching standards and effective practice

This section of the review examines teaching standards as a means of creating a framework around effective teaching practices and the expectations of graduate teachers. It focusses in particular on the knowledge and professional practice attributes expected of graduates for accreditation. A growth in requirements to accredit teachers within such a framework has been promoted by governments both nationally and internationally (AITSL, 2016; Department for Education, 2013; National Board for Professional Teaching Standards, 2014). The purpose of this requirement is to improve teaching practice by explicitly framing the literature on effective teaching, setting the priorities for PST preparation adopted by providers.

Standards have been among a number of responses to concerns about teacher quality, professionalism, and the ongoing failure to translate the findings of research into teaching practice. Other initiatives adopted in various jurisdictions include pre-employment testing of graduates, and new requirements for teacher-preparation courses (AITSL, 2016; Board of Studies Teaching & Educational Standards, NSW, 2012;
Current standards have built upon previous iterations progressively, with both professionally controlled and government bodies having had an impact on their development (National Board for Professional Teaching Standards, 2013; New South Wales Institute of Teachers, 2005; Training and Development Agency for Schools, 2008). Government has sought to more closely prescribe teacher attributes not just at graduate level, but throughout the development of an individual’s career. In the Australian context, the frameworks defined by these requirements have included what teachers should know (professional knowledge), be able to do (professional practice), and how they operate as a part of a wider professional community (professional engagement), in terms of meeting the needs of students in inclusive classrooms. Other educational jurisdictions have developed similar categories within which to organise their expectations.

Most important for the purposes of this research is the connection between standards and the literature on effective practice, in that effective teaching skills and practices, classroom-management skills, collaboration and communication skills and the capacity to monitor student progress and provide feedback, among others, are clearly represented within expressions of teaching standards across jurisdictions. Further, the existence of standards brings clarity to what is intended in shaping the schema development of PSTs. An examination of a number of sets of standards and their links to effective practice literature as examples of this are described in the next section.

### 3.3 Sets of standards

This section describes examples of teaching standards applicable in three jurisdictions. The examples used are to illustrate the ways in which research about effective teaching practices can be seen to be represented in standards. The first examples of standards are drawn from those applied to graduate-level special educators in the US. These standards are those developed by the Council for Exceptional Children (CEC), a peak body in that country that advocates within the field of education for children who are considered ‘exceptional’. In the US, exceptional means that they do not fit within the ‘normal range’ of development for their age. The second group consists of examples drawn from teaching standards applied to graduates from teacher-preparation programs in the UK, as determined by the English Department for Education. The third group of examples
are those that apply to graduates from programs within Australia, as determined by the AITSL.

Within the US, there are a number of bodies that deal with teacher accreditation and the application of standards. One of these bodies is the National Council for Accreditation of Teacher Education (NCATE). While it is primarily responsible for the voluntary accreditation of courses by providers of teacher-education programs, NCATE also works in collaboration with other bodies accrediting teachers, in a manner that helps ensure consistency across programs and graduates. The CEC is a long-established group that lobbies government at local, state and federal level as an advocate for children with exceptionalities, including children with disabilities. The CEC has developed sets of preparation standards for special educators at both initial and advanced levels. These standards were approved by NCATE in 2012. Approval of these preparation standards supports the CEC’s ongoing attempts to entrench research-based practices in performance-based recognition of special education preparation programs and provide a framework of expectations of the skills able to be predicted of graduates from accredited courses.

In 2011, the First Report of the Independent Review of Teachers’ Standards (Coates, 2011) was presented by the Secretary of State for Education in the UK. This report presented a set of standards against which teachers could be measured to attain Qualified Teacher Status, thus making them able to teach within the jurisdiction. These standards were introduced for use from September 2012. Like the CEC standards, those in the English jurisdiction focus on the knowledge and skills required of a graduate to allow effective classroom practice. As with the CEC standards, those applied to graduates in the UK include aspects of practice pertaining to teachers in inclusive settings. In particular, Section 6 of the UK standards refers to the adaptation/differentiation of instruction to meet the needs of students with particular educational needs, described in the standards as those with higher ability, those for whom English is a second language and students with disabilities (Coates, 2011).

While teaching standards at graduate (and higher) level within the Australian context are determined nationally by the AITSL, school education is generally considered to be the responsibility of the states. Some states have additional requirements of providers for accreditation of teacher-preparation programs that are considered by these jurisdictions to better prepare graduates for practice. NSW, for example, requires
teacher-preparation programs to include a stand-alone unit of inclusive education. Other states do not have this requirement, arguing that embedded approaches are more effective. Regardless of the approach taken, all aspects of the national framework are required to be met by graduates. As with the previously described sets of standards, those within Australia include specific requirements focussed on the needs of students with disabilities. The skills required include those reflected within the effective practice literature, such as differentiation, classroom-management skills, and assessment and reporting skills. Examples of teaching standards from each of these jurisdictions, matched against the literature associated with effective teaching practice, as described in the earlier sections of this review, are reported in Appendix 5.
As the table in Appendix 5 indicates, the findings of research into effective practice in inclusive classrooms are well represented within frameworks of teaching practice, with teaching standards from all three jurisdictions showing clear links to the body of literature described in Chapter 2. These frameworks provide a structure against which not only is the accreditation of a graduate measured, but against which programs of teacher preparation can be designed and, where required within a jurisdiction, submitted for accreditation. What is evident from examining examples of standards frameworks across jurisdictions is that international standards for graduate teachers have explicit expectations of the capacity of graduates emerging from programs of preparation. These expectations have a clear line of sight to the literature on effective teaching practices and describe what participants should be able to do on completion of their preparation (i.e. on graduation). These considerations are important for this research as the fundamental proposition being tested is whether PSTs develop a schema for practice that reflects their preparation program. This proposition forms the basis of the instrument developed for data collection. Teacher-preparation programs are described in the next section of the review.

### 3.4 Teacher preparation

The previous section described how ongoing examination of teachers and teaching has contributed to the development of teaching standards against which graduates from teacher-preparation programs can be measured. In providing this framework, teacher-preparation programs are also influenced in the content and structure of their offerings in an effort to ensure that their graduates meet standards and are thus able to be accredited as teachers. For a number of jurisdictions, the programs themselves require accreditation, whereby providers need to demonstrate where and how the capacity to meet the teaching standards will be developed. In other jurisdictions, while such accreditation is not a requirement, it is seen as desirable. Important here is the recognition that professional teaching standards are embedded within teacher-preparation courses, thus representing the attributes that can be expected of graduates at the completion of their study.

Within Australia, accreditation of teacher-preparation programs is mandatory and is described within the document *Accreditation of initial teacher education programs in Australia: Standards and procedures* (2011). While the national process is overseen by the AITSL, it is implemented within each state by a body vested with that
responsibility. For NSW, for example, up until recently that body was the Board of Studies Teaching & Educational Standards, NSW. Recently, this body has been rebadged as the New South Wales Education Standards Authority. While there are program standards and requirements placed on providing institutions, the major emphasis is to “outline what an initial teacher-education program needs to do to prepare teachers to teach in Australian schools, and to meet the National Professional Standards for Teachers at the Graduate career stage” (AITSL, 2011, p. 1). The driving force for an accreditation process within this jurisdiction is the teaching standards described earlier. AITSL rationalises its approach as motivating continuous improvement in initial teacher education and providing a mechanism to make institutions accountable for their delivery of quality teacher-education programs. AITSL (p. 1) describes how “The Standards and Procedures provide a framework that outlines what constitutes quality in initial teacher education … they present a common understanding and language and allow for professional discussions between teachers, principals, teacher educators, professional associations and the public.”

Within the US, the responsibility for accreditation and certification of both programs and teachers is also shared between state and national authorities. In 2013, the Council for the Accreditation of Educator Preparation was formed from NCATE and the Teacher Education Accreditation Council. From 2016, the council’s accreditation standards were fully implemented. These standards, similarly to those in Australia, aim to delineate the providers’ responsibilities in ensuring that teaching standards are embedded within programs. A 2014 report by the American Psychological Association, Assessing and evaluating teacher preparation programs, describes the importance of this approach as the standards “require teacher education programs to demonstrate their graduates are capable of having strong positive effects on student learning” (p. 2). Further, the association argues, this needs to be informed by well-established scientific methods of data collection that address the measurement of behaviour as their source. Again in a similar manner to Australia, capturing the essence of teaching standards, which are themselves based in research about effective teaching, is the fundamental intent of accreditation approaches in this jurisdiction.

There are a number of pathways and providers for initial teacher training in the jurisdiction covering England and Wales. These pathways can include both university-based (leading to qualifications such as the Post Graduate Certificate in Education) and school-based programs, where schools or groups of schools can apply for registration as
providers of initial teacher training. Regardless of the type of training, all programs must include classroom experience in schools and underpinning knowledge of teaching. All providers of programs leading to Qualified Teacher Status undergo mandatory regular inspection by the Office for Standards in Education, Children’s Services and Skills. Providers are required to show how their programs will allow the development of graduates who can meet the teaching standards for the jurisdiction. As with the Australian and US contexts, it is the teaching standards, reflecting the effective practice literature that can be seen to have a significant influence on the accreditation of teacher-preparation programs. Requiring this accreditation has had a follow-on consequence for the structure and content of programs aiming to prepare teachers for classroom practice.

Across international jurisdictions, aspects of the effective practice literature, represented in standards frameworks, can be seen to impact the content of teacher-preparation programs. Examining and comparing information from institutional providers from three such jurisdictions - Australia, the US and the UK – indicates how this impact is represented, including examples of subject titles and descriptions, and designated outcomes from preparation programs in each. Appendix 6 describes this analysis. Institutions represented are, for the Australian context, Charles Sturt University and the University of Newcastle. Both of these institutions are recognised within that jurisdiction as providers of graduate teachers. Likewise, the US is represented by Stanford University and Kansas University. Both of these institutions are recognised as providers of ‘quality teachers’ within that jurisdiction. Brunel University represents the UK context, with it, too, representing a well-recognised provider of teachers.
What can be seen from the table is that the key areas identified in the effective practices literature are clearly represented in the preparation programs from differing jurisdictions and institutions. Effective teaching practices and skills emerged with a high representation of aspects of preparation programs, both within individual subjects/courses and across programs more widely. Classroom-management skills, and their capacity to assist in the creation of positive learning environments, are also well represented, as are skills of communication with both families and other professionals. The capacity to monitor student progress through a variety of relevant assessment approaches, and to provide feedback on student outcomes, to both students and carers, is also represented from all example sites examined. Thus, the table illustrates a clear line of sight from the research on effective teaching through to teacher-preparation programs, mediated by teaching standards at graduate level. As such, it is intrinsically linked to this thesis in that it indicates what would be reasonable expectations of the schema development of PSTs at the point of their graduation.

Notwithstanding the evolution of standards as frameworks embedding effective practice literature into frameworks for practice, questions still remain as to the quality of teachers and their preparation. Numerous reports from both national and international jurisdictions have continued to call into question the ability of teacher-education programs to graduate quality teachers. In Australia, these reports include *Quality Matters* (Ramsay, 2000) and *Top of the Class* (Hartsuyker, 2007), while internationally *Educating School Teachers*, (Levine, 2006) in the US, and *Quality Assurance in Teacher Education in Europe* (Eurydice, 2006) from the European Commission are examples. Some of the ongoing issues raised in these reports include inconsistent program offerings, inconsistent entry standards, and a lack of clear connection between the tertiary site and school-based practicums. Despite these reports, however, the processes of accreditation of both courses and graduates against an extant framework of standards make it reasonable to expect that graduates will have a base of knowledge, understanding and skills at graduate level enabling them to engage as effective classroom practitioners.

### 3.5 Summary

This chapter of the review has examined how literature describing effective teaching practices has been used to develop frameworks of professional standards. These standards can be seen to be important drivers of the content of teacher-preparation
programs, acting as an important link bridging the gap between what research informs as being effective teaching practice and what graduates can be expected to have experienced throughout their courses. For the purposes of this research, these considerations are important in delineating the attributes of teachers on graduation from their preparation programs and the schema for professional practice of those individuals. Further, the chapter has examined the research-to-practice gap in education that is frequently reported as problematic in the literature, and has described how standards are one way of addressing this concern. At the same time, it acknowledges the findings of a number of reports from jurisdictions both within and outside of Australia into the preparation of teachers. In an effort to place a structure around what graduates should know and be able to do on completing their preparation programs, reflecting their development of a schema for practice, various jurisdictions have developed sets of teaching standards that embed the characteristics of effective practice into frameworks used to guide both individuals, as well as the institutions offering the programs that prepare them for practice. In this preparation, programs implement a variety of academic and practicum-based learning experiences that are intended to impact on the cognition of PSTs and allow them to develop an individual schema for practice. This graduate schema is then further developed by both individual experience and professional development activities. Impacts on the cognition of PSTs will be examined in the next chapter of this review.
Chapter 4: The cognitive development of pre-service teachers

The previous chapters of this review examined the literature about effective teaching practices, how this literature is translated into effective practice in inclusive settings, how the body of literature in this domain is embedded within frameworks of teaching standards, and how these standards are used to frame teacher-preparation programs. These bodies of literature are important as collectively they describe what is intended as the professional skill-set of a graduate teacher entering the profession. As such, they are reflective of the schema development that would be expected from these graduates.

The extent to which these practices are implemented by graduate teachers reflects and is mediated by the way they think about their practice. This chapter examines the cognitive development of PSTs focussing on key ideas in cognitive psychology and the ability of preparation courses to impact on, and help to shape the cognition of, graduates. It focuses specifically on the way cognition mediates decisions about the practice of graduate teachers.

The capacity of teachers to implement the skills taught in teacher-preparation programs at a level defined by graduate standards is significantly impacted by what they think about their practice, and what they have been taught. This capacity is important for this research, as the thesis focusses on measuring the cognition of PSTs, reflected in their schema for practice. Hence, one of the outcomes of teacher preparation concerns the cognitive changes PSTs experience as they develop an understanding of what is involved with being a teacher (Yuan & Lee, 2015). This chapter of the literature review will examine the field of teacher cognition, in particular the cognitive impacts of teacher-preparation courses on the thinking, and subsequently behaviour, of graduate teachers. It will examine the concept of a schema as a construct from the field of cognitive psychology, providing a mechanism allowing an individual to develop memory structures from prior experience. This construct mediates how teachers behave in the classroom as a result of their beliefs about practice (Borg, 2003). These memory structures are important in that they can ultimately allow individuals to actualise appropriate responses to familiar situations, as well as acting as a mechanism to reduce cognitive load in complex environments. When applied to teaching, this complex environment is represented by the unpredictable and frequently challenging nature of classroom practice.
This chapter of the review, further, examines the relationship between teacher behaviour and teacher thinking, and how teacher beliefs as an expression of cognition influence those behaviours, examining what factors are described in the literature as having an influence on teacher cognition. Finally, the chapter will examine how a schema can also be represented as an organisational phenomenon, examining how the concept of schema is apparent in a number of theories relevant to organisations, and an understanding of how learning takes place. The need for an individual’s schema to resonate with that of a field of practice if an individual is to successfully engage with that field is also explored. The following sections describe the results of the searches undertaken and an elaboration of the literature reviewed.

In conducting this piece of the review, literature searches were conducted with an initial focus on cognitive psychology. In addition to foundational texts and articles, searches were completed using the descriptors *the role of cognition in behaviour, schema in cognitive psychology* and *cognitive load*. These descriptors resulted in a large body of literature, with the role of cognition in behaviour and cognitive load, for example, resulting in over 10,000 and almost 34,000 positive results respectively. The initial search was limited to the previous 10 years to ensure the most recent research was captured, then further refined to studies focussing on cognition and reasoning, problem solving, schema and cognition, learning and memory, which narrowed the outcomes to 112 relevant sources. Examination of these sources provided citations and references to key earlier research in the field for further investigation. This earlier research was then folded into the review. In applying these concepts to teacher preparation, teacher behaviour, the factors influencing the cognition of PSTs and the impact of teacher-preparation courses on cognition, descriptors used were *cognition of pre-service teachers, influences on the cognition of pre-service teachers and impact of teacher preparation on cognition of pre-service teachers*. These additional descriptors focussed the search on those aspects particularly relevant to teacher education, while further searches, including *teacher beliefs and teacher behaviour, teacher cognition and teacher behaviour, and cognitive load in classrooms* helped to link more closely to behaviour and practice as representations of beliefs. Ultimately, 61 sources were examined, with some of these having little relevance to this research, while others provided additional relevant literature. While the body of literature was strong for cognition more broadly, it should be noted that there were few recent studies
specifically focussed on the impacts of teacher preparation programs on the cognitive processes of graduates from these programs.

As described above, this phase of the review also involved an exploration of the role of cognition and schema within the theoretical bases of the study and of schema as an organisational construct. The latter focusses on the role of schema within self-organising systems and schema within communities of practice, where collaboration with others is essential in promoting both individual and organisational schema. These concepts were initially presented in Section 1, and are important for this research given the nature of inclusive practice as a collaborative endeavour among numerous stakeholders. For this collaboration to occur, it is necessary to examine the extent to which the field of teaching and schools as microcosms of that field have developed the conditions for a shared schema for practice, including the pattern language exemplified in such enterprises.

The search also investigated applications of complexity theory and self-organising systems theory in education. Several seminal sources were used; however, further searches were conducted using the same databases described in the introduction to the literature review (see Part 2). Descriptors of application of complexity theory to education, application of self-organising systems theory to education and combinations of these with pre-service teacher education provided a limited, but adequate variety of sources, with 22 results. As previously noted, some of these were found to have minimal relevance to this research, while others provided further citations for follow-up. Exploration of the concept of communities of practice was also undertaken, again with particular reference to application within PST preparation. Descriptors included characteristics of communities of practice, application of communities of practice to professional practice, application of communities of practice within education and combinations of these with pre-service teacher education, resulting in 29 sources.

4.1 Cognitive psychology, memory, learning and schema

Cognitive psychology describes the study of mental processes within humans. Bruner (1990, p. 33) defines the field as being focussed on the “processes and transactions involved in the construction of meanings”. These processes guide our actions within cultural boundaries, as they are reflections of our experiences (Bruner, 1990). Consequently, they impact on all aspects of thinking, feeling and behaving (Bruner, 1990; McLeod, 2015). Cognitive psychology posits that these mental processes, known
as mediational processes, can be studied and can help to understand behaviour. Mediational processes involve the processing of information from the environment through perception, selective attention and short-term memory before transferral to long-term memory for potential later retrieval. Cognitive psychology uses predominantly experimental techniques to examine the mediational processes that occur between stimulus and response (McLeod, 2015). While consideration of mental processes and the operation of the human mind have been in evidence since the early Greeks (Marshall, 1995), it was not until the first third of the 20th century that deeper considerations of how the mind ‘worked’ contributed to the growth and development of research into mediational processes. Bartlett (1932), in research examining the capacity of individuals to accurately remember excerpts from reading, introduced the notion of a schema as concerning an organisation of past experiences that were able to inform an individual’s responses. At the same time Piaget (1932, 1952), in researching the development of thinking in children, used the terminology of schemata, constructed from a collection of individual schemas, to describe how children built knowledge from previous experiences into their cognition as they grew and developed.

In an early experiment, Tolman and Honzik (1930) conducted a series of maze experiments with rats in an attempt to show that they were active processors of information. These researchers divided their subjects into three groups – those that were immediately rewarded (with food), those that received a delayed reward (only given food on the 11th–17th days of the experiment) and those that received no reward. They found that the delayed reward group was quicker in negotiating the maze once the reward was instigated, hypothesising that the motivation of the reward instigated a process between stimulus and response. Tolman (1948) described this as the development of a cognitive map that allowed his subjects to access prior learning, and as evidence of cognitive processing taking place. This cognitive map was seen as a memory structure that had developed within the subjects as a result of their learning. Several early researchers posited that such structures would have analogies within humans (Neisser, 1967; Wiener, 1948). The publication of the seminal work *The magical number 7 plus or minus 2* (Miller, 1956) is often used as a point by which to delineate cognitive psychology as a field of research in its own right. In the paper, Miller (1956) synthesised the available research on human sensory processing and memory span to conclude that the capacity of the brain is limited to processing between five and nine pieces of information at any one time, depending on the individual.
Miller’s early work contributed to a rapid expansion of research in the field and its ongoing influence in all areas of psychology (McLeod, 2015).

4.2 Cognition, memory and learning

The work of early researchers in cognitive psychology has been extended in more recent times by researchers such as Kirschner et al. (2006), whose research examines the existence of similar structures to those initially defined by Tolman (1948) in humans. These authors refer to a “human cognitive architecture”, describing one aspect of it as being “concerned with the manner in which our cognitive structures are organised” (p. 76). In particular, they describe the process of learning from a cognitive perspective. Learning is seen as involving the processing of information in working memory and transferring this to long-term memory. Sweller (1994) describes working memory as the cognitive structure where “the information at hand is consciously attended to” (p. 297) and is particularly important when the information is new. Long-term memory is the cognitive structure where previously learned material is stored. Such material is able to be “processed automatically without conscious effort” (Sweller, 1994, p. 297), hence making little demand on working memory and allowing an individual to simultaneously focus elsewhere. This memory is effectively unlimited and “is viewed as the central structure of human cognition. It contains huge amounts of knowledge that can be described as hierarchically organised schemas that allow us to categorise different problem states and decide upon the most appropriate solution moves” (Paas et al., 2010, p. 116).

Kirschner et al. (2006) further discuss two well-known characteristics of working memory described by the accumulated research in the field. The first of these is its limited capacity. The second is its limited duration. A seminal paper from the perspective of capacity is that of Miller (1956), described above. Miller synthesised the existing work of the time about information measurement and the “amount of information” (p. 81) capable of being processed to determine what he referred to as the “magical number” (p. 81) of seven, plus or minus two individual pieces. Further studies have indicated that Miller may have been optimistic in his determination. Ongoing research into short-term memory capacity (Broadbent, 1975; Sanders, 1968; Sperling, 1960) indicate a variation in capacity, with Cowan (2001) suggesting that this number could be as low as four.
From the perspective of the construct of duration, which is concerned with the time information stays in the short-term memory, an early study by Peterson and Peterson (1959) examined the short-term retention of individual items by participants. These researchers performed two experiments with 24 participants. The first of these examined the ability to recall consonant syllables after exposure, for differing time intervals, while also counting back from a given number “in order to minimise rehearsal behaviour” (p. 194). The second experiment examined the impact of increasing the number of rehearsals on recall, hypothesising that “forgetting should proceed at differential rates for items with differing numbers of repetitions” (p. 196). They examined repetitions of exposure that were silent, as well as those involving sounding out of the stimulus material. These researchers found that the ability to accurately recall items decreased exponentially with time over small time periods (with a maximum of 18 seconds used). Further, they found that repetition improved recall, with sounding out having an even greater impact than silent exposure.

4.3 Cognition and schema

The human cognitive architecture described in the previous section concerns short and long-term memory involving a number of cognitive structures, known within the field of cognitive psychology as schema. From a psychological stand-point, understanding of schemas builds on the preceding descriptions by researchers examining how individuals process information, learn and remember, without overloading their capacity. In providing this support, schema are described as cognitive structures that help individuals to understand the world, allowing them to survive in a changing environment (Nadkarni & Narayanan, 2007). The development of schemas assists individuals in their environment because they become familiar with typical situations in their everyday routines, thus limiting the cognitive processing required. An individual can organise new perceptions into schemata, and associated schemas, and act without effort, as thought processes are effectively automated (Kleider, Pezdek, Goldinger & Kirk, 2008). The role of schema in teaching, learning and within organisations is discussed in more detail later in the review.

Work in the area of schema theory from the perspective of cognitive psychology progressed significantly through the 1970s and 1980s, led by the work of researchers such as Minsky (1975) and Rumelhart (1980). While the earlier work of Bartlett (1932) linking memory to the concept of a schema had made little impact on memory research
(Broadbent, 1970), Minsky saw distinct parallels between work in his area of expertise (artificial intelligence) and human cognition. Minsky concludes that “humans were using top-down schema-based information to carry out many psychological tasks” (Brewer, 2001, p. 67). Minsky calls these memory structures frames, and posits that understanding these processes better could be helpful in his attempts to design computer models that exhibited human intelligence. Minsky’s work was instrumental in re-invigorating research into, and understanding of, the workings of memory to form schemas in the field of cognitive psychology.

Rumelhart was a psychologist who worked within the area of human cognition. Like Minsky, Rumelhart was also interested in artificial intelligence, in particular computer simulations of perception (Rumelhart & McClelland, 1986). From the perspective of schema theory, Rumelhart (1980) building on the work of Minsky, described how schemata were able to represent knowledge at all levels of complexity, from the simplest to the most abstract. New knowledge would be processed by the brain and would either add to an already existing schema, or begin a new one. In this way, an individual would build schemas that were able to represent “all levels of our experience, at all levels of abstraction. Finally, our schemata are our knowledge. All of our generic knowledge is embedded in schemata” (Rumelhart, 1980, p. 41).

A schema is defined by Marshall (1995, p. 40) as “a vehicle of memory” that allows individuals to organise their experiences from similar areas of life. Such organisation would have additional characteristics. It would allow an individual to recognise newer, additional experiences that were similar (and likewise ones that were dissimilar) to existing frameworks; it would allow access to a “generic framework” containing the essential verbal and non-verbal elements of similar experiences; it would allow individuals to “draw inferences, make estimates, create goals and develop plans using the framework”; and it allows the utilisation of skills, procedures or rules when faced with a problem that is relevant for a particular framework (Marshall, 1995, p. 40). Such an understanding is consistent with the work of earlier researchers, described above, as well as other researchers such as Sweller and Cooper (1985) and Seel et al. (2006). These researchers perceive schemas as ways in which individuals recognise patterns in the world, classify these and link them to existing cognitive structures, and respond appropriately. Seel et al. (2006, p. 303) describe these frameworks, or mental models, as providing “a powerful mechanism for storing knowledge in the human mind” that, because of their ability to “influence human behaviour … have significant impact on
virtually all forms of human activity.” The development of schemas assists individuals with both memory and managing learning because they become familiar with typical situations, thus limiting the processing required. An individual can organise new perceptions into schemata and act without effort, as thought processes are effectively automated (Kleider et al., 2008).

Schemas are also described by Sweller (1988) as being a primary factor in allowing novices and experts to be differentiated in problem solving. Sweller argues that in the absence of well-developed schemas, the cognitive load associated with problem solving is such that it requires all of the processing ability of a novice, often precluding the activation of related prior knowledge and preventing ongoing schema development. To allow schemas to develop, Sweller (1999) proposes that information needs to be processed by working memory. Instruction, therefore needs to ensure that working memory load is reduced, allowing long-term memory changes characterised by schema acquisition to occur. Once a schema has been developed for a given activity, its activation in familiar, though often complex, situations allows for a reduced cognitive load and for working memory to focus on other activities.

During the 1990s, schema theory was used by Marshall (1995) both as a mechanism for instruction, for example in teaching approaches to mathematics problem-solving techniques, and as a means of assessing learning. Marshall proposes that when used as the basis of instruction, schema approaches facilitate the creation by students of the fundamental connections that need to be made between often disconnected aspects of a concept. In solving a mathematics problem for example, a schema might consist of an individual having previously developed a step-by-step approach to interpreting the problem, then representing it symbolically and finally solving it. In terms of assessment, she argues that the use of schema-based assessment would allow a greater exploration of the deep learning and cognitive changes attained by students, rather than the shallower surface level aspects explored by traditional examination techniques.

One of the cornerstones of Marshall’s (1995) work is her description of four levels of ‘knowledge’ which, when taken together, comprise a functional schema for a particular situation or concept. The knowledge types articulated in her work consist of identification knowledge, elaboration knowledge, planning knowledge and execution knowledge, and are consistent with other researchers such as Sweller (1988) and Seel et al. (2006), who describe schema development as a result of internalising new
experiences into existing structures. In Marshall’s model, identification knowledge centres on pattern recognition and is described by Marshall (p. 41) as the “most common gateway to schema activation”. In identification knowledge, there is a concurrent processing of the features of a situation matched against previous experiences of similar encounters. While two or more schemas may share some aspects, each schema has its particular foundation of knowledge.

Elaboration knowledge involves individuals activating further information about the situation, both verbal and visual, from their experiences. Using elaboration knowledge involves creating a mental model about the situation and testing it against a “template” based on previous interactions. (Marshall, 1995, p. 41). This testing allows an individual to make an interpretation as to whether the situation fits into an existing schema or not, then involving either adoption of the existing schema or modification to it, or the creation of a new structure.

Marshall (1995) describes planning knowledge as that which allows a schema to be used to “make plans, create expectations and set up goals and sub-goals” (p. 41). The complexity of the planning that occurs depends substantially on the level of experience of the individual; it is not until individuals develop knowledge at the planning level that they are considered to have a functional, working schema for a given situation (Marshall, 1995, p. 41). It is the attainment of this level of schema knowledge, and the interface between it and execution knowledge that is crucial. In teaching, for example, it is at this level that the planning about how to respond to a typical classroom scenario comes into play. Execution knowledge “is knowledge that allows the individual to carry out the steps of the plan” (Marshall, 1995, p. 41). Execution knowledge is often drawn from many schemas, and hence experiences. It dictates what action should arise from the planning stage. These knowledge types are used in the methodology for this research, the details of which are described more fully in Part 3. For this research, these levels of schema are important as they ultimately determine whether an individual has an effective, functional schema for a given situation and they form the underpinning to the instrument developed as part of this research.

Considerations of cognitive load, schema development, learning and their implications for teachers in the complex classroom environment have been examined by a number of researchers (Sweller, 1988; Sweller, van Merrienboer & Paas, 1998). Feldon (2007, p. 123) describes how feelings of being “overwhelmed by the amount of simultaneous
activity in a classroom” is well represented in the literature about teaching, in particular when applied to pre-service or novice teachers. Such cognitive overload not only impacts the ability of individuals to perform in conditions of high cognitive demand, but also their ability to process and learn from such situations. Provision of experiences allowing the incremental development of schemas, using approaches aimed at decreasing extrinsic cognitive load, is described by a number of researchers as one way of facilitating a reduction in cognitive load and allowing teaching practitioners to better attend to the immediate requirements of the classroom (Feldon, 2007; Rogers, Maurer, Salas & Fisk, 1997; Sweller, 1988).

From the perspective of teacher preparation, schemas for practice would be expected to develop through involvement in activities and input related to the knowledge and skills required of practitioners. These activities and input are based in teaching standards describing the role and responsibilities of practitioners in the classroom and progress incrementally over the course of a student’s professional preparation. Further, through the inter-relationship of both theoretical and practicum components of preparation courses, an individual, on graduation, could be expected to have built such schemas on which they could draw. Having these schemas then allows a graduate to respond to situations, while at the same time allowing working memory to continue to process newer information from their practice to continually modify these schemas. This capacity is related to cognitive load, discussed in the next section.

4.4 Cognitive load

In the late 1980s, the work in cognitive psychology developed by previous researchers such as Minsky (1975) and Rumelhart (1980) around the development and activation of schemas began to focus on the concept of cognitive load. This work was further progressed by Sweller (1988), who developed cognitive load theory. Cognitive load theory “is concerned with the learning of complex cognitive tasks, in which learners are often overwhelmed by the number of interactive information elements that need to be processed simultaneously before meaningful learning can commence” (Paas et al., 2010, p. 116). Importantly for this research, Sweller’s ongoing research with colleagues has included the application of ideas about memory structures and information processing to classroom contexts and the teaching/learning process (Yu, Jin & Sweller, 2002).

Cognitive load can be understood as the amount of working memory required by an individual to carry out a particular task, and is often differentiated into three types –
intrinsic load, extraneous load and germane load. Intrinsic load is defined as the degree of difficulty associated with a particular task (Chandler & Sweller, 1991). In delineating instructional approaches to decrease cognitive load of complex problems, these authors describe how the difficulty of a task as a whole cannot be altered. The instructional techniques can, however, be altered by using techniques such as breaking complex tasks down into separately taught components, then recombining. In the context of a graduate teacher, for example, this might be exemplified by breaking down a complex mathematical operation into steps, teaching these steps, and then showing how they fit together as a whole. The instructional approaches chosen by instructors are defined as contributing to the extraneous cognitive load, which is the unnecessary load placed on a learner by poor choice of instructional approaches or materials.

Using the example above, a failure to break the mathematical operation into steps, or to appropriately sequence these steps, will contribute to the extraneous load, thus allowing the learner less processing capacity for learning. Where a task has a high intrinsic load, it is imperative that clear, well scaffolded, instructional materials are designed to avoid using limited working memory resources in having to process poorly designed approaches.

Germane load is delineated as that devoted to the processing, construction and automation of schemas (Sweller et al., 1998). It is this aspect that is responsible for ‘learning’ as schema construction takes place from the processing of information in working memory, for storage in long-term memory. Sweller et al. (1998) describe the relationship between cognitive load and schema development in terms of knowledge development. These authors describe how “knowledge is stored in long-term memory in the form of schemas” (p. 255). When stored in this manner, schemas provide both a “mechanism for knowledge organisation” (p. 255) as well as a way of reducing the load applied to working memory. As the capacity of working memory is limited, schemas act to allow it to focus on novel aspects of a scenario by retrieving knowledge already previously mastered. Sweller et al. (1998, p. 255) describe the development of complex schemas as an “active, constructive process.” For the classroom-based example above, having developed a schema about a particular process and appropriate instructional approaches during their pre-service coursework would assist a graduate in ensuring that potential pitfalls when designing learning activities were avoided. From the perspective of learning, scope and sequence of materials is an important consideration, as “it is through the building of increasing numbers of ever more complex schemas by
combining elements consisting of lower level schemas into higher level schemas that skilled performance develops” (Sweller et al., 1998, p. 255). Also from the perspective of learning, Sweller et al. (p. 265) describe the importance of ensuring that instructional approaches and materials “reduce extraneous cognitive load and redirect learners’ attention to cognitive processes that are directly relevant to the construction of schemas.”

Given the understandings described above, for teacher-preparation programs to be effective in preparing beginning teachers for the complex environment of the classroom requires the building of schemas. In classroom environments, graduates are expected to plan for and engage a diversity of learners in developmentally appropriate instruction, while simultaneously managing the day-to-day interactions arising in that environment. Schema development allows the management of familiar situations, while simultaneously allowing sufficient working memory to respond appropriately to situations not previously encountered. Consideration of aspects of cognitive psychology such as working memory, short- and long-term memory, cognitive load, schema development and learning are important for the development of teacher-preparation programs, and for this thesis. These considerations underpin and help explain the possible changes in PST cognition that enable graduates to instantiate their learning and to operate in the complex environment of the classroom.

Using the complex mathematics example from above, the development of a schema about how to manage appropriate learning activities for this task then allows for greater attention to be paid to newer, more novel aspects that may arise within the environment. Given the content of the previous chapters in this review, these schemas then are based in teaching standards, which are themselves based on the literature describing effective teaching practices. These standards have been the basis of a graduate’s preparation program, and are intrinsically linked to how graduates respond to different situations, in authentic settings, on completion of their preparation. It is reasonable, therefore, to suppose that graduates will develop schemas for practice as they progress through a professional preparation program and graduate with schemas that could be reasonably expected of an entry-level professional. This relationship between cognition and behaviour is examined in more detail in the following section of the review.
4.5 Teacher cognition and teacher behaviour

Advances in understanding about cognition – the way the human mind processes information, transfers learning from short to long-term memory and builds increasingly complex schemas – advanced significantly in the decades between 1950 and 1970 (Leary & Tangney, 2012). As these developments in the field of cognitive psychology took place, they began to resonate more specifically within the field of education, teaching and the ways in which “teachers played a much more active and central role in shaping educational processes than previously acknowledged” (Borg, 2015, p. 6). As early as the late 1960s, an almost exclusive research focus on teacher behaviours in the classroom was beginning to come under scrutiny as these developments in cognitive psychology “highlighted the influence of thinking on behaviour” (Borg, 2015, p. 6). The importance of the cognition of teachers as the focus of research was highlighted by the 1975 report of the National Institute of Education conference in the US, which concluded that “what teachers do is directed in no small measure by what they think” (p. 1). This section will examine research on the cognitive development of PSTs, with particular reference to the impact of preparation courses on shaping the schema for teaching of graduates and how this schema impacts behaviour. The capacity of teacher-preparation programs to instigate cognitive change, impacting ultimately on the actions of graduates within the classroom, is an important consideration for understanding whether PSTs develop cognitive structures allowing them to translate what has been learned in their programs into their own practice.

Teacher cognition can be thought of and defined in terms of “what teachers think, know and believe and the relationships of mental constructs to what teachers do” (Borg, 2003, p. 81). Similarly, Kagan (1990) defines teacher cognition as “pre- or in-service teachers’ self-reflections; beliefs and knowledge about teaching, students, and content; and awareness of problem-solving strategies endemic to classroom teaching” (p. 419). Common to these definitions is the explicit connection between beliefs and teacher thinking as a part of the cognition of teachers and the clear link to teacher behaviour represented by what teachers do in the classroom.

Previous chapters of this review have described literature on effective teaching practices, how these practices translate into effective teaching for students with diverse learning needs and the development of teaching standards. The review described a body of research-based practice within the field of teaching. It was further shown through the
literature that this body of work is the focus of teacher-preparation programs (translated through teaching standards). The standards are expected to drive preparation programs and influence the practices of graduates. This research pursues the proposition that given the focus of PST preparation on meeting a standards-based framework, based on the literature around effective teaching practice, and the importance of cognitive mediation, the schema development of graduate teachers should reflect their preparation programs, including the standards and approaches for teachers to which those programs are referenced. Graduate teachers, as a result of their experiences, develop schemas for implementing effective teaching approaches in their practice, albeit at an introductory level.

In examining the influences impacting on teacher cognition, Borg (2003) describes how research has indicated that a number of factors have an impact. These influences are summarised in Figure 4.1 below.

![Figure 4.1: Teacher cognition, schooling, professional education and classroom practice (Borg, 2003, p. 82)](image)

The diagram represents Borg’s (2003) perspective on the interplay between different aspects impacting the development of teachers’ cognition. While the diagram was not
used as a metaphor to guide the construction of this review, it serves to validate the structure and foci as described in this chapter. In conducting the first part of this chapter, for example, both cognition and cognitive load were examined. While Borg’s work focusses on aspects of the former of these, it does not examine aspects of cognitive load involved with processing of experiences and instantiating responses. Importantly, however, it affirms that PST coursework has the capacity to impact teacher cognition. This impact, however, is mediated by other factors pertaining to the individual’s own biography (such as their own school experience). Failure to account for such influences in the delivery of coursework can severely limit its influence on cognition. Other aspects of PST preparation programs, such as practicum experiences, also have an influence either subconsciously, or through reflective practice structured into such experiences. Contextual factors such as the site of practicum experiences, or first teaching placement are also significant in developing teacher cognition. Studies exploring these influences are examined in more detail below.

### 4.6 Factors influencing pre-service teacher thinking

While the majority of Borg’s ongoing research has been focussed on cognition within the area of language education, it builds on more general studies (Holt-Reynolds, 1992; Johnson, 1994) that describe the impacts of various factors on PST cognition as they progress through their preparation courses. Some studies propose that the ability of preparation courses to have such an impact on thinking is limited – if not negligible (Kagan, 1992). These studies, and importantly the subsequent critique of them, are examined in more detail later in this review. The studies following are illustrative of the range of factors that can have such influences. The findings of these studies exemplify how teacher thinking – that is, teacher cognition – is influenced, and how this ultimately affects teachers’ classroom behaviours.

#### 4.6.1 Studies indicating teacher-preparation programs have limited impact

In a review focussing on the professional growth, defined as “changes over time in the behaviour, knowledge, images, beliefs or perceptions” (p. 131) of pre-service and beginning teachers, Kagan (1992) examined 40 studies published between 1987 and 1991 that had examined “teacher development based on cognitive studies of expertise” (p. 129), at either pre-service or first-year teacher level. The objectives of Kagan’s
review were to determine the degree of coherence of the learning-to-teach literature in the timeframe under consideration; to determine if a set of common themes existed within the studies; and, if so, to develop a professional model for growth, describing “the nature of teacher education programs most likely” (Kagan, 1992, p. 130) to contribute to PST mastery of knowledge and skills; and, if common themes were apparent, to use the model to maximise learning from naturally-occurring processes and stages.

Themes that arose from the studies reviewed included aspects of teaching such as what contexts were required for growth, defined by Kagan (p. 131) as “changes over time in the behaviour, knowledge, images, beliefs, or perceptions of novice teachers”; the impact of limited pedagogical knowledge, in particular how to develop “routines that integrate instruction and management” (p. 156); and issues related to the role of ‘image of self-as-a-teacher’, which changes over time as knowledge of pupils and classrooms changes. Despite these findings, Kagan describes numerous inconsistencies and contradictions among the studies considered in her review. These include differences in descriptions of the relationship between coursework and practicum experiences; questions as to whether candidates actually changed their personal beliefs and images about teaching and the classroom environment over the duration of their course; and the degree to which PSTs actually shifted their focus from themselves to their pupils over the duration of their courses, particularly during practicum. Overall, Kagan concludes that “researchers appear to know remarkably little about the evolution of teaching skills” (p. 129) and that it was only through cognitive dissonance that novices would “confront and modify their personal beliefs” (p. 145).

Some examples of the studies used by Kagan are examined in detail below; however, it is important to note here that her work has been significantly critiqued by a number of researchers, such as Dunkin (1995, 1996) and Grossman (1992). While one of Kagan’s conclusions was that that engagement with PST education courses appeared to have little impact on the cognition of PSTs, such critiques of her methodology, choice of studies and findings, leave her work, and this conclusion, in particular, open to question.

Part of Kagan’s (1992) analysis included a study by Calderhead and Robson (1991) who found that, despite a year of input from a PST education program, the images about what constituted good teaching among the participants correlated more with the participants’ own experiences as pupils than with the course input. These researchers
conducted interviews with 12 pre-service primary teachers throughout the first year of their preparation program, although the study included complete data sets for only seven participants. Interviews were conducted prior to the commencement of their program, and on three other occasions spread over the year. The interviews aimed to collect data from the participants about the tasks of a teacher, including their responsibilities in the school-based component (such as planning, responding to classroom incidents and coping with difficulties encountered by their pupils), their backgrounds prior to commencement and what they saw as the major influences on their thinking about teaching as the year progressed. Calderhead and Robson conclude, consistent with Borg’s (2003) model and with other research, that beginning teachers “have quite powerful and influential images of teaching” (p. 8) that can be challenging to teacher educators. These images created impediments for the participants in responding to scenarios. When asked at the end of the year to write a script involving teaching an individual, group or whole class, the participants responded far more strongly from the teachers perspective than any considerations from the perspective of students, having “difficulty taking context and children into account” (Calderhead & Robson, 1991, p. 6).

A further study included in Kagan’s (1992) analysis was that of McDaniel (1991), who conducted interviews with a cohort of 22 PSTs studying a foundational course in educational philosophy that also included observations within classrooms. McDaniel interviewed each participant six times over the duration of the semester-long course, examining the ways in which connections were made between the theoretical material and the observations. In a similar manner to Calderhead and Robson (1991), McDaniel found that PST prior beliefs and experiences had a significant impact on their description of classroom observations. Neither course content nor the field observations appeared to have any major impact on their prior beliefs.

Dunkin (1995; 1996) describes Kagan’s (1992) work as being methodologically flawed, thus potentially contributing significant erroneous conclusions to the debate. Dunkin bases his critique on a number of factors. These factors include the use of predetermined themes, the subjective selection of studies that reflected her own priorities; that 25% of the sample came from the same two authors; that she had been uncritical of the design of the studies examined (failing to discriminate weak designs from strong); and that she had made significant bibliographic errors, with some studies included having been rejected from the journals to which they are attributed, and others where purported co-
authors have denied collaboration. Indeed, Dunkin concludes his 1995 presentation with questions as to how what he perceived as misrepresentations within Kagan’s work could have a significant misleading impact on readers. Dunkin’s (1995) views further reflect those of Grossman (1992), who had responded earlier to Kagan’s article. In her response, Grossman describes the limitations of Kagan’s use of literature as being representative of only “one sector of the teacher education community” (p. 171). In critiquing Kagan’s rationale for inclusion of particular studies, Grossman lists numerous others that would fit Kagan’s parameters, but were not used in her review. Grossman describes how “the existing literature on learning to teach does not lead inexorably towards Kagan’s conclusions, nor is the evidence across competing discourse communities of researchers on teacher education as clear and convincing as she suggests” (p. 171).

Despite the critiques of her work and conclusions, the findings of individual studies included in Kagan’s (1992) review clearly indicate the challenges associated in overcoming previously held beliefs and of impacting the cognition of PSTs. The studies of PSTs cover a range of foci, such as the role played by pre-existing beliefs (e.g. Calderhead & Robson, 1991; McDaniel, 1991 as reported within this review) through to considerations around images of self-as-a-teacher (Bullough, 1991). Studies of first-year and beginning teachers predominantly focussed on the need to acquire knowledge about pupils within the classroom, and to apply that knowledge to the image of self-as-a-teacher (Bullough, 1987; Grossman, 1989). The vast majority of the studies in Kagan’s review were, however, small-scale (<15 participants for 30 studies), with most relying on information provided by participants through interviews, journaling and other written reports (36 of the 40). These limitations must be considered, along with the body of research indicating that teacher-preparation programs can have an impact on the cognition of PSTs, described in the section following.

4.6.2 Studies indicating teacher-preparation programs do impact cognition

The previous section described research indicating that teacher-preparation programs have limited (if any) impact on the cognitive development of PSTs. This section of the review examines research that indicates that, while there are challenges involved, such programs do have an impact on the cognition of PSTs as they progress through their program. It includes a number of studies excluded by Kagan’s (1992) review that
provided one of the major bases of critique of Kagan’s work (e.g. Grossman & Richert, 1988).

In a study of the relationship between the personal history of PSTs and its impact on the formal study of teaching, representing the biographical influences inherent in PSTs, Holt-Reynolds (1992) interviewed nine participants who had no field experience prior to enrolling in a subject on teaching the content area of reading. Six interviews were conducted with each participant, the first two aimed at gathering information about the “participants’ experiences of community, school and home” with the next three “focussed on participants’ impressions of the purpose and value of course readings, statements made in class by the professor or by peers in discussion” (p. 328). Participants were also asked to write a list of the main ideas about teaching to which they had been exposed, and rank these in order of importance. In the final interview, participants were asked to read 36 statements made within the context of classes (having been taken from class recordings) and to rate them on a Likert scale as to how much they agreed or disagreed with the statements, with a rationale as to their choices. Holt-Reynolds concludes from her study that among participants, having spent a significant amount of time as students in schools had a substantial influence on their initial ideas about what constituted a good teacher. These influences “work behind the scenes as invisible, often tacitly known criteria for evaluating the potential efficacy of ideas, theories, and strategies of instruction they encounter as they formally study teaching” (p. 343).

In a similar study, Weinstein (1990) also investigated biographical aspects of PST cognition, in particular the influence of prior schooling. Weinstein explored the perceptions of a cohort of 38 first-year PSTs as to the views held about the characteristics of good teachers and how these perceptions, which were strongly focussed on affective and interpersonal issues, significantly influenced participants’ cognition about teaching. Participants were asked to complete an open-ended questionnaire where they listed six of these characteristics and their self-rating as to how well they perceived their own capacities against these criteria. After a semester of study, volunteers were then asked to participate in an interview to determine any changes in their thinking. Twelve participants agreed to be interviewed.

Weinstein’s (1990) findings were similar to those reported by Holt-Reynolds (1992), where previous perceptions seemed to be a dominant influence on participants’
perceptions. In reporting her results, Weinstein comments that what was “most striking about the data reported here [was] the lack of change that occurred during the semester” (p. 285, original emphasis). Weinstein cautions that those designing programs of teacher education need to ensure that they built experiences that would “help prospective teachers examine their preconceptions and appreciate the complexity and uncertainty of teaching” (p. 286) if the programs are to be successful in instigating conceptual change.

While both these studies reinforce the importance of acknowledging the influence of prior experiences in the formation of teacher cognition, there are some clear limitations to the findings. Both studies involved self-reporting or self-categorising of responses, and both involved relatively small numbers of participants, rather than applied tasks providing clear evidence of cognitive change and schema development. These issues aside, both studies did, however, identify the critical role of preconceived ideas on the cognition of participants, as well as the importance of building experiences into teacher-preparation courses that create the cognitive dissonance described by researchers such as Kagan (1992) to challenge these ideas.

A number of studies included in the Wilson et al. (2002) examination of empirical research into teacher education, described earlier in this review, focussed specifically on the cognitive changes occurring as a result of teacher-preparation programs (Adams & Krockover, 1997; Hollingsworth, 1989). In investigating the nature of knowledge structures developed by undergraduate pre-service science teachers, Adams and Krockover (1997) implemented a study that was “grounded in the postulates of teacher cognition in that teachers construct their own schema from their experiences in order to comprehend, plan for, and respond to the dynamics of their classroom” (p. 633). These researchers collected data via interviews and classroom observations with four graduates from a large university preparation program, and interviews of two faculty members with joint appointments in both science and education, and syllabus analysis. Their goal was to investigate the ability of pre-service programs to impact on teacher cognition and influence PST ability to understand, plan for and respond appropriately to classroom situations. The authors propose that as events and experiences take place, such as those experienced in a teacher-preparation program, they become a part of the cognitive structures, or schema, of an individual. Retrieval of this knowledge does not involve a process of deliberative remembering, but rather is reflected in the responses and behaviours of individuals as schemas are activated. As a consequence, individuals’ memories of significant incidents, coupled with observations of behaviour, can serve as
the basis of inferences about schema development. Adams and Krockover found that there were “aspects of the science education program that do translate into praxis and become part of the teachers’ knowledge structures” and that “it appeared that the program does provide a framework from which these beginning teachers constructed their cognition of the science classroom” (p. 649). The degree of internalisation of experiences from the program into PST schema were, however, mediated by previous experiences and context. For example, participants reported a wide variability in their attribution of knowledge about general pedagogical principles and specific pedagogical content knowledge to the pre-service program. Analysis indicated that this variability was “attributable to the context of the school situation” (Adams & Krockover, 1997, p. 643) in terms of the amount of teacher support available, the demographics of the school and the classes taught.

While the strength of Adams and Krockover’s (1997) study lay in its approach to using qualitative methods to obtain a depth of information from a number of different sources, it also had limitations, including a number acknowledged by the researchers. As with a number of previously described studies, the small sample size make the study limited in its ability to be generalised, while the researchers acknowledge the “context and culture of the teacher participants’ schools” (p. 641) as a limitation, in that context can be influential on both what is taught, as well as how instruction takes place. Further, while the use of observational data is a strength here, the use of interview data as indicators of participant thinking and inferential measures of schema development, rather than a more applied approach aimed at directly determining a level of schema development through exhibiting skills and knowledge represents a limitation.

In one stage of a longitudinal study, Hollingsworth (1989) investigated cognitive change, and its relationship to prior beliefs, in a sample of PSTs engaged in a preparation program. The sample comprised 14 elementary and secondary PSTs. Hollingsworth gathered qualitative data through conducting interviews and observations with participants as they entered the program, engaged in the experiences provided and finally engaged in practice teaching of reading in classrooms. Initial interviews were described by the authors as providing a baseline for comparison, with a “constant comparative process” (p. 166), allowing for examination of the development of ideas within participants. This approach is reported as informing “an evolving understanding of various influences on cognitive change” (p. 166), or participants’ schema. In a similar manner to Adams and Krockover (1997), inferences were drawn from knowledge
growth based on interview evidence and behaviours based on classroom observations as to the cognitive development of participants. Data were analysed from four perspectives: first, the patterns of intellectual change as participants moved from the novice PST stage into beginning as classroom teachers was considered; second, “the personal, program, and contextual influences or constraints on that change” (p. 160) was examined; third, how supervising teachers and academics may have mediated any observable changes; and finally, the impact of prior beliefs on cognitive change. In investigating the cognitive development taking place, the contextual, personal and prior knowledge factors evident in Borg’s (2003) model were clear. For example, Hollingsworth found that students entered their programs with particular beliefs/ideas about teaching reading to children. These beliefs were, however, altered after exposure to general educational principles, particular subject pedagogies, academic classroom tasks, and supervision, such that “revised beliefs about teaching reading” evolved that showed that students had developed “more specific comprehensive knowledge of teaching reading” (p. 178) than had been initially apparent.

Hollingsworth (1989) used the findings of the research to inform the development of a model of learning to teach. In the model, Hollingsworth proposed that program content and context in three areas mediate between pre-program beliefs and any change in pre-program beliefs. The three areas are ideas about general management (such as classroom organisation and discipline), ideas about subject content and pedagogy, and ideas about other academic classroom tasks (such as evaluation of learning). Hollingsworth found that there was observable intellectual growth within the participant group; however, it was important to understand prior beliefs and to create cognitive dissonance around these in order to facilitate cognitive change. While describing how appropriate contextual conditions can help PSTs adjust their cognition as a result of instruction, Hollingsworth also recognised some limitations. The small sample size and constraining the study to only one preparation program were described as limiting its ability to be more broadly applied. As with previous studies described, this study also relied heavily on data derived from interviews rather than participants completing any task that may be able to be used as a more direct measure of schema development. These considerations aside, Hollingsworth concludes, consistent with Borg’s (2003) model, that a flexible approach in teacher preparation, allowing instructors to address students with a variety of ideas on commencement is essential, as these ideas can have a significant impact on teacher cognition if not addressed.
A study by Kettle and Sellars (1996) implemented what they describe as a mixed methods approach to investigate the development of what they termed PST ‘practical theory of teaching’. The researchers describe this construct as being an expression of the participants’ ‘system of knowledge, skills and attitudes related to teaching’ (p. 1) and how these were incorporated “into their growing schema of teaching and learning” (p. 23), as a result of engaging with course-based experiences. Their study aimed to examine the development of PST understandings of teaching over a one-year timespan. Kettle and Sellars analysed samples of reflective writing, interviewed participants and used card sorting techniques to examine growth in understanding of teaching practice. Reflective writing was analysed at mid-year and end-of-year using participants’ reflective journals, which they had been required to maintain at the end of each weekly workshop. The reflective tasks required the PSTs to write a brief reflective summary identifying any new learning as well as any unresolved issues or questions raised by the week’s activities. In particular, participants were asked to highlight “incidents that impacted on their practical theory” (p. 5) that were then used to assist in the development of a taxonomy of key teaching principles developed from all data sources. Semi-structured interviews were conducted on four separate occasions with each participant. Thematic analysis was used on each occasion, with the key themes from each interview then used to determine the focus questions for those subsequent to it. Card sorting took place after the second interview. This involved participants grouping key themes identified in earlier interviews and reviewing the themes identified, with the groupings developed by participants further informing the taxonomy of key teaching principles.

As with other studies previously elaborated, Kettle and Sellars (1996) used these data-gathering techniques to collect information that they argued was indicative of a growth in participants’ practical theory of teaching. Evolution of the participants’ ideas indicated through interviews, card sorting and participant reflections, over the time of the study, was used to infer cognitive growth and schema development, hence development in practical theory. From an initial sample of four volunteers, two completed the requisites of the study, while the other two withdrew due to competing demands. The authors report a number of factors impacting on the development of participants’ understanding of teaching. Key teaching principles identified by participants changed in their importance over time, as progressive learning experiences
(including subject input and practicum placements) impacted on participant understandings.

The overall findings reported by Kettle and Sellars (1996) indicate that participation in teacher-education programs did shape and develop participants’ cognition, particularly when explicit teaching of skills (such as reflective practice) was included. Personal biography, practicum experiences, the theoretical components of the program and critical reflection were all described as influential in shaping understanding. This shaping, however, was found to be contingent upon a number of factors, including taking into account and challenging the prior beliefs of PSTs. The cognitive dissonance described as necessary by these authors is consistent with the findings of previous studies described in this chapter. Other factors included the teaching of skills in a structured manner, ensuring quality practicum experiences with supportive associates and encouraging reflective writing. While using a number of data sources to inform the results of their work, the small sample size of participants in this study, as with those previously described, again make it difficult to generalise the findings to broader contexts. Further, as with previous studies, data collection was based predominantly on methods that involved self-perception (through reflective writing) and interviews. Throughout these studies, what is clear is the absence of any objective measure of schema development.

Additional studies also indicate that teacher-preparation programs have the capability of impacting on the cognition of PSTs. In a qualitative study aimed at examining the effects of teacher education on PSTs, Grossman and Richert (1988) followed six novice teachers during their teacher-preparation year, examining both coursework and fieldwork aspects. Using data based on interviews and observations from a larger study, the researchers analysed information about both subject knowledge and pedagogical knowledge, as well as participants’ perspectives as to the sources of their understandings about these. Interviews had been conducted both prior to and after classroom participation. Initial interviews focused on the “development of intellectual biographies” (p. 56) examining what participants perceived about teaching. These were followed by interviews, as the participants engaged with the practicum, about their plans for particular lessons, probing for “the sources of their ideas and knowledge; in discussing lesson plans, materials and classroom instruction” (p. 56). Finally, at the end of the year, participants were interviewed “specifically about their professional preparation and the knowledge they attributed gaining through both fieldwork and
coursework” (p. 56). Data were coded into categories based on the types of knowledge and the sources of knowledge reported by participants. These categories were reported by the authors as being those generally accepted in the field (such as general pedagogical knowledge, subject matter knowledge and knowledge of learners). These categories were, however, given the caveat that “the knowledge base for teaching has never been systematically defined” (p. 53).

Grossman and Richert (1988) found that both coursework and fieldwork were reported by participants as having made a contribution to their understanding about teaching. These self-reports indicated that participants acquired knowledge from both fieldwork and course experiences and that both aspects impacted on the way they thought about the learning/teaching process. The cognitive development described was, however, as with previous studies, inferred by what participants reported, rather than the result of any method of direct measurement. They conclude that, in contrast to some previous research, “teacher education coursework does influence prospective teachers” (Grossman & Richert, 1988, p. 60).

While, as with a number of other studies, Grossman and Richert (1988) used a number of data sources to support their findings, the small sample size acts as a limiting factor for their study. As with other studies examined in this review, their study also relied on self-reporting by participants about their acquisition of knowledge during their teacher-preparation year, rather than any objective external assessment. The use of valid and reliable external measures to either complement or replace self-reporting has been shown to enhance the accuracy of research considerably (Fan et al., 2006). The use of such measures also helps in overcoming issues where less direct approaches, such as interviews, are used to infer cognitive growth rather than the external measures described by researchers such as Fan et al. (2006). While self-report data-collection methodologies have been described as useful in obtaining rich descriptions of information that may be exclusive to an individual’s experience, they have also been described as having issues in areas such as individual’s memory errors, being difficult to verify, having frequent temporal errors and often significant emotional attachments (Stone et al., 2009). Further, when gathering such data, frequently “we are asking persons to go well beyond” specific facts or finite events and “to engage in higher-order cognitive processes … involving weighting, inference, prediction, interpretation, and evaluation” (Podsakoff & Organ, 1986, p. 533).
In a study investigating how English as a Second Language teachers constructed their understanding of teaching when exposed to the methods and approaches of a teacher-preparation program, Tang, Lee and Chun (2012) followed four PSTs in a four-year longitudinal study, as they progressed through their program. The theoretical underpinnings of the classroom practices of participants were examined using descriptive accounts, surveys, lesson plan analyses, lesson recordings and interviews. Given the relationship described previously showing the impact of beliefs on cognition (Borg, 2003), these researchers used thematic analysis of data, the outcomes of which, in part, challenged the concept that previously held beliefs can inhibit learning. The researchers, however, describe how it is often assumed “that the conservative beliefs of PSTs remain latent during formal training at the university” (p. 91), but come to the fore once a graduate has responsibility for a classroom. Further, they describe how, at times, any attempts at innovation on the part of PSTs could be stifled by practicum supervisors, further entrenching a return to practices from their own schooling. Despite different theoretical perspectives, participants were found to all teach in a similar manner, more reflective of traditional approaches. They did, however, engage in what the authors describe as a hybridisation, bringing some new knowledge into their practice. While the researchers conclude that some cognitive change did occur and that “constant discussion with peers, mentors and faculty staff, and experimentation during the teaching practicum can foster the adoption of a university-taught teaching approach by pre-service teachers” (p. 105), the data-collection techniques used in this study further represented a situation where inferences were made between cognitive and potential, although untested, indicators of that growth.

Research in the area of teacher cognition describes the ways cognition can be significantly influenced by a number of factors related to PST beliefs and experiences. Studies also indicate, however, that it can be impacted by teacher-preparation courses. Further, this impact can carry through to the way graduates from teacher-preparation programs see their work. The studies examined above described how multiple perspectives can be taken to different aspects of teacher preparation, and the work of beginning teachers. While some studies indicate that well designed, coherent courses that deliberately challenge the prior conceptions of PSTs are supportive in having an impact on cognition, others question this. At the same time, few studies have specifically examined the role of teacher-preparation programs in facilitating PST
development of a schema for practice. This schema is discussed in the following section and serves as a significant rationale for this current research.

Borg (2009, p. 3) describes eight themes about the relationship between teacher cognition and teacher behaviour arising from research in this area. These themes particularly focus on the impacts of prior cognition on pre-service and beginning teachers. These themes are that teachers’ cognitions can be powerfully influenced by their own experiences as learners; influence what and how teachers learn during teacher-education programs; act as a filter through which teachers interpret any new information and experience from their preparation courses; may outweigh the effects of teacher education in influencing what teachers do in the classroom; can be deep-rooted and resistant to change; can exert a persistent long-term influence on teachers’ instructional practices; are, at the same time, not always reflected in what teachers do in the classroom; and intersect bi-directionally with experience (i.e. beliefs influence practices but practices can also lead to changes in beliefs). Much of this research, as reported here, has been small-scale, with methodologies that rely heavily on self-reported, qualitative data making inferences about cognitive change, rather than attempting to directly measure it. Further, these data are retrospective in nature, with this temporal shift one of the challenges described for self-reporting (Stone et al., 2009). As such they are used to infer change in cognition from other information, rather than using a specific tool focussed on measuring schema development at different points in time. Clearly, a need exists for further research in this area, where such an instrument with strong validity and reliability is implemented.

Overall, the literature on the efficacy of teacher-preparation courses, and in particular, work that addresses the most fundamental questions about how (or whether) an individual’s schema, cognitive framework and overall construction of teaching are significantly influenced by such preparation, highlights studies that frequently lack definitive outcomes. What is clear is that, despite Borg (2009) suggesting the eight themes described above, research investigating the effects of teacher-education programs on the cognitive development of PSTs has shown varying results that tend to depend significantly on the particular site and course investigated. Much of the research that has been completed in this area has tended to be small-scale, qualitative research, using indirect measures based on self-reported perspectives. For others, important questions have been raised as to the veracity of findings. What can be determined is that
there are some significant factors impacting PST cognition and the ways that preparation courses can influence this cognition. These aspects include:

- biographical influences, including an individual’s own schooling experiences, where studies such as Holt-Reynolds (1992) and Weinstein (1990) describe the challenges associated with PST perceptions of what constitutes good teachers/teaching
- the nature of the coursework undertaken, including consideration of practicum components, where findings indicate that, while coursework can have an impact on cognition, this will only take place where preconceptions are deliberately deconstructed and where there is a close link between what is instructed in class and what PSTs see practised in the field (Adams & Krockover, 1997; Hollingsworth, 1989)
- contextual factors, such as where novice teachers may begin their teaching career (and the degree to which practice is consistent with instruction received/practicum) and the degree to which skills were explicitly taught (Hollingsworth, 1989; Kettle & Sellars, 1996)
- factors associated with inferences made about cognition and self-reporting methodologies (Stone et al., 2009).

What appears to be absent, however, is any attempt at larger-scale research being implemented using methodologies and instruments that objectively measure the cognition of PSTs and their schema development, for any aspect of the teaching skills described in teaching standards designated for graduates. The studies examined frequently rely, rather, on data-collection approaches such as reflections and the self-reporting of attitudes/beliefs, usually retrospectively, as indicators of potential schema development. In developing an instrumental approach to schema development within a disciplined framework, and applying that to a larger group of participants, this research aims to fill that gap.

The research reported in this section has examined the cognition of individual PSTs and evidence of the efficacy of teacher-preparation programs in assisting in its development. Given that teaching is a profession that has historically been perceived as a solitary activity, with high levels of autonomy given to practitioners (Daniel, Auhl & Hastings, 2013), much of this research examines the impact on individual schema development. It further raises questions as to how and why the impact of prior experiences such as those
pertaining to an individual’s own educational experience, or incidents experienced while on practicum (Borg, 2003) are so influential.

More recently, as reported in the section on inclusive educational practice (see Chapter 2), meeting the needs of students has been seen as requiring a more collaborative approach, where teachers work in consultation with others to achieve educational outcomes. Guided by literature on effective teaching practice and embedded in teaching standards, this individual schema development would be expected to show some consistency among individuals. Such a consistency for graduates would be influenced by the practice environments experienced both on placement and on graduation, where the attitudes and perspectives of the teaching practice communities in which they operate. To reinforce schema development initiated by coursework, PSTs must experience environments that are conducive to the development of professional schema more widely and to schema development about the practice standards of inclusive education more specifically. For educational communities to function effectively and for collaboration to occur at the level described within the literature, this consistency would be a requirement, so that the individuals collaborating have a shared understanding of the substance of the conversations taking place, and a learning and teaching context can be established that reinforces individual learning, with “learning and teaching as a model of practice derived from theory, constructs and research” (Drengenberg & Bain, 2016, p. 6). This shared understanding represents a common schema for practice, emerging from engagement with teacher-preparation courses and repeated exposure to authentic experiences at increasingly complex levels. This common schema for practice is derived from the teaching standards described earlier.

The research described above indicates how such experiences can act to create a framework guiding practitioners on an individual and hence organisational level. On an individual level, repeated exposure to knowledge and practices, at incremental levels as progress through a program occurs, would be expected to allow the development of a schema for a given situation with sufficient coherence to influence their practice. On an organisational level, it results from the agency of individuals in an organisation, the repeated engagement in the enterprise of a system and helps those within the system to recognise relevant aspects of their work, allowing them to execute their particular roles within it (Gell-Mann, 1994). Given the research on good teaching practice, embedded in teaching standards and reflected in preparation programs, it is reasonable to expect that a schema could or would develop from such repeated engagements. This schema would
help agents within the system avoid cognitive overload by having developed responses to the standard features of the enterprise, thus enabling cognitive load to focus on and allow adaptation to aspects that may not be considered normal. Bain (2007, p. 44) uses the example of doctors from different countries who may have never worked together and speak different languages being able to do so as they instantiate the regularities, common rules and protocols – that is the common schema – within their practice. This is possible because the field possesses a schema for practice that is reflected and instantiated in the agency of individual practitioners. Given the connection between teaching practices, standards and preparation programs, it would be expected that individuals’ engagement in a preparation program (in this case as a PST) would impact their cognition and facilitate the development of schemas around the practices inherent to the profession. These schemas would allow a graduate to enter a classroom and operate within that environment, continually modifying their schemas in the light of new experiences. The ability to develop an understanding of the practices of a field, or a schema for practice, is apparent in a number of theoretical perspectives, in particular self-organising systems and communities of practice, both of which are relevant to this research. These perspectives, and their connection to schema development, are described in the following sections.

4.7 Organisational schema, complexity and self-organising systems

The previous section raised the concept of an organisational schema that could reasonably be expected to evolve in a profession where individuals are collaborating within the enterprise of the system. Given the number of factors described as having an impact on individual schema development, it is important to recognise that the extent to which any schema developed during teacher preparation is instantiated will also be dependent on the environments in which PSTs experience their practicums and in which graduates begin their teaching career. As the organisations responsible for teaching and learning at scale, schools, too, have an organisational schema. This section examines this organisational schema, and how in a field of practice, it represents the ways of implementing aspects of the field in a consistent way. Further, it examines how such an organisational schema is represented theoretically in self-organising systems theory, and within communities of practice theory.
Ideas about complexity theory and complex adaptive systems began to emerge from the middle of the 1960s as a way of helping to explain phenomena where simple cause-effect linear models no longer seemed to apply (Santonus, 1998). Instead, complexity theory explores the interconnectedness of systems and how they are dynamic in nature, relying on feedback to allow the system to evolve and adapt. Originating in the physical and biological sciences with the work of researchers such as Prigogine (1984) in the field of particle physics, Gell-Mann (1994), also a particle physicist, and Kaufmann (1995), a well-known biologist, this theory attempted to explain the behaviour of systems that were responsive to feedback from their environment, self-organising through a process called emergence (Waldrop, 1993).

More recently, applications of complexity and self-organising systems have been seen in the social sciences, in fields such as economics (Arthur, Durlauf & Lane, 1997), political and social systems (Axelrod, 1997) and education (Bain, 2007; Davis & Sumara, 2006). While theories of self-organisation have been promoted in various fields for several decades (Ashby, 1962), it is only this more recent research that has considered schools and education from the perspective of complex adaptive systems, in particular from the perspective of self-organisation (Bain, 2007; Morrison, 2002).

Self-organising systems, based in the field of complex adaptive systems, have a number of identifiable characteristics/principles. It is the functioning of systems exhibiting these characteristics that both produces and refines organisational schema. Within the context of self-organising schools, six of these principles allow for the type of bottom up self-organisation that is characteristic of such systems. Bain (2007) describes these principles as being simple rules, embedded design, similarity at scale, emergent feedback, dispersed control and a common school-level schema. The development of the common schema arises as a result of the interaction of other characteristics and is what allows agents to collaborate with each other in commonly understood ways. The current research investigates the degree to which individual PSTs develop a schema for practice, in a context where it is contested as to the establishment of a wider organisational schema. Given the body of work on effective teaching practices, teaching standards representing the simple rules within the system and the use of these standards to inform teacher-preparation programs, it is reasonable to expect that an outcome of a graduate’s experiences would be some degree of compatibility between the development of an individual schema, and that of the field organisationally (e.g. the
nature of standards, evidence-based practice as applied systemically) as expressed in the practice of a whole school.

### 4.7.1 Principles underpinning self-organisation in education

Simple rules are responsible for driving the regular activities of human systems. They allow individuals to understand and instantiate the common schema. Simple rules drive the form and function of a system (Bain, 2007), describing the day-to-day activities that represent the activation of the schema. Simple rules allow agents to contribute to practice in a transparent manner by provision of their feedback on the systems’ operation. From an education perspective, examples of the simple rules would focus on (among other things) the specific learning and teaching competencies required of graduates and other staff within a given institution.

Embedded design allows schools to “embed their beliefs, values, and actions about teaching and learning in every part of the organisation’s design” (Bain, 2007, p. 49). Embedded design also allows institutions to create the self-repeating patterns described by Waldrop (1993) as characteristic of complex systems, and makes an important contribution to schema development at both individual and organisational levels. By embedding the simple rules within all aspects of the organisation, such that they pervade the day-to-day activities of a group, self-reinforcement can take place as agents become more familiar with practices, thus contributing to the sort of common understandings necessary for schema building. Building on the example from above, a simple rule about specific learning and teaching competencies might include a requirement for practice to be evidence-based. This requirement for evidence to support practice can then be built into all aspects of the institution’s practices.

Such embeddedness brings about a similarity within different levels of an organisation, be it a school, university or other, such that the self-repeating patterns can be seen within the organisational structures at all levels (Gleick, 1987). This is known as similarity at scale, and it allows agents within the system to have an understanding of its operation, and their role within it. The evidence-based practices used within the embedded design would be reflected at all levels within the organisation. For example, within a school, they would be seen within the classroom, as well as within the decision-making processes at middle- and upper-management levels.
Emergent feedback (Bain, 2007; Bain & Drengenberg, 2016) is the way a complex talks to itself (Pascale, MIllemann & Gioja, 2000), providing real-time information directing the next course of action. Feedback can be positive, which can contribute to the growth and development of an aspect of the system’s work (Wheatley, 1999), amplifying even small changes (Stacey, 1992), or negative, in which case it will result in diminishing returns and result in changes to that aspect of work (Marion, 1999). Such feedback allows the system to address problems and to acknowledge successes in a proximal manner, rather than at some time in the future, when it may be too late to have significant impact. The communication and collaboration required for effective feedback mechanisms is crucial to successful complex systems (Cilliers, 1998).

Dispersed control means that all agents have both the opportunity for making a contribution to the system, but also that recognition for the impact of a system is also shared, rather than being vested in management. It also means that no individual needs to feel ‘total responsibility’ for the success, or otherwise, of an initiative, as this responsibility is spread across the group. Dispersed control is a logical consequence of collective intelligence (Engelbart, 1995) and the contribution of agents through their professional practice, which suggests that organisations that can garner the collective inputs of their agents have a higher level of success than those who do not.

As a characteristic of self-organising systems at an organisational level, the need for a common schema allowing for the work of the organisation to progress is clear within the literature. This organisational schema needs to be consistent with the individual schemas of those within the organisation for these individuals to be able to practise coherently. Such a schema encapsulates the evidence-based practices delineated in standards for graduate teachers, with the principles described above providing a means of instantiating these practices within the complex system of the school environment. Measuring the development of individual schema in graduates in a systematic manner is the major aim of this research. As such, schema at both individual and organisational level are important theoretical considerations. It would be expected that PSTs would be influenced by the schema of the field, through such aspects as practicum placements. What is reported in the literature, however, is the idiosyncratic nature of such experiences. Given this variability and the way such experiences influence individuals, it is unclear that these experiences are based upon a reinforcing body of professional practice, at scale, in schools (Bain & Drengenberg, 2016). The concept of a schema for practice is also implied within communities of practice, described in the next section. In
communities of practice, members of the community engage in a common field of interest with a shared understanding of the field to develop and promote knowledge in their practice. As such, a community of practice provides an appropriate vehicle for self-organisation to occur.

### 4.7.2 Organisational schema and communities of practice

Lave and Wenger’s (1991) conceptualisation of communities of practice is based in social learning theory proposed by researchers such as Bandura (1977). Their proposition is that people learn by engaging with others in a shared domain, initially through a process described as legitimate peripheral participation; but as time engaged, and knowledge, in the domain of the participant increase, so too does their engagement in terms of its complexity. This growth bears marked similarities to schema development, which is described by researchers such as Marshall (1995) as growing in complexity as experiences and additional knowledge impact on existing structures.

Wenger (2006) proposes that a community of practice has three defining characteristics: the domain, the community and the practice. The domain concerns an area of interest to participants and a shared competence in that area that others do not possess. In describing teaching as a community of practice, it is the domain that some authors question, with the sort of commonalities of practice and shared professional language not always evident (Bain & Drengenberg, 2016; Bowker & Star, 2000). This is discussed in further detail below. Engagement involves a commitment to the practice within the community. The community involves members participating in joint activities, exchanging information and developing new knowledge and ways of thinking around the domain. Engagement with the community also involves the building of relationships with others within the community that enable the sharing of ideas, such that participants are able to engage in a process of reciprocal learning from, and teaching, others. The practice concerns a shared repertoire of resources, knowledge and experiences based in a particular practice and built over time. This shared practice, conveyed through a shared pattern language, means that there are established ways of approaching commonly encountered problems, and of developing solutions to new concerns as they arise. Wenger stresses that members are practitioners, not just a group of people with a similar interest.

The shared practice, implemented by practitioner members of a practice community, has three contextual features, as described by Bowker and Star (2000). These features,
described earlier in this review, consist of comparability, visibility and professional control. These three features contribute to a professional context, where Bain and Drengenberg (2016, p. 18) describe conditions such that “working in a particular way or to a professional standard can be expected to yield a successful outcome”. In such conditions, “there is a degree of predictability there is an expectancy of effect and ways to attribute that effect back to the work process and the research from which it is derived” (original emphasis). Bain and Drengenberg describe the working conditions of a professional field allowing this degree of predictability as having a number of characteristics. These authors describe quality professional practice, first, as being controlled by the profession. Other characteristics include having valid standards informing accredited preparation and training; having workable distinctions about effective practices, based on evidence, structured into these standards; having clear and transparently applied consequences for malpractice; and having rewards and appropriate recognition structured into the profession. When in play together, these characteristics create the conditions of comparability and visibility that contribute to the production of the discernible distinctions in practice that would be expected in a community of practice as an individual progresses from novice to expert (Drengenberg & Bain, 2016).

The concept of communities of practice (Lave & Wenger, 1991; Wenger, McDermott & Snyder, 2002; Wenger & Snyder, 2000) can be seen to have some significant synergies with both self-organisation and complex adaptive systems. These theoretical underpinnings provide a framework within which the common vision and commitment to the key ideas, functions and purposes of the community can evolve. In addition, there exists within communities of practice, as with self-organising systems, a pattern language that “consists of the terms that the community uses to express itself, to organise its models and practice” (Smethurst, 1997, p. 1). Having a common language allows members to articulate their profession, to record progress within that profession and to ensure that communities do not continue to “reinvent the wheel as their members work together” (Avgeriou, Papasalouros, Retalis & Skordalakis, 2003, cited in Bain, 2007, p. 46). This pattern language allows members a medium through which to transact the schema of the domain of the community in a consistent manner, clearly understood by all practitioners. It further allows practitioners to evolve their agency as their personal schema evolves through their participation in the system. While Bain (2007) describes how a number of multigenerational studies, including the work of Elmore (1996) have indicated that only a minority of teachers display sufficient
professional schema knowledge to allow such pattern language to evolve, a number of studies have shown that such skills can be developed when they are the focus of a deliberate attempt to do so (Bain et al., 2009; Lancaster & Auhl, 2013).

In the first of these studies, the authors investigated the relationship between the development of pattern language frequency and sophistication and the course design in a cohort of 54 PSTs, engaged in a mandatory inclusive education course. The study identified common pattern language terms measured through the participant’s reflective writing. These authors found that “preservice teachers increased the frequency and sophistication of pattern language use over the course of the study” (p. 345), concluding that their findings gave support to the proposition that it was possible to contribute to PST pattern language development through deliberate design.

The second study cited investigated two approaches to facilitating pattern language development – an embedded design approach, in a similar manner to the first study, and an applied experience approach involving field placement. The two approaches involved a total of 103 participants drawn from separate campuses of a regional Australian university. Eighty-three participants experienced the embedded design approach, while 20 experienced an applied experience approach. The study found that while both conditions increased the frequency and sophistication of pattern language usage, this improvement was differential. The results indicate “statistically significant differences between conditions in favour of the Embedded Design participants on every occasion” (p. 376 - original emphasis). Most important is the evidence that development of the pattern language of a field can be facilitated with a deliberate approach to designing courses.

By implication, such deliberate intent within course design would also be expected to facilitate the development of a schema for practice instantiating the pattern language developed within communities. Studies such as those described above show what is possible within course design. The research here examines what eventuates from engagement with the experiences provided in a number of existing teacher-education programs. As described above, the major intent of this research is to determine the individual schema development of PSTs. Schema development would be expected to be reflected in growing usage of pattern language on progression through a preparation program. This development of pattern language will also be examined as a part of this thesis. What is notable, however, is Wenger’s observation (2006, cited in Bain, 2007,
p. 47) indicating his perception that the concept of communities of practice is “yet to be successfully applied in education”, in part due to the lack of consistent professional language. Lack of professional language suggests the potential for other factors described within the literature as being necessary conditions for a profession to establish itself, such as the professional control of practice, visibility and comparability (Bowker & Star, 2000) to also still be in an evolutionary process. By implication then, the individual schema development occurring in PSTs is occurring without clear evidence about the existence of professional practice, at scale, for the field (Bain & Drengenberg, 2016).

Thus, for individuals to participate actively in the community comprising their ‘system’, they require a schema that has a degree of compatibility with that of the community. This schema would encapsulate the domain of the practice as well as the shared repository of knowledge and experience contributing to it. It would involve the use of the language of the profession in communicating ideas about it, and relational and collaborative skills in engaging with others within the community (Murphy, 1999). Of course, the reciprocal of this is also necessary, in that for schema to be sustained and developed, the community itself must reinforce individuals in their engagement. Communities of practice have been described by some researchers as effective approaches for promoting collaboration in situations where the expansion of individual expertise is a focus and where collective intelligence can be brought to a particular problem (Goldstein & Butler, 2010). Such collaboration is essential given both the personal (individual) nature of schema and the interpersonal (organisational) nature of the construct. At the same time, it must be recognised that such collaboration, in and of itself, will not engender professional schema development in the absence of other necessary conditions (e.g. if the community does not have professional control). Courses aimed at preparing teachers for practice need to be cognisant of research in the field of teacher cognition to ensure the learning experiences provided create a context that both challenges preconceptions, but also contributes to advancing the field. For the degree of collaboration suggested by some authors, however, (Ashman & Elkins, 2012; Thousand & Villa, 2000) as being required for successful teaching in contemporary classrooms, composed of diverse learners, it is essential that graduate teachers (agents) complete their courses with a level of shared understanding about, and commitment to, their roles within the community. Only then can they become active, contributing
members of the community of practice in which they find themselves situated, and only then can such a system have the potential to self-organise.

Consideration of ideas around professional communities from the theoretical perspectives described in the literature above leads to a number of conclusions. This literature would indicate that standards, which are based in the evidence around learning and teaching, are the current drivers of teacher-preparation programs. These standards should, then drive the development of professional learning communities that students experience during practicum and more broadly on graduation. The extent to which this can reasonably be expected across different professional teaching communities, however, remains unclear, with existing research perhaps suggesting that it is unlikely that graduates become immersed in teaching communities based on best practice and clearly referenced to standards. This thesis aims to help provide further information about the degree to which graduates are prepared for classroom practice within both individual and organisational contexts.

4.8 Summary

This section has described multiple aspects of the literature around the cognitive development of PSTs. Cognitive development is important because it facilitates PSTs responding within the complex environment of the classroom in a manner that reflects the expected practices of graduates as established by research on best practice and as described in teaching standards encapsulating this practice. In doing this, the chapter:

- Established the nature of cognition and teacher cognition, while describing early research in the field of cognitive psychology (Bartlett, 1932; Miller, 1956), when researchers began to examine the mediational processes involved with information processing.
- Examined how that research informed ideas about information processing, learning and memory (Kirschner et al., 2006; Sweller, 1994) and about schema development (Minsky, 1975; Rumelhart, 1980). The importance of schema has been established in earlier sections of the review describing research into effective teaching practices, standards and teacher preparation as an important factor assisting graduates in managing the multiple, simultaneous demands on their cognitive resources.
Described how these considerations also influenced researchers studying the impacts of cognitive load on schema development and learning (Feldon, 2007; Sweller, 1988). Research in this area describes the construct of schemas as important in assisting graduates to implement effective practices within their classrooms, allowing practice to be mediated by cognition. Development of schemas about practice is described as assisting in reducing the cognitive load inherent in the complexities of teaching practice.

Examined the literature on the factors influencing PST cognition and those factors identified as having an impact (Borg, 2003), and examined the studies concerning the nature of that impact. The impact of courses of teacher preparation have been identified as one of these influences. While some research has described limited impact of these programs (Kagan, 1992) other studies have found that such programs do have an influence on cognitive development (Adams & Krockover, 1997; Grossman & Richert, 1988; Holt-Reynolds, 1992; Tang et al., 2012). Such considerations are important as there is a well-established link between the cognition of PSTs, represented by their schema for practice, and their behaviour in the classroom context (Borg, 2015; Kagan, 1990). Further, the types of studies reported in the literature have been described, with their findings and limitations; in particular, the dominance of small-scale, self-reporting approaches to data collection rather than the presence of other, more objective proximal measurement at a given point in time.

Described how individual schemas connect with organisational schemas. If an individual schema is consistent with and reinforced by the professional context within a community of practice, cognitive load should be reduced. If, however, an individual’s schema is not consistent with the context in which graduates find themselves practicing, cognitive load is likely to increase markedly and result in significant challenges for the individual.

Reviewed the literature about how these schemas are represented in theoretical perspectives about the teaching/learning process. This literature has examined schema from both an individual perspective and that of an organisation/field. Organisational schemas represent the professional practices of a field, at scale, and what characterises such a field (Bain & Drengenberg, 2016; Bowker & Star, 2000). In a given field of practice, individuals interact with each other within the professional domain, using the pattern language of the field (Avgeriou et al., 2003; Bain et al., 2009; Smethurst, 1997). Schemas for practice within a
profession are visible in both self-organising systems (Bain, 2007; Davis & Sumara, 2006) and communities of practice (Lave & Wenger, 1991).

Taken together, these considerations provide the background to the thesis developed in this research – that having engaged in teacher-preparation programs, based in standards derived from a body of research on best practices, and entering organisations populated by professionals who have also met the requirements of these standards, students will develop entry-level schemas allowing them not only to practise their profession within a classroom, but to engage within their learning communities in discussing and developing the practice. Further, it is reasonable to expect that the individual schema of a practitioner would resonate with the organisational schema of the field, allowing such engagement to occur, although questions have been raised regarding the extent to which those conditions exist at the scale of practice communities in schools and in the field more broadly. It is within this context that the research proposed in this thesis is situated and seeks to determine the extent to which graduates from teacher-preparation programs develop a professional schema for practice that is consistent with what research and the literature indicate as necessary for contemporary classrooms. This is critically important if we are to determine the extent to which the assumptions and expectations of teacher preparation are producing graduates with the capacity to engage with the diversity and complexity represented in such settings, especially in inclusive education.

This schema development is the fundamental premise of this thesis. What the literature shows, however, is that attempts to measure teacher cognition have relied upon small-scale studies, most commonly implementing interview/questionnaire-based approaches. These approaches rely on self-reported information and inferential indicators of schema development, rather than direct measures. There is a need for the development of valid and reliable instruments and methods that objectively measure the schema development of PSTs. This will help to ensure that their capacity to meet the demands of the classroom environment develops appropriately throughout their course of study. The ability to measure schema development and examples of this within the literature are the focus of the next chapter of this review.
Chapter 5: Schema measurement, scenario-based assessment and instrument development

The previous chapters of this review have built the case as to why, given the existence of a body of literature, standards for practice and the intentions and content of teacher-preparation programs, graduate teachers should possess a schema for their professional practice. This schema would have developed as PSTs progressed through programs of teacher preparation, having been constructed progressively over the duration of a program. Their schema would allow individuals to respond in increasingly complex ways to typical classroom scenarios, albeit, on graduation, at an early-career level.

Previous chapters of the review have examined how teaching standards, based in literature on effective teaching practice, guide institutions in developing preparation programs. Literature on the cognition of PSTs describes the research on how these preparation programs impact on the thinking of graduates, hence their behaviours in the complexity of the classroom environment.

This chapter of the literature review focuses on the measurement of schema and the challenges, more broadly, of measuring cognition as it relates to teaching. It examines the literature on the use of authentic scenarios for both instructional purposes and, crucially, for assessment of mastery of course materials across a diversity of professional areas. Specifically, the use of scenario-based assessment will be examined in studies particularly focussed on schema development. Further, Chapter 5 examines ways in which schema development can be measured while framing a disciplined approach to instrument development that allows the measurement of schema within PSTs.

5.1 The challenges of measuring cognitive structures

Measuring schema is a complex task, requiring the collection and analysis of data often revolving around higher-order thinking and interconnectedness between numerous pieces of information. As described in previous chapters, a number of researchers have conducted studies aimed at measuring schema development in PSTs (Adams & Krockover, 1997; Hollingsworth, 1989; Tang et al., 2012). As has been described, these studies report varying outcomes and faced numerous challenges. Among these challenges are the small cohorts of participants used in a number of studies (Kettle & Sellars, 1996; Tang et al., 2012), the use of indirect measures to infer cognitive change (Hollingsworth, 1989; Kettle & Sellars, 1996) and the use of self-reporting...
methodologies. The findings of these studies assume that participants’ self-reporting about a process is synonymous with schema development, an assumption that was not tested in any of the studies and that makes developing conclusive findings challenging (Podsakoff & Organ, 1986; Stone et al., 2009). A number of researchers, such as Marshall (1995) have taken on the challenge of developing approaches that facilitate objective approaches to the measurement of schema, and its use both as a tool of instruction and as a means of assessment.

Marshall (1995) reports on research conducted over a longitudinal time period that investigated a number of aspects of cognitive psychology, in particular aspects related to schema development and schema assessment. Her early work focussed on application of schemas to problem solving, with a major focus on the application of schema theory to arithmetic story problems. In one such study, Marshall (1988) reports on the performance of four participants in an assessment model based on schema development. Participants were all college freshmen who, on preliminary testing, had shown poor levels of problem-solving skills. After instruction “designed to teach students how to understand the relationships expressed in arithmetic story problem” (Marshall, 1988, p. 7) and build a schema for problem solving, using what the researcher termed intelligent computer-assisted instruction, participants were assessed in each of Marshall’s aspects of schema knowledge – identification knowledge, elaboration knowledge, planning knowledge and execution knowledge. Using a combination of direct observation, talk aloud and questioning, Marshall (1988) asked participants to solve a number of story problems that were structured in the same manner as those used in instruction. The level of schema development was based on participants’ ability to implement the components that had been instructed, including feature recognition (being able to recognise that the features of a particular problem fitted with previous experience), constraints (recognising the way in which the features fitted together), planning and goal setting (the examination of planning a way forward given the feature recognition and constraints); and execution (the “ability to formulate appropriate arithmetic expressions to reflect the problem situation”) (Marshall, 1988, p. 10). In assessing these aspects, Marshall (1988) also aimed to assess the connectivity between each level of the components, as she argued that “a fully developed schema would have many links among components as well as within them” (p. 3). She considered this connectivity a crucial aspect of schema formation and development as the constituent features needed to not only be connected to each other, but allow automatic retrieval
and activation of other pieces for processing (Marshall, 1988). Such automaticity enabled reduction of cognitive load and freed cognitive space to process new material, linking closely to work described earlier by Sweller (1988), Sweller et al. (1998) and Feldon (2007). In her study, Marshall (1988) found that using the instructional method described assisted participants in schema building and that “understanding improves as an individual builds the components of schema knowledge and links these components together” (Marshall, 1988, p. 13). Having focussed particularly on using schema-based models for instruction, Marshall (1995) gave consideration to approaches that allow a measurement of schema level to be attained. Marshall (1995) describes this as an essential component of teaching and learning if schema-based instruction/assessment is to be adopted.

Marshall (1995) describes interviews and thinking aloud as some approaches to determine schema level. She also indicates that these approaches can be problematic, describing how individuals are not always sure of how they are approaching a particular problem in terms of their cognitive processes. Marshall further outlines a number of alternative approaches to determining levels of schema development. Such approaches included direct observation of responses to given situations, use of checklists to determine frequency of desired responses, simulations, and use of written responses by participants describing how they would respond to given situations. Some of these methods were described as being of limited utility as they are resource intensive, involving direct observation of behaviours/responses to situations for extended timeframes. All of the approaches described by Marshall involve an assessment of the ability of an individual to exhibit a particular skill, or aspect of knowledge, after immersion in some form of preparation. This preparation frequently involved using explicit teaching approaches to inform the skill/knowledge development of the students before immersion in situations where they were required to show their mastery of what had been instructed. A number of these assessment approaches involved individual responses to scenario-based problem-solving exercises. This involved presenting written scenarios to learners in the context of authentic professional problems. Application of skills and knowledge was then applied to the situation, and the responses to it were examined.

With the complexity of the task of measuring schema referred to above, Marshall (1995) describes a number of considerations that need to be addressed in adopting a scenario-based approach. First, the instrument used must be representative of the construct.
Second, it must explore the extent to which learners have developed and can instantiate the schemas resulting from instruction. Third, the instrument must be sufficiently open-ended so as to allow for individualisation of responses as “no two individuals will form identical schemas” (Marshall, 1995, p. 267).

A number of other authors have described various ways of measuring schema and applications of ideas about schema to practice. Some examples of the diverse application of schema measurement includes analysis of skill development in throwing an object after instruction and practice (Wulf, 1991), examination of the ability to problem solve within the context of authentic computer-based simulations (Seel et al., 2006) and exploring how an individual’s degree of political sophistication impacts their learning and schema development from news events (Rhee & Cappella, 1997). Wulf conducted an investigation into the structure of practice sessions of children’s motor skill development, with a view to optimising schema formation. Wulf’s study involved 88 children with a mean age of 11.3 tested on a throwing task after instruction. Three groups practised under variable conditions of distance and weight of the object with a further group having constant weight and distance. All groups, along with a control who had received no instruction or practice, were then tested with new conditions of weight and distance. Wulf found that “variable practice in general facilitated recall and recognition on the novel task” and that the motor schema developed seemed to be best facilitated by a high level of “contextual interference” (p. 123), (in this case randomising the order of instruction). The schema development measure in this study was provided by requiring the application of skills and understandings already instructed and practised to a novel scenario and measuring accuracy. Wulf argues that the instruction and practice approach led to the development of a schema for the most efficient way to propel an object. The variable approach allowed for a more refined schema, such that in the novel situation those groups who had experienced this approach in instruction showed evidence that “variable practice in fact leads to the formation of motor schemata” (Wulf, 1991, p. 131). Marshall’s (1995) criteria can be recognised within the context of Wulf’s study. The task required for assessment is representative of both the construct under scrutiny and the instruction that has taken place. It examines the extent to which a schema has been developed and can be instantiated, and is open-ended in that no two of the individual participants would of necessity have developed the same schema, but variations have still allowed success with the task.
In a study of schema development as an indicator of retention of the mental models used in the instruction of engineers, Seel et al. (2006), “drew upon the theoretical frameworks of the learning-dependent progression of mental models … to determine the extent to which the step-by-step construction and revision of mental models results in an abstract schema for acquiring troubleshooting skills” (p. 323). These researchers examined the development of complex troubleshooting skills in a computer-simulated scenario with 26 engineering and chemical engineering students. In building a schema for practice, participants participated in three sessions where they engaged with the simulation and were instructed as to how it operated. This introduction “provided the students with the requisite information about the system and then allowed them to practice manipulating its controls” (Seel et al., 2006, p. 312) and instructed them on possible malfunctions and appropriate responses to these. In the assessment stage, participants were required to play the role of plant operators in a computer simulation of a distillation plant. They were required to diagnose and repair specific malfunctions provided within the simulation as quickly and efficiently as possible, after having explained the cause of the malfunction and proposed solution. Measures of performance in addressing the scenarios were taken, with responses judged for consistency against a resolution provided by an expert. The researchers found that time taken, self-efficacy and cognitive flexibility were significant factors in successful problem solving. As with Wulf’s (1991) study, that of Seel et al. (2006) can be seen to reflect Marshall’s (1995) criteria. In this case, the task required for assessment was again representative of both the construct under scrutiny and the instruction that had taken place. It represented authentic scenarios within the scope of practice of the participants and realistic problems that could eventuate within their setting. It examined the extent to which a schema had been developed and could be instantiated in the problem-solving scenarios. While the task in this situation may be considered a little less open-ended, in that there may be an ‘optimal’ response, at the same time, a degree of open-endedness can be seen in that a number of responses may still allow a diagnosis and repair of the malfunctions within time constraints.

Rhee and Cappella (1997) conducted research into the role of political sophistication in individuals learning from news events. Learning was described by the authors in terms of schema development. These researchers conducted two studies to gather data for their research. The first employed notices posted in a variety of media circulated through professional communications networks, religious groups’ newsletters and direct
targeting of workplaces to recruit 350 participants from six major media markets in the US (New York, Philadelphia, Washington, DC, Dallas, Los Angeles and Chicago). The authors stressed that the sample was not random and that participants were paid for their involvement. A pre-test questionnaire was administered to each participant, prior to exposure to any news articles, to determine characteristics of each participant from the perspective of their political sophistication, civics knowledge, political involvement, attention to national issues and media news exposure. Internal reliability measures varied within each sub-section from 0.31 to 0.79. Participants were then provided with representative news items related to healthcare reform agendas within the US. A post-test questionnaire was completed at the end of the week that examined learning, argumentative depth and construct differentiation. The researchers found that participants who had scored more highly in political sophistication learned more, had more differentiated constructs that focussed on relevant issues and were able to develop higher quality arguments than those with lesser sophistication. This was seen as evidence for having developed a more complex schema.

A second study conducted by Rhee and Cappella (1997) aimed to consolidate understanding of “the predictive ability of political sophistication” (p. 219) by gathering data from participants in a simulated election campaign to examine the impacts of news reporting. In this study, 276 adults were recruited across seven states in the US, deemed to be “representative in terms of gender, age and race as compared to estimates of US voter population” (p. 220). A pre-test/post-test design was again implemented and simulated news reports provided over a one-week timeframe. The findings supported those of the first study, in that political sophistication was seen as predictive of both the quantity of material consumed, but also the learning derived from it. In terms of Marshall’s (1995) criteria, Rhee and Cappella’s research can also be seen to exhibit representativeness, a capacity to build schema and a clear open-endedness. As such, the scenarios described would be considered to be authentic and to potentially allow for the gauging of a developing schema.

The examples described illustrate how Marshall’s (1995) criteria of representativeness, capacity to develop schema and open-endedness may be realised. Instruments aimed at presenting situations to practitioners typical of what would be represented in practice are frequently labelled as ‘authentic’ approaches. Scenario-based representations, as described in the studies examined, exemplify one method of applying these authentic
approaches. The use of authentic assessment, and in particular scenario-based methods, for assessment purposes is examined in the following section.

5.2 Using scenario-based approaches as authentic assessment

The use of what are often described as authentic learning activities in both tertiary teaching and assessment is represented within numerous professional fields, with research reporting that it improves student learning outcomes when activities take place within a practice context (Hewitt, 2008; Keyes & Burns, 2008). Using similar authentic methods, such as scenario-based approaches, simulations or project-based learning for assessment has been described as enhancing dependable approaches to instruction, where learners are required to display a mastery of the skills of a profession under authentic conditions (Bowden & Marton, 1998). Authentic learning and assessment situations have variously been described as case studies, simulations, scenarios and problem-based learning approaches, among others, although each of these often has subtle differences from another. Authentic approaches to teaching, learning and assessment have been defined as particularly important, as tertiary programs in all discipline areas have increasingly involved the use of technology and the online environment (Din & Jabeen, 2014). When used in instruction, these approaches are aimed at the development of cognitive skills, often alongside teamwork and communicative skills, to enhance the ability of undergraduate students in professional fields to problem solve, and to develop decision-making abilities (Din & Jabeen, 2014; Tunny, Papinczak & Young, 2010). The capacity to problem solve and make decisions relies on the development of schema facilitating significant automaticity, as described by Marshall (1988; 1995) and Sweller et al. (1998). Similarly, when used as tools of assessment, authentic approaches are described as being particularly useful when “predicting student ability to function competently in future professional practice” (Gulikers, Bastiaens & Kirschner, 2004, p. 75); such capacity being indicative of schema development within the field.

Scenario-based approaches as an example of authentic assessment, in particular, involve presenting learners with standardised narrative representations, validated as being typical of what will be experienced when students complete their studies and begin to practise in their particular field. When implementing this approach, issues of content validity and reliability are considered particularly important (Education Development...
Scenario-based approaches are used extensively in a number of practice fields, including law (Kam, Ruyters, Coburn & Toohey, 2012), the medical and para-medical fields (Brazil, 2008; Janing, 1997; Lee, Grantham & Boyd, 2008) and PST education (Meldrum, 2011), among others. While there is a link between authentic assessment and schema, the examples chosen are representative of studies into the measurement of learning, rather than participant cognition and schema development. Well-validated scenarios are frequently described as advantageous because not only are they engaging for learners, but also because they are described as assisting in the transfer of knowledge and skills into the workplace. To help ensure this validity, a well-disciplined approach to scenario development is required, as is explicated below for each example described above. The degree to which this discipline is clear varies within the examples included. Mietzner and Reger (2005) describe other positive factors for the use of scenario-based approaches. These include that they allow for a number of possible plausible outcomes; that they can allow for the identification of situations for which an individual/organisation is not prepared, and that they can contribute to an improvement in learning and decision-making processes through facilitating collaboration and through provision of feedback. At the same time, they are seen as very time-consuming and being generally more qualitative in nature, requiring greater input from identified suitable experts who are recognised within their field as having deep knowledge.

A 2011 project implemented at the Royal Melbourne Institute of Technology involved embedding a problem-based learning approach based on authentic scenarios into aspects of the institute’s law degrees. The project, titled Practice Aspects in the Juris Doctor, aimed to embed a “new learning and assessment approach … using a range of strategies and tools” into law degrees, allowing students “to better develop skills in legal interviewing, legal problem solving and advocacy” (Kam et al., 2012, p. 19). A series of scenarios, developed using external advice, was created along with supporting documents and video recordings, guiding students through both practical and written tasks. Importantly for the study in question, assessment was implemented using similar practical approaches as had been used during instruction in that the scenarios provided for assessment were developed along the same lines and focussed on the same skill-set as those for instructional purposes. For example, one of the instructional scenarios focussed on the development of skills in negotiation and mediation in the context of a court room. Assessment in this area required students to demonstrate these skills in the
authentic scenario of a court case. A mark-sheet describing criteria and mark allocation was made freely available prior to the assessment. Sixty-one students were involved in the pilot, along with six practitioner assessors, six people acting in a ‘client’ role, an administrative assistant and an academic staff member. Evaluation of the project gathered both quantitative (via questionnaire) and qualitative (via focus group) data from students and practitioner assessors. Five students volunteered to participate, as did five practitioner assessors. The findings indicate that the student participants found the approach “both interesting and challenging” (Kam et al., 2012, p. 23), with an appreciation of the opportunity provided to apply theory to practice with guidance from practitioners. There were, however, some areas in need of improvement. In particular, there was dissatisfaction with the application of the marking scale, with participants expressing the perspective that it was inconsistent with the information provided early in the session. Practitioner assessors reported that students were well prepared for the tasks, showing maturity in their thinking and respect for the process. The practitioners also reported having some concerns about the marking scale and its capacity to accurately reflect performance.

While the small number of participants (five) in the evaluation stage of the project was seen to provide useful information for its ongoing development, it stands as a limiting factor in the ability to generalise results more widely. Further, while the scenarios used were developed in conjunction with expert practitioners, there is no evidence presented describing the establishment of any validation process, apart from the initial consultation, for these that would ascertain their psychometric integrity. The mark-sheet used, while described as being based on the assessment criteria, is not described as having any reliability measures established to ensure consistent application in the assessment context – an issue raised by both the students concerned and the practitioner assessors applying the device.

Janing (1997) implemented a two-year, longitudinal study with 55 paramedic students in order to examine the effectiveness of using written scenarios, based on clinical problems, as an instructional approach to facilitate higher-order thinking skills and encourage self-direction. The study was completed in the context of paramedic training shifting toward “protocol-driven care initiated on the paramedic’s judgement of the patient’s problem(s)” (Janing, 1997, p. 215). For each area of the course, a written exercise was given to students with “information on mechanism of injury/history, environmental factors, and physical signs and symptoms of a given patient” (Janing,
A scenario interpretation form was provided to scaffold this work. Students were required to analyse the case, identifying and rationalising proposed interventions. This was followed by additional reading before lecture-based input centred on the same scenario interpretation form. Students were then presented with a scenario-based assignment to be completed prior to the subsequent session. For consistency, assignments were graded by the same instructor throughout the course. There were 12 assignments throughout the course, increasing in complexity as students progressed through the course.

Janing’s (1997) study employed a pre-test/post-test approach with post-test scores being compared to final examination scores, as well as to scores of a subset of questions aimed at examining higher-order thinking. Relationships between pre- and post-test scores was undertaken using a one-tailed dependent t-test, while age, experience and previous education were analysed post hoc using one-way analysis of variance (ANOVA). Janing found that using scenarios enhanced the ability of participants to think critically and self-direct. There was no significant effects for age, experience or previous education. While validity was established by using scores obtained by previous cohorts and applying the Pearson correlation coefficient, and internal reliability using the Kuder-Richardson test, Janing describes several significant limitations to her study. These limitations included the sample size, the consideration that sample selection was based on the score attained in an entrance exam and that no control group was used. Janing recognised that this meant the effects described may well have been the result of maturation, rather than the intervention implemented.

In what was described as a pilot study by its authors, Lee et al. (2008) implemented clinical scenarios with 12 intensive care paramedics to examine any differences between using high fidelity and low fidelity mannequins in the assessment of clinical performance. All participants were described as having engaged with critical care training with “frequent scenario-based assessments” (Lee et al., 2008, p. 508) forming the basis of the assessment component of the course. The trial implemented a randomised crossover study in which the performance of volunteers who had undergone critical care training was assessed by three independent assessors who were all accredited as instructors in Advanced Paediatric Life Support. Further subjective data were gathered using questionnaires and a rating scale. The scenarios used in the study had “prespecified key treatment points that needed to be achieved”, were “designed at the appropriate level for the ICP [intensive care paramedic]” and “were in the same
format as the scenarios they have been exposed to as part of their training” (Lee et al., 2008, p. 509). These conditions are described as ensuring that participants were familiar with the process, as they had encountered this style of scenario-based assessment approach frequently during their training. In commenting on issues of validity and reliability, the authors state that they “did not set out to formally evaluate the validity and reliability” (Lee et al., 2008, p. 511) of their process, as it was a pilot study. They did, however, recognise that important information would have been obtained had this process been undertaken.

In an editorial introducing and critiquing the Lee et al. (2008) article described above, Brazil (2008) recognised that “scenario-based assessment of clinician performance offers a number of obvious advantages” (p. 456). These advantages include the reliability provided by use of standardised scenarios as well as the requirement to operate in a “realistic clinical context” making such assessments “more valid than tests of knowledge alone” (p. 456). Brazil, however, describes the importance of scenario fidelity as being “central to assessment validity” (p. 456). While describing the scenario design, having been completed “by content experts, using an intuitive approach to the realism and expected difficulty of the challenge” (p. 456) as contributing to face validity, she suggests that further content validity and reliability measures would enhance the strength of the Lee et al. study.

Meldrum (2011) used a scenario-based teaching approach in the final year of a physical education teacher education course to help in “preparing students for their future teaching careers” (Meldrum, 2011, p. 133). In her study, Meldrum introduced 25 final-year students to an authentic scenario-based approach as “a powerful tool of learning, as well as modelling a pedagogy students could use in the upper levels of secondary school” (p. 134). She proposes that such an approach was important in engendering the qualities “identified as characteristics of better teachers” (Meldrum, 2011, p. 134) such as reflective practice and developing classroom environments supportive of all learners. Meldrum describes this as of particular importance in a field where many of their university experiences “in the applied sciences further induct them into transmission pedagogies which treat learning as a one-way transmission of knowledge from teacher to student” (p. 134). Meldrum asked participants to develop responses to a number of scenarios throughout the course. The first scenario asked participants as individuals to consider their futures as professionals over the forthcoming three years. The second was a group task implementing a structured approach to developing responses to authentic
situations from students’ practicum experiences. Developing responses to these authentic scenarios formed the basis of assessment for the subject. Both a written submission and an oral presentation were required describing the approaches that the group would recommend as resulting in a positive outcome. Meldrum gave no description of approaches to enhance the validity or reliability of the scenarios developed. Further, although marking criteria were outlined in general terms for the assessment phase within the study, no attempts at establishing the validity or reliability of these criteria was reported.

Further data were collected from participants at the end of the session using a survey with a series of open-ended questions. These questions focussed on participants’ perceptions of using scenario-based approaches for exploring and developing an understanding of professional issues. Meldrum (2011) found that, while many of the participants were challenged by the scenario approach, they also reported it as a valuable way of authentically exploring the issues and situations experienced in classroom environments.

This section has described examples of the use of scenarios as both a pedagogical approach and as an approach used in the assessment of student learning. The examples chosen are presented as authentic measures of learning, rather than studies focussed on schema development. As such, they attempted to measure achievement against criteria, rather than providing a direct measure of cognition. At the same time, research into schema development has used indicators of authentic learning from scenario-based tasks as evidence of schema construction and expansion (Rhee & Cappella, 1997; Seel et al., 2006; Wulf, 1991), albeit with a lack of validation processes beyond expert authentication. This section has emphasised how the use of scenarios to assess student learning is important in allowing authentic assessment of situations encountered in a field on a day-to-day basis, and the capacity of students to respond to these authentic representations. Further, it has highlighted scenario fidelity as a major factor in the use of such approaches, and the importance of ensuring that depictions of authentic contexts have rigorous processes applied to ensure both validity and reliability.

An important consideration for this research is the way in which using scenarios to represent authentic practice can be employed to explore the cognition of those studying to enter particular fields. Such representations would also apply to PSTs and their practice. As such, the application of a rigorous process of instrument development to
ensure that the instrument meets Marshall’s (1995) criteria, described earlier (being representative of the construct, exploring the extent to which learners can instantiate the schemas resulting from instruction and being sufficiently open ended so as to allow for individualisation) is essential. Equally essential within such a disciplined process is the capacity to enhance the validity and reliability of both the instrument developed, as it is applied with participants, and the response format implemented in grading their accounts.

Goldfried and D’Zurilla (1969) describe a development framework through which such scenarios, and appropriate responses to those, can be established, allowing aspects of learning to be measured. These authors describe the use of such an approach as important in strengthening the validity and reliability of such measures for their intended purpose. While Goldfried and D’Zurilla’s approach also employed expert opinion as a part of the validation process, it extended this more widely, as is described in the following section. Both Marshall (1995) and Goldfried and D’Zurilla (1969, p. 166) describe the use of verbal or written descriptions of situations, to which participants responded either orally or in writing, as being an appropriate approach to assessing competence in complex areas, provided the response was “not only clear as to what a person might do if he were in that situation, but also how he would go about doing it.” Goldfried and D’Zurilla’s framework, called the BAM, is described in the next section.

5.3 The behavioural-analytic method

The BAM was developed by Goldfried and D’Zurilla (1969) as a method that facilitates the development of instruments aimed at exploring “the relationship between an individual’s behaviour and the environment” (Goldfried & D’Zurilla, 1969, p. 163). It uses a criterion analysis to allow “the development of measuring instruments based specifically on those behaviour-environment interactions” (Goldfried & D’Zurilla, 1969, p. 163), which are identified for a given situation. The model focuses on individual competence for a given scenario, defined by Goldfried and D’Zurilla as being “the effective response of the individual to specific life situations” (p. 158). Defined in terms of influence on the environment, effective behaviour is described as “a response or pattern of responses to a problematic situation that alters the situation so it is no longer problematic” while at the same time producing “a maximum of other positive consequences and a minimum of negative ones” (p. 158). Goldfried and D’Zurilla
describe their approach as having the potential to make an “important contribution” in the area of “professional and graduate training” (original emphasis) where “a reliable and valid measure of competence” (p. 191) is required. These attributes are important for this research in contributing to the development of a valid and reliable scenario-based assessment of schema for the specific life situations referred to by Goldfried and D’Zurilla, and for the subsequent marking criteria.

Goldfried and D’Zurilla’s (1969) model has five specific steps, the use of which are a key to the validation of the measure being developed in this research. These steps – situational analysis, response enumeration, response evaluation, development of measuring instrument and evaluation of the measure – are described below.

Step 1: Situational analysis – Goldfried and D’Zurilla (1969) describe this step as fundamental to the BAM. It focusses on “specific situations” (p. 164, original emphasis) that individuals will experience within their environment. These conditions must be “those specific, but meaningful situations with which most individuals in the particular environment must cope effectively in order to be considered ‘competent’” (p. 164). These situations need to be somewhat open-ended such that responses can be described in terms of a number of characteristics, including frequency of response, the existence of a wide range of possible alternative responses and the requirement for a decision to be made by the individual as to the response most likely to produce a desired outcome. Sweller et al. (1998) refer to automation as being important in schema construction and activation, where the salient features of a situation allow the observation of a fluid and accurate response to a situation, in comparison to a “slow and clumsy” (p. 258) performance for situations where a schema has not been built. Similarly, Marshall (1995) identifies the necessity for individuals to have identification knowledge for a given situation before schema activation can be measured. Asking for a justification for a suggested response can then identify the existence of elaboration knowledge and higher levels of development.

Situational analysis also serves as a content validation step. Burns (2000) describes content validity as ensuring that the content in an instrument is valid and a fair representation of the purposes for which it is being used. Such validity is usually determined on the basis of judgement; however, more formal approaches are also frequently adopted. Johnson and Christensen (2008) describes three steps in the process of content validation. The first of these steps requires an understanding of the construct
being measured, the second, an examination of the content in the specific measure being used and the third “a decision as to whether the content on the test adequately represents the content domain” (p. 152).

The purpose of situational analysis is to verify that the situation described by the scenario involves “those specific but meaningful situations with which most individuals in the particular environment must cope effectively in order to be considered ‘competent’” (Goldfried & D’Zurilla, 1969, p. 164). Effectively, this phase involves ensuring that the scenario described is representative of what would be expected in a given situation – a validation of the scenario.

Evidence for the content validation of a scenario in the present research can be developed from a number of sources, including an examination of the literature in the field of inclusive education, allowing the identification of the key challenges of inclusive classrooms, examination of the key standards pertaining to diversity within classrooms, the use of expert judges, the experiences of existing teachers in their first year of practice and from the groups used in piloting the instrument. The ability to respond appropriately to the scenario described (i.e. to be considered competent) would represent the ability to instantiate an appropriate schema for action for the given situation. This ability would be indicative of the existence of schema knowledge (Marshall, 1995).

In addition, Goldfried and D’Zurilla (1969) consider that the scenario should be reasonably problematical – that the most relevant or effective approach to handling each situation may not be apparent, but rather require some complexity of analysis. Goldfried and D’Zurilla describe a variety of ways for the conduct of this analysis and scenario development, including direct observations or interviews with those typically involved in the situations.

Marshall (1995), Sweller et al. (1998), and Goldfried and D’Zurilla (1969) all suggest a number of ways in which information about a particular situation can be collected. These approaches include direct observation of behaviours, simulations/role plays and written responses to scenario-based problems.

Step 2: Response enumeration – Goldfried and D’Zurilla (1969) describe this stage as serving three major purposes. The first is a consideration of the variety of responses that may occur to a situation and a preliminary evaluation of the likely effectiveness of
these. The second purpose was to ensure clarity of the situation. Goldfried and D’Zurilla (p. 165) describe “conditional” responses as indicative of vagueness, where conditional responses are shown by language such as “my reaction would depend on ….” Early identification of this lack of clarity allows “steps to be taken to add relevant detail”. The final purpose described by Goldfried and D’Zurilla is to assist in response evaluation, which is the “sampling of potential responses … which are to be used in obtaining criterion judgements of effectiveness” (p. 165). Procedures for response enumeration are described by the authors as being variable. The best approach, that of direct observation, is described as being potentially problematic with significant difficulty in the maintenance of “almost constant surveillance over individuals in the naturalistic setting” (p. 165). Alternative approaches described, as with the situational analysis, include role plays or other authentic simulations of the scenarios “by such means as films, slides, and verbal or written descriptions” (p. 165), with participants providing either verbal or written responses. Additional validity in the development of scenarios can be provided by individuals identified as having expert knowledge, as described in the response evaluation.

Step 3: Response evaluation – this stage aims to make a “determination of the degree of effectiveness” (Goldfried & D’Zurilla, 1969, p. 166) of the potential courses of action identified in the previous step. Goldfried and D’Zurilla describe such judgements as being made by “significant others” (p. 166) in the environment who have knowledge relevant to the situation, to ensure that it is representative of that situation. These significant others are described by the authors as individuals possessing three major characteristics. First, they are familiar with the environment, having “frequent contact with the people to whom the assessment technique will be applied” (p. 166). Second, they have positions/roles in making determinations as to whether particular responses will be effective or ineffective in the situation under consideration. Third, the judges are individuals “whose opinions are likely to be respected by others, particularly those toward whom the assessment will be directed” (p. 166). In providing perspectives on responses allowing comparisons to be drawn, the judges provide information as to the most effective courses of action, both affirming the inclusion of desirable aspects in the description of a situation and indicating aspects of the situation that should be eliminated. This is described by Goldfried and D’Zurilla (p. 167) as serving to “improve reliability and validity”.
Step 4: Development of the measure – Goldfried and D’Zurilla, (1969) contend that following the previous three steps allows for the development of a measuring format where both the content of aspects for inclusion as well as criteria for scoring them can be derived. While they reinforce that direct observation is the most effective way of implementation, they also reiterate that this may not be practical. This perspective is consistent with that of other authors such as Marshall (1995) and Sweller et al. (1998). Compromise approaches, as described in the earlier steps, such as role-playing or written responses to scenarios are suggested. In particular, the authors suggest that asking participants to imagine themselves responding to a particular context and describing both what they are doing and how they are going about it “approximates the real situation as closely as is practically possible” (Goldfried & D’Zurilla, 1969, p. 167). While still requiring evaluation (Step 5), the authors contend that “competence may now be defined operationally by the overall adequacy of the individual’s performance on the measuring instrument” (Goldfried & D’Zurilla, 1969, p. 168).

Step 5: Evaluation of the measure for effectiveness – evaluation issues associated with the measure are described as not differing “substantially from those carried out in the evaluation of most any measuring instrument” (Goldfried & D’Zurilla, 1969, p. 168). These involve further investigation of issues of validity and reliability to ensure that the measure is an authentic representation of the situation, appropriate responses and competence of individuals providing the response.

The BAM has been applied to the development of measures in a number of areas where competence in a given situation is required. One of these areas is to assess social problem-solving skills and determine subsequent intervention requirements for individuals. Often, these measures have been applied to populations of people with disabilities. Social problem-solving approaches have proven to be efficacious in the treatment of anxiety and depression, while poor problem-solving ability has been shown to be a “significant predictor of aggression” (Anderson & Kazantzis, 2008, p. 98). Some examples of the application of the BAM to the development of such measures include an informal rating matrix measuring social skills in adolescents (Bain, 1991), a social problem-solving skills measure developed by Loumidis (1993), and the identification of challenging situations arising for physical education teachers when teaching children with autism spectrum disorders in mainstream classes (Obrusnikova & Dillon, 2011). The BAM has also been used for other purposes, such as an enhancement of the validity.
of existing scales developed to measure social skills deficits to inform training programs for people who have experienced an acquired brain injury (Marsh, 2016).

One of the challenges of using scenario-based representations is ensuring both the validity and reliability of the measures developed. The BAM provides a disciplined approach to content validation within scenario development by drawing on authentic sources (such as literature, prescribed standards and recognised experts) to provide information at all stages. By using such sources through the identification of a given situation and the identification and evaluation of potential responses to that situation, measures are developed that have a high degree of content validity for the situation. The use of such sources of information is illustrated in the examples that follow.

Bain (1991) implemented the BAM in the development of an informal teacher rating matrix focussing on social skills and behaviour. The matrix was being developed, in particular, “for use with early adolescents in school settings” (Bain, 1991, p. 3). He describes the BAM as providing a “framework for determining the content validity of the proposed assessment device” (Bain, 1991, p. 8). This validity was described as essential in terms of both the “behaviour of interest and the context in which that behaviour occurs” (Bain, 1991, p. 8). The study involved 63 teachers (58 from high schools and five from upper primary schools) randomly selected from a range of educational settings (38 regular education, 21 special education and four from a juvenile detention facility) from both rural and urban settings across Australia and the US. Fifty-five students aged from 12 to 15 were also randomly selected from regular education, special education and juvenile detention facilities from Australia and the US. Bain used literature, curriculum documents and a variety of existing assessment devices to develop an initial general list of social skills. Both teacher and student perspectives were also sought “to further ensure that the skills obtained … had social validity for early adolescent aged students in school settings” (Bain, 1991, p. 9). Eight special education teachers were then asked to develop written “optimum responses” (Bain, 1991, p. 12) to problematic situations involving identified skills. These responses were reviewed by the researcher, with those occurring most frequently then included as accepted responses. A range of possible responses was then obtained from students. Overall, the “responses of students and teachers were ranked in order” (Bain, 1991, p. 13), and provided to two independent judges, consistent with the requirements of the BAM. Two further expert judges were then asked to examine the items and potential responses to provide further content validity, while reliability measures were undertaken using the Spearman Rank Correlation.
Order Correlation procedure, resulting in a correlation coefficient of 0.89. Exploration of internal consistency resulted in a Cronbach’s alpha of 0.85.

Bain (1991) concludes that the IRM provides a useful, easily administered tool for teachers to implement as “a practical screening device for rating social skill” (Bain, 1991, p. 16). While it should be considered as part of a “comprehensive assessment battery” (Bain, 1991, p. 17), it provided a valid and reliable approach to allowing the identification, and hence development of remediation strategies, for problematic behaviours. The use of literature, existing documentation and expert practitioner input to identify appropriate responses to complex situations is an important example of the application of Goldfried and D’Zurilla’s (1969) approach to instrument development.

Loumidis (1993) implemented the BAM to develop a social problem-solving skills measure for use with people with learning disabilities. Loumidis (1993, p. 60) drew on the literature to identify “components of problem solving” to inform the development of scenarios “representative and relevant” to the lives of participants. The author then conducted a pilot study using informal interviews with 28 participants. These included five clinical psychologists/senior nursing staff, six residential social workers/day care instructors and 17 people with learning disabilities from both residential facilities and day program centres. Loumidis used information from both the literature and interviews to inform the development of a series of typical social problem-solving scenarios. These included aspects such as the source of the problem (impersonal practical problems involving issues such as safety; problems involving personal; needs/desires such as wanting to meet new people; and problems involving interpersonal conflict, such as coping with objectionable behaviour) and the type of problem (such as those involving peers/co-workers, those involving ‘authority figures’ and those involving strangers). Possible alternative responses were gathered during the interview stage through a series of open-ended questions (e.g. outlining a scenario and asking respondents to describe how they would deal with the situation and any other things that could be done). A detailed scoring matrix was developed using information from both the literature, about components of social problem solving, and responses from interviews allowing the degree of effectiveness (Goldfried & D’Zurilla, 1969) of responses to be determined.

Loumidis (1993, p. 31) describes the approach taken as important in developing valid approaches to measuring social skills with “an emphasis on qualitative aspects of solutions to problems (such as effectiveness and social acceptability)”. Using both the
literature and a pilot study is described as helping to ensure content and face validity for the instrument, with such measures providing well-validated objective data, rather than those relying on self-reporting. This was described by Loumidis as important with the intended target cohort of the instrument. No reliability data, however, were reported for the instrument.

A study by Obrusnikova and Dillon (2011) implemented the BAM (Goldfried & D’Zurilla, 1969) to help identify “the teaching challenges that occur when students with ASD [autism spectrum disorders] are educated in GPE [general physical education] classes” (Obrusnikova & Dillon, 2011, p. 115). These authors describe the BAM as being particularly relevant as it is “one of the most widely used approaches to identifying individual, behavioural and environmental” (Obrusnikova & Dillon, 2011, p. 15) responses to complex situations in both therapeutic and educational studies. It is described as being useful in its ability to guide the development of measures aimed at assessing “the process of individuals interacting in situations with challenging demands and the problem solving process as they attempt to find a solution that is effective for the given situation” (Obrusnikova & Dillon, 2011, p. 15). The study was completed as part of the development of the Inventory of Teaching Challenges for Inclusive Physical Education. In their study, Obrusnikova and Dillon sampled 43 teachers from various geographic regions of the US, who responded to two online questionnaires based on a written vignette/scenario. One questionnaire consisted of demographic information, while the other gathered data about “participants’ perceptions of challenges that occurred when teaching students with ASD in their GPE classes” (Obrusnikova & Dillon, 2011, p. 116). Participants were required to meet a number of criteria, such as being licenced to teach general physical education (GPE) or adapted physical education in at least one state, currently holding a full-time teaching position, with at least two years’ experience, and having had experience teaching physical education to a student similar to that described in a scenario provided to participants. The written scenario provided to participants described a hypothetical student with characteristics “based upon the twelve DSM IV-TR criteria for AS” (Obrusnikova & Dillon, 2011, p. 116). These criteria are those described by the American Psychiatric Association (2000) in its Diagnostic and Statistical Manual (4th ed.). The description used a gender-neutral name to avoid any potential biases and avoided labelling, rather, using descriptions of characteristics and behaviours to elicit responses. Content validity, readability and technical quality of both the scenario and questionnaires were established by having two
panels acting as expert judges (Goldfried & D’Zurilla, 1969). The judges had the appropriate qualifications and experience in adapted physical education and GPE, and in conducting research surveys, to be considered as appropriate for this role. Reliability was calculated using Cohen’s kappa, with a reliability score of 0.94.

Obrusnikova and Dillon (2011) report that participants listed 225 separate teaching challenges arising from their scenario. These challenges could, however, be categorised into three major areas: those involving managerial situations (termed cooperative challenges), those involving instructional challenges (termed competitive), and those involving social aspects (termed individualistic). The researchers conclude that implementation of the BAM had allowed the identification of a raft of challenges that may be encountered by teachers of the target group to help in the development of school-based interventions, and in determining the support needs of students in GPE classes. The authors further suggest that the findings may be useful in informing both pre-service and in-service courses for physical educators.

A significant advantage of applying the BAM to the development of instruments that aim to measure and categorise a ‘response to scenario’ emerging from these studies lies in its use of a number of sources to assist in providing content validity for both the situation and for the potential responses enumerated (Goldfried & D’Zurilla, 1969). These sources include considerations of aspects such as literature and expert judges to provide guidance. Goldfried and D’Zurilla (1969) describe how these responses could be measured in a number of ways, including by direct observation, role-playing or by provision of a written response to the particular situation. Responses could then be gauged in terms of their likely effectiveness in terms of providing a positive outcome for the situation. Examples of the implementation of the BAM above described the development of an appropriate response format as well as the importance of consistent measures to allow scoring of responses. Information to guide the development of such response formats could, in a similar manner to the instrument, be guided by sources such as literature and expert input. As described earlier, Marshall (1988) considers both the content of responses as well as the connectivity within them to be crucial to allow an individual to evidence schema development. Hence, approaches to scoring these responses must have the capacity to allow for judgements to be made in both of these aspects. Using the BAM to guide the development of a measure for schema development and to help ensure validity of a scenario aimed at doing so also requires a disciplined approach to scoring. What is required, then, is an approach that allows for a
categorisation of responses that reflects not just multiple levels but also has the capacity to allow for the complexity of connectivity between varying aspects of the response. In terms of written responses to scenarios, one such approach to scoring is application of the SOLO taxonomy. This approach is described, along with studies having implemented it in the categorisation of written responses, in the next section.

5.4 The Structure of the Observed Learning Outcome taxonomy

The SOLO taxonomy (Biggs & Collis, 1982) is a model based on the structure of learning outcomes evidenced by students in their responses to a task or problem from a learning activity. Biggs and Collis (1982, p. xi) describe it as an approach to evaluating learning quality able to be applied “in a wide variety of school and college situations, in most subject areas”. SOLO has also been applied to designing and aligning curriculum, being a key aspect of constructive alignment in outcomes-based education (Biggs, 2003). Having developed an authentic scenario within the constraints of the BAM, the SOLO taxonomy offers a structured approach to consistently scoring responses.

The SOLO taxonomy (Biggs & Collis, 1982) is structured around five levels of response, each level showing progressively increasing complexity. These levels, while based on a modification of Piaget’s developmental stages (Collis, 1975) are described by Biggs and Collis (1982, p. 31) as being “isomorphic to, but logically distinct from” Piaget’s stages, in that one focusses on development, while the other on learning outcomes. This link to Piaget’s work, along with Biggs and Collis’ (1982) modifications, allows the application of the SOLO taxonomy to written responses to be used to make inferences about cognition based on the SOLO levels. The stages in the SOLO taxonomy are:

- pre-structural, where an individual shows no knowledge or understanding of an idea
- uni-structural, where an individual shows one relevant concept
- multi-structural, where an individual shows that they have a number of relevant concepts
- relational, where an individual begins to link relevant concepts together
- extended abstract, where an individual shows the capacity to generalise the related ideas to novel situations.
The levels within the SOLO taxonomy lend themselves to schema measurement within responses to a validated scenario. If, for example, we compare Marshall’s (1995) concept of identification knowledge within a schema level, some similarity can be seen to a written response to a scenario that may be uni-structural. The response shows some ability to recognise a situation, but is limited by having insufficient schema development to elaborate or connect schemata and potentially move to a multi-structural response.

This flexibility within the taxonomy has allowed SOLO to be used extensively for a diversity of purposes, including to inform the structure of learning activities (Martin, 2011); as an approach to structuring and scoring assessment items (Baxter & Dudley, 2008; Brown, Irving & Keegan, 2008; Gahan & Lawrie, 2011; Hattie & Purdie, 1998), determining the effective outcomes of counselling (Burnett, 1999), and in researching learning and teaching (Gibels, Van de Watering, Dochy & Van den Bossche, 2005). Diverse examples of studies using SOLO in response categorisation are described below.

In a project aimed at developing “a model for promoting strategic change in higher education institutions for the enhancement of student learning in STEM [science, technology, engineering and mathematics]” (Gahan & Lawrie, 2011, p. 4), interdisciplinary scenario-inquiry tasks were implemented with students enrolled in large (defined as >1000 students by the researchers) first-year subjects in an attempt to address the “multiple challenges” of such groups in “the provision of effective teaching and learning opportunities” (Gahan & Lawrie, 2011, p. 5). Such tasks are defined by the authors as “collaborative active learning tasks set in interdisciplinary contexts” (Gahan & Lawrie, 2011, p. 6). Scenarios were developed by a team of writers from across science disciplines. For each discipline, an individual quest was identified. These individual quests were then synthesised into an interdisciplinary scenario-inquiry task meta-question, creating the basis of a scenario. These scenarios were then “trialled by postgraduate students to assess ease of information retrieval, level of challenge and applicability of the IQs [individual quests]” (Gahan & Lawrie, 2011, p. 11) prior to being implemented for investigation by students in an enquiry-based learning approach.

Apart from this trialling, no further validation of the scenarios was reported in the study. In the absence of a clearly disciplined approach to scenario development, this lack of validation represents a potentially significant oversight on the part of the researchers.
Students were required to work collaboratively on a scenario to develop a comprehensive written report. While assessment approaches implemented within the subject involved structured peer assessment, for the purposes of the research into the approach, both quantitative and qualitative data were examined. Quantitative data were gathered via a pre-test/post-test online survey. Qualitative data were developed through an application of the SOLO taxonomy to a random sample of the student products. This process involved two assessors, who had not been involved in any instruction within the subject, separately completing an analysis to allocate a SOLO score. The score “was developed according to the extent to which students had met the criteria of the assessment task” (Gahan & Lawrie, 2011, p. 27) and allowed participants to show clear evidence of mastery of the major concepts required within responses, as well as the level of interconnectedness between features. The approach described resonated with Marshall’s (1995) levels of schema knowledge and connections between schemas allowing the solving of complex problems. The researchers in this project reported that there was evidence from the SOLO analysis that the collaborative approach used allowed students “to demonstrate multiple levels of achievement and transition to higher order thinking” (Gahan & Lawrie, 2011, p. 29). The SOLO approach was seen as providing a strong tool allowing the measurement of the complexity of responses across the range required (Gahan & Lawrie, 2011). Despite this, there remains a clear measurement problem with the scenarios themselves, given the lack of validation processes delineated above.

Baxter and Dudley (2008) conducted a study into using SOLO both in the structure/development and grading of examination questions in a subject involving two different approaches to teaching games – teaching games for understanding and sport education. SOLO was seen by the authors as providing a means of gaining information about respondents’ complexity of thinking as well as the degree of connection they were able to show between different aspects of information pertaining to a given question. The three-hour written examination comprised a number of open-ended tasks described by the authors as being particularly open to SOLO analysis. The questions were presented as brief scenarios allowing for “a variety of levels of response reflecting the quality and depth of conceptual understanding” (Baxter & Dudley, 2008, p. 8). Students were required to develop a written response to each. SOLO was chosen because of its “capacity to measure and categorise different levels of conceptual understanding” (Baxter & Dudley, 2008, p. 6). This strength of SOLO to allow for clear discrimination
between written responses is important in its application in Baxter and Dudley’s study. The researchers report that the approach to both the development of the examination and its grading enabled “effective discrimination between levels of student achievement at a tertiary level” (Baxter & Dudley, 2008, p. 12).

In an exploratory study to examine what participants had learned from counselling, Burnett (1999) received responses from 35 participants who volunteered to take part in the study. The participants were aged from 19 to 65 years and were receiving counselling services for a variety of personal and relationship-based reasons. Burnett used a number of agencies providing counselling services to facilitate access to participants. These agencies provided clients with an envelope containing information about the study, an open-ended pro-forma where participants were asked to write a letter to a friend about what they had learned during counselling, and a return envelope. Participants self-selected by writing and posting a response. Responses were categorised by the author, then “checked by a second person experienced at using the SOLO taxonomy in a student learning context” (Burnett, 1999, p. 570). Inter-rater reliability was established above 85%.

While Burnett (1999) describes the outcomes of the study as potentially offering a useful new approach to the determination of the outcomes of the counselling process, he suggests caution, given some of the limitations of the study. These limitations include selection bias (with potentially only those who were positive about the impact of counselling responding); the variance in ability of client capacity to express themselves in writing; and the self-reporting nature of the study, where client perspectives “can be affected by clients’ moods and dispositions” (Burnett, 1999, p. 578).

5.5 Summary

Previous sections of this review examined studies that aimed to determine the impact on the schema development of PSTs associated with various factors, including tertiary preparation courses. Many of these studies were small in scale, with measures implemented that provide inferential indicators of schema development, rather than direct measures. Further, many of these studies rely on data from self-reporting of information, rather than approaches aimed at directly measuring schema.

This chapter of the literature review has described the use of authentic scenario-based approaches in determining the level of skill development of professionals within a
number of fields. It has examined studies having implemented such approaches and has extended this to considering the application of scenario-based instruments to determining levels of schema development. The BAM (Goldfried & D’Zurilla, 1969) was described as a disciplined approach to instrument development, with the SOLO taxonomy (Biggs & Collis, 1982) as an appropriate approach to classifying responses.

Marshall’s (1995) levels of knowledge within schema development can be seen to have close connections to Biggs and Collis’ (1982) levels within the SOLO taxonomy. While this connectedness will be further detailed in the work following, such connectedness provides an opportunity to use the SOLO taxonomy to analyse responses to an open-ended scenario-based problem, focussed on professional problem solving, to determine a level of schema development for teaching classrooms consisting of students with diverse learning needs.

The levels of complexity within SOLO can be used as indicators of the level of development of schema knowledge for an individual around a given construct. Schema for teaching students with diverse learning needs provide the construct, while the different levels of Marshall’s (1995) schema are used as the lens through which responses are viewed, where the different levels of schema development are viewed as being analogous to the different levels within the SOLO taxonomy. The overall instrument development process seeks to operationalise the construct of a schema for teaching students with diverse needs. Achieving this goal is dependent on developing a scenario that represents authentic practice and a measure that accurately represents the construct.

The need for methodical approaches to developing measuring tools is apparent from examination of the studies explored. To use scenario-based methods in the assessment of knowledge, skills and schema development requires a disciplined approach to instrument development and scoring approaches that ensures validity and reliability of both the instrument and its scoring. As described in the studies above, while all meet some of the requirements ensuring validity and reliability, none meet all of these. This current research aims to implement an approach to developing an instrument to measure schema for practice using methods to ensure a high degree of validity and reliability. This is described in more detail in the methodology section (see Part 3, Chapter 6).
5.6 Summary of issues impacting on pre-service teacher development of a schema for practice

Implementing effective teaching practices in inclusive settings is a challenge to teachers in contemporary classrooms, especially as the numbers of children represented in mainstream contexts increases (Foreman & Arthur-Kelly, 2014). Successfully meeting the needs of students with disabilities in the mainstream requires mastery of the knowledges and practices of effective teachers. The review has drawn on a number of distinctive bodies of research to explore and confirm the existence of a core of teaching practice with reference to what constitutes effective teaching, and with a particular reference to that practice in inclusive settings; it has examined how the characteristics of effective practice are embedded in frameworks of teaching standards, and how this global process impacts teacher-preparation programs; and it has examined how teacher-preparation programs, through standards frameworks, attempt to build on the teacher effectiveness literature. Unsurprisingly, these knowledges and skills, such as the capacity to align pedagogy to student needs, the capacity to differentiate material and having strong classroom-management skills, are also well represented in research about effective inclusive practice (Jordan et al., 2009). For effective teachers in inclusive settings, these skills are well supported by the capacity to collaborate within teams and communicate effectively with a variety of stakeholders, such as parents and varying allied health therapists (Dettmer, Knackendoffel & Thurston, 2013; Friend & Cook, 2012). In preparing for classroom practice, building this basis of knowledge and skills requires careful consideration of intentional scaffolding of materials in increasingly complex levels to ensure that, upon graduation, PSTs are prepared for engagement in the profession.

Research on teacher cognition would suggest that such mastery of inclusive practice is underpinned by the way teachers think about their practice and the schema they develop to guide their work. A number of studies have examined the impact on PST cognition of the experiences provided within teacher-preparation courses and the impacts of these experiences in developing the graduate-level schema for practice described above. This cognition is important not only because of the relationship between what teachers think and how they behave in classrooms, but also because of the varying influences that impact on cognition (Borg, 2003). The literature examined shows that human cognitive architecture is complex, and impacting on cognition requires careful consideration of instructional approaches to ensure that the deeply held beliefs of PSTs are challenged.
and, where necessary, changed. Without such approaches, the capacity of pre-service programs to impact cognition and help in individual schema development is limited (Hollingsworth, 1989; Holt-Reynolds, 1992; Kagan, 1992; Weinstein, 1990). Development of schemas that allow individuals to practise in ways that reflect effective teaching literature is important as it helps reduce cognitive load, allowing more processing capacity for novel situations (Sweller, 1999).

The existing research findings on teachers’ cognition and schema development would suggest that while the conditions exist for the development of a professionally controlled schema (Bain & Drengenberg, 2016; Bowker & Star, 2000) based on the research on effective teaching and standards associated with inclusive practice, graduate teachers’ cognition may be more influenced by their experiences as students in the broader education system than their professional preparation experiences. Further, the findings that indicate a positive influence of teacher preparation on teacher cognition are predominantly based on self-report and indirect measurement (Grossman & Richert, 1988; Kettle & Sellars, 1996). As a consequence, this review has also examined research on the development and validation of instruments used for particular purposes, in this case for measuring a schema as an individual cognitive construct with a specific focus on professionally controlled practice. Thus, the review examined literature around ways of measuring the cognitive development of individuals with respect to their schema. In particular, the literature focussed on using scenario-based measures to make direct measurements of schema development was considered. The importance of validity and reliability of instrument development and using a structured approach to enhance these is a major consideration. Approaches to scoring/categorising responses was considered, while the reliability of such methodologies was also examined.

What can also be determined from the review is that despite the significant body of knowledge about ‘what works’ in classrooms (Hattie, 2009; Marzano, 1998), uptake of this knowledge in classroom practice has been challenging for the field. Given that 50% of the variance in student achievement can be attributable to teachers and the way they teach (Hattie, 2003) and earlier studies indicating that teachers and teaching did have positive influences on student achievement (Brophy & Good, 1986; Fraser et al., 1987), ensuring that PSTs have a thorough grounding in evidence-based practices stands as an important challenge to institutions delivering preparation programs. Despite the body of research into what constitutes effective teaching practices, the literature reports a consistent failure for that research to be translated into routine classroom practice.
(Grima-Farrell, 2012; Vanderlinde & van Braak, 2010). This phenomenon is so well represented within the literature that the concept of the ‘research-to-practice’ gap within teaching has become the subject of research in its own right. While various authors have proposed a number of rationales for this (Bain & Drengenberg, 2016; Korthagen, 2010), governments in different jurisdictions, on a global level, have responded by the establishment of standards and accreditation for both practitioners and providers of programs preparing PSTs for practice (AITSL, 2016; Board of Studies Teaching & Educational Standards, NSW, 2012; Department for Education, 2011; National Board for Professional Teaching Standards, 2014; NCATE, 2008). These standards provide an extant framework for the capacities that are expected of graduates, and hence what should be included within preparation frameworks. This research suggests that having the characteristics of effective teaching practice embedded with standards frameworks, and guiding the structure of PST preparation should help to ensure that graduates from these courses develop a schema for practice that includes the knowledge, skills and understandings required for effective graduate-level practitioners. However, the extent to which this is the case is currently unknown.

The intent of this research is to add to our understanding of schema development in graduate teachers as a way of informing the extent to which teacher preparation influences schema development as a precursor to broader action about the ways teacher preparation can bridge the research-to-practice gap in the field. In examining various facets of individual schema development, the impact of the environments in which those schemas developed by individuals, at graduate level during their teacher preparation, are instantiated in classrooms must also be considered. Here, the concept of an organisational schema is also considered within the review. Organisational schemas pertain to the extent to which a schema for professional practice exists more broadly at scale within a field, and reflects the knowledge developed within graduates during their preparation and reinforced in routine practice when they enter the profession (Bain & Drengenberg, 2016). These schemas are also able to be situated within theoretical underpinnings, for this research, self-organising systems (Bain, 2007) and communities of practice (Lave & Wenger, 1991). Within this context the individual schema can be viewed in part as a reflection of the broader professional practice schema of the field.

In summary, the review established the content and context associated with schema development in graduate teachers, including the existence of a relevant body of evidence-based practice that constitutes the basic content of such a schema, the way
standards of practice include that content and shape the design of teacher-preparation programs, and the cognitive influences associated with graduate teacher engagement with their professional preparation. When taken together this work shows that the conditions exist for graduate teachers, as a result of their experiences, to possess in some form a schema for their professional practice that can be subject to measurement. This research seeks to build a device appropriate for measuring such a schema and then determine the nature of schema development among graduate teachers and the extent to which it reflects the demands of the inclusive classroom. Figure 5.1 below captures the considerations examined through the review.

![Diagram](image)

**Figure 5.1:** Aspects informing the construct of schema for teaching students with diverse learning needs

The following broad research questions/statements of intent and hypotheses are derived from the review and represent more specifically the contentions described in the summary above.

1. That the need exists to develop an instrument to measure schema for teaching students with disabilities in the mainstream. The intent of this research is that the development of such an instrument be realised. The instrument will be developed within a disciplined framework to improve validity and will address the gaps identified in the literature review, in that it will:
a. be based on direct measurement of schema through responses to a validated
   scenario, rather than the self-reported practices described in many of the studies
   from the review
b. have well-developed response criteria with strong reliability measure
c. be of a scale to allow clear statistical analysis of responses, rather than small-scale
   studies
d. show measures of validity and reliability within acceptable ranges for these
   characteristics
e. be capable of measuring a schema for inclusive classroom practice.

2. That, given a common standards framework, the development of a graduate
   teacher schema for practice could be expected across institutions/programs
   that share the same framework.

3. That a schema for inclusive classroom practice develops incrementally as
   PSTs progress through their programs of study, from a pre-preparation
   baseline to a graduate schema for entry-level classroom practice.

4. The schema for teaching possessed by graduates of a PST education program
   would differ from those possessed by graduates of a non-teacher-education
   degree, and experienced teachers who are also graduates of a Master of
   Inclusive Education.
Part 3: Methodology, results and discussion

Part 3 of this thesis consists of three chapters. This chapter outlines the research questions for each of the three studies and the methodology utilised. Chapter 7 presents the results. Chapter 8 discusses the findings, outlines the implications for practice and makes suggestions about future research.

Chapter 6: Methodology

The purpose of this research was to determine the extent to which final-year PSTs in NSW had developed a schema for teaching students with diverse learning needs in their future classrooms, and the extent to which this schema changed over the time during which PSTs were engaged in their studies. Underpinning the research are the bodies of literature examined in Part 2. The review examined the characteristics of effective teaching practice, including how this practice plays out in inclusive settings; how teaching standards provide a framework for effective teaching practices; how these standards inform teacher-preparation programs; how the body of knowledge representing knowledge about teaching can be represented within theory; and the impact of teacher-preparation programs on the cognition of PSTs. The fifth and final chapter of the review examined approaches to measuring schema as well as approaches to instrument development.

Collectively, this research sought to establish that a case could be made for the development of a schema for practice by PSTs as a function of the practice expectations of the field, their professional preparation, and the conditions under which that preparation occurred. The conduct of this research received ethics approval by the School of Teacher Education ethics committee, approval number 302/2009/15.

The research conducted for this investigation consisted of three separate, but interrelated, studies that informed and reinforced each other. The inter-relationship between these studies is described in Figure 6.1, below. The first of these studies, Study 1 – the instrument study – involved the development and validation of an empirically-derived scenario-based instrument, allowing the measurement of cognitive processes, called the schema for teaching scale (STS). This was needed as scenario-based measures – as described in the literature review – often use more ad hoc scenarios,
based on face validation without a structured and rigorous process of development and validation.

The subsequent studies were predicated on a successful instrument development and validation phase. These investigations consisted of a second study (Study 2) applying the instrument and implementing a cohort design (Cook & Campbell, 1979) to make a determination of the extent to which students entering teacher education courses may already have developed some form of a schema, and any changes that may occur in this schema over time, as these PSTs progress through a teacher-preparation program.

The third study (Study 3) implemented a large-scale post-test-only control and comparison group design (Cook & Campbell, 1979), with more than one experimental group to compare the level of schema development within PSTs across three different institutions. This third study also included comparison groups of experienced teachers with a Master of Inclusive Education and a group from the final year of an undergraduate exercise physiology course. These comparison groups were used to enhance construct validity by helping to control for any impacts from maturation as well as to determine the sensitivity of the measure, including the detection of any floor.
effects associated with its use. This chapter reports on the methodology underpinning each study, and on the methodology as a whole. An overview of each study and its associated research questions/hypotheses is initially presented, followed by a detailed explication of the methodology for individual studies.

6.1 Research questions

For this research the focus is the inclusion of students with disabilities, including those with significant learning difficulties, in mainstream classrooms. The main questions this research aims to answer are listed below, and where applicable are stated in research hypothesis (H1) and null hypothesis (H0) forms. As the intent of Study 1 was to produce a valid and reliable measure of the schema development of PSTs, it does not lend itself to questions. Rather, the elaboration of this stage is concerned with methods for determination of content validity, criterion and discriminant validity, and reliability.

6.1.1 Study 1: Instrument development

Study 1 focused on the development and validation of an instrument, the STS and its scoring rubric, the REF, that can be used to measure schema development within a given cohort of participants. Given the literature outlined in the previous chapter, a need exists to develop an instrument for this purpose that addresses the gaps described therein.

The first intent of the study was to produce an instrument that:

- presents a valid and authentic situation allowing the activation of knowledge having been developed over time through exposure to increasingly complex ideas and practices
- reflects the accepted standards for graduate-level teaching as indicated by the literature and accreditation standards
- provides an objective measure of schema development by directly testing participants’ schema development, determined without reliance on proxy variables and self-reported indicators of changes in thinking, perspectives and opinions
- meets accepted validity and reliability criteria
allows for discrimination between different levels of schema development between participants within different year levels, different professional fields, and graduates from post-graduate level studies.

In developing the instrument, Study 1 employed the BAM (Goldfried & D’Zurilla, 1969) as a methodological framework. The REF was constructed using an approach combining the analytical aspects of the SOLO taxonomy (Biggs & Collis, 1982) with Marshall’s (1995) levels of schema knowledge to determine schema development from responses in a validated problem-based approach. Areas of investigation in the development of the instrument were informed by the literature pertaining to best practice in inclusive teaching and by the requirements of aspects of the standards of the AITSL. Within the jurisdiction of NSW education, the standards are now overseen by the New South Wales Education Standards Authority on behalf of AITSL. In this research, a jurisdiction is defined as a geographic region over which an authority has authority.

The BAM developed by Goldfried and D’Zurilla (1969) is a methodology to measure behavioural responses to stimuli. Specifically, their five-step method comprises situational analysis, response enumeration, response evaluation, measure development and evaluation of the measure, as described below:

1. Situational analysis examines the context/situation of interest. In this step, the response in question is described in terms of a number of characteristics, including frequency, the requirement for a decision to be made and the existence of a wide range of alternative responses. As described in the literature review, Goldfried and D’Zurilla (1969) outline a number of ways in which information at this step can be collected, including written responses to scenario-based problems, as is the case for Study 1.

2. Response enumeration explores likely responses to the context. Here, a variety of responses to the developing scenario are examined and evaluated. For Study 1, the responses were compared to literature-based best practice, as embedded in the standards.

3. Response evaluation investigates possible responses to the context for their likelihood of producing a range of probable outcomes. Here, the scenario and responses are examined by what Goldfried and D’Zurilla (1969) describe as “significant others” (p. 166) who have knowledge relevant to the situation to ensure that it is representative of a given situation.
4. Measurement development, and for Study 1 the grading criteria, develop, and refine and implement the scenario and grading criteria.

5. Evaluation of the measure for effectiveness.

The specific application of this framework is elaborated later in this chapter (see Section 6.2.1.5).

6.1.2 Study 2: The cohort study

This section describes the research questions associated with Study 2, followed by the research hypothesis and null hypothesis for each question where appropriate.

Research Question 1: To what extent do students entering PST education courses possess a schema for professional practice with respect to teaching students with diverse learning needs in mainstream classrooms, based upon responses to the STS?

Research Question 2: To what extent does the schema for teaching students with diverse learning needs in mainstream classrooms of PSTs develop from a baseline to the end of each year, as they progress annually through their course?

H1: There will be statistically significant differences between measurement occasions for the cohort from the STS categorisation of responses, such that the level of schema development of PSTs for teaching students with diverse learning needs in mainstream classrooms improves over time from a baseline of 0/1 as students progress through their program.

H0: There will be no statistically significant differences between measurement occasions for the cohort from the STS categorisation of responses, such that the level of schema development of PSTs for teaching students with diverse learning needs in mainstream classrooms improves over time from a baseline of 0/1 as students progress through their program.

Research Question 3: To what extent does the pattern language associated with teaching students with diverse learning needs in mainstream classrooms of PSTs produce statistically significant increases from a baseline as they progress through their course?

H1: There will be statistically significant evidence of increased pattern language use by PSTs as they progress through their course from the point prior to commencement through to the end of Year 1, Year 2, Year 3 and Year 4.
H0: There will be no statistically significant evidence of increased pattern language use by PSTs as they progress through their course from the point prior to commencement through to the end of Year 1, Year 2, Year 3 and Year 4.

6.1.3 Study 3: The comparison study

This section describes the research questions associated with Study 3, followed by the research and null hypothesis where applicable. In this study, differences across institutions and comparison groups are examined.

Research Question 4: Have PSTs in their final year of university, in any of the institutions represented in this study, developed a functioning, professionally developed schema for teaching students with diverse learning needs in mainstream classrooms? This schema equates to a level 3 (a score of 30) or above from the STS (derived from Marshall’s (1995) definition of planning knowledge schema and Biggs and Collis’ (1982) relational level within the SOLO taxonomy).

Research Question 5: Are there statistically significant differences in the schema development of PSTs for teaching students with diverse learning needs in mainstream classrooms in comparison to graduates with a Master of Inclusive Education?

H1: There will be a statistically significant difference in responses on the STS categorisation of schema development for teaching students with diverse learning needs in mainstream classrooms between fourth-year graduate teachers and master’s level practicing teachers.

H0: There will be no statistically significant difference in responses on the STS categorisation of schema development for teaching students with diverse learning needs in mainstream classrooms between fourth-year graduate teachers and master’s level practicing teachers.

Research Question 6: Are there statistically significant differences in the schema development for teaching students with diverse learning needs in mainstream classrooms of pre-service educators in comparison to those studying in another professional field?

H1: There will be a statistically significant difference in scores on the STS indicating schema development for teaching students with diverse learning needs in
mainstream classrooms between fourth-year graduate teachers and those studying in the fourth year of another professional field (undergraduate exercise physiology).

H0: There will be no statistically significant difference in scores on the STS indicating schema development for teaching students with diverse learning needs in mainstream classrooms between fourth-year graduate teachers and those studying in the fourth year another professional field (undergraduate exercise physiology).

Research Question 7: Are there statistically significant differences in schema development for teaching students with diverse learning needs in mainstream classrooms of PSTs in their final year of university across the institutions represented in this study?

H1: There will be statistically significant evidence of differences in schema development for teaching students with diverse learning needs in mainstream classrooms across the institution attended based on the STS categorisation of responses.

H0: There will be no statistically significant evidence of differences in schema development for teaching students with diverse learning needs in mainstream classrooms across the institution attended based on the STS categorisation of responses.

Research Question 8: To what extent is there evidence of pattern language use associated with teaching students with diverse learning needs in mainstream classrooms of PSTs on completion of their preparation program across all institutions represented in this study?

Research Question 9: Are there statistically significant differences in pattern language development for teaching students with diverse learning needs in mainstream classrooms of PSTs in their final year of university, based on the institutions represented in this study?

H1: There will be statistically significant evidence of differences in pattern language development for teaching students with diverse learning needs in mainstream classrooms based on the institution attended and the STS categorisation of responses.
H0: There will be no statistically significant evidence of differences in pattern language development for teaching students with diverse learning needs in mainstream classrooms based on the institution attended and, the STS categorisation of responses.

6.2 Methodology of each study

This section describes the methodologies implemented for each of the studies contributing to this thesis. It describes the development of the instrument (in Study 1) used to determine schema level across groups, including a description of the participants, the setting and the development process. It then describes the use of the instrument within Study 2 and Study 3 for all groups.

6.2.1 Study 1: Instrument development

This section describes the development of the instrument used in the subsequent studies to measure schema in pre-service teachers. It describes a disciplined framework within which this development took place to enhance validity and reliability of the measure. This framework, the BAM, is an example of a process guiding the development of a behavioural assessment such that examination of responses/behaviours can be reliably interpreted by trained observers.

6.2.1.1 Participants

Application of Goldfried and D’Zurilla’s (1969) BAM to the instrument development process for Study 1 involved the use of three participant groups – expert judges, teachers in their first year of practice and three pilot groups. The roles of each of these groups is described in the section on the BAM later in this chapter (see Section 6.2.1.5.)

The written scenario was supplied to eight experts, chosen for their expertise in inclusive school settings. These expert judges were then asked to validate the scenario as being representative of what beginning teachers would typically be expected to encounter as they began their classroom experiences. Two of these experts were based in the tertiary sector, with close involvement in school-based teacher preparation. These judges were provided with the scenario face-to-face. The remaining six were principals of schools, representing primary schools, high schools and central schools, across sectors (public, private and Catholic).
Table 6.1 describes the characteristics of these judges making them suitable for content validation.
Table 6.1: Characteristics of expert judges qualifying them for their role

<table>
<thead>
<tr>
<th>Expert judge</th>
<th>Setting</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tertiary sector – head of professional experience unit (PEU)</td>
<td>Classroom teacher for 16 years prior to moving to tertiary sector in teacher education. Lecturer in teacher education for 12 years before appointment as head of PEU. Completed PhD focussing on practicum components of teacher education.</td>
</tr>
<tr>
<td>2</td>
<td>Tertiary sector – academic responsible for delivering subjects within practicum component. Also responsible for frequent in-school observations of pre-service teachers on practicum</td>
<td>Classroom teacher/head teacher in various jurisdictions for 19 years before moving to tertiary sector. Lecturer in teacher education for 16 years.</td>
</tr>
<tr>
<td>3</td>
<td>Principal – large public regional high school</td>
<td>Classroom teacher, head teacher, deputy principal and principal for over 30 years.</td>
</tr>
<tr>
<td>4</td>
<td>Principal – medium Catholic primary school</td>
<td>Classroom teacher, assistant principal, principal of two-teacher school and principal of larger schools for over 30 years.</td>
</tr>
<tr>
<td>5</td>
<td>Principal – medium single-sex Catholic high school</td>
<td>Classroom teacher, key learning area (KLA) coordinator, assistant principal and principal of central schools and principal of larger schools for 36 years.</td>
</tr>
<tr>
<td>6</td>
<td>Principal – small public central school</td>
<td>Classroom teacher, head teacher, deputy principal and principal for 23 years.</td>
</tr>
<tr>
<td>7</td>
<td>Principal – large Catholic high school</td>
<td>Classroom teacher, KLA coordinator, assistant principal and principal for 28 years.</td>
</tr>
<tr>
<td>8</td>
<td>Principal – medium public primary school</td>
<td>Classroom teacher, assistant principal, deputy principal and principal for over 30 years.</td>
</tr>
</tbody>
</table>

Further, a sample of teachers in their first year of classroom teaching was chosen at random, sent information about the study and asked to participate in the scenario validation. These teachers were selected from a list of graduates from the researcher’s institution from the previous year and contacted via email using their last known email
address. As well, settings frequently used by the institution for practicum placement were contacted to determine if they had first-year teachers who may be willing to participate. Thirty personal invitations were distributed, with three ‘unable to be delivered’, seven failures to respond and six who indicated they had not yet taken up teaching positions. The remaining 14 were sent the scenario and asked to provide a written response as to the degree to which it was representative of their experiences of the classroom. After a follow-up reminder, 11 responses were finally received. As a follow-up, a further 20 schools were contacted, with seven indicating they had first-year teachers. Three of these teachers responded to requests to participate, giving a total of 14 responses. These participants represent a broad cross-section of the education sector, with public, private and Catholic systemic schools included, as well as a small number of single-sex schools.

In addition, three groups of participants were used to pilot the tool and REF. The first group consisted of students in the final year of studying primary teaching (n = 23). These participants were recruited from a cohort of final-year PSTs known to the researcher. The second group consisted of final-year students in an exercise physiology course (n = 18), from the same institution as the PSTs. These participants were chosen because, while students in exercise physiology have some instruction on meeting the needs of clients at various levels, this is in a one-to-one situation. While it would be expected that prospective future clients for this cohort would represent the same diversity as is present within society (i.e. would include the same range of abilities and disabilities present within the wider population), these participants have not had specific professional preparation on teaching groups of people, nor diverse classroom populations. As such, they act as a baseline for schema knowledge development, as their knowledge would primarily be formed from their own schooling experiences.

The third group consisted of current practitioners in education who had recently graduated from a Master of Inclusive Education (n = 17) from the same institution as the PSTs. These participants were recruited by email, using the last known email address from the list of graduates for the previous two years of graduates from the master’s course at the researcher’s institution. All were employed in varying settings within Australian schools (mainstream public, private and Catholic schools; segregated schools for specific purposes in NSW; juvenile justice centres in NSW; and specialist schools for students with challenging behaviours in NSW). Initially, 39 emails were
sent outlining the nature of the research, the information sheet and ethics information. Twenty-six initial responses were received, with 17 completing the task requested.

These groups were chosen to help ensure that the scenario and responses were sensitive to the full range of responses possible within the scale. The exercise physiology and master’s groups were also included in the comparison study (Study 3) described in Section 6.2.3.1.

6.2.1.2 Setting

The setting for Study 1 was a regional university in inland NSW (Site 1). In addition, principals from several schools were approached via personal contact and email to assist as experts. The university has a well-established Faculty of Education, which has provided courses in teacher education for over 50 years. It currently delivers undergraduate and post-graduate courses in both primary and secondary education, along with a number of specialist master’s level degrees. This faculty is also responsible for courses conducted within the School of Human Movement Studies, which delivers programs preparing graduates for a variety of professional careers based on exercise physiology.

6.2.1.3 Background

As described in the literature review, the use of scenario-based instruction and assessment has been employed in a number of professional fields other than teaching (Brazil, 2008; Folmer et al., 2003; Janing, 1997; Klügel et al., 2006). In instruction, such scenarios are used as examples of situations typically experienced by practitioners where appropriate responses are taught. In assessment, scenarios are used to examine the responses of pre-service professionals to situations that demonstrate their professional competence. Such scenario-based assessment allows an individual to apply the skills, knowledge and practices developed throughout the duration of their professional preparation (Shepherd et al., 2007).

6.2.1.4 Literature and construct validity

The construct being assessed in this research is a schema, possessed by PSTs, for teaching students with diverse learning needs in mainstream settings. This construct is derived from and informed by a number of sources, as was described in Figure 5.1 at the conclusion of the literature review. These areas include theoretical considerations,
the literature, the current state of play within teacher-education programs and
government influences through the development of teaching standards (among other
things). The experiences of an individual during their own schooling, too, plays a role in
their schema development. The factors identified in the literature providing validity to
the instrument development for this research include that describing effective teaching
practice, particularly in inclusive settings, and the characteristics of this practice. How
these practices are embedded in graduate teaching standards, and subsequently, in
teacher-preparation programs, was also described in the literature review, and informed
the development of the scenario used in this research. Finally, the literature about the
impact of teacher preparation on individual cognitive development and schema
building, including how individual experiences impact on that cognition, inform the
development of the scenario and evaluation of responses to it.

Existing research from schema theory substantiates the idea of schema development
(Marshall, 1995), while both self-organising systems and communities of practice have
a common framework for practice as an intrinsic part of their structure (Bain, 2007;
Morrison, 2002; Wenger et al., 2002; Wenger & Snyder, 2000). Educational
jurisdictions throughout the world have put an extant framework within which the
construct can be applied, by the formulation of teaching standards and the influence of
independent bodies on the design of teacher-preparation programs (AITSL, 2011;
NCATE, 2008; New South Wales Department of Education and Training, 1998; New
South Wales Institute of Teachers, 2005; Training and Development Agency for
Schools, 2008). Further, these examples imply that by the time of their graduation, the
experiences with which students have engaged as a part of their course will build upon
each other to ensure that graduates from teacher-education courses will each have
developed a coherent schema for practice in their particular specialisation, at least at
graduate level. All of these inform and are informed by the existing literature in the
field. The BAM is applied to develop a measurement approach to assess the construct.
This is described in the next section.

6.2.1.5 Application of the behavioural-analytic method

The instrument development process involved the use of the steps of Goldfried and
D’Zurilla’s (1969) model (situational analysis, response enumeration, response
evaluation, measure development and evaluation of the measure) to the development of
a scenario and a format from which to evaluate responses. There were four phases in the
scenario development, involving drawing on the literature base for inclusion, expert judges, teachers in their first year of practice, and the three pilot groups.

The development of the scenario first used an examination of the literature on effective teaching practices, teaching standards, teacher preparation and schema development, coupled with that on the diversity of students represented within contemporary mainstream settings, to develop a description of what would be a realistic classroom scenario faced by a graduate teacher at the beginning of the school year. As was described in the literature review, the characteristics of effective teaching practice (including effective inclusive teaching) have been well researched over a number of years. More recently, these characteristics have been embedded into teaching standards that have, themselves, been used by institutions in their programs preparing PSTs for the profession. At the same time, for many jurisdictions the attainment of these standards at graduate level is a requirement for registration as a teacher. The impact of these courses on the cognition of PSTs and their development of a schema for practice is seminal to this stage.

Goldfried and D’Zurilla’s (1969) five-step approach as it was applied to the instrument development process is outlined in detail below.

**Step A: Situational analysis**

To assist in ensuring that the scenario adopted was representative of that faced by teachers in the performance of their professional responsibilities, a seven-step process was implemented, synthesising the key features of inclusive classrooms with the key challenges described by teachers in catering for a diversity of learning needs. These were then matched against those standards for graduate teachers relevant to meeting the needs of diverse classroom populations. Adoption of the BAM as a framework in which to develop a scenario with clear content validation derived from the literature base and the standards arising from this literature was a further consideration. As an example of the development of a behavioural assessment, this was particularly important given the literature indicating a general lack of clear validation processes with respect to existing scenario-based assessments.

This process can be summarised as follows:

1. Completion of a review of the literature on the demands of inclusive classrooms.
2. Identification of the key features arising from the literature.
3. Completion of a review of the literature on key features of inclusive classrooms.
4. Identification of the key challenges arising from this literature.
5. A review of the graduate-level teaching standards relating to teaching diverse populations in regular classrooms.
6. Identification of the key graduate-level teaching standards.
7. Scenario development – embedding of Steps 2, 4 and 6 into a classroom-based scenario.

The final stage of this process, the development of the scenario, used the key features identified as ‘challenges’ to construct a classroom case reflective of the identified obstacles to inclusive practice and the key standards associated with these. The classroom depicted consisted of students with a diversity of learning needs, with a particular emphasis on students with disabilities and identified learning difficulties. This situation is reflective of key graduate-level standards such as Standard 1.5 – “Demonstrate knowledge and understanding of strategies for differentiating teaching to meet the specific learning needs of students across the full range of abilities” and Standard 1.6 – “Demonstrate broad knowledge and understanding of legislative requirements and teaching strategies that support participation and learning of students with disability” (AITSL, 2011, p. 9). These key standards were considered alongside a scenario reflecting the key concerns drawn out in the literature. An example of one of these concerns in the scenario is the provision of limited support time for students, thus reflecting the findings of authors such as Kaufmann, Gerber and Semmel (1988). The key features of inclusive classrooms assisted in the identification of responses that reflect the literature on successful inclusive practices. The final scenario is described in the results for Study 1 (see Section 7.1).

Having developed a draft scenario from the seven-step approach described above, validation by expert judges and new practitioners was implemented to verify the contentions presented in the literature. In applying Goldfried and D’Zurilla’s (1969) framework, judgements need to be made as to the authenticity of the scenario provided. These judgements need to be made by “significant others” (Goldfried & D’Zurilla, p. 166) who have frequent contact with the people to whom the technique will be applied, have a role in judging the effectiveness of particular courses of action and whose opinions are likely to be respected by others. These expert judges and new practitioners were asked to provide written feedback on the degree to which the scenario was representative of their experience of contemporary classrooms.
In particular, they were asked to verify that:

- in their experience, classrooms had become more diverse and inclusive of a wider variety of students, in particular students with disabilities
- the scenario developed, which included students with diverse learning needs including students with identified disabilities, was a true representation of classrooms they had experienced and the skills required of teachers
- the approximate percentages of students in each category (severe sustained learning difficulty/disability; at some risk of not meeting stage appropriate outcomes without some additional assistance; at low risk of not meeting age-appropriate outcomes) were a true reflection of their experience.

For the two university-based judges, who experienced a variety of different settings in their day-to-day work, this judgement was based on their understanding developed as they visited and experienced a wide variety of school-based settings. The six judges who were principals of schools were asked to respond from the perspective of the school for which they were responsible, while the 14 first-year teachers were asked to respond on the basis of the class (or classes) they had experienced.

The eight experienced judges all fitted the previously described criteria (Goldfried & D’Zurilla, 1969). Six were principals of comprehensive schools in NSW, while two were involved in the tertiary preparation of PSTs, as summarised in Table 6.1. In their roles, they had contact with those to whom the scenario would be applied; they had a role in judging the effectiveness of various courses of action and their opinions were likely to be respected by others. In their review, the judges were asked to provide a written response as to whether the scenario would be considered to adequately represent what graduate teachers would be expected to face and do in their first year of teaching, with the intent of using this feedback to refine and develop the scenario.

Procedurally, these judges were asked to provide a written response to verify that:

- their school regularly enrolled students with disabilities in mainstream classrooms
- mainstream classroom teachers were required, with support, to meet the educational needs of these students
the percentages described in the scenario (5% severe/sustained learning difficulty, 15% requiring some additional support and 80% making satisfactory progress within regular teaching provision) were sound proportions.

The sample of teachers included both primary and secondary graduates, currently in their first year of classroom teaching. This group also acted as expert judges; they could compare their experiences to that described in the scenario and comment on the degree to which it represented their experiences. These teachers were asked to give written feedback on the correlation between their experiences and that described in the scenario, using the questions described above. In addition, they were invited to make suggestions as to how the scenario may be adjusted to better reflect their experiences, with the intent of using this feedback to further refine the scenario. This feedback acted as a further validation of the scenario, particularly in terms of ensuring that it was a fair representation of the situations encountered by teachers within the school system.

Procedurally, these first-year teachers were asked to provide a written response to verify that:

- their class was a mainstream class that included students with disabilities
- they were required to meet the educational needs of these students (with support)
- the percentages described in the scenario (5% severe/sustained learning difficulty; 15% requiring some additional support and 80% making satisfactory progress within regular teaching provision) were representative of their class and/or school.

The completed scenario aimed to reflect the challenges of inclusion in a classroom setting and the diversity of students constituting any given class, and hence to elicit the responses that may be required from a teacher instructing that class. As such, it aimed to provide participants with the opportunity to develop an action plan for teaching students with diverse learning needs in a mainstream setting, by adopting a variety of appropriate pedagogies and practices. It is reflective of both literary perspectives as well as of the perspectives of a number of school and university-based practitioners. This is elaborated below in the second step of Goldfried and D’Zurilla’s (1960) approach.

**Step B: Response enumeration**

Response enumeration involves the analysis of responses to consider the variety of possible perspectives that may arise from the scenario. Goldfried and D’Zurilla (1969,
p. 165) describe how the “specific procedures” for this element “may vary” depending on the particular setting and context. Given that few institutional settings allow for sufficient environmental control to allow observation in naturalistic settings, other methods are described as being appropriate. Other approaches outlined by Goldfried and D’Zurilla include the employment of methods such as simulation of the situations by either verbal or written responses to scenarios. These are described by the authors as being particularly useful in analysing areas of competence that “involve complex overt and covert responses” (Goldfried & D’Zurilla, 1969, p. 165). In analysing such areas, it was also necessary to use a structured framework in developing a methodology allowing for the categorisation of responses. In Study 1 the response enumeration involved seven steps, with some also informing the next step – response evaluation. These steps were:

1. the synthesis of the SOLO taxonomy levels and Marshall’s (1995) schema knowledge levels to determine SDLs. This involved application of research based approaches for which existing validity has been established (SOLO and schema based methodology).
2. the development of a scoring rubric/REF allowing each aspect of the responses to be measured against the SDLs
3. gathering data by provision of the scenario to pilot groups and collection of responses
4. refinement of REF both by the researcher and with the assistance of a trained research assistant
5. gathering of further data from research groups
6. further refinement of the REF and establishment of inter-rater reliability
7. testing internal consistency using Cronbach’s alpha (Cronbach, 1951).

Each of these steps is described in greater detail below.

**Step 1:** Synthesis of the Structure of the Observed Learning Outcome taxonomy levels and Marshall’s (1995) schema knowledge levels to determine schema development levels

As was described in the literature review, two frameworks were selected to allow for a SDL to be determined from a written response to scenario. SOLO (Biggs & Collis, 1982) allows for written responses to a situation to be categorised based on the complexity of reactions to the problem posed, while Marshall’s (1995) framework describing schema development allows for judgements to be made as to the degree of
schema development of an individual with respect to a given situation. Marshall further allows for a determination as to whether or not an individual had reached a level that would be described as a ‘functional’ or ‘working’ schema for the situation.

The process undertaken here involved a comparison of the levels of structure within the SOLO taxonomy (Biggs & Collis, 1982) and Marshall’s (1995) schema knowledge levels, along with the respective authors’ descriptions of each of these aspects. This process involved using the descriptors from each author of aspects delineating each level of schema development, including the level of professional knowledge required for each level; the working memory demand required for each level; related to this, the sophistication of the cognitive processing required for different levels within each framework; and the capacity of responses within a particular category to connect different aspects within a scenario. Examination of these allowed for parallels to be drawn between the two, such that a SOLO analysis of written responses to the scenario could be linked to an analogous schema level. The outcome of this connection between SOLO and levels of schema knowledge is discussed in the results section Study 1 (see Section 7.1.1).

The next stage in the development of the STS concerned examination of the relationship between the levels of complexity determined by a SOLO analysis of the response and a comparable SDL for the response by comparison to Marshall’s knowledge levels (Marshall, 1995). For example, the response of an individual with no experience or background study in classroom management, being asked to respond professionally to a situation where these skills are required has response possibilities such that Marshall (1995) would indicate that this individual has had insufficient ‘experiences’ to allow the development of an appropriate schema to allow a response to the situation. At the same time, SOLO taxonomy would categorise a response such as ‘I don’t know’ within the pre-structural range, as no effective output is evident.

As elaborated in the results, this scrutiny allowed for responses to be analysed to determine a level of complexity of the approaches used by participants in addressing the scenario. The level of complexity was used to determine a level of schema development represented by the response.
Step 2: Development of a scoring rubric as a part of the schema for teaching scale, allowing each aspect of the responses to be measured against the schema development levels

The scoring rubric (the REF) allowed for the development of descriptors that would be evident at each level of schema development. These descriptors related to the content of what could be expected within each section, facilitating the scoring of responses and enhancing reliability. The rubric elements are designed to be closely aligned with the standards and longitudinal empirically validated literature. Further, it is important that the rubric elements are closely aligned with the validated scenario to ensure that that elements graded represent what is required within the standards.

The content for the scoring rubric was completed by examining the standards required of graduate teachers (AITSL, 2011) and making a determination of what these standards meant for practice. For example, the AITSL (2011) standards, at graduate level, indicate that teachers have the capacity to “differentiate teaching to meet the specific learning needs of students across the full range of abilities” (Standard 1.5, AITSL, 2011, p. 9) and have developed “strategies to support full participation of students with disability” (Standard 1.6, AITSL, p. 9). Having these capacities would mean that graduates were able to write appropriate differentiated learner outcomes, differentiate classroom materials according to need, differentiate content, process and products for students as necessary; implement teaching/learning strategies in the delivery of material, monitor progress; provide feedback; and evaluate the effectiveness of the teaching delivered.

Using these two standards as the basis, descriptors for each were developed in a rubric style evaluation format. Each of these different aspects were tabulated against the STS ratings (0–4), with a descriptor for the rating being drawn from both SOLO (Biggs & Collis, 1982) and Marshall (1995) synthesised within the STS.

As is described in detail within the results section (see Section 7.1.2), the different levels of Marshall’s (1995) schema were used as the lens through which responses were viewed, where the different levels of schema development were viewed as being related to the different response levels within the SOLO taxonomy. The level of schema development attributed to an individual can, then, be determined by analysis of the complexity of their response to an open-ended scenario-based problem-solving exercise.
Step 3: Gathering data by provision of the scenario to pilot groups and collection of responses

Participants from the pilot groups (master’s graduates, final-year teacher education and exercise physiology) were asked to complete a response to the scenario, as described earlier. This entailed the researcher attending on-campus sessions for the undergraduate course participants and email contact for the master’s participants.

For the undergraduate groups, the researcher attended scheduled classes by arrangement with the relevant subject coordinators. The purpose of the research was explained, information sheets distributed and ethical considerations outlined. Those who agreed to participate were then given a copy of the scenario and the requirements of their written response, paper on which to write and asked to complete their response. Participants were advised to:

- carefully read the scenario
- describe in writing, using the categories within the scenario as a guide, how they would respond to the scenario
- use professional language that would be able to be understood by another teacher in their description
- take as much time as was necessary to develop a full response.

For the master’s graduates, all necessary information was included in the email, along with a request to phone the researcher if they required further detail. Responses were emailed to the researcher by those who agreed to participate.

Step 4: Refinement of the response evaluation framework both by the researcher and with the assistance of a trained research assistant

The REF was applied to the responses from the pilot groups, initially by the researcher for elaboration and refinement, then in conjunction with a research assistant trained in the application of SOLO and the STS. The following steps describe this process, in two separate phases. The first phase involved the researcher working individually on the REF criteria, while the second phase involved the researcher working with a research assistant. The steps in this process are described below.

- The researcher chose ten scripts at random and applied the REF to rating these scripts. As issues arose, such as a response that could not be adequately rated, additions and clarifications were made to the detail of the REF. The same scripts
were rated a week later to test consistency, with a formal comparison of grades allocated on each occasion being undertaken.

- This process was repeated with a further ten scripts to continue to inform the criteria within the REF.
- The process was repeated until consistency was attained on grading occasions and no further additions were required to the criteria.
- A research assistant was employed who had previous experience in the application of SOLO to written responses. This research assistant was also an experienced casual academic staff member teaching across a range of subject areas in inclusive education. The RA was trained in the application of the REF. Ten scripts were then chosen at random by an administrative assistant employed within the researchers unit. These were rated by both the researcher and the trained RA and responses compared and discussed at length to further develop and refine the REF.
- This process was repeated until a 90% concordance rate was achieved.

Step 5: Gathering of further data from research groups.

Data were collected (responses to the scenario) from all research groups (a cohort prior to commencement of study, a cohort at the end of their first year of preparation, a cohort at the end of their second year of preparation, a cohort at the end of their third year of preparation, and cohorts at the end of their final year from all institutions). The researcher attended classes for each cohort and followed the procedure described above. Where data were collected from other institutions, again the researcher travelled to those institutions and completed the process.

Step 6: Further refinement of the response evaluation framework and establishment of inter-rater reliability

A further sample of 20 responses was randomly selected by the administrative assistant. This assistant was instructed to ensure that all cohorts were represented in the sample. For these responses, the following procedure was followed:

- Responses were blind double-marked by the researcher and the same experienced research assistant described above.
- After the blind double-marking, response ratings were compared and discussed, allowing for further refinement of the REF.
• This process was repeated twice, until the criteria in the REF on this wider group of responses were stable for both markers and no further refinement was necessary for agreement.

• As the final step in this process, 112 scripts chosen by the administrative assistant randomly from each cohort were blind double-marked by the researcher and the research assistant, and an inter-rater reliability measure (Cohen’s kappa) was determined. This step also informed the evaluation phase of the BAM.

**Step 7:** Testing internal consistency using Cronbach’s alpha

Cronbach’s alpha (Cronbach, 1951) was used to ensure that individual items within the scenario were measuring the same construct, thus allowing the scale to be verified. Cronbach’s alpha is a widely used statistic as a measure of internal consistency. This statistic indicates how closely related a set of items within a group are and is considered to be a measure of scale reliability, thus allowing summation of the individual elements of the REF. All 346 participants were included in the derivation of this statistic, including those previously double-blind marked for the reliability measure.

**Step C:** Response evaluation

Goldfried and D’Zurilla (1969) describe this stage as involving a determination of “the degree of effectiveness of each of the potential courses of action in terms of its likely effects or consequences” (Goldfried & D’Zurilla, 1969, p. 166). In gauging this, and as a further check of the content, construct and discriminant validity of the instrument used, three groups of participants were used to pilot the tool prior to its full implementation, as outlined in the steps above. The REF developed allowed for discrimination between responses, and a rating of them, based on their likely effectiveness as a response to the scenario.

Cone (1977) describes the methods used for development of behavioural assessments as varying on a continuum from using direct procedures (such as observation) to more indirect methods (such as interviews). For either methodology, issues of validity and reliability, and in particular ensuring that content validity is established, are important considerations. For this type of assessment, Cone (1977) argues that once content validity has been established, reliability measures, such as inter-rater reliability, can then be established through adequate instruction and practise for observers of behaviour. This instruction and training is described by Cone (1977) as being crucial in ensuring that behavioural assessments are applied with consistency.
As described earlier, one of these groups consisted of students in their final year of studying a primary teaching degree; a second consisted of final-year students in an exercise physiology program, while the third group consisted of students having recently completed a Master of Inclusive Education. All members of this latter group were current practitioners in the field of education. These participant groups were also used in the subsequent studies.

Given that the construct involves teaching diverse learners in mainstream classrooms, it would seem reasonable that, if the instrument is valid for its stated purposes, the first group (final year of teaching) would exhibit responses showing an ability to provide an appropriate response to the scenario. Some professional pattern language for teaching diverse learners would be apparent, with some connectedness within their responses (i.e. a schema that shows some development for the construct being investigated). This would be reasonable to expect as participants from this group were at a point culminating four years of educational study, and the instrument and REF had been developed using the body of literature described in the literature review, alongside the graduate-level standards for teachers (AITSL, 2011).

The second group (final year of exercise physiology) would be expected to be limited in these areas, given that their course contained limited input on these skills. The third group, being current experienced practitioners with a master’s level speciality in an area that focusses on meeting the needs of diverse learners, would be expected to show responses exhibiting a higher level of understanding of appropriate responses, a greater level of professional pattern language use, with significant connections between different aspects of their response (i.e. a far more developed schema for teaching students with diverse learning needs).

For the first two groups, data were collected by the researcher obtaining permission to visit tutorials in the respective courses, explaining the purpose of the research to the students and their role within it, and seeking participants to volunteer a written response to the scenario provided. On arrival at each tutorial, the researcher was introduced by the instructor and outlined a brief history of himself to the group. The purpose of the particular study, including its position as a part of a PhD thesis was explained. Participants were advised of ethical considerations, and those agreeing to participate completed the administrative requirements of informed consent and willingness to participate in the study. Participants were assured that there would be no penalty
involved with any decision not to participate, and that all information collected would remain anonymous in the writing up of the research. They were further assured that no information about the study, their responses, or their decision to participate or otherwise would be shared with the instructors from their course. Participants were then given the scenario in written form and asked to plan and write their responses. The need to use professional language where appropriate was stressed, both verbally and on the scenario description page.

Participants were further advised that their responses would take in the vicinity of 30 minutes to complete, but that this was not meant to restrict their response in any way. They were informed that their responses should be completed individually, with specific instructions as described earlier. At the end of 25 minutes, participants were told that there was five minutes left and at the end of 30 minutes, participants were asked to begin to finalise their response and submit them. If available, additional time was used to ensure that responses were as complete as participants were able to produce. All cohorts were allowed an extension of time, where required, although only a small number of participants made use of this. These instructions were then replicated with later groups of participants, as is described later in this section (see Step D).

Written responses were then transcribed into electronic form for scoring and further analysis. Master’s graduates were contacted by email and asked to participate in the study by developing a written response and emailing it to the researcher for analysis. All graduates from the previous three years were contacted using their last known contact details.

These graduate participants functioned in a number of capacities, in particular providing construct validity to the instrument, allowing the level of schema knowledge of graduate PSTs to be compared to a group who would not be expected to exhibit a higher level of schema knowledge around the construct as well as with a group for whom a high level of knowledge would be expected.

**Step D: Development of measurement format**

Goldfried and D’Zurilla (1969, p. 167) describe how the procedures delineated above specify both the “content of the items which are to be used in the measuring instrument” as well as providing “empirically derived criteria for scoring the measure”. Given that the scenario-based instrument described is likely to involve participants in descriptions of complex behaviour patterns and engage them in significant cognitive activity, such as
planning for the future, these authors suggest that “a written or verbal description by the subject of his own likely behaviour” (Goldfried & D’Zurilla, 1969, p. 167) is appropriate. They describe this approach as a type of ‘cognitive role-play’. In the situation, participants draw on their knowledge to write a description of how they imagine themselves responding in a given situation. This involves “asking a subject to imagine himself responding in a particular situation as if it were actually occurring (indicating not only what he is doing, but also how he is going about doing it …. [that] approximates the real situation as closely as practically possible” (Goldfried & D’Zurilla, 1969, p. 167). Participants in this current research were asked to implement such a cognitive role-play, where they were asked to imagine they were responding to the scenario in a realistic manner by drawing on the skills, professional language and professional knowledge they had developed while completing their course. The approach to participants completing this cognitive role-play is described in detail earlier in this section, with participants being asked to respond in writing to a scenario informed by literature and jurisdictional requirements (such as graduate-level teaching standards).

For the majority of participants, a timeframe between 20 and 40 minutes proved to be more than adequate, although some of the master’s level participants reported taking in the vicinity of one hour.

**Step E: Evaluation of the measure**

Initial consistency and reliability indicators of the measure were undertaken by the researcher, with the assistance of a research assistant, blind-marking a sample of papers. The first occurrence of this used responses from the pilot groups, while the second occasion used sample responses from all cohorts. This approach allowed for further development of the grading rubric (the REF) to allow for both inter-rater reliability and internal consistency to be measured, as described above.

Inter-rater reliability of the instrument was determined as described above, by grading using two markers who had been trained in SOLO analysis, schema knowledge development, application of the STS and recognition of pattern language, to determine the complexity of answers provided. The researcher worked with an assistant in the refining of the REF, which was initially developed by consideration of each of the response sections requested of participants. This process resulted in several categories being split and an overall format graded across nine categories. Double blind-marking
of 20 responses, chosen at random by a separate administrative assistant, allowed for further refinement. Finally, a sample of 112 responses representative of all groups within the study were double-blind marked and Cohen’s kappa determined.

Comparison groups were included in all response evaluation to ensure that the measure developed was capable of both discriminating between differing levels of schema knowledge and could be reliably applied across different groups of respondents. This helped to ensure that a consistency of scoring was evident for each level.

**6.2.1.6 Summary**

The intention of this research was to develop and apply an instrument, using Goldfried and D’Zurilla’s approach, allowing the measurement of PST schema for practice. The aspect of schema particularly under scrutiny was the capacity of graduates to meet the needs of students with disability in mainstream settings. Goldfried and D’Zurilla’s (1969) framework has continued to provide solid support from the perspective of validation of instrumentation aimed at measuring and analysing responses to particular situations. This involved the following steps:

- examination of the literature on effective teaching and effective teaching in inclusive settings
- examination of the literature on schema development and human cognitive architecture
- examination of the literature on jurisdictional requirements for both graduates from pre-service teaching programs, as well as for institutions offering these programs
- development and validation of a scenario-based approach to determining schema development, based in the above considerations, including the development and refinement of a REF
- piloting and refining the instrument
- gathering data from participants in settings representing diverse geographical and demographic situations.

While the approach described in this methodology has significant strengths, it also has some limitations. The strengths of the methodology for Study 1 lies, predominantly, in the use of a structured framework (the BAM) around the construction of the instrument used for the measurements. Application of this framework allowed for an embedding of
the findings from the review of literature into an instrument ensuring a high degree of content validity. Further strengths for the approach include:

- that it used a direct measure for schema, rather than the use of self-reports or proxy measures
- that it adopted a large-scale quantitative approach to the collection and analysis of data, rather than small-scale qualitative approaches (again, often using self-reports or proxy measures)
- that the measure focussed on a situation judged by experts to be realistic for a graduate teacher to encounter
- that the methodology allowed for the development of a scenario that allowed for a variety of responses to be presented.

While having significant strengths, there are also some limitations of the methodology that need to be acknowledged. Primarily, for scenario-based assessment, how individuals actually react in a given situation may be different to how they think they will respond. Other limitations include:

- The instrument was developed using jurisdictional requirements from one educational jurisdiction. While these are shown in the literature review to have strong connections to other international requirements, this remained as a limitation.
- While participants were drawn from a variety of geographical sites within the jurisdiction concerned, there is a limitation in that all were drawn from this jurisdiction (i.e. NSW, Australia).

Study 1 aimed to contribute to the field by using a structured framework for the development of an instrument to measure the SDL of PSTs. It then then applied the instrument to PSTs at different stages of their course, as elaborated in the following section.

6.2.2 Study 2: The cohort study

The second study applied the instrument developed in Study 1 – the STS – to make a determination of the extent to which students entering teacher-education courses may already have developed some form of schema. In addition, it explored any changes that may occur in this schema over time, as these students progress through a teacher-education course. Research Questions 1–3, with their corresponding research and null
hypotheses, were listed in Section 6.1.2. In brief, they relate to entrance level schema, scores on the STS and pattern language development.

A cohort design (Cook & Campbell, 1979) was implemented for Study 2. The nature of this is described in Section 6.2.2.4 on research design. The cohort design was used in conjunction with the STS in this study to track evidence for schema development from a cohort from students’ first involvement with an undergraduate level course (and prior to any academic input) through to a cohort at the point just prior to course completion.

Marshall (1995) describes schema construction as a developmental process that requires repeated experiences in a given area to allow the development of interconnections. The study employed Marshall’s developmental approach, through the STS, to examine whether changes in schema occur over the duration of students’ experience in their pre-service preparation. In this approach, schema is viewed as a dynamic construct that develops as individuals are exposed to increasing frequency and sophistication of concepts. The expectation is that a teacher’s schema would continue to evolve over an individual’s career. The schema of a graduate would represent an early career iteration of a dynamic conceptual framework for professional action.

### 6.2.2.1 Participants

For Study 2, a sample of 193 PSTs agreed to participate in the research. They were drawn from a total possible pool of 275 participants, and represented all PSTs from the researcher’s institution attending the scheduled lecture for their education studies core subject at the time the researcher was also in attendance. All participants were enrolled in an undergraduate degree in primary teaching at an inland university campus in NSW. Students in the final semester of each year of the course were asked to participate in the study, while a cohort of students new to studies in education were asked to participate in the first week of their course (orientation week), prior to the delivery of any instruction. This sample consisted of a mix of individuals from rural, regional and urban areas of the state. The majority of the intake each year came to university education directly from school settings; however, a number of mature age students were also represented. Tables 6.2–6.6 below describe further detail about the sample.
Table 6.2: Gender breakdown by years of course completion for Study 2

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<th>Years of course completion</th>
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Table 6.3: Place of origin breakdown by years of course completion for Study 2

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Table 6.4: Age breakdown by years of course completion for Study 2

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<td>75</td>
<td>9</td>
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</tbody>
</table>
Table 6.5: Previous study breakdown by years of course completion for Study 2

<table>
<thead>
<tr>
<th>Years of course completion</th>
<th>School Cert.</th>
<th>Higher School Cert.</th>
<th>Trade/ TAFE Cert.</th>
<th>Diploma or equivalent</th>
<th>Under-grad. degree</th>
<th>Total</th>
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<tr>
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<td>33</td>
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<td>2</td>
<td>44</td>
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<td>3</td>
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<td>1</td>
<td>29</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
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<td>149</td>
<td>21</td>
<td>5</td>
<td>14</td>
<td>193</td>
</tr>
</tbody>
</table>

Note: This table shows the highest level of study previously undertaken by participants from each cohort in the study.

Table 6.6: UAI/ATAR breakdown by years of course completion for Study 2

<table>
<thead>
<tr>
<th>Years of course completion</th>
<th>&lt;50</th>
<th>51–60</th>
<th>61–70</th>
<th>71–80</th>
<th>81–90</th>
<th>91–100</th>
<th>NA</th>
<th>Total</th>
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</thead>
<tbody>
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</tr>
<tr>
<td>1</td>
<td>3</td>
<td>11</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>3</td>
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<td>7</td>
<td>2</td>
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<td>5</td>
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<td>2</td>
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<tr>
<td>Total</td>
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<td>32</td>
<td>49</td>
<td>16</td>
<td>5</td>
<td>29</td>
<td>193</td>
</tr>
</tbody>
</table>

Note: UAI is the Universities Admission Index, which is based on a student’s performance in the jurisdiction’s external examinations. The ATAR (Australian Tertiary Admissions Rank) is its predecessor. The table shows the UAI/ATAR achieved by participants from each cohort in the study. NA refers to students who did not complete Higher School Certificate study.

6.2.2.2 Setting

The setting for Study 2 was a regional university in inland NSW (Site 1). This setting was the same institution described for Study 1. The university is a multi-campus institution offering undergraduate and post-graduate courses through both on-campus and online modes, with a total enrolment of over 35,000 students.
6.2.2.3 Variables

The independent variable for Study 2 is the course of study being undertaken, with five levels of this variable: Year 0–Year 4. Year 0 represents a measurement taken prior to PSTs beginning their course of study, with the remaining levels representing completion of subsequent years.

There are five levels of the independent variable included in this study. The first level of the independent variable consists of participants who have experienced no academic input in teaching/education (i.e. are enrolled in education-based courses, but as yet have had no input). The remaining four levels consist of students at the end of their first, second, third and fourth years respectively.

The dependent variables for the study are:

1. Schema development – to what degree have participants developed a coherent schema for professional practice as they progress through their course?
2. The development of pattern language for teaching the diversity of students represented in mainstream classrooms – how has the frequency of pattern language changed as PSTs progress through their course?

The dependent measures are the level of schema response as measured by the STS, and the frequency of pattern language use determined by the subset of that scale examining pattern language usage.

6.2.2.4 Research design

As described in the introduction to Study 2, a cohort design (Cook & Campbell, 1979) was used for this process. As indicated by the diagrammatic representation of the design in Figure 6.1, an application of the instrument occurred at the beginning of the students’ first year of enrolment in an education course, prior to any instruction taking place (O1). For subsequent cohorts, O1 indicates when the observation has taken place, as detailed in the following paragraph.

A second cohort was examined having had one year of a teacher-education course (X1), a third having experienced two years of their course (X1 and X2) and a fourth having experienced three years of instruction (X1, X2 and X3). The final cohort will have experienced an almost complete course in education and will also be included in the wider study outlined in Study 3.
A cohort design, as described by Cook and Campbell (1979) was used for this process. This implies that an instrument applied to one group within an institution could be applied to successive cohorts and the outcomes would be comparable. Cohort designs entail using different participants for each cohort because of the assumption that variation between the successive years is minimal. Cook and Campbell describe a cohort design as being particularly useful because groups in organisations do not tend to vary significantly from year to year. While described as being not as exact as groups with random assignment, the fact that groups “are likely to be more similar to each other” (Cook & Campbell, 1979, p. 127) makes determination of causality more likely.

For Study 2, the cohort design served a number of purposes. Primarily, the design had as its core purpose a determination of what changes, if any, occurred in schema development over the course of PST preparation. In addition, it allowed an examination of any level of schema development that may have occurred prior to engagement with such a course, thus establishing a baseline for the measure.

Application of the design entailed, as described in Section 6.2.2.1 on the participants, the researcher attending an orientation week session to collect data from PSTs about to begin their studies (Year 0) and a scheduled lecture in the last two weeks of session for cohorts at the end of each year of study from Year 1 to Year 4.

6.2.2.5 Threats to validity

Internal validity is described by Cook and Campbell (1979, p. 37) as the “approximate validity with which we infer that a relationship between two variables is causal”. These authors also describe internal validity as being closely associated with statistical conclusion validity, as it, too, is concerned with covariance between variables. For Study 2 the maintenance of a high degree of internal validity was desirable in
considering the covariance between the degree of schema development apparent and having engaged in successive levels of a pre-service education course.

A number of threats to the internal validity of research designs exist. These include issues such as history, maturation, testing, changes to instrumentation and selection (Shadish, Cook, & Campbell, 2002, p. 55). For the design chosen for this investigation, Shadish et al. (2002, p. 55) describe nine such threats, while Johnson and Christensen (2008, p. 310) outline 10 threats that need to be considered. These threats are described by these authors as being able to be addressed by the strong experimental design inherent, where control groups are used and where random assignment to groups is used. While this investigation implemented a number of comparison groups, random assignment to groups did not occur. The sequence of studies involved in this research served to help address these concerns. Using Goldfried and D’Zurilla’s (1969) framework for the development of the instrument in Study 1 ensured that a disciplined process was followed for this phase of the research. Application of the instrument to the pilot groups and to the cohort design in Study 2 added further strength to the overall design, and assisted in addressing issues of validity and reliability.

The threats to internal validity impacting on the design of this research can be categorised as having posed a potential major threat, or as having posed only a low level of threat. These threats are summarised in Table 6.7, with those considered as possible major threats discussed below. Those considered as posing only a low level of threat are discussed in Appendix 1.
### Table 6.7: Threats to internal validity

<table>
<thead>
<tr>
<th>Threats to internal validity</th>
<th>Potential major threat</th>
<th>Low level of threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambiguous temporal procedure</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Maturation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Instrumentation</td>
<td>X</td>
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<td>Testing</td>
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<td>Selection</td>
<td>X</td>
<td></td>
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<tr>
<td>Attrition/mortality</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Additive &amp; interactive effects</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Potential major threat: History**

History is considered more of a threat in designs involving pre-test/post-test situations, where there is the possibility that some observed effect may result from an event that occurs between the two testings, but that is not itself a part of any implemented treatment. For this design, however, as with the threat of ambiguous temporal procedure, there existed the reality that all university students had at least some involvement in school education and therefore come to the study with some history that could influence responses. This threat was addressed in part by assessing student schema development prior to participation in the teacher-preparation program. The cohort study, with its pre-test for students ‘new’ to education, investigated any pre-existing schemata as well as tracking any apparent schema development, thus helping to address this threat.

The internal validity of this research may also be threatened by a ‘history’ within each institution. Each setting has its own set of lecturers/tutors within the institution, hence the likelihood of different ‘treatments’. As this is a part of the focus of this research, whether or not such differences exert an influence is not a threat.

**Potential major threat: Maturation**

As with the threat from history, maturation can be more of an issue for pre-test/post-test designs, where observed effects can be due to participants developing in a particular area due to age, experience and similar effects between the two testing periods. As data
were predominantly collected on one occasion in Study 2, this threat is less significant. It remains a possibility, however, that any evidence for changes in schema development could be attributed to a maturation process over the duration of a respondent’s course. It is important to ensure, for the purposes of this study, that insofar as possible, any apparent schema development can be ascribed to the course being undertaken and a student’s participation within that course. The combination of a cohort design (Study 2) alongside the use of comparison groups from other institutions (in Study 3) assist in addressing these potential concerns overall.

**Potential major threat: Additive and interactive effects**

Additive and interactive effects refer to the fact that varying “threats to internal validity can combine to produce complex biases in multi-group designs” (Johnson & Christensen, 2008, p. 263). For this research, such effects could be considered to be an important concern. By conducting the research as three linked studies, however, these threats were diminished as each of the studies informed the others in terms of ensuring the validity of the instrument and the process. In addition, by addressing threats in other areas, the effect of these threats was also considered.

**6.2.2.6 Additional instrument validation**

A further purpose for Study 2 was, by gathering data prior to engagement with course input, as well as at the completion of each year, the discriminant validity of the STS was significantly strengthened by allowing the growth of schema development to be investigated as course completion progressed. Due to time constraints, it was not possible to follow the same group through their course for the four years that would otherwise be required. The cohort design made use of the limited variability of groups within organisations such as universities (Cook & Campbell, 1979) to facilitate collection of data.

Gronlund (1988, cited in Fraenkel & Wallen, 2006) describes criterion validity for instruments as concerning an individual’s “performance on one instrument … the one being validated” (p. 155) with some other independent criterion. As described above it would be expected that there would be some correlation between the education-based inputs i.e. the number of successfully completed subjects/years of program) into a student’s degree and their SDL. This exploration was the basis of Study 2, which acted to both strengthen and further validate the overall research.
6.2.2.7 Data collection and procedures

Procedurally, the approaches taken for Study 2 were the same as those described in Study 1. These procedures involved data being collected as written responses from participants and scored using the REF developed for the STS. In both this study and Study 3, quantitative data were generated by analysing a written response to a given scenario. Written responses were analysed from the perspective of both the sophistication of the response as a measure of SDL and the frequency of pattern language apparent (Bain et al., 2009).

On arrival the researcher was introduced by the instructor and outlined a brief personal history to the group. As described earlier, the nature of the research and ethical considerations were explained. The scenario was provided and its requirements explained, including timeframes. All participants had adequate time to complete their response, before submitting for transcription and analysis.

6.2.2.8 Analysis of data

Data analysis techniques used for Study 2 involved a number of measures examining descriptive statistics as well as those allowing any statistically significant differences between cohorts’ levels on the STS to be examined. ANOVA was completed, with the Statistical Package for the Social Sciences (SPSS) being used for this purpose.

Responses were analysed as described above. After the development of the STS, a summative score was developed reflecting an overall capacity of participants to respond to the scenario provided. This summative score was obtained by adding the scores for different response sections of the scenario, as indicated was possible by strong internal consistency measures. ANOVA was used to determine any statistically significant differences between the groups represented, including the comparison groups.

The frequency of pattern language usage was determined by examination of the number of pattern language terms identified in each participant’s response. These terms were derived from the literature describing the types of pattern language that would be expected from a practitioner within the teaching profession and were drawn from the philosophy, theory and research about inclusive education; the field of assessment and evaluation within education; terminology used for service delivery within jurisdictions; and terminology from instruction and classroom practice, as described in the literature review (see Appendix 7). As the ability to use pattern language has been described as
being connected to the knowledge necessary to develop a schema and participate in a community of practice, use of such language is important in the ability to describe classroom-based problem-solving situations. These analysis techniques were repeated in the subsequent comparison study.

6.2.3 Study 3: The comparison study

The goal for Study 3 was to investigate any differences in the schema development of final-year PSTs across a number of different institutions. This study also included an exploration of any differences in schema development (for teaching diverse learners) in comparison groups for students who were in a professional practice field outside education (exercise physiology) and experienced post-graduate students from a master’s level course in inclusive education. Comparison groups, in particular those from the master’s level cohort, were also used as an indicator of the capacity to develop a complex schema around the construct.

Both Study 2 and Study 3 serve a dual purpose in this research. Primarily, they address a series of research hypotheses about schema development. Research Questions 4–9, with their corresponding research and null hypotheses, were listed in Section 6.1.3. In brief, they relate to scores on the STS, comparison between PSTs and master’s graduates in the scale, comparison between PSTs and graduates from a different professional field on the scale, differences in final year and PSTs across institutions, pattern language development in PSTs and differences in pattern language development across cohorts.

In addition, both of these studies provided information that added to the validation of the instrument developed. For example, Study 3 added construct validity data to the instrument development process by determining whether PSTs respond differently to members of other professional groups. The comparison groups also served as quasi-control groups strengthening the internal validity of the design, establishing a baseline and allowing the detection of any potential floor or ceiling effects in the instrument.

6.2.3.1 Participants

Study 3 was composed of a master’s level comparison group, an exercise physiology comparison group and final-year teacher-education students in NSW who were enrolled in either an undergraduate degree in primary or secondary teaching or a post-graduate Bachelor of Teaching degree in either primary or secondary teaching at two additional
institutions to that included for Study 2. These institutions offer teacher-preparation programs employing the same AITSL standards as the inland university (see Appendix 2). These institutions were selected for the study as they represent a broad demographic cross-section of program providers within the jurisdiction of NSW. The sites represent large city urban, regional coastal urban and regional inland providers. Further, the researcher had a personal and professional connection with faculty staff involved in inclusive education at these sites. These people were contacted and given details of the study. These details, along with a copy of the researcher’s institutional ethics protocols, were forwarded to the deans of the faculties for their approval. These institutions are described in more detail in Section 6.2.3.2. The two comparison groups previously described also formed part of Study 3.

Responses were obtained from 158 final-year teacher-education undergraduates who agreed to participate in the study from the three university teacher-education programs. There were 40 participants from Site 1, 57 from Site 2 and 61 from Site 3. The sample consisted of both female and male students, with prospective primary and high school teachers being represented. Eighteen responses were received from participants involved in the exercise physiology comparison group. These participants were recruited through the researcher making contact with the relevant head of school, who gave permission and suggested an academic staff member to contact. The academic staff member agreed to have the researcher attend a tutorial class to invite participation. All attendees at the tutorial agreed to participate. Seventeen responses were received from the Master of Inclusive Education comparison group. As described earlier, these participants were recruited by email contact with graduates from a program into which the researcher was an instructor. Emails were sent to each graduate’s most recent known contact. Initially, 25 invitations were sent, with four of these ‘unable to be delivered’. A further 10 invitations were sent, with two ‘unable to be delivered’. Of the 29 delivered messages, responses indicating an inability to participate were received from five and no response from a further seven. This made a total sample of 193. The members of the master’s group were not asked to include demographic data, while the exercise physiology comparison group were not asked to provide data concerning the ‘education course’ in which they were involved, as it was not applicable to them. For the necessary groups, a variety of ages, ethnic and socio-economic backgrounds was represented, reflective of the diversity within society. Tables 6.8–6.13 describe the participants in Study 3 in detail.
### Table 6.8: Gender breakdown by site/group for Study 3

<table>
<thead>
<tr>
<th>Setting</th>
<th>Female</th>
<th>Male</th>
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<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>36</td>
<td>4</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Site 2</td>
<td>36</td>
<td>21</td>
<td>0</td>
<td>57</td>
</tr>
<tr>
<td>Site 3</td>
<td>42</td>
<td>19</td>
<td>0</td>
<td>61</td>
</tr>
<tr>
<td>Masters</td>
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<td>17</td>
<td>17</td>
</tr>
<tr>
<td>EP</td>
<td>15</td>
<td>3</td>
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<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>129</strong></td>
<td><strong>47</strong></td>
<td><strong>17</strong></td>
<td><strong>193</strong></td>
</tr>
</tbody>
</table>

Note: EP = exercise physiology

### Table 6.9: Place of origin by site/group for Study 3

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<thead>
<tr>
<th>Setting</th>
<th>Rural</th>
<th>Regional city</th>
<th>Major city</th>
<th>No response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>Site 1</td>
<td>17</td>
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<td>40</td>
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<tr>
<td>Site 2</td>
<td>22</td>
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<td>5</td>
<td>0</td>
<td>57</td>
</tr>
<tr>
<td>Site 3</td>
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<td>48</td>
<td>0</td>
<td>61</td>
</tr>
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<td>Masters</td>
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<td>0</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>EP</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>46</strong></td>
<td><strong>64</strong></td>
<td><strong>66</strong></td>
<td><strong>17</strong></td>
<td><strong>193</strong></td>
</tr>
</tbody>
</table>

Note: EP = exercise physiology
Table 6.10: Age breakdown by site/group for Study 3

<table>
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<tr>
<th>Setting</th>
<th>Age 17–20</th>
<th>21–25</th>
<th>26–30</th>
<th>31–40</th>
<th>&gt;40</th>
<th>No response</th>
<th>Total</th>
</tr>
</thead>
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</tr>
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<td>Site 2</td>
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<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>57</td>
</tr>
<tr>
<td>Site 3</td>
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<td>4</td>
<td>2</td>
<td>0</td>
<td>61</td>
</tr>
<tr>
<td>Masters</td>
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<td>17</td>
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<tr>
<td>EP</td>
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<td>15</td>
<td>1</td>
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<td>0</td>
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<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td><strong>150</strong></td>
<td><strong>8</strong></td>
<td><strong>5</strong></td>
<td><strong>8</strong></td>
<td><strong>17</strong></td>
<td><strong>193</strong></td>
</tr>
</tbody>
</table>

*Note: EP = exercise physiology*

Table 6.11: Previous study breakdown by site/group for Study 3

<table>
<thead>
<tr>
<th>Setting</th>
<th>School Cert.</th>
<th>Higher School Cert.</th>
<th>Trade /TAFE Cert.</th>
<th>Diploma or equivalent</th>
<th>Under-grad. degree</th>
<th>No response</th>
<th>Total</th>
</tr>
</thead>
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<td>0</td>
<td>40</td>
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<tr>
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<td>1</td>
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<td>57</td>
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<td>1</td>
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<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td><strong>140</strong></td>
<td><strong>8</strong></td>
<td><strong>7</strong></td>
<td><strong>20</strong></td>
<td><strong>17</strong></td>
<td><strong>193</strong></td>
</tr>
</tbody>
</table>

*Note: EP = exercise physiology*
Table 6.12: UAI/ATAR breakdown by institution for comparison

<table>
<thead>
<tr>
<th>Setting</th>
<th>UAI/ATAR</th>
<th>&lt;50</th>
<th>51–60</th>
<th>61–70</th>
<th>71–80</th>
<th>81–90</th>
<th>91–100</th>
<th>NA</th>
<th>No response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td></td>
<td>2</td>
<td>6</td>
<td>6</td>
<td>14</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Site 2</td>
<td></td>
<td>1</td>
<td>3</td>
<td>10</td>
<td>19</td>
<td>16</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>57</td>
</tr>
<tr>
<td>Site 3</td>
<td></td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>17</td>
<td>18</td>
<td>8</td>
<td>9</td>
<td>0</td>
<td>61</td>
</tr>
<tr>
<td>Masters</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>EP</td>
<td></td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>4</td>
<td>12</td>
<td>25</td>
<td>54</td>
<td>42</td>
<td>14</td>
<td>25</td>
<td>17</td>
<td>193</td>
</tr>
</tbody>
</table>

Note: UAI is the Universities Admission Index, which is based on a student’s performance in the jurisdiction’s external examinations. The ATAR (Australian Tertiary Admissions Rank) is its predecessor. The table shows the UAI/ATAR achieved by participants from each cohort in the study. NA refers to students who did not complete Higher School Certificate study. EP = exercise physiology

Table 6.13: Primary/secondary method breakdown by site/group for Study 3

<table>
<thead>
<tr>
<th>Setting</th>
<th>Primary or secondary method</th>
<th>Primary</th>
<th>Secondary</th>
<th>N/A</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td></td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Site 2</td>
<td></td>
<td>0</td>
<td>57</td>
<td>0</td>
<td>57</td>
</tr>
<tr>
<td>Site 3</td>
<td></td>
<td>27</td>
<td>34</td>
<td>0</td>
<td>61</td>
</tr>
<tr>
<td>Masters</td>
<td></td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>EP</td>
<td></td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>67</td>
<td>91</td>
<td>35</td>
<td>193</td>
</tr>
</tbody>
</table>

Note: EP = exercise physiology

The sample and cell sizes described in Tables 6.8–6.13 provide sufficient participants for statistically significant differences to be detected using ANOVA with $\alpha = 0.05$ (Cohen, 1988; 1990)

### 6.2.3.2 Setting

The settings for Study 3 were three university sites covering regional and urban areas of NSW. Each of the settings has well-established faculties or schools of education and
courses in both primary and secondary education. The comparison/control groups were
drawn from both internal and distance education courses offered by the researcher’s site
in regional NSW.

Site 1 is a regional university in inland NSW, and was the focus of Study 2.

Site 2 is a well-established major provider of teacher-education courses located in
NSW’s capital city (Sydney). It provides PST programs for both primary and secondary
undergraduates.

Site 3 is in a large and well-established regional city on the coast of NSW, and has been
offering pre-service preparation programs since its establishment.

6.2.3.3 Variables

The independent variable for Study 3 was the preparation received by participants,
represented by the different courses studied by both the education students and those
from non-education comparison groups. For Study 3, a group who had experienced no
academic input related to teacher preparation (exercise physiology students), was
compared to the main body of participants who had experienced an almost complete
education course, and to a group who had experienced a full undergraduate degree
course, had significant experience in education and had recently completed a Master of
Inclusive Education. The structure of each of the undergraduate courses as well as the
master’s level comparison group is described in detail in Appendix 2. Effectively, this
created three levels within the variable – a Level 0 (no background in education), a
Level 1 (complete degree in teaching/education) and a Level 2 (complete degree,
significant experience and Master of Inclusive Education).

The dependent variables for the study are:

1. Schema development – to what degree have participants developed a coherent
   schema for professional practice on completion of their program of preparation?
2. The development of pattern language for teaching the diversity of students
   represented in mainstream classrooms – how has the frequency of pattern language
   developed by the completion of a preparation program, thus allowing engagement
   within the profession?
The specific research questions and hypotheses associated with these variables were described in Section 6.1.3.

6.2.3.4 Research design

The research design implemented in Study 3 was a large-scale post-test-only control and comparison group design (Cook & Campbell, 1979), with more than one experimental group. While the disadvantages of post-test-only designs are often described as a lack of control over pre-treatment variables and non-random subject loss, the addition of control and comparison groups allow for a higher degree of likelihood as to any observed impacts being a result of the treatment (in this case, the particular preparation course participants at different sites had experienced). Coupled with Study 2, this work was designed to determine whether programs of teacher preparation covaried with outcomes from the STS scenario. Given that the treatments experienced by participants at different sites were all developed within the same standards framework, it is reasonable that similar outcomes would result.

Diagrammatically, the design for the post-test-only control and comparison group design, with more than one experimental group is described in Figure 6.2, with the independent variable being the score on the STS and for pattern language usage.

\[
\begin{align*}
X_{ep} \text{ (Control – exercise physiology)} & : O \\
X_{Med} \text{ (Comparison – master’s education)} & : O \\
X_1 \text{ (university 1)} & : O \\
X_2 \text{ (university 2)} & : O \\
X_3 \text{ (university 3)} & : O
\end{align*}
\]

**Figure 6.3:** Research design for Study 3

Johnson and Christensen (2008) argue that such designs are particularly strong due to the control that is provided over threats to internal validity. This is due to both the presence of a comparison/control group and to the random assignment commonly
employed in these designs. While Study 3 is based in an experimental methodology, assignment to random groups was not possible due to the different sites and courses chosen.

The design for Study 3 also draws strength from the process involved with Study 1 and Study 2. In Study 1, a disciplined process of development was implemented to ensure that the instrument developed had a high degree of validity and reliability. Study 2 examined this further by implementing the instrument in a cohort design allowing its ability to detect changes in schema knowledge to be tested as students progressed through their course over time. This process provided insights to any change in schema development over time that could then inform the one-shot approach employed in Study 3. While the methodology also has limitations in that variables associated with demographics have not been analysed, and that all respondents were drawn from jurisdictions within NSW (Australia), nonetheless, the use of the design described provides a degree of rigour to the approach implemented. Threats to validity for Study 3 are considered in the next section.

6.2.3.5 Threats to validity

Given that Study 3 was effectively an extension of Study 2, applying the same instrumentation to additional cohorts of participants, threats to validity remain fundamentally the same. The exception to this is the potential for both maturation and selection to act as a threat to validity. Given that all cohorts (with the exception of the control/comparison groups) for this study had experienced the same level of exposure to PST education, maturation as a threat becomes minor, rather than major. The considerations described above (such as the disciplined approach to instrument development and the use of comparison groups) offer some control over these threats. Importantly, the purpose of Study 3 is primarily observational, making a point estimate of the schema development of students on completion of their courses of study and including the comparison groups.

Threats to validity for Study 3 are summarised in Table 6.14.
Table 6.14: Threats to internal validity

<table>
<thead>
<tr>
<th>Threats to internal validity</th>
<th>Potential major threat</th>
<th>Low level of threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambiguous temporal procedure</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Maturation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Instrumentation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Testing</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Regression artefact</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Selection</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Attrition/mortality</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Additive &amp; interactive effects</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Potential threat: History**

History remains a threat to the internal validity of Study 3, and is addressed in the same way as Study 2 (see Section 6.2.2.5)

**Potential threat: Selection**

The selection effect refers to differences that may exist between participants in one group as opposed to other groups. For this research, selection effects have the potential to be a threat to the design implemented, as each of the groups of participants is selected due to their site. Each group thus had the potential to have different characteristics and hence may have responded differently. This potential threat is addressed by the use of comparison groups and the scope of the study, including that all groups are examined using instrumentation based in common standards for graduate teachers.

**Potential threat: Additive and interactive effects**

Additive and interactive effects remain a threat to the internal validity of Study 3, and is addressed in the same way as in Study 2 (see Section 6.2.2.5)

6.2.3.6 Dependability of measurement

Cook and Campbell (1979) describe post-test-only designs as being useful in situations where “a treatment is implemented before the researcher can prepare for it and so the research design is worked out after the treatment has begun” (p. 98). In Study 3, where the measurement of schema development is based on the cumulative effect of a four-
year course of study, such a situation necessitating this ex post facto approach is clearly present. Cook and Campbell also describe the most obvious flaw in such designs as being the absence of pre-tests. This, they argue, can lead to the “possibility that any post-test differences between the groups can be attributed either to a treatment effect or to selection differences between the different groups” (p. 98). Study 2 again provides some insights, and to some extent addresses this, as it measures changes over time, albeit with different participants. Study 3 allowed for a measure of schema development to be determined after participation in a program of teacher preparation within a number of sites.

At the same time, Cook and Campbell (1979, p. 98) contend that the absence of a pre-test “does not necessarily imply the absence of pre-test observations”. These authors describe how the use of other records can often be used to make some determination as to what the pre-test scores may have been. For the current research, this has been addressed through the collection of data prior to the beginning of course input (during orientation week) in the cohort phase (Study 2), which helps in strengthening the design of Study 3 by providing a baseline of entry-level schema. Also important is the consideration that the study is not seeking to make comparisons about any differences in ‘quality’ of treatments represented by the different sites. Rather, it is seeking to determine the impact of courses where all groups (with the exception of the control/comparison groups) had completed courses of preparation in approved standards-based teacher-education programs.

Given that studies into the development of schema in PSTs have little precedent, Study 3 aimed to develop a baseline of understanding about the contribution of teacher-education programs to such schema development from which more specific hypotheses can evolve.

6.2.3.7 Data collection and procedures

As described earlier, the approach adopted for this investigation involves the use of a scenario-based instrument to collect written responses from participants. The collection of quantitative data concerns the measurement of a given quantity, or changes to a given quantity, often, but not always, as the result of a specific intervention.

A variety of tools/measuring instruments can be used to collect such data, including instruments such as surveys and questionnaires (Johnson & Christensen, 2008).
Interviews can also serve as a source of quantitative data (Johnson & Christensen, 2008), as can analysis of texts and documents (Van Note Chism & Banta, 2007). The information collected from such sources is then codified and a variety of statistical analyses applied to it.

In Study 3, both qualitative and quantitative data were generated by analysing a written response to a given scenario. The application of a scoring rubric (Van Note Chism & Banta, 2007), in this case the REF described earlier, was used to determine a SDL, while the frequency of pattern language apparent (Bain et al., 2009) in the response was also examined.

Data were collected at each site by the researcher having made contact with academic staff in each and having organised with the institutions permission to attend scheduled sessions. The researcher attended each institution in person, and was allocated time in a one-hour lecture for Site 1, a two-hour tutorial sessions for Site 2 and three-hour workshops for Site 3, to explain the study and collect the data. Participants were asked to volunteer to participate in the research on a whole-group basis, with the majority of attendees participating. There were (overall) five potential participants who declined to participate at Site 1, one at Site 2 and six at Site 3.

For each session attended, the procedures followed were as for Study 2 (see Section 6.2.2.7). Summarising those procedures, data collection involved:

- the purpose of the research being explained and informed consent obtained for those who expressed a willingness to participate
- participants being assured that all responses or their decision to not participate would remain confidential
- participants being assured that there would be no penalty involved with any decision not to participate
- the need to use professional language where appropriate being stressed, both verbally and on the scenario description page
- participants being advised that their response would take in the vicinity of 30 minutes to complete, but that this was not meant to restrict their response in any way
- participants being informed that their response should be completed individually
• at the end of 25 minutes, participants being told that there was five minutes left, and at the end of 30 minutes participants being asked to begin to finalise their response and submit it
• all cohorts being allowed an extension of time, where required.

On completion of instructions, participants were asked to provide their written response to the scenario provided.

6.2.3.8 Analysis of data

As with Study 2, a number of data analysis techniques were required to interpret the information collected in Study 3. Measures examining descriptive statistics, as well as those allowing any statistically significant differences between cohorts’ levels on the STS to be examined, were employed. As the methodology for Study 3 was similar to that previously implemented, the analytical techniques implemented reflect that similarity. Analysis for the comparison centred on both the complexity of response, allowing an allocation of SDL as indicated by the STS level, as well as the frequency of pattern language usage as indicated by researcher analysis.

Analysis of the data employed one-way ANOVA using SPSS to determine if there were any statistically significant differences between the means of the groups in the study. This software provides an output indicating that there either are, or are not, groups that are statistically significantly different from each other, but requires further post-hoc testing to make a determination as to which groups may have this difference.

Transcripts were also analysed for frequency of professional pattern language, in a similar manner to that described for Study 2, with this providing a field for overall schema development.

The overall goal of the analysis described was to both validate data previously collected and to enhance the data to allow a basis to the identification of what factors, if any, have a significant influence on the development of a schema for teaching students in diverse classrooms in mainstream settings.

6.3 Conclusion to methodology

This chapter has described the methodology developed that allowed data to be gathered to respond to the research questions. It described three studies. The first of these
concerned the development of an instrument to determine the degree to which participants had developed a schema around the construct of teaching students with disabilities in mainstream settings. This instrument development adopted a structured framework as suggested by Goldfried and D’Zurilla, (1969) and was informed by the bodies of work represented in the literature review. This development was also described in terms of how validity and reliability of the instrument were determined. Study 2 applied this instrument in a cohort study to examine how schema changed as PSTs progressed through a course of preparation. Study 3 further applied the instrument to determine the degree to which PSTs who were about to graduate had developed the schema described above. These PST participants represented three major providers of teacher-preparation programs in NSW, where those programs had been developed and accredited as meeting the same set of standards determined by AITSL (2011). The results of each of these studies is reported in the next chapter.
Chapter 7: Results

This chapter presents the results for the three studies described in Chapter 6. Study 1 involved the development of an instrument to measure the schema development of PSTs. Study 2 employed the instrument in a cohort design to investigate PST schema development over the duration of their preparation program. Study 3 used the instrument in a comparison study to examine the extent to which graduating final-year PSTs from three universities in NSW, had developed this schema. The findings from the final-year students were compared to a cohort from a different professional field (exercise physiology) and to graduates of a Master of Inclusive Education. Study 1 findings are reported for the instrument development process described in the methodology chapter, including reporting on validity and reliability measures. Study 2 and Study 3 address the research questions using descriptive and inferential statistics to examine schema development and the frequency of pattern language use. The results will be presented in order, commencing with those for Study 1 – instrument development. As with the methodology section, these results for individuals studies are closely connected, informing and being informed by each other. Figure 7.1 describes this inter-relationship.

Figure 7.1 The inter-relationship between results for each study
7.1 Study 1: Instrument development

Study 1 focussed on the development of an instrument to measure schema development using the following in the development process:

- the BAM (Goldfried & D’Zurilla, 1969)
- the accepted standards for graduate-level teaching
- the literature on effective practice in inclusive education.

This section reports on the stages in the development of this instrument. The first step of the BAM (Goldfried & D’Zurilla, 1969), the situational analysis, takes up the need/challenge to provide empirical validation of scenarios employed in the assessment process and ensures that those scenarios are representative of the construct and, in this case, authentic situations likely to be encountered by practitioners. The scenario was first informed by three key sources of information – the literature related to inclusive classroom teaching practice, the literature on the challenges faced by graduate teachers in inclusive settings and the national standards for graduate teachers.

7.1.1 Results of situational analysis

This section will report on the results of the application of the situational analysis component of the BAM. In particular, it will focus on the key themes and features identified in the literature, the key challenges perceived by teachers of inclusive teaching classrooms and the key graduate-level teaching standards related to teaching in diverse classrooms that inform a valid scenario.

7.1.1.1 Key themes and features identified in the literature

The literature on the demands of inclusive classroom settings was used to identify key content for the scenario. This literature was aggregated under the following key themes and features:

1. Effective teaching skills and practices – where a strong mastery of the knowledge and practices for effective teaching more generally was seen as foundational. The particular aspects seen as essential for inclusive classrooms were the capacity to:
   a. develop engaging learning tasks and create positive learning environments;
   b. differentiate and scaffold learning from an individual’s current level;
   c. manage time and classroom environment effectively;
   d. challenge students with tasks requiring higher-order thinking skills; and
   e. expect success from students.
2. Collaboration and communication skills – particularly in contemporary inclusive settings where teachers are required to develop and maintain IEPs that may involve numerous trans-disciplinary practitioners, as well as to maintain positive communication with parents and caregivers.

3. The capacity to monitor student progress and provide feedback to students, carers and other stakeholders.

4. Establishing positive attitudes and dispositions toward inclusive teaching.

These literature themes and features informed the development of a first draft of the scenario, described in the text box below.
Initial Draft Classroom Scenario

As a final-year education student, you have been anxiously surveying all the available media for positions vacant in your field.

One lazy Saturday morning, you are reading the *Sydney Morning Herald*’s positions vacant in the education section and the ideal job jumps out from the page. Excitedly, you spend considerable time in preparing a thorough application and your work is rewarded by an invitation to present for an interview. HOWEVER, this is no ordinary school and the interview process requires not only the normal formal procedures but also the preparation and presentation of a demonstration lesson. You are asked by the principal to prepare a lesson and to locate it in the context in which it will be taught. To assist you, the principal has provided the following rubric.

In no more than two pages, prepare an outline for a topic/content of your choosing covering the following sections that you could use to assist you in the preparation of your demonstration lesson:

- Description of learning goals/outcomes
- Brief description of lesson including the pedagogy chosen
- Where does the lesson lie within a wider sequence of lessons?
- How does it cater for different learning approaches and developmental stages?
- How will you use assessment, including feedback to students, within this lesson and the sequence of which it is a part?
- How will the lesson be evaluated and what sources of information will be used for this?

Throughout your description, you should try to use the professional language of teaching to which you have been exposed throughout the duration of your course.

7.1.1.2 Summary of literature, key challenges, and graduate-level teaching standards employed to refine the scenario

Many teachers report feeling under-prepared, under supported and challenged by the expectations of systems over which they feel they have little control. The literature related to these aspects of teaching was employed to further refine and develop the scenario.

In addition, the standards of the AITSL (2011), overseen by state authorities were employed to refine the scenario. These standards affirm the need for graduate teachers to have a schema for practice with respect to operating within diverse classrooms.
Examples of the current, relevant standards include requirements for graduates to:

- demonstrate knowledge and understanding of strategies for differentiating teaching to meet the specific learning needs of students across the full range of abilities (Standard 1.5)
- demonstrate broad knowledge and understanding of legislative requirements and teaching strategies that support participation and learning of students with disability (Standard 1.6)
- set learning goals that provide achievable challenges for students of varying abilities and characteristics (Standard 3.1)
- include a range of teaching strategies in teaching (Standard 3.3)
- describe a broad range of strategies for involving parents/carers in the educative process (Standard 3.7)
- demonstrate the capacity to organise classroom activities and provide clear directions (Standard 4.2)
- demonstrate understanding of assessment strategies, including informal and formal, diagnostic, formative and summative approaches, to assess student learning (Standard 5.1).

Table 7.1 summarises this key information for the inclusive classroom from the literature, showing how it relates to the scenario sections, to the key AITSL (2011) standards and how each is aligned to the response evaluation (level 3) criteria. As described earlier, level 3 responses are those defined as a functional schema for practice. This alignment further evidences the content validity of the instrument developed.
<table>
<thead>
<tr>
<th>Scenario sections</th>
<th>Key graduate standards (AITSL, 2011)</th>
<th>Response evaluation format section with example (level 3) criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Write a paragraph describing the intended learning goals/outcomes of the lesson, including the way they would be differentiated for the three groups described</td>
<td>Standard 1: Know students and how they learn. In particular: 1.5 Demonstrate knowledge and understanding of strategies for differentiating teaching to meet the specific learning needs of students across the full range of abilities.</td>
<td>2a. Outcomes written for three groups Clear outcomes are written catering for all groups described although some aspects may not be completely feasible</td>
</tr>
<tr>
<td>Standard 3: Plan for and implement effective teaching and learning. In particular: 3.1 Set learning goals that provide achievable challenges for students of varying abilities and characteristics.</td>
<td>2b. Outcomes differentiated for three groups There are obvious and generally correct attempts to differentiate to meet the needs of all groups of students</td>
<td></td>
</tr>
</tbody>
</table>
2. Write a brief narrative describing how you would differentiate the lesson in terms of:
   - what you teach (the content)
   - how you teach it (the process/pedagogies used)
   - how learning will be assessed (what product(s) would show that learning had taken place)

to cater for a diversity of learners, in particular students with disabilities.

| Standard 1 - Know students and how they learn. In particular: |
| - 1.5 Demonstrate knowledge and understanding of strategies for differentiating teaching to meet the specific learning needs of students across the full range of abilities |
| - 1.6 Demonstrate broad knowledge and understanding of legislative requirements and teaching strategies that support participation and learning of students with disability. |

| Standard 2 - Know the content and how to teach it. In particular: |
| - 2.1 Demonstrate knowledge and understanding of the concepts, substance and structure of the content and teaching strategies of the teaching area. |
| - 2.2 Organise content into an effective learning and teaching sequence. |

3. Differentiation – content, process and products

Differentiation of content, process and products is apparent, catering for all groups described in the scenario. The response is limited in terms of strategies described.

| 3. Differentiation – content, process and products |
| - Differentiation of content, process and products is apparent, catering for all groups described in the scenario. The response is limited in terms of strategies described |

3. Write a paragraph describing how you would use feedback to students and how student progress through the series of lessons will be monitored.

| Standard 5 – Assess, provide feedback and report on student learning. In particular: |
| - 4a. Use of feedback to students |

There are at least two feedback mechanisms described as well as some indication of how these will be used to assist student learning.
<table>
<thead>
<tr>
<th>5.1 Demonstrate understanding of assessment strategies, including informal and formal, diagnostic, formative and summative approaches to assess student learning.</th>
</tr>
</thead>
</table>
| 4b. Monitoring of progress
There are at least two mechanisms described for monitoring of student progress as well as some indication of how these will be used to assist student learning as well as several suitable processes|
| 5.2 Demonstrate an understanding of the purpose of providing timely and appropriate feedback to students about their learning. |
| 4. Write a brief paragraph describing how you would evaluate the effectiveness of the lesson and what sources of information will be used for this. |
| 3.6 Demonstrate broad knowledge of strategies that can be used to evaluate teaching programs to improve student learning. |
| 5. Evaluation of effectiveness of lesson and appropriate sources of information for this |
| A clear plan for evaluation is described with three or more appropriate mechanisms listed for collection of information. The sources of information described may lack variety |
7.1.1.3 Requirements of the scenario

The factors described above were employed to refine the scenario clarifying the expectations of typical graduate teachers on appointment to their first school. A further iteration of the scenario was developed to include the following:

1. plan engaging lessons within a meaningful sequence, including setting and differentiating appropriate goals
2. determine appropriate content, pedagogies and methods of assessment of learning for all learners
3. use these methods of assessment to monitor progress and provide appropriate feedback to students and others
4. evaluate and reflect on the effectiveness of lessons and use that information to inform future practice.

A major development in this iteration was the inclusion of information on the relative numbers of students represented within a classroom, as well as a significant explication and structuring of how to approach the writing of a response. This version of the evolving scenario is shown the text box below.
Revised Classroom Scenario

You are a teaching graduate and have been successful in obtaining a teaching position in a class/subject suitable to your training.

In the week prior to commencing your appointment, you were advised that you would be responsible for teaching a number of students with disabilities. While experiencing a little additional trepidation about this, you are not surprised, as you have been made aware through the progress of your university course about diverse classroom composition. This diversity was explained to you with the assistance of the three-tier model (below) showing the approximate percentages of students who would require additional assistance within the student population.

Note: Adapted from Walker et al. (1996)
Revised Classroom Scenario (cont.)

These studies have also prepared you to teach students from Aboriginal backgrounds, students for whom English is a further language, students with challenging behaviours and the wide variety of social, ethnic, cultural and religious backgrounds represented within the community.

To ensure that you are ‘on the right track’ to meet the needs of all the students in your class, you decide to prepare a sample lesson to show your supervising teacher for advice and feedback.

Prepare a brief outline for a topic/content of your choosing covering the following sections that you could use to assist you in the preparation of your demonstration lesson.

- A brief description of the lesson, including its overall context within a sequence of lessons/unit of work and the intended learning goals/outcomes.
- How you would differentiate the lesson in terms of:
  - what you teach
  - how you teach it
  - how learning will be assessed to cater for a diversity of learners, in particular students with disabilities.
- How you would use feedback to students and how will student progress through the series of lessons be monitored.
- How you would evaluate the effectiveness of the lesson and what sources of information will be used for this?

Throughout your description, you should try to use the professional language of teaching to which you have been exposed throughout the duration of your course.

The scenario was refined further to include requirements described by Marshall (1995), enabling participants to respond based on the experiences gained through their preparation programs. These requirements – that scenarios must be representative of the construct and must be open-ended enough to allow for individualised responses from the instruction provided in an area to be implemented, resulted in the final scenario presented below, including formatting. Major changes for the final version (see the text box over page) included a simplification of some language, replacing the diagram describing the percentages of students in each category with a textual summary of its contents, and further clarification of response formats.
Final Classroom Scenario

You are a teaching graduate and have been successful in obtaining a teaching position in a class/subject suitable to your training.

In the week prior to commencing your appointment, you were advised that you would be responsible for teaching an inclusive classroom that would include a number of students with diverse learning needs, including several with identified disabilities. This diversity is represented by:

- students who experience severe sustained learning difficulty/disability (approximately 5% of your students)
- students who are at some risk of not meeting age appropriate outcomes but make adequate progress with some additional help (approximately 15% of your students)
- students who are at low risk of not meeting age appropriate outcomes and who make satisfactory progress within the context of regular class input (approximately 80% of your students). (Walker et al., 1996)

Use the knowledge acquired in your teacher education course to prepare a sample lesson to show your supervising teacher for advice and feedback. To do so, prepare a brief outline for a topic/content of your choosing covering the following sections that you could use to assist you in the preparation of your demonstration lesson:

- Write a paragraph giving a brief description of the lesson, including its overall context within a sequence of lessons/unit of work.
- Write a paragraph describing the intended learning goals/outcomes of the lesson, including the way they would be differentiated for the three groups described above.
- Write a brief narrative describing how you would differentiate the lesson in terms of:
  - what you teach (the content)
  - how you teach it (the process/pedagogies used)
  - how learning will be assessed (what product(s) would show that learning had taken place)
  to cater for a diversity of learners, in particular students with disabilities.
- Write a paragraph describing how you would use feedback to students and how student progress through the series of lessons will be monitored.
- Write a brief paragraph describing how you would evaluate the effectiveness of the lesson and what sources of information will be used for this.

Your response should address the needs of the three groups of students described in the scenario. Throughout your description, you should make specific reference to the methodologies, teaching practices and the professional language of teaching to which you have been exposed throughout the duration of your course.

Reference

The scenario was then subjected to additional content validation through feedback from significant others, including expert judges and first-year teachers. The results of this component are described in the next section.

7.1.1.4 Responses from expert judges

As described in Section 6.2.1.1, the draft scenario was provided to eight expert judges. These individuals were asked to verify that the scenario provided an authentic representation of the educational environments for which they were responsible. All responses indicated that the scenario was appropriate in describing the classroom environment and the skills required. A number of responses indicated that there were varying factors impacting on student learning and that the proportions of students in each of the categories taken from Walker et al. (1996) may be an underestimate. Extracts from a number of the expert responses are included below.

Response 1 – The scenario is an accurate representation of the range of needs in the classroom. These days add in at least one child on the autistic spectrum and one oppositional, plus three ADD [attention deficit disorder] and you’ve probably nailed it. In my situation I have found that staff have not enough understanding of behaviour management and need a large input from me to learn how to manage a classroom effectively. (Principal, medium public primary school)

Response 2 – Scenario is reasonably representative of a class situation. Your questions to be addressed are appropriate to a normal day’s work for any teacher in a primary school. (Principal, medium Catholic primary school)

Response 3 – The scenario is representative of the composition of classes in schools, and does prompt beginning teachers to plan curriculum which is inclusive. I think there are a number factors which teachers should consider when planning inclusive curriculum for students, particularly in schools in Western NSW Region. A significant number of schools in Western NSW Region enrol students who are affected by intersecting factors of disadvantage, including Aboriginality, poverty, unemployment, health and disability, isolation, refugee status, cultural and language background, housing and family structure - collectively Low SES background. (Principal, small public central school)

Response 4 – My day-to-day work involves visiting a lot of schools and classrooms. I would say that your scenario is broadly representative of what I see in these settings, although the percentages vary somewhat on an individual school basis. (Head of professional experience unit in the tertiary sector)
As a result of this feedback, no additional adjustments were deemed necessary for the scenario at this point in the development process.

### 7.1.1.5 Responses from first-year teachers

In addition to the expert judges described in the previous section, the scenario was also provided to a sample of teachers in their first year of teaching (also described in Section 6.2.1.1). These teachers represent a broad cross-section of educational jurisdictions within NSW. These participants were asked to verify that they were responsible for teaching a mainstream class that included students with disability whose educational needs they were also responsible for. They were further asked to verify that the percentages described in the scenario were representative of their setting.

In validating the scenario, all of the participants confirmed that it presented a situation that was representative of their experience. Participants indicated they were working in mainstream classrooms where there was representation of students with a disability. The proportions of students requiring additional assistance described in the scenario (Walker, et al., 1996) were verified, although one respondent indicated that he could not confirm these numbers, due to the size of his setting and the small number (one) of students who had a disability within the setting. The level of assistance available to support the education of students with disabilities was described by participants as variable.

Examples of responses are included below.

Response 1 – I ended up getting a job in a small village in a two-teacher school. I have a boy in my class who has an intellectual disability. He is well accepted within the school and community as just one of the kids. I can’t say on this experience whether or not your percentages are right. I can say though that I don’t get much support other than the principal. (Early career/primary teacher in small rural setting)

Response 2 – In the classes I teach, there are students with identified disabilities. I have a couple of students with ASD [autism spectrum disorder] and ADD [attention deficit disorder], as well as quite a few with language and numeracy problems. There is some support available with some part-time teacher’s aides and learning support teachers to help with planning. (Teacher in medium-sized high school).

Response 3 – Every school I have been to has students with disabilities, as well as students with learning difficulties (mostly literacy and numeracy). The
support for these students varies. It seems like the bigger schools have more support but they also have more kids to work with. (Casual teacher based in regional city)

Response 4 – I’m teaching Year 4 and have several children with disabilities. There are also some who need more help with maths and reading, so your numbers are pretty close. There is some support, but not enough. (Primary teacher in medium rural township)

This feedback further validated the scenario as representative of classrooms within the NSW context. As a result of this feedback, no adjustments to the scenario were deemed necessary.

7.1.1.6 Summary of situational analysis

The combination of the connections to the literature described above, the examination of the teaching standards applicable within the jurisdiction, the feedback from expert judges and the validation from teachers in their first year of practice produced a scenario that was deemed to be content valid for the purpose for which it was developed.

7.1.2 Results of response enumeration, evaluation and development of the measuring format

This section describes the response enumeration, response evaluation and measurement development stages of the BAM to the ongoing development of the instrument. These stages describe and validate the likely responses to the scenario. In presenting the data for these stages, the section will describe the synthesis of Marshall’s (1995) schema levels with the SOLO taxonomy to inform the SDLs in the REF, the use of the AITSL (2011) teaching standards to build a bridge between responses and the SDL, and the use of pilot test data (both the researcher alone and the researcher with an additional marker) to inform development. Statistical data are also presented for the initial and final stages of development. The results for the different stages of these parts of the BAM process are described below.

7.1.2.1 Content validation of response format: Synthesis of the Structure of the Observed Learning Outcome taxonomy and Marshall’s schema levels

The content validation of the REF employed two existing frameworks for response evaluation in combination to build the content of the response format: Marshall’s (1995)
knowledge levels for schema development and the SOLO taxonomy developed by Biggs and Collis (1982).

As described in the literature, Marshall’s (1995) schema development knowledge consists of four levels: identification knowledge – the knowledge that contributes to initial recognition of a situation/event/experience; elaboration knowledge – the knowledge providing elaborations about main features of a situation/event; planning knowledge – the level of knowledge allowing existing schema to be used to make plans and set goals; and execution knowledge – which allows an individual to carry out steps of a plan they may have evolved and to make predictions as to outcomes. These levels are developmental and build from an individual’s growing experiences with a particular situation. For Study 1, Marshall’s classifications were used to define the schema levels.

The SOLO taxonomy is, similarly, a measure that allows increasingly complex responses to a situation/question to be analysed. It consists of five levels: pre-structural – involving minimal working memory with an output where there is no relationship between the cue to a situation and the response given; uni-structural – involving a low level of working memory, where respondents can generalise in their response in terms of one aspect only; multi-structural – requiring a medium level of working memory with respondents showing some ability to generalise with respect to a number of independent aspects of a situation; relational – requiring a higher cognitive demand, and a high level of working where responses to cues show the ability to generalise and draw relationships between different aspects relating to a situation; and extended abstract – having the highest cognitive demand and maximal working memory as it involves significant interrelationships and connections between different aspects of the situation in question.

For Study 1, a significant factor in using the SOLO taxonomy is its existing reliability and validity data. In examining these considerations, Biggs and Collis (1982) describe how inter-judge agreement is the most pertinent reliability measure. In studies reported by them, correlations ranged from 0.71 to 0.95 (Biggs & Collis, 1982, p. 204), which they describe as being within acceptable limits. Validity was examined by Biggs and Collis from three different aspects. First, “agreement with teacher ratings of quality” (p. 204); second, through factor analysis; and third, through process analysis. The results of this examination indicated a high level of validity through association with school achievement in mathematical and language skills. In collecting their data, Biggs
and Collis used SOLO to categorise responses to more open-ended, literature-based questions. For the purposes of the current research, it should be noted that SOLO was used with a content validated scenario, which had a demonstrated content validity for the situation in question.

In this thesis, the SOLO taxonomy descriptions were used in conjunction with Marshall’s (1995) levels to allow categorisation of written responses to the scenario. In doing so, an existing valid and reliable format was strengthened by mediating it with Marshall’s levels to allow an SDL to be determined.

As described in the methodology, examinations of Marshall’s (1995) knowledge levels and the SOLO taxonomy were undertaken to allow categorisation of written responses to the scenario. SDLs for the STS were developed by synthesising the descriptors for each to a SDL. For example, comparison of identification knowledge from Marshall’s framework with the uni-structural dimension from SOLO showed that both frameworks indicated some (but limited) knowledge around a construct, with little or no connectivity between the aspects of the construct that may be recognised by an individual.

Table 7.2 shows the results of this synthesis, based on the descriptors delineated by Marshall (1995) and Biggs and Collis (1982). The term ‘pre-schematic’ is not used by Marshall, but was developed by the researcher to represent a situation within Marshall’s framework, where an individual effectively has little/no knowledge of a given situation such that it has no relationship to existing schema.
<table>
<thead>
<tr>
<th>Marshall's knowledge levels</th>
<th>SOLO taxonomy levels</th>
<th>Schema development level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-schematic</td>
<td>Pre-structural: this involves minimal working memory and results in an output where there is no relationship between the cue to a situation and the response given. There is little connection between the two and no consistency between them. This level within SOLO is not consistent with any level of schema development.</td>
<td>0 – Responses at this level indicate a minimal understanding of an appropriate professional response to the scenario, with no valid strategies to address it and no connections between suggested strategies. There is little evidence of knowledge of pattern language or its use. There may be no attempt at the task.</td>
</tr>
<tr>
<td>Identification knowledge: this is the knowledge that contributes to initial recognition of a situation/event/experience. It involves simultaneous cognitive processing of a number of features, each of which is distinctive, although some aspects may be shared. Often, there are few connections between aspects of the information.</td>
<td>Uni-structural: this level involves a generally lower level of working memory, where respondents can generalise in their response in terms of one aspect only. There is usually little evidence of connections made between cue and response, only allowing one aspect of a situation to be considered and resulting in responses which may involve ‘jumping to conclusions’.</td>
<td>1 – Responses at this level indicate a limited understanding of an appropriate professional response to the scenario, with few valid strategies to address it and limited connections between suggested strategies. There may be some evidence of knowledge of pattern language and its use, although this is minimal and may be used incorrectly.</td>
</tr>
<tr>
<td>Marshall’s knowledge levels</td>
<td>SOLO taxonomy levels</td>
<td>Schema development level</td>
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<tr>
<td>----------------------------</td>
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</tr>
<tr>
<td>Elaboration knowledge: this is the knowledge that provides elaborations about main features of a situation/event. It is primarily declarative in nature and requires some connectivity between sub-schema and knowledge chunks. It allows an individual to create a mental model about the current problem. It can tend to be interpretive in nature, where details can be discarded in favour of interpretations. It helps to provide a framework for tentative hypotheses, involving both recognition of a given situation (identification knowledge) and evaluation of the situation against previous experiences (elaboration knowledge).</td>
<td>Multi-structural: this level requires a medium level of working memory. Respondents show some ability to generalise, particularly with respect to a number of independent aspects that may be apparent in a cue. Little connectivity may still be made between aspects of data in the cue and responses to it.</td>
<td>2 – Responses at this level indicate an incomplete understanding of an appropriate response to the scenario, but show some understanding of a professional response to it. There may be a little evidence of knowledge of pattern language and its use, although this is minimal and may be used incorrectly or in non-specific ways.</td>
</tr>
<tr>
<td>Planning knowledge: this is the level of knowledge where existing schema can be used to make plans and set goals. It requires connectivity and strong networks to exist between sub-schema and knowledge chunks. It develops with each use of a particular schema and is the level required as an indicator of the existence of a working schema for a given area.</td>
<td>Relational: this level has a higher cognitive demand and hence a high level of working memory is required. Responses to cues show the ability to generalise within given or experienced content. There is interconnectivity apparent between aspects of data within the cue provided, with no inconsistency between cue and responses within the given system.</td>
<td>3 – Responses at this level indicate a good understanding of an appropriate professional response to the scenario, with a number of valid strategies to address it and clear connections between suggested strategies that constitute a rudimentary plan. There is evidence of knowledge of pattern language and its use, with correct usage and clear connections between concepts.</td>
</tr>
<tr>
<td>Execution knowledge: this level of knowledge allows an individual to carry out steps of a plan they may have evolved and to make predictions as to outcomes. It involves different techniques leading to action and enabling action. This knowledge and associated techniques is often shared among schema and is indicative of complex interrelationships among these.</td>
<td>Extended abstract: this level of response has the highest cognitive demand and maximal working memory. It involves significant interrelationships and connections being made between the data provided in a cue and responses made. This level of response shows an ability to generalise to situations not yet experienced and allows for open decisions for possible logical alternatives.</td>
<td>4 – Responses at this level indicate a complex understanding of an appropriate professional response to the scenario, with numerous valid strategies to address it and extensive connections between suggested strategies, showing an extensive, clear plan of action. There is extensive evidence of knowledge of pattern language and its use, with clear connections between concepts.</td>
</tr>
</tbody>
</table>
Having generated the SDLs described above, a format allowing the interpretation of responses was necessary. The development of this format is described in the next sections.

7.1.2.2 Development of scoring rubric/response evaluation framework

The next stage in the development of the REF concerned using the SDLs described in Table 7.2 to develop a scoring rubric allowing for the categorisation of individual participant’s responses. The development of this stage involved using the teaching standards (AITSL, 2011) against the descriptors for the SDLs for each section requested in the scenario.

This approach to developing the response format involved an examination of differing responses to a scenario and determination of which of these responses are (or are not) likely to result in positive outcomes for the situation described. The initial REF was developed using the graduate-level standards from AITSL (2011). These standards describe what is required of graduates with respect to their capacity to meet the needs of all learners within inclusive classrooms. Each of the different sections of the scenario was matched with a corresponding descriptor for SDL, derived from the synthesis of Marshall (1995) and SOLO, as described in the previous section.

Table 7.3 shows the results for the initial REF developed by the researcher. This table indicates which of the standards is relevant to each of the sections, with descriptions of the different SDLs that informed grading of the responses.
Table 7.2: Initial descriptors of different schema development levels for scenario sections based on AITSL standards for graduate teachers

<table>
<thead>
<tr>
<th>Response section</th>
<th>STS level</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief description of lesson (Standard 2 – all)</td>
<td>No attempt or a response that is tautological with little relevance to the question</td>
<td>The task is attempted but the response either only describes one appropriate aspect or only displays minor relevance to the scenario</td>
<td>There is clear engagement with the task, but an incomplete understanding of an appropriate response to the scenario is apparent. Some understanding of a professional response to it is evidenced by correctly identifying a number of different aspects</td>
<td>Responses at this level indicate a good understanding of an appropriate professional response to the scenario, with a number of valid strategies to address it and clear connections between suggested strategies that constitute a rudimentary plan</td>
<td>Responses at this level indicate a complex understanding of an appropriate professional response to the scenario, with numerous valid strategies to address it and extensive connections between suggested strategies, showing a detailed, clear plan of action</td>
<td></td>
</tr>
<tr>
<td>Outcomes written and differentiated for three groups (Standard 1.5, 3.1)</td>
<td>No outcomes written or Outcomes showing no understanding of accepted structure and no apparent differentiation for groups</td>
<td>Outcomes are written, but may not be correctly structured. Attempts at differentiation may be apparent but inappropriate for the scenario described</td>
<td>Outcomes are correctly written with clear attempts to differentiate for all groups. Differentiation may not be completely appropriate</td>
<td>Clear and appropriate outcomes written with obvious and generally correct attempts to differentiate appropriately to meet the needs of all groups of students</td>
<td>Sophisticated outcomes correctly differentiated and clearly addressing the needs of all groups of students</td>
<td></td>
</tr>
<tr>
<td>Response section</td>
<td>STS level</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td>------------------</td>
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<tr>
<td>3. Differentiation – content, process and products</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Standard 1.5, 5.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No attempt or No evidence of differentiation at any level, with no valid strategies for content, process or product</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responses attempt differentiation appropriately but only in one/two areas and with limited strategies described which may not cater for all groups within the scenario</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responses attempt to differentiate in two/three areas but with limitations to the strategies described and which may not cater for all groups within the scenario</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differentiation of content, process and products is apparent and appropriate, catering for all groups described in the scenario. The response is limited in terms of strategies described</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numerous valid strategies recommended capable of meeting the needs of all three groups of students. Differentiation of all three areas is clearly evident</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Use of feedback to students and monitoring of progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Standard 5.2)</td>
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<td></td>
</tr>
<tr>
<td>Response shows little/no understanding of the use of feedback to students nor of monitoring student progress, with no suitable strategies for either process described</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responses show an understanding of the use of feedback to students and of monitoring student progress, but with few/no suitable strategies for either process described</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is a clear understanding of the use of feedback to students and of the importance of monitoring student progress. Some suitable strategies are described for both purposes</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There are various appropriate feedback mechanisms described as well as several suitable processes for monitoring of student progress</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There are numerous and various appropriate feedback mechanisms described as well as a range of suitable processes for monitoring of student progress</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STS level</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Response section</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5. Evaluation of effectiveness of lesson and appropriate sources of information for this (Standard 3.6)</td>
<td>There are no suitable strategies described for the collection of information for evaluative purposes nor any clear understanding of the need for evaluation</td>
<td>The response attempts to recognise the need for evaluation and describes one/two sources of information to inform the evaluation. These sources may not be appropriate for the purpose intended</td>
<td>The response clearly recognises the need for evaluation and describes one/two appropriate sources of information to inform the evaluation</td>
<td>A clear plan for evaluation is described with a three or more appropriate mechanisms listed for collection of information. The sources of information described may lack variety</td>
<td>A clear and explicit plan for evaluation is described with a wide variety of mechanisms listed for collection of appropriate information</td>
<td></td>
</tr>
<tr>
<td>6. Connectivity, both between scenario (cue) and response and between sections</td>
<td>Little connectivity apparent throughout the response, with the response provided showing little connection to the scenario described</td>
<td>There is some, if limited, evidence of an understanding of the scenario and the response attempts to connect to it. There are limited connections between suggested strategies and the overall response tends to lack connectedness and coherence</td>
<td>There is some connection between the scenario and the response, but an incomplete understanding of an appropriate response to the scenario is apparent, with few connections between sections and a lack of overall coherence</td>
<td>There is evidence of a good understanding of an appropriate professional response to the scenario, with a number of valid strategies to address it and clear connections between suggested strategies that constitute a rudimentary plan</td>
<td>There is extensive and fluent connections within response showing numerous valid strategies to address it and extensive connections between suggested strategies. A clear and appropriate plan of action is apparent. A cogent, coherent response</td>
<td></td>
</tr>
<tr>
<td>STS level</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>Response section</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Evidence of use of pattern language</td>
<td>Little or no use of pattern language is apparent</td>
<td>Some evidence of pattern language, but used idiosyncratically in a loose, disconnected manner</td>
<td>There is a little evidence of knowledge of pattern language and its use, although this is minimal and may be used incorrectly or in non-specific ways</td>
<td>There is evidence of knowledge of pattern language and its use, with correct usage and clear connections between concepts</td>
<td>Extensive use of pattern language is apparent throughout the work, with clear connections between concepts</td>
<td></td>
</tr>
</tbody>
</table>

Note: STS = schema for teaching scale; AITSL = Australian Institute for Teaching and School Leadership
7.1.2.3 Scoring responses – the pilot groups

Summing the responses in each field allowed for the determination of an overall scale score. Based on the synthesis of Marshall’s (1995) levels of schema development and the SOLO taxonomy shown in Table 7.3, and Marshall’s description of a functional schema as being a schema existing at a level where planning knowledge is able to be accessed, a functional schema was initially defined as a score of 21 (showing achievement at Level 3 for each aspect). The revised REF, with a 10-point scale (as described in the sections below) meant that a functional level of schema would be a score of 30 (Level 3 in each of 10 fields).

As detailed in Section 6.2.1, three distinct cohorts were involved in the completion of responses to the scenario for the initial pilot studies as a preliminary testing of the REF prior to gathering responses from all groups represented in the research. These groups informed the ongoing refinement of the REF, extending it from the original seven-point format described in Table 7.3 to a 10-point format. This development is elaborated in the sections following.

The first of the pilot groups consisted of 23 final semester PSTs who had returned to the setting after completion of their final 10-week internship. As detailed more fully in Study 2, the mean score on the final REF for this cohort on the 10-point format was 9.17. Eighteen participants drawn from students completing their final semester in an exercise physiology degree agreed to complete responses to the scenario, representing participants at the same level of maturity as those from the initial teacher-education degree, but with no study of teacher preparation. The mean score for this cohort, again on the 10-point format, was 8.46. Seventeen recent graduates from a Master of Inclusive Education also agreed to participate, helping to ensure that the scenario and its categories of response were sensitive to the full range of potential responses. As detailed more fully in Study 3, the mean score for this cohort on the 10-point format was 30.15. The responses of groups showed that the instrument was capable of demonstrating that:

- the framework of the scenario and the REF was able to discriminate a range of scores from those categorised
- a functional level of schema, as described earlier, was able to be achieved by some participants.

These pilot groups were further used to inform the additional refinement of the REF, to develop a table of score bands on their meanings, based on the Marshall (1995)/SOLO
synthesis (see Table 7.4, below) and as a part of the establishment of inter-rater reliability, as described in the next sections.

**Table 7.3:** Score bands and their meanings from 10-point criteria based on the synthesis of Marshall (1995), the Structure of the Observed Learning Outcome taxonomy (Biggs & Collis, 1982) and pilot marking outcomes

<table>
<thead>
<tr>
<th>Schema development level</th>
<th>Score range</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–1</td>
<td>0–9</td>
<td>Responses in this range indicate a minimal understanding of an appropriate professional response to the scenario. There are no valid strategies to address it and no connections between suggested strategies. There is little evidence of knowledge of pattern language or its use. There may be no attempt at the task, or an attempt may be a simple restatement of information within the scenario.</td>
</tr>
<tr>
<td>2</td>
<td>10–19</td>
<td>Responses at this level indicate an incomplete understanding of an appropriate response to the scenario but show some understanding of a professional response to it. There may be a little evidence of knowledge of pattern language and its use, although this is minimal and may be used incorrectly or in non-specific ways.</td>
</tr>
<tr>
<td>3</td>
<td>20–29</td>
<td>Responses at this level indicate a good understanding of an appropriate professional response to the scenario, with a number of valid strategies to address it and clear connections between suggested strategies that constitute a rudimentary plan. There is evidence of knowledge of pattern language and its use, with correct usage and clear connections between concepts.</td>
</tr>
<tr>
<td>4</td>
<td>30–40</td>
<td>Responses at this level indicate a complex understanding of an appropriate professional response to the scenario, with numerous valid strategies to address it and extensive connections between suggested strategies, showing an extensive, clear plan of action. There is extensive evidence of knowledge of pattern language and its use, with clear connections between concepts.</td>
</tr>
</tbody>
</table>
7.1.2.4 Further refinement of the response evaluation framework

Application of the REF to responses obtained from pilot groups resulted in further development and clarification. This involved the researcher scoring responses on the pilot group’s responses (described above), before moving to inclusion of a research assistant as a second rater. The results of both the researcher categorising alone and the researcher categorising with this trained research assistant are included below. These results show how the content of the REF evolved. For the researcher working alone, Kendall’s correlation coefficient (Kendall’s tau-b) was used to examine test-retest reliability, as the assumptions of the Pearson correlation coefficient were violated. For the researcher working with the research assistant, percentage agreement was used, with Cohen’s kappa applied to the full inter-rater reliability measure described later in this section. As described in Section 6.2.1.5, this reliability check consisted of the researcher applying the REF to a sample of 10 scripts, which were then categorised a second time (in random order) a week later. Table 7.5 shows the results of this initial categorisation (researcher alone). As shown in the table, the value of Kendall’s tau-b, used to determine the test-retest reliability between the two instances of measurement, indicated low reliability.
Table 7.4: Researcher categorisation of pilot responses to inform refinement of response evaluation framework – initial trial

<table>
<thead>
<tr>
<th>Criteria</th>
<th>1</th>
<th>2a</th>
<th>2b</th>
<th>3</th>
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<th>5</th>
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<tbody>
<tr>
<td>Case</td>
<td>T1</td>
<td>T2</td>
<td>D</td>
<td>T1</td>
<td>T2</td>
<td>D</td>
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<td>0</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Kendall’s tau-b for this data set was not significant \( r_t = 0.469, p < 0.077 \), hence showing low reliability
T1 = trial 1; T2 = trial 2; D = difference between trials
Prior to the second trial, discrepancies were noted and adjustments made to the format. These adjustments consisted of tightening the language within the REF to more clearly allow discrimination between responses. Sections 2 and 3, pertaining to outcomes and differentiation, were the major items clarified.

The final trial for the researcher working alone is reported in Table 7.6. For this example, Criterion 2 had already required sufficient clarification to be split into two separate, but related items, labelled 2a and 2b. The first of these concerned the capacity to write learner outcomes and the second to then differentiate those outcomes (see Table 7.8 below). Kendall’s tau-b was again implemented to determine the correlation between the two instances of measurement. As shown in the table, the value of this statistic for the measurement occasions indicated excellent reliability. Based on this outcome, the pilot testing progressed to include the involvement of more than one rater.
Table 7.5: Researcher categorisation of pilot responses to inform refinement of response evaluation framework – final trial

<table>
<thead>
<tr>
<th>Criteria</th>
<th>1</th>
<th>2a</th>
<th>2b</th>
<th>3</th>
<th>4</th>
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<td>T1</td>
<td>T2</td>
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</tbody>
</table>

Note: Kendall’s tau-b for this data set was significant ($r_\tau = 0.989$, $p < 0.01$), hence showing excellent reliability.

T1 = trial 1; T2 = trial 2; D = difference between trials.
Using the same approach implemented with the researcher alone, a further 10 responses were scored by both the researcher and a trained research assistant. Table 7.7 shows the results of this trial. In this trial, 65 of 80 cells, or 81%, showed agreement. For this trial, Criteria 1, 4, 6 and 7 were still apparent as areas of frequent disagreement, requiring further clarification and development. Adjustments were made to the rubric at this point including additions to descriptors in Section 1 to clearly clarify the requirement for scope and sequence as well as additions to Section 7 to place numeric requirements on pattern language for each category.
Table 7.6: Research assistant blind categorisation of schema for teaching scale to further inform refinement of the response evaluation framework

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Case</th>
<th>1</th>
<th>2a</th>
<th>2b</th>
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<td>D</td>
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<td>4</td>
<td>4</td>
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</tr>
</tbody>
</table>

Note: RA = research assistant; R = researcher; D = difference between scores
7.1.2.5 Further data collection

Further responses to the scenario were then collected from other cohorts resulting in participants from Year 0, Year 1, Year 2 and Year 3 to provide responses from Site 1 to inform Study 2, while participant responses from two further research sites were gathered. Numbers of participants for each of these cohorts are described in the participant sections of Chapter 6. These responses were included in the next phase of REF refinement, with the results reported below.

7.1.2.6 Final refinement of the response evaluation framework

A series of three separate sessions of response categorisation, with all cohorts represented in the sample, resulted in additional refinements to the REF, in particular the splitting of Criteria 4 and 6 into additional discrete benchmarks (4a & 4b; 6a & 6b). This was achieved by separate scoring of responses by the researcher, in conjunction with the trained research assistant. The final REF descriptors are described in Table 7.8. Application of these descriptors within double blind-marking of 20 responses eventuated in agreement for 188 of 200 cells. This result equated to a 94% agreement, as shown in Table 7.9. The higher level of agreement across all sections of measurement for this trial indicated a closer concurrence in categorisation. This revised rubric was then used in determining a measure for inter-rater reliability, as reported following Tables 7.8 and 7.9.
### Table 7.7: Final descriptors of different schema development levels for scenario sections after examination of pilot responses and refinement of criteria

<table>
<thead>
<tr>
<th>Response section</th>
<th>STS Level</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Brief description of lesson (Standard 2 – all)</td>
<td>No attempt or a response that is tautological with little relevance to the question</td>
<td>The task is attempted but the response either only describes one aspect or only displays minor relevance to the scenario. There is little/no evidence of scope or sequence within the group of lessons/unit of work and no indication of timing of lesson</td>
<td>There is clear engagement with the task, but an incomplete understanding of a full response to the scenario is apparent. Some understanding of a professional response to it is evidenced by correctly identifying a number of different aspects such as the scope and sequencing of the lesson and feasible timing of it</td>
<td>Responses at this level indicate a good understanding of a professional response to the scenario, with a number of valid strategies to address it and clear connections between suggested strategies that constitute a rudimentary plan. Scope and sequence are clear and indicate a plan for required prior knowledge and where the unit is heading</td>
<td>Responses at this level indicate a complex understanding of a professional response to the scenario in that there are numerous valid strategies to address the learning needs of the three groups described and extensive connections between suggested strategies. There is a detailed, clear plan of action around the lesson and its place within a sequence/unit of work</td>
<td></td>
</tr>
<tr>
<td>Response section</td>
<td>STS Level</td>
<td>0</td>
<td>1</td>
<td>2</td>
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</tr>
<tr>
<td>2a. Outcomes written for three groups (Structure of condition, action, criteria) (Standard 1.5, 3.1)</td>
<td></td>
<td>No outcomes written</td>
<td>Outcomes are written, but may not be correctly structured or may be missing some aspect</td>
<td>Outcomes are correctly written with all areas (condition, action, criteria) obvious. Not all aspects described may be feasible for the relevant group</td>
<td>Clear outcomes are written catering for all groups described although some aspects may not be completely feasible</td>
<td>There are a range of elaborated outcomes written catering for all groups described with all aspects feasible for all groups</td>
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<tr>
<td></td>
<td>or</td>
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<tr>
<td></td>
<td>Some indication of outcomes but showing no understanding of accepted structure/purpose</td>
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</tr>
<tr>
<td>2b. Outcomes differentiated for three groups (Standard 1.5, 3.1)</td>
<td></td>
<td>No attempt apparent to differentiate for groups</td>
<td>Attempts at differentiation may be apparent but do not meet the needs described in the scenario</td>
<td>There is a clear attempt to differentiate for all groups. Differentiation may not be complete for the three levels described in the scenario</td>
<td>There are obvious and generally correct attempts to differentiate to meet the needs of all groups of students</td>
<td>Outcomes are correctly differentiated and elaborated at three levels clearly addressing the needs of all groups of students</td>
</tr>
<tr>
<td>STS Level</td>
<td>0</td>
<td>1</td>
<td>2</td>
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<td><strong>Response section</strong></td>
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<tr>
<td>3. Differentiation – content, process and products (Standard 1.5, 1.6, 5.1)</td>
<td>No attempt or No evidence of differentiation at any level, with no valid strategies for content, process or product</td>
<td>Responses may recognise the need for differentiation and may attempt to differentiate at different levels. This may be only in one/two areas and with limited strategies described. The differentiation may not cater for all groups within the scenario</td>
<td>Responses attempt to differentiate in two/three areas but with limitations to the strategies described and which may not cater for all groups within the scenario</td>
<td>Differentiation of content, process and products is apparent, catering for all groups described in the scenario. The response is limited in terms of strategies described</td>
<td>Numerous strategies are recommended capable of meeting the needs of all three groups of students. Differentiation of all three areas is clearly evident</td>
<td></td>
</tr>
<tr>
<td>4a. Use of feedback to students (Standard 5.2)</td>
<td>Response shows little/no understanding of the use of feedback to students with no suitable strategies described</td>
<td>Response shows an understanding of the use of feedback to students, but no strategies doing so described</td>
<td>There is a clear understanding of the use of feedback to students with at least one suitable strategy described for this purpose</td>
<td>There are at least two feedback mechanisms described as well as some indication of how these will be used to assist student learning</td>
<td>There are numerous and various feedback mechanisms described and a clear plan to allow these to inform student learning</td>
<td></td>
</tr>
<tr>
<td>STS Level</td>
<td>0</td>
<td>1</td>
<td>2</td>
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<tr>
<td>4b. Monitoring of progress (Standard 5.1, 5.2)</td>
<td>Response shows little/no understanding of the need to monitor student progress, with no suitable strategies described</td>
<td>Responses show an understanding of the importance of monitoring student progress but no suitable strategies are described</td>
<td>There is a clear understanding of the importance of constantly monitoring student progress with at least one suitable strategy described for this purpose</td>
<td>There are at least two mechanisms described for monitoring of student progress as well as some indication of how these will be used to assist student learning as well as several suitable processes</td>
<td>There are numerous and various mechanisms described for monitoring of student progress and a clear plan to allow these to inform student learning</td>
<td></td>
</tr>
<tr>
<td>5. Evaluation of effectiveness of lesson and appropriate sources of information for this (Standard 3.6)</td>
<td>There are no suitable strategies described for the collection of information for evaluative purposes nor any clear understanding of the need for evaluation</td>
<td>The response attempts to recognise the need for evaluation and describes one/two sources of information to inform the evaluation. These sources may not be appropriate for the purpose intended</td>
<td>The response clearly recognises the need for evaluation and describes one/two appropriate sources of information to inform the evaluation</td>
<td>A clear plan for evaluation is described with three or more appropriate mechanisms listed for collection of information. The sources of information described may lack variety</td>
<td>A clear and explicit plan for evaluation is described with a wide variety of mechanisms listed for collection of appropriate information</td>
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</tr>
<tr>
<td>STS Level</td>
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<tr>
<td>6a. Connectivity between scenario (cue) and response</td>
<td>There is little connectivity apparent with the response provided showing little connection to the scenario described</td>
<td>There is some, if limited, evidence of an understanding of the scenario and the response attempts to connect to it</td>
<td>There is some connection between the scenario and the response, but an incomplete understanding of a response reflecting awareness of how to respond to the scenario is apparent</td>
<td>There is evidence of a good understanding of a professional response to the scenario, with a number of valid strategies to address it</td>
<td>There is extensive and fluent connections within the response showing numerous valid strategies to address it</td>
<td></td>
</tr>
<tr>
<td>6b. Connectivity between sections</td>
<td>There is little connectivity apparent throughout the different sections of the response</td>
<td>There are limited connections between suggested strategies and the overall response tends to lack connectedness and coherence</td>
<td>There are few connections between sections and a lack of overall coherence</td>
<td>There are clear connections between each section and between suggested strategies that constitute a rudimentary plan</td>
<td>There are extensive connections between suggested strategies. A clear and appropriate plan of action is apparent. A cogent, coherent response</td>
<td></td>
</tr>
<tr>
<td>STS Level</td>
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<tr>
<td>7. Evidence of use of pattern language</td>
<td>Little or no use of pattern language is apparent (&lt;5 instances/page)</td>
<td>Some evidence of pattern language, but used idiosyncratically in a loose, disconnected manner (5–10 instances/page)</td>
<td>There is a little evidence of knowledge of pattern language and its use, although this is minimal and may be used incorrectly or in non-specific ways. (10–15 instances/page)</td>
<td>There is evidence of knowledge of pattern language and its use, with correct usage and clear connections between concepts. (15–20 instances/page)</td>
<td>Extensive use of pattern language is apparent throughout the work, with clear connections between concepts. (&gt;20 instances per page)</td>
<td></td>
</tr>
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</table>

*Note: STS = schema for teaching scale*
<table>
<thead>
<tr>
<th>Criteria</th>
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<th>2b</th>
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Table 7.8: Research assistant and researcher results for refinement of response evaluation framework and establishment of reliability for categorisations
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<td>0</td>
<td>+1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
7.1.3 Evaluation of the measure

This step of the BAM extends the pilot process to examine the psychometric properties of the instrument to ensure that it represents a reliable measure of the construct in question. For Study 1, internal consistency and inter-rater reliability were examined. The results of this examination are reported below.

7.1.3.1 Internal consistency of the measure

Cronbach’s alpha (Cronbach, 1951) was calculated as a measure of internal consistency reliability for the STS. This statistic is reported on a scale from 0 to 1, with higher values representing greater internal consistency. A score of less than 0.5 is considered unacceptable, with 0.7 being the minimum score considered acceptable. A value of 0.94 was obtained indicating an excellent (>0.9) level of internal consistency that supports the validation of the content of the measure. This is shown in Table 7.10 below. Item statistics, the inter-item correlation matrix and scale statistics are all reported in Appendix 4.

Table 7.9: Reliability statistics for the schema for teaching scale using Cronbach’s alpha (Cronbach, 1951)

<table>
<thead>
<tr>
<th>Cronbach’s alpha</th>
<th>Cronbach’s alpha based on standardised items</th>
<th>Number of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.940</td>
<td>0.941</td>
<td>10</td>
</tr>
</tbody>
</table>

7.1.3.2 Establishment of inter-rater reliability

As described earlier in this chapter, a series of trial categorisations and consequent refinements to the REF were undertaken. The final REF, reported in Table 7.8, was then used by two raters to categorise 112 responses to the scenario to determine a measure of inter-rater reliability. The results for the inter-rater reliability check described in Chapter 6 are reported in this section. Inter-rater reliability was calculated using Cohen’s kappa. Fleiss (1981) indicates three ranges of values for this statistic: 0–0.4 being poor; 0.4–0.75 as fair to good and above 0.75 as excellent. For Study 1 the statistic was found to be $k = 0.704 (p < 0.001)$, 95% confidence interval (CI) (0.618, 0.790), indicating a good agreement between the raters. Being on the upper boundary of the category in question, and just below the excellent range, this value was deemed to be acceptable for the study,
particularly in light of the 94% agreement attained in the pilot study. This is shown in Table 7.11.

**Table 7.10:** Inter-rater reliability statistics for the schema for teaching scale using Cohen’s kappa

<table>
<thead>
<tr>
<th>Measure of agreement</th>
<th>Value</th>
<th>Asymptotic standard error&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Approximate T&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Approximate significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa</td>
<td>704</td>
<td>0.044</td>
<td>28.894</td>
<td>0.000</td>
</tr>
<tr>
<td>Number of valid cases</td>
<td>112</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note:*

<sup>a</sup> Not assuming the null hypothesis

<sup>b</sup> Using the asymptotic standard error assuming the null hypothesis

### 7.1.4 Conclusion

This section has described the results of Study 1, instrument development. The study responded to the lack of validated instruments for measuring schema, as described in the literature. It has described the results of a disciplined process, the framework of the BAM, to address this need. Further data related to validation is situated in Study 2 and Study 3, and are reported in those sections. Construct validity was established with reference to literature and AITSL standards, while the outcomes of piloting reinforce the capacity of the instrument to discriminate different levels of the construct. Testing for reliability was undertaken as a part of the BAM, including test-retest reliability in the pilot groups and with evaluation of the instrument using these measures as an essential component. This process resulted in the production of an instrument that has a high degree of validity and reliability.

Having developed an instrument that shows high fidelity in terms of validity and reliability, the next stage of this research was to apply the instrument in a cohort design, then a comparison design. The results for these two studies follow.

### 7.2 Study 2: The cohort study

This research employed the STS in a cohort study of PSTs. The purposes of Study 2 were, first, to establish a baseline for schema development prior to entry into a teacher-preparation program and second, to determine any changes in schema development that occurred as PSTs progress from the beginning of their initial teacher-education program
(prior to any academic or practicum input) until the final semester of their program, just prior to completion. Cohort studies are described by Cook and Campbell (1979) as allowing for a comparison of performance of different cohorts within an institution, as it is reasonable to assume that contiguous cohorts only differ slightly from each other. In particular, Study 2 will report on results for Research Questions 1–3, with the corresponding research and null hypotheses, as described in Section 6.1.2.

### 7.2.1 Research Question 1: Entrance level schema

The descriptive statistics for this analysis are described in Table 7.12.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 0</td>
<td>6.81</td>
<td>2.916</td>
<td>53</td>
</tr>
<tr>
<td>Year 1</td>
<td>5.88</td>
<td>3.814</td>
<td>33</td>
</tr>
<tr>
<td>Year 2</td>
<td>8.07</td>
<td>3.385</td>
<td>44</td>
</tr>
<tr>
<td>Year 3</td>
<td>15.48</td>
<td>5.550</td>
<td>23</td>
</tr>
<tr>
<td>Year 4</td>
<td>9.17</td>
<td>4.733</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>8.46</td>
<td>4.828</td>
<td>193</td>
</tr>
</tbody>
</table>

*Note: Dependent variable: Schema for teaching scale score (maximum possible score = 40)*

What the data indicate is that none of the cohorts in the participant group had developed a functional schema (defined earlier as a score of 30 out of a possible 40, or Level 3 on the STS). The minimum score of 5.88 was for the cohort who had already completed one year of their program – a lower score than that achieved by the cohort about to begin their studies. The maximum score of 15.48 was scored by the cohort nearing the completion of their third year. This cohort had just completed a dedicated inclusive education subject as a part of the program. This finding indicates that the STS is capable of detecting a change in schema development where it exists. Detecting this was an initial concern given the low scores recorded in the first three administrations. The Year 3 cohort was also smaller than the usual on-campus intake for the program. Given the cohort design (Cook & Campbell, 1979) implemented for this study indicating little difference between contiguous cohorts within an institution, the results for the Year 4 cohort (mean = 9.17) are somewhat surprising. While not a longitudinal study, it would
be reasonable to expect that the learning and skills of the Year 4 cohort would have continued to progress, and that their outcomes would reflect this growth. This was not apparent in the responses by the end of the program of study. Examination of the data allowed Research Question 1 to be addressed, with the results indicating that participants in the Year 0 cohort attained a mean score of 6.81 on the STS, indicating no functional schema on entrance to their PST education program.

### 7.2.2 Research Question 2: Scores on the schema for teaching scale

To address the second research question, a one-way ANOVA was conducted to evaluate the relationship between STS score and the number of years of PST education in which participants had engaged. The independent variable included five levels: no engagement (data collected during orientation week prior to participation in the teacher-preparation course), one year of engagement, two years of engagement, three years of engagement and four years of engagement. The dependent variable was the score in the STS.

The ANOVA for the relationship between STS score and the number of years of PST education was significant, $F (4, 188) = 24.265, p < 0.001$. The strength of the relationship between the length of engagement and STS score, as assessed by eta-squared ($\eta^2$), was strong with engagement time accounting for 34% of the variance in the dependent variable (see Table 7.13).

<table>
<thead>
<tr>
<th>Dependent variable: Schema for teaching scale level</th>
<th>Type III sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>$F$</th>
<th>Sig.</th>
<th>Partial eta-squared</th>
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</thead>
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<tr>
<td>Corrected model</td>
<td>1524.021a</td>
<td>4</td>
<td>381.005</td>
<td>24.265</td>
<td>0.000</td>
<td>0.340</td>
</tr>
<tr>
<td>Intercept</td>
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<td>14690.558</td>
<td>935.597</td>
<td>0.000</td>
<td>0.833</td>
</tr>
<tr>
<td>Setting</td>
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<td>4</td>
<td>381.005</td>
<td>24.265</td>
<td>0.000</td>
<td>0.340</td>
</tr>
<tr>
<td>Error</td>
<td>2951.938</td>
<td>188</td>
<td>15.702</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>18293.000</td>
<td>193</td>
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<td></td>
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<tr>
<td>Corrected total</td>
<td>4475.959</td>
<td>192</td>
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</table>

*Note:*

a. $R^2 = 0.340$ (Adjusted $R^2 = 0.326$)
Follow-up post-hoc comparisons were conducted to evaluate pair-wise differences among the means. Tukey’s, REGWQ’s and Dunnett’s C tests were all completed. The variances ranged from 8.50 to 30.80 (see Table 7.12). While most were not dramatically different from each other, with the exception of the Year 4 cohort, a test for homogeneity of variances (Levene’s test) was completed. This test proved significant, \( p = 0.004 \) (see Table 7.14), hence the results for Tukey’s and REGWQ were ignored. As Dunnett’s C does not assume equal variances, this assisted in controlling for Type 1 error across the multiple pair-wise comparisons.

**Table 7.13: Levene’s test of equality of error variances\(^{a,b}\)**

<table>
<thead>
<tr>
<th>Schema for teaching score based on</th>
<th>Levene’s statistic</th>
<th>( df1 )</th>
<th>( df2 )</th>
<th>Sig.</th>
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<td>Mean</td>
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<td>4</td>
<td>188</td>
<td>0.004</td>
</tr>
<tr>
<td>Median</td>
<td>3.198</td>
<td>4</td>
<td>188</td>
<td>0.014</td>
</tr>
<tr>
<td>Median and with adjusted ( df )</td>
<td>3.198</td>
<td>4</td>
<td>138.949</td>
<td>0.015</td>
</tr>
<tr>
<td>Trimmed mean</td>
<td>3.822</td>
<td>4</td>
<td>188</td>
<td>0.005</td>
</tr>
</tbody>
</table>

*Note: Tests the null hypothesis that the error variance of the dependent variable is equal across groups.*

STS = schema for teaching scale; \( df = \) degrees of freedom

a. Dependent variable: schema for teaching scale level

b. Design: Intercept + Setting

As shown in Table 7.15, there were significant differences in the means of Cohorts 1 (prior to input) and 4 (end of Year 3); Cohorts 2 (end of Year 1) and 4 (end of Year 3); Cohorts 2 (end of Year 1) and 5 (end of Year 4); Cohorts 3 (end of Year 2) and 4 (end of Year 3); and Cohorts 4 (end of Year 3) and 5 (end of Year 4). No other significant differences were apparent. Also as shown in Table 7.15, Cohort 4, which consisted of PSTs who had just completed their third year of engagement, had a mean that was statistically significantly different from all other cohorts.
Table 7.14: Multiple comparisons for the schema for teaching scale – Dunnett’s C test

<table>
<thead>
<tr>
<th>(I) Setting</th>
<th>(J) Setting</th>
<th>Mean difference (I–J)</th>
<th>Std. error</th>
<th>95% CI Lower bound</th>
<th>95% CI Upper bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>0.93</td>
<td>0.775</td>
<td>–1.29</td>
<td>3.16</td>
</tr>
<tr>
<td></td>
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<td>–1.26</td>
<td>0.649</td>
<td>–3.10</td>
<td>0.58</td>
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<tr>
<td></td>
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<td>–8.67*</td>
<td>1.225</td>
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<td>–5.05</td>
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<tr>
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<td>–5.67</td>
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<td>0.837</td>
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<td>1.225</td>
<td>5.05</td>
<td>12.28</td>
</tr>
<tr>
<td></td>
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<td>1.334</td>
<td>5.67</td>
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<tr>
<td></td>
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<td>7.41*</td>
<td>1.265</td>
<td>3.68</td>
<td>11.14</td>
</tr>
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<td>6.30*</td>
<td>1.378</td>
<td>2.26</td>
<td>10.35</td>
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<td>1</td>
<td>2.36</td>
<td>0.849</td>
<td>–0.06</td>
<td>4.78</td>
</tr>
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<td>1.000</td>
<td>0.42</td>
<td>6.17</td>
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<td>0.906</td>
<td>–1.48</td>
<td>3.69</td>
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<tr>
<td></td>
<td>4</td>
<td>–6.30*</td>
<td>1.378</td>
<td>–10.35</td>
<td>–2.26</td>
</tr>
</tbody>
</table>

Note: Dependent variable: schema for teaching scale score
Based on observed means.
The error term is Mean Square(Error) = 15.702.
* The mean difference is significant at the 0.05 level.
CI = confidence interval
Figure 7.2 shows the distribution of scores for all cohorts from prior to engagement (Year 0) to the end of final year (Year 4). Figure 7.2 represents the same information at 95% CI.

**Figure 7.2:** Changes in schema for teaching scores with years of progression through preparation program

![Box plot showing changes in teaching scores](image)

**Figure 7.3:** 95% confidence intervals for changes in scheme for teaching scores with years of progression through preparation program

![Confidence interval plot](image)

This analysis allowed Research Question 2 to be addressed. For this research question, there were statistically significant differences between measurement occasions, thus the null hypothesis is rejected and the research hypothesis accepted. It should be noted,
however, that for this result, the significant differences were predominantly between the cohort at the end of Year 3 and all other cohorts. Further, while the results indicate statistical significance, the very low scores in relation to what constitutes a score for a functional schema (30.00) for all cohorts, shows the lack of schema development year-on-year overall. None of the groups had a functional schema for inclusive practice.

### 7.2.3 Research Question 3: Pattern language development

To address Research Question 3, a one-way ANOVA was conducted to evaluate the differences in pattern language scores over the number of years of PST education in which participants had engaged. Pattern language use was determined by a count of the number of pattern language terms, as described in the literature (see appendix 7 for these terms), used by participants in their responses. Mastery of the pattern language of a professional field is important in allowing practitioners to have a common basis with which to describe and advance their practice. This field was situated as one aspect of the wider STS and as such was scored on a 0–4 level, as with the other field in the study. A score of 3 or above in this field showed evidence of a sufficient mastery of pattern language that would allow a practitioner to engage with others working in the same field, as it corresponds to the STS level required for a functional schema. Scores below this threshold indicate a lack of mastery of this professional skill as they indicate a use of professional language that is insufficient to provide a firm basis for comparability of practice.

The independent variable for Study 2 included five levels: no engagement (data collected during orientation week), one year of engagement, two years of engagement, three years of engagement and four years of engagement. The dependent variable was the score obtained for pattern language field from the STS. The descriptive statistics for this analysis are shown in Table 7.16. What this table clearly shows is that there was no representation of pattern language for the Year 0, Year 1 or Year 2 cohorts. As with the STS scores, an increase was noted for Year 3, followed by a decrease in scores for the Year 4 cohort. No participants from the first three cohorts scored above 0, hence the mean of 0, and only minimal scores were attained by any participants in Year 3 and Year 4. As with schema development, a level sufficient to allow for engagement with other professionals in the fields would be a planning level of mastery in Marshall’s (1995) knowledge levels. What should be noted, however, is that from a maximum possible score of 4 for this field (the maximum for any of the fields in the REF), none of
the cohorts scored a sufficient mean to indicate adequate mastery of professional pattern language at any level of experience.

**Table 7.15:** Descriptive statistics allowing determination of variances

<table>
<thead>
<tr>
<th>Setting</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 0</td>
<td>0.00</td>
<td>0.000</td>
<td>53</td>
</tr>
<tr>
<td>Year 1</td>
<td>0.00</td>
<td>0.000</td>
<td>33</td>
</tr>
<tr>
<td>Year 2</td>
<td>0.00</td>
<td>0.000</td>
<td>44</td>
</tr>
<tr>
<td>Year 3</td>
<td>0.30</td>
<td>0.470</td>
<td>23</td>
</tr>
<tr>
<td>Year 4</td>
<td>0.10</td>
<td>0.304</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>0.06</td>
<td>0.232</td>
<td>193</td>
</tr>
</tbody>
</table>

*Note: Dependent variable: Pattern language development*

The ANOVA was significant, $F(4, 188) = 10.563, p < 0.001$. The strength of the relationship between the length of engagement and pattern language score, as assessed by $\eta^2$ was strong, with $\eta^2 = 0.184$ (see Table 7.17).

**Table 7.16:** Results of one-way analysis of variance for pattern language development

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>$F$</th>
<th>Sig.</th>
<th>Partial eta-squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>1.903$^a$</td>
<td>4</td>
<td>0.476</td>
<td>10.563</td>
<td>0.000</td>
<td>0.184</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.165</td>
<td>1</td>
<td>1.165</td>
<td>25.853</td>
<td>0.000</td>
<td>0.121</td>
</tr>
<tr>
<td>Setting</td>
<td>1.903</td>
<td>4</td>
<td>0.476</td>
<td>10.563</td>
<td>0.000</td>
<td>0.184</td>
</tr>
<tr>
<td>Error</td>
<td>8.470</td>
<td>188</td>
<td>0.045</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11.000</td>
<td>193</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Dependent variable: Pattern language development
$df$ = degrees of freedom

a. $R^2 = 0.184$ (Adjusted $R^2 = 0.166$)

Follow-up post-hoc comparisons were conducted to evaluate pair-wise differences among the means. Tukey’s, REGWQ’s and Dunnett’s C tests were all completed. The variances ranged from 0.00 to 0.22 (see Table 7.16). While most were not dramatically different from each other, with three of the cohorts having a mean score of 0, a test for
homogeneity of variances (Levene’s test) was completed. This test proved significant, $p < 0.001$, hence the results for Tukey’s and REGWQ’s tests were disregarded (see Table 7.18). As Dunnett’s C does not assume equal variances, this assisted in controlling for Type 1 error across the multiple pair-wise comparisons.

Table 7.17: Levene’s test of equality of error variances$^{a,b}$

<table>
<thead>
<tr>
<th>Pattern language development based on</th>
<th>Levene statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>60.618</td>
<td>4</td>
<td>188</td>
<td>0.000</td>
</tr>
<tr>
<td>Median</td>
<td>10.563</td>
<td>4</td>
<td>188</td>
<td>0.000</td>
</tr>
<tr>
<td>Median and with adjusted df</td>
<td>10.563</td>
<td>4</td>
<td>50.869</td>
<td>0.000</td>
</tr>
<tr>
<td>Trimmed mean</td>
<td>44.669</td>
<td>4</td>
<td>188</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: Tests the null hypothesis that the error variance of the dependent variable is equal across groups.  
$df =$ degrees of freedom  
a. Dependent variable: 7.000000  
b. Design: Intercept + Setting

The results indicate statistically significant differences in the means of Cohorts 1 (prior to input) and 4 (end of Year 3); Cohorts 2 (end of year 1) and 4 (end of Year 3); and Cohorts 3 (end of Year 2) and 4 (end of Year 3); No other significant differences were apparent, with Cohort 5 (end of Year 4) showing no significant differences when measured against all other cohorts (see Table 7.19). These results indicate that in terms of Research Question 3, the null hypothesis is rejected and the research hypothesis accepted. While there was statistically significant evidence of pattern language development, it must be recognised that this did not eventuate until the end of three years of preparation. Further, when pattern language was in evidence, it was at very low levels, below that which would be required to engage meaningfully with a community of practice (a score of 3 would be required for this, as described above).

Figure 7.4 shows the distribution of scores for all cohorts from prior to engagement (Year 0) to the end of final year (Year 4) at 95% CI.
Table 7.18: Multiple comparisons for pattern language development – Dunnett’s C test

<table>
<thead>
<tr>
<th>(I) Setting</th>
<th>(J) Setting</th>
<th>Mean difference (I–J)</th>
<th>Std. error</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lower bound</td>
<td>Upper bound</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.00</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0.00</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>-0.30’</td>
<td>0.098</td>
<td>-0.60</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>-0.10</td>
<td>0.048</td>
<td>-0.24</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0.00</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.00</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>-0.30’</td>
<td>0.098</td>
<td>-0.60</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>-0.10</td>
<td>0.048</td>
<td>-0.24</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0.00</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>-0.30’</td>
<td>0.098</td>
<td>-0.60</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>-0.10</td>
<td>0.048</td>
<td>-0.24</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0.30’</td>
<td>0.098</td>
<td>0.01</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0.30’</td>
<td>0.098</td>
<td>0.01</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.30’</td>
<td>0.098</td>
<td>0.01</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0.10</td>
<td>0.109</td>
<td>-0.12</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0.10</td>
<td>0.048</td>
<td>-0.04</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.10</td>
<td>0.048</td>
<td>-0.04</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>-0.20</td>
<td>0.109</td>
<td>-0.53</td>
</tr>
</tbody>
</table>

Note: Based on observed means.
The error term is Mean Square (Error) = 0.045.
* The mean difference is significant at the 0.05 level.
CI = confidence interval
7.2.4 Conclusion

As the results described above illustrate, and with reference to Research Questions 1–3, with a mean score of 6.81 on the STS, candidates entering PST preparation courses have no functional schema (defined earlier as a score of 30) for teaching students with diverse learning needs. What the results also indicate is that no significant change took place until the end of the third year of their preparation program, where a large increase is seen. This increase could, however, be due to recent teaching in a dedicated Inclusive Education subject. Even so, the scores apparent here are not sufficient to indicate functionality. This increase is then followed by a decrease by the end of the fourth year – just prior to graduation – where the mean score for this cohort drops back to almost the same mean as that shown by the cohort at the completion of Year 2. The most striking finding from the results of Study 2 is that at no point did participants show anywhere near the threshold level for a functional level of schema development allowing them to plan for the needs of diverse learners (planning knowledge) and execute these plans (execution knowledge). This is despite their year-on-year participation in a standards-based teacher-preparation program.

A similar outcome is described by the results for pattern language development, with mean scores of 0 at the commencement of a degree, and no evidence of development until the completion of Year 3. With a small rise to a mean of 0.3 (out of a possible 4), followed by a drop to 0.1 by the end of Year 4 (in a similar manner to that shown for
STS scores), there is little evidence of sufficient professional language to allow graduates to function in a community of practice. These findings will be examined in more detail in Chapter 8.

### 7.3 Study 3: The comparison study

For Study 3, students in the final semester of their teacher-preparation course from three universities, (including the Study 2 institution) were asked to complete the scenario-based instrument to determine the degree to which they had developed a schema for teaching diverse learners in mainstream settings. Additional benchmarking comparisons were made with a non-teaching course and a group having completed the final semester of a Master of Inclusive Education. These groups served as control/comparison groups and provided a term of reference for conclusions about the degree of schema development in graduates of the undergraduate courses.

Study 3 builds on and extends the findings of Study 2 (cohort design) in helping to develop a better understanding of the degree to which pre-service graduate teachers across a number of settings are prepared for teaching in diverse classrooms, particularly in the light of the results from Study 2, which showed little evidence of the development of a functional schema for practice in the Study 2 institution.

The data also serve to provide further evidence of construct validity across the study by showing the ability of the instrument to discriminate between disparate groups and ensuring that it does not exhibit a floor effect; a concern given the low scores in Study 2, although addressed in part by the Year 3 scores in that study. It would be expected that the master’s group, composed of experienced teachers with advanced qualifications, should be able to demonstrate adequate levels of schema development, thus an important comparison for Study 2. The addition of this group allowed the instrument developed in Study 1 to show sensitivity across a wide range of values for different groups of participants.

In particular, Study 3 will report on results for Research Questions 4–9 (Section 6.1.3), with the corresponding research and null hypotheses (where applicable).
7.3.1. **Research Question 4: Scores on the schema for teaching scale**

The descriptive statistics for this analysis are described in Table 7.20.

**Table 7.19: Descriptive statistics allowing determination of variances for Study 3**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>9.17</td>
<td>4.733</td>
<td>40</td>
</tr>
<tr>
<td>Site 2</td>
<td>8.33</td>
<td>3.819</td>
<td>57</td>
</tr>
<tr>
<td>Site 3</td>
<td>6.97</td>
<td>3.941</td>
<td>61</td>
</tr>
<tr>
<td>Masters</td>
<td>30.15</td>
<td>3.708</td>
<td>17</td>
</tr>
<tr>
<td>EP</td>
<td>5.28</td>
<td>2.396</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9.70</strong></td>
<td><strong>7.524</strong></td>
<td><strong>193</strong></td>
</tr>
</tbody>
</table>

*Note: Dependent variable: Pattern language development  
EP = exercise physiology*

What the data indicate is that none of the cohorts in the participant groups from the final-year cohorts at any university had developed a functional schema (defined earlier as a score of 30 out of a possible 40, or Level 3 on the STS). The minimum mean score was 6.97, with a maximum mean score of 9.17. While related to later questions, this data also indicate that graduates from a Master of Inclusive Education with experience in inclusive settings have attained a functional schema for practice with respect to the construct. The results also indicate that graduates from a professional field in another discipline have not developed a functional schema and thus, that the instrument is capable of detecting schema development, where it exists. This finding is further validated by the end of Year 3 cohort in Study 2 having shown a mean of 15.48 (see Table 7.12).

7.3.2 **Research Question 5: Comparison of pre-service teachers and master’s graduates on the schema for teaching scale**

In answering Research Questions 5, 6 and 7, a one-way ANOVA was conducted to evaluate the relationship between STS score and the particular cohorts from which participants had been drawn. The results of this analysis are reported below, with each of the research questions being separately examined in Sections 7.3.3 and 7.3.4 respectively. These results are summated in the conclusion for Study 3 (Section 7.3.7).
The independent variable for Study 3 included five levels: three separate sites for undergraduate participants in PST preparation, exercise physiology and master’s level graduates. The dependent variable was the score in the STS.

The descriptive statistics for Study 3 were described in Table 7.20. As this table shows, none of the sites had undergraduate scores indicating a functional schema. A functional schema was defined in the methodology as a Level 3 or above on the STS derived from Marshall’s (1995) definition of planning knowledge schema and Biggs and Collis’ (1982) relational level within the SOLO taxonomy. This level equates to a score of 30 on that scale. The results indicate that only the master’s comparison group has attained a mean equal to or above that score.

The ANOVA was significant, $F(4, 188) = 126.782, p < 0.001$. The strength of the relationship between the different sites (cohorts) and STS score, as assessed by $\eta^2$, was strong, with the cohort accounting for 73% of the variance in the dependent variable, as shown in Table 7.21.

**Table 7.20:** Results of one-way analysis of variance for schema for teaching score for Study 3

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III sum of squares</th>
<th>$df$</th>
<th>Mean square</th>
<th>$F$</th>
<th>Sig.</th>
<th>Partial etasquared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected model</td>
<td>7930.583$^a$</td>
<td>4</td>
<td>1982.646</td>
<td>126.782</td>
<td>0.000</td>
<td>0.730</td>
</tr>
<tr>
<td>Intercept</td>
<td>20600.820</td>
<td>1</td>
<td>20600.820</td>
<td>1317.337</td>
<td>0.000</td>
<td>0.875</td>
</tr>
<tr>
<td>Setting</td>
<td>7930.583</td>
<td>4</td>
<td>1982.646</td>
<td>126.782</td>
<td>0.000</td>
<td>0.730</td>
</tr>
<tr>
<td>Error</td>
<td>2939.987</td>
<td>188</td>
<td>15.638</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29028.000</td>
<td>193</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected total</td>
<td>10870.570</td>
<td>192</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Dependent variable: schema for teaching scale level*

a. $R^2 = 0.730$ (Adjusted $R^2 = 0.724$)

Follow-up post-hoc comparisons were conducted to evaluate pair-wise differences among the means. Tukey’s, REGWQ’s and Dunnett’s C tests were all completed. The variances ranged from 5.74 to 22.40 (see Table 7.20). Variances were not dramatically different from each other, with the exception of Cohort 4 (master’s). A test for homogeneity of variances (Levene’s test) was completed. This test proved not to be
significant, \( p = 0.109 \) (see Table 7.22), hence the results for Tukey’s and REGWQ’s tests were used for further analysis (see Table 7.23).

**Table 7.21: Levene’s test of equality of error variances\(^{a,b}\)**

<table>
<thead>
<tr>
<th>Schema for teaching level based on</th>
<th>Levene statistic</th>
<th>( df_1 )</th>
<th>( df_2 )</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.917</td>
<td>4</td>
<td>188</td>
<td>0.109</td>
</tr>
<tr>
<td>Median</td>
<td>1.937</td>
<td>4</td>
<td>188</td>
<td>0.106</td>
</tr>
<tr>
<td>Median and with adjusted ( df )</td>
<td>1.937</td>
<td>4</td>
<td>177.060</td>
<td>0.106</td>
</tr>
<tr>
<td>Trimmed mean</td>
<td>1.964</td>
<td>4</td>
<td>188</td>
<td>0.102</td>
</tr>
</tbody>
</table>

*Note: Tests the null hypothesis that the error variance of the dependent variable is equal across groups.\(^{a}\) \( df = \) degrees of freedom\(^{b}\)

Research Question 5 examined any differences between final-year PSTs and graduates from a Master of Inclusive Education. There were statistically significant differences in the means of the master’s cohort and all participants from sites where final semester undergraduate data were collected. As the descriptive statistics indicate and the ANOVA clearly shows (see Table 7.20), none of the undergraduate level participants attained a score that would be considered a functional level of schema for the construct, with mean scores of 9.17, 8.33 and 6.97 for the respective sites. Pair-wise comparisons indicate that, compared to the master’s mean of 30.15, there is a statistically significant difference between the master’s and all undergraduate cohorts. This leads to a rejection of the null hypothesis and an acceptance of the research hypothesis.

Fundamentally, this result indicates that while graduates from a master’s level degree have developed a schema for practice around the construct, the participants about to graduate as practicing teachers have not, although again there is some evidence of undergraduates moving toward a functional schema with the end of Year 3 cohort’s result (15.48). Unfortunately, as described in Study 2, this result washes out by the end of Year 4, rather than being built upon in the final year of the course.
Table 7.22: Multiple comparisons for schema for teaching scores for Study 3 – Tukey’s test

<table>
<thead>
<tr>
<th>(I) Setting</th>
<th>(J) Setting</th>
<th>Mean difference (I–J)</th>
<th>Std. error</th>
<th>Sig.</th>
<th>95% CI</th>
<th>Lower bound</th>
<th>Upper bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>Site 2</td>
<td>0.84</td>
<td>0.816</td>
<td>0.840</td>
<td>~1.41</td>
<td>3.09</td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>Site 2</td>
<td>2.21</td>
<td>0.805</td>
<td>0.051</td>
<td>~0.01</td>
<td>4.42</td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>Masters</td>
<td>~20.83</td>
<td>1.145</td>
<td>0.000</td>
<td>~23.98</td>
<td>~17.67</td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>EP</td>
<td>3.90</td>
<td>1.122</td>
<td>0.006</td>
<td>0.81</td>
<td>6.99</td>
<td></td>
</tr>
<tr>
<td>Site 2</td>
<td>Site 1</td>
<td>~0.84</td>
<td>0.816</td>
<td>0.840</td>
<td>~3.09</td>
<td>1.41</td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>Site 2</td>
<td>1.37</td>
<td>0.729</td>
<td>0.334</td>
<td>~0.64</td>
<td>3.37</td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>Masters</td>
<td>~21.67</td>
<td>1.093</td>
<td>0.000</td>
<td>~24.68</td>
<td>~18.66</td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>EP</td>
<td>3.06</td>
<td>1.069</td>
<td>0.038</td>
<td>0.11</td>
<td>6.00</td>
<td></td>
</tr>
<tr>
<td>Site 1</td>
<td>Site 2</td>
<td>~2.21</td>
<td>0.805</td>
<td>0.051</td>
<td>~4.42</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Site 2</td>
<td>Site 3</td>
<td>~1.37</td>
<td>0.729</td>
<td>0.334</td>
<td>~3.37</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>Site 2</td>
<td>Masters</td>
<td>~23.03</td>
<td>1.085</td>
<td>0.000</td>
<td>~26.02</td>
<td>~20.05</td>
<td></td>
</tr>
<tr>
<td>Site 2</td>
<td>EP</td>
<td>1.69</td>
<td>1.061</td>
<td>0.504</td>
<td>~1.23</td>
<td>4.61</td>
<td></td>
</tr>
<tr>
<td>Master’s graduates</td>
<td>Site 1</td>
<td>20.83</td>
<td>1.145</td>
<td>0.000</td>
<td>17.67</td>
<td>23.98</td>
<td></td>
</tr>
<tr>
<td>Site 2</td>
<td>Site 1</td>
<td>21.67</td>
<td>1.093</td>
<td>0.000</td>
<td>18.66</td>
<td>24.68</td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>Site 1</td>
<td>23.03</td>
<td>1.085</td>
<td>0.000</td>
<td>20.05</td>
<td>26.02</td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>EP</td>
<td>24.72</td>
<td>1.337</td>
<td>0.000</td>
<td>21.04</td>
<td>28.41</td>
<td></td>
</tr>
<tr>
<td>EP</td>
<td>Site 1</td>
<td>~3.90</td>
<td>1.122</td>
<td>0.006</td>
<td>~6.99</td>
<td>~0.81</td>
<td></td>
</tr>
<tr>
<td>Site 2</td>
<td>Site 1</td>
<td>~3.06</td>
<td>1.069</td>
<td>0.038</td>
<td>~6.00</td>
<td>~0.11</td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>Site 1</td>
<td>~1.69</td>
<td>1.061</td>
<td>0.504</td>
<td>~4.61</td>
<td>1.23</td>
<td></td>
</tr>
<tr>
<td>Masters</td>
<td>Site 1</td>
<td>~24.72</td>
<td>1.337</td>
<td>0.000</td>
<td>~28.41</td>
<td>~21.04</td>
<td></td>
</tr>
</tbody>
</table>

Note: Dependent variable: schema for teaching level
Based on observed means.
The error term is Mean Square(Error) = 15.638.
* The mean difference is significant at the 0.05 level.
CI = confidence interval;
EP = exercise physiology

Figure 7.5 shows the distribution of scores for all groups in Study 3. Figure 7.6 represents the same information at 95% CI.
Figure 7.5: Differences in schema for teaching scores for different sites and comparison groups

Figure 7.6: 95% confidence intervals for undergraduate sites and comparison groups

7.3.3 Research Question 6: Comparison of pre-service teachers and graduates from a different professional field on the schema for teaching scale

Research Question 6 examined any differences between final-year PSTs and a comparison group in the same stage of a degree in exercise physiology. Significant differences were apparent between the undergraduate participants from Site 1 and Site 2
and the exercise physiology cohort, although these were not apparent for participants from Site 3. As the descriptive statistics indicate and the ANOVA clearly shows (see Table 7.20), neither the undergraduate level participants, nor the comparison group attained a score that would be considered a functional level of schema for the construct, with mean scores of 9.17, 8.33 and 6.97 for the respective sites and 5.28 for the comparison group. Pair-wise comparisons (see Table 7.23) indicate that there was a statistically significant difference at the 0.05 level between the comparison group and Site 1 \( (p = 0.006) \) and Site 2 \( (p = 0.038) \); however, there was no significant difference for Site 3 \( (p = 0.504) \). This leads to an overall rejection of the null hypothesis and an acceptance of the research hypothesis, with some qualification, however, in that the mixed outcomes all indicated a very low base of schema development for all cohorts.

### 7.3.4 Research Question 7: Differences in final-year pre-service teachers across institutions

Research Question 7 explored any university-based differences that may be indicated across the institutions represented in the study. As the descriptive statistics indicate and the ANOVA clearly shows, there are no significant differences between any of the sites from which data were gathered for Study 3. This leads to an acceptance of the null hypothesis for this research question. Examination of the results for this question affirms that none of the final-year PSTs, about to enter the teaching workforce, have developed a functioning professional schema around the construct at any of the universities included in the study.

### 7.3.5 Research Question 8: Pattern language development in pre-service cohorts

Research Question 8 examined the development of pattern language in the PST cohorts across the different institutions represented in the study. The descriptive statistics for Study 3 are described in Table 7.24. As the table shows, none of the sites represented (or indeed the comparison groups) displayed sufficient mastery of pattern language for a professional level engagement in the community of practice. As with the scale reported in Study 2, a functional level of pattern language would be considered a Level 3 or above for that category on the STS. This equates to a score of 3 (out of a possible 4). All undergraduate participant sites had a mean marginally above 0, exercise physiology was 0, while master’s graduates had a mean score of 1.47. Given that the master’s graduates were experienced classroom practitioners who had recently completed a higher level
degree requiring use of pattern language, this result was somewhat surprising. This finding will be taken up in Chapter 8.

**Table 7.23: Descriptive statistics allowing determination of variances**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>0.10</td>
<td>0.304</td>
<td>40</td>
</tr>
<tr>
<td>Site 2</td>
<td>0.04</td>
<td>0.186</td>
<td>57</td>
</tr>
<tr>
<td>Site 3</td>
<td>0.03</td>
<td>0.180</td>
<td>61</td>
</tr>
<tr>
<td>Masters</td>
<td>1.47</td>
<td>0.943</td>
<td>17</td>
</tr>
<tr>
<td>EP</td>
<td>0.00</td>
<td>0.000</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0.17</strong></td>
<td><strong>0.527</strong></td>
<td><strong>193</strong></td>
</tr>
</tbody>
</table>

*Note: Dependent variable: Pattern language (maximum = 4). EP = exercise physiology*

### 7.3.6 Research Question 9: Differences in pattern language development across cohorts

In answering Research Question 9, a one-way ANOVA was conducted to evaluate the relationship between pattern language scores and the site or group from which participants had been drawn. The results of this analysis are reported in Table 7.25, and are summarised in the Section 7.3.7. This analysis also includes the comparison groups from the exercise physiology degree and the Master of Inclusive Education graduates.
The independent variable included five levels: three separate sites for undergraduate participants in PST preparation, exercise physiology and master’s level graduates. The dependent variable was the score obtained for the pattern language field from the STS.

Table 7.24: Results of one-way analysis of variance for pattern language development in Study 3

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial eta-squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected model</td>
<td>31.658&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4</td>
<td>7.914</td>
<td>68.569</td>
<td>0.000</td>
<td>0.593</td>
</tr>
<tr>
<td>Intercept</td>
<td>15.489</td>
<td>1</td>
<td>15.489</td>
<td>134.196</td>
<td>0.000</td>
<td>0.417</td>
</tr>
<tr>
<td>Setting</td>
<td>31.658</td>
<td>4</td>
<td>7.914</td>
<td>68.569</td>
<td>0.000</td>
<td>0.593</td>
</tr>
<tr>
<td>Error</td>
<td>21.700</td>
<td>188</td>
<td>0.115</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59.000</td>
<td>193</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Dependent variable: Pattern language  
<sup>a</sup> R<sup>2</sup> = 0.593 (Adjusted R<sup>2</sup> = 0.585)  
df = degrees of freedom

The ANOVA was significant, $F(4, 188) = 68.569, p < 0.001$. The strength of the relationship between the group and pattern language score, as assessed by $\eta^2$ was strong, with $\eta^2 = 0.593$ (see Table 7.25).

Follow-up post-hoc comparisons were conducted to evaluate pair-wise differences among the means. Tukey’s, REGWQ and Dunnett’s C tests were all completed. The variances ranged from 0.00 to 0.89 (see Table 7.24). While most variances were not dramatically different from each other, a test for homogeneity of variances (Levene’s test) was completed. This test proved significant, $p < 0.001$, hence the results for Tukey’s and REGWQ’s tests were disregarded (see Table 7.26). As Dunnett’s C test does not assume equal variances, this assisted in controlling for Type 1 error across the multiple pair-wise comparisons.
### Table 7.25: Levene’s test of equality of error variances\textsuperscript{a,b}

<table>
<thead>
<tr>
<th>Pattern language development based on</th>
<th>Levene statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>43.110</td>
<td>4</td>
<td>188</td>
<td>0.000</td>
</tr>
<tr>
<td>Median</td>
<td>23.302</td>
<td>4</td>
<td>188</td>
<td>0.000</td>
</tr>
<tr>
<td>Median and with adjusted df</td>
<td>23.302</td>
<td>4</td>
<td>48.839</td>
<td>0.000</td>
</tr>
<tr>
<td>Trimmed mean</td>
<td>41.251</td>
<td>4</td>
<td>188</td>
<td>0.000</td>
</tr>
</tbody>
</table>

\textit{Note:} Tests the null hypothesis that the error variance of the dependent variable is equal across groups. 
\textit{df} = degrees of freedom 
\( a \). Dependent variable: Pattern language 
\( b \). Design: Intercept + Setting

There were significant differences in the means of all groups when compared to the mean of the master’s group. No other significant differences were apparent, as shown in Table 7.27.
### Table 7.26: Multiple comparisons for pattern language development Study 3 – Dunnett’s C test

<table>
<thead>
<tr>
<th>(I) Setting</th>
<th>(J) Setting</th>
<th>Mean difference (I–J)</th>
<th>Std. error</th>
<th>95% CI</th>
<th>Lower bound</th>
<th>Upper bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>6</td>
<td>0.06</td>
<td>0.054</td>
<td>–0.09 0.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>0.07</td>
<td>0.053</td>
<td>–0.08 0.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>–1.37*</td>
<td>0.234</td>
<td>–2.08 –0.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>0.10</td>
<td>0.048</td>
<td>–0.04 0.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site 2</td>
<td>5</td>
<td>–0.06</td>
<td>0.054</td>
<td>–0.22 0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>0.00</td>
<td>0.034</td>
<td>–0.09 0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>–1.44*</td>
<td>0.230</td>
<td>–2.14 –0.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>0.04</td>
<td>0.025</td>
<td>–0.03 0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>5</td>
<td>–0.07</td>
<td>0.053</td>
<td>–0.22 0.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>0.00</td>
<td>0.034</td>
<td>–0.10 0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>–1.44*</td>
<td>0.230</td>
<td>–2.14 –0.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>0.03</td>
<td>0.023</td>
<td>–0.03 0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Master’s graduates</td>
<td>5</td>
<td>1.37*</td>
<td>0.234</td>
<td>0.66 2.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>1.44*</td>
<td>0.230</td>
<td>0.73 2.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>1.44*</td>
<td>0.230</td>
<td>0.73 2.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>1.47*</td>
<td>0.229</td>
<td>0.77 2.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP</td>
<td>5</td>
<td>–0.10</td>
<td>0.048</td>
<td>–0.24 0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>–0.04</td>
<td>0.025</td>
<td>–0.10 0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>–0.03</td>
<td>0.023</td>
<td>–0.10 0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>–1.47*</td>
<td>0.229</td>
<td>–2.17 –0.77</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Dependent Variable: Pattern language

Based on observed means.
The error term is Mean Square (Error) = 0.115.
* The mean difference is significant at the 0.05 level.
CI = confidence interval; EP = exercise physiology
Figure 7.7 shows the distribution of scores for all undergraduate sites and comparison groups at 95% CI.

**Figure 7.7: 95% confidence intervals for undergraduate sites and comparison groups**

In answering Research Questions 8 and 9, there is little evidence of pattern language development from any of the PST cohorts represented in Study 3. With mean scores of 0.10, 0.04 and 0.03 (from a maximum of 4 as the maximum score for any field in the REF) for these sites, the level of professional pattern language for meaningful engagement is negligible. As described in the literature review, this pattern language is seen as being necessary for practitioners in a field of practice to both engage with other practitioners as well as to advance their profession. For Research Question 9, the results indicate a rejection of the null hypothesis as there is a statistically significant difference for the master’s cohort. It must be recognised, however, that this difference, while significant, is still based on a low mean score (1.47) for that cohort.

### 7.3.7 Conclusion

As the results described above illustrate, and with reference to Research Questions 4–9 listed in Section 6.1.3, there are a number of important findings arising from this analysis. First, the instrument showed itself to be sensitive to detecting the presence of a schema (when it did exist) as well as to detecting different levels of schema development. The variation in mean scores, ranging from a low of 5.28 (exercise physiology in Study 3) through 15.48 (the cohort at the end of Year 3 in Study 2) to
30.15 (master’s level graduates in Study 3), with a range of mean and individual scores throughout, indicate that the application of the BAM allowed for the development of an instrument capable of fulfilling the aim of measuring schema.

Probably the most significant finding of both Study 2 and Study 3 is that there is no development of a functional schema for practice by any cohort at any institution, with the exception of the graduates from a Master of Inclusive Education. A functioning schema, defined as a Level 3 in the STS (or equivalent to an STS score of 30). With a score of 30.15, this master’s comparison group showed the capacity to address the scenario in appropriate ways so as to achieve a positive outcome. Mean scores of 9.17 (Site 1), 8.33 (Site 2) and 6.97 (Site 3) indicate little in the way of schema development from any of the cohorts about to graduate from the institutions participating.

The ANOVA indicated the difference in scores was statistically significant between the schema development of PSTs when compared to graduates with a Master of Inclusive Education across all three undergraduate sites examined. At the same time, there was no statistically significant difference between the mean scores of the undergraduate groups. There was also a small significant difference between the undergraduate groups from Sites 1 and 2 and the mean for the exercise physiology group, although not for Site 3 when it was compared to the exercise physiology group.

That the mean scores for a professional field with no classroom preparation shows little difference to those who have been studying teaching for four years is alarming.

When examining pattern language development, the results indicate no evidence of undergraduates from any of the three sites having developed an appropriate level of the pattern language required to engage collaboratively with professional practice. While there are statistically significant differences between the mean for the master’s graduates and all other groups, the results indicate that the baseline score for all groups is low, with 1.47 of a possible 4 for the master’s group and the next highest being 0.10 for Site 1. Given that the previous results for the STS indicated that the instrument is capable of detecting schema with no floor effect, these results would indicate that professional language development has not occurred in the courses, despite its importance for professional teaching practice.
7.4 Summary of results

This chapter has examined the results for the three studies described in the introduction and methodology. It has described the outcome of the process implemented to develop the STS, including validity and reliability information. The chapter then presented the results of using the STS within a cohort design at one institution to determine any year-on-year changes to schema and frequency of pattern language use as a result of engagement with a course preparing PSTs for classroom practice. Finally, it presented the results of further implementation of the STS in a comparison study with final-year PSTs at three separate institutions within NSW. Also included in Study 3 were a cohort of graduates from a Master of Inclusive Education and a cohort of undergraduates in their final semester of a degree in exercise physiology. Taken together, what these results show is that it is possible to develop an instrument with good levels of validity and reliability to measure schema.

When applied to a cohort study, the instrument showed that there was little evidence of the development of a schema as PSTs progressed through their course. The instrument did show some development at the end of their third year. This schema was not, however, consolidated by final-year course input and, in fact, appeared to dissipate.

Application of the instrument to PSTs in the final weeks of their preparation indicated little evidence of schema development across three institutions. The master’s comparison group showed that development of a professional and functional schema for practice is possible, also showing the instrument was not subject to floor effects and was able to detect schema development (when it did exist) in a cohort of participants. Comparing results to a cohort in the final session of another professional qualification showed some, although quite minor, differences.

In terms of examination of pattern language for all groups, no substantial level of pattern language was apparent in the responses of any of the cohorts from whom data was collected. Discussion of these results and their implications will be undertaken in the next chapter.
Chapter 8: Discussion

This chapter will draw on the prior sections of the dissertation to summarise, interpret and explain the findings described in Chapter 7. It will consider the implications for practice and suggestions for future research, and identify the limitations of the study.

This investigation examined the thesis that beginning teachers, on graduation from a program of PST preparation, should have developed a schema for practice and the capacity to describe the planning and execution of a teaching response to the demands of an inclusive classroom. Further, this schema should develop in a year-on-year manner, as the PST’s engage more deeply with the learning experiences included in a standards-based teacher-preparation program. The schema developed would be expected to reflect the extant research about what constitutes best practice in the field, taught to a level reflective of the graduate standards for beginning teachers. These standards describe the requirements for the design and accreditation of teacher-preparation programs, and the expected capabilities of graduates.

This research sought to develop a valid and reliable instrument for measuring teacher schema, and then applied that instrument to determine whether such a schema developed over the course of a PST’s preparation experience and on graduation from a number of different universities. As with both the methodology and the results, the discussion for each study cannot be considered in isolation from each other. The inter-relationship between the discussion sections for each study, as with previous sections, both informs and is informed by the other studies. This inter-relationship is described in Figure 8.1, below.
8.1 Overview of the research and data collection

To test the thesis, three studies were conducted. Study 1 developed a valid and reliable instrument, the STS, to objectively measure the schema development of participants. The STS requires participants to generate a written response to an authentic scenario. Data informing this study were collected within the framework of the BAM (Goldfried & D’Zurilla, 1969) including an examination of literature on teaching standards (both national and international); a synthesis of Marshall’s (1995) schema knowledge levels and Biggs and Collis’ (1982) SOLO taxonomy; the views of expert judges; and the use of pilot groups.

Study 2 employed the STS in a cohort design to examine the year-on-year development of a schema in participants as a result of being engaged with a course of PST preparation. Data for this study were collected by evaluating cohorts of PSTs from one site representing those about to begin their courses (designated Year 0 and collected during orientation week), year-on-year (designated Years 1–3, collected on campus) through to those about to graduate from their courses (designated Year 4, collected upon participants’ return to the institution after completion of their final practicum).

Study 3 employed the STS in a comparison study to examine graduate-level schema development from three different providers of PST education within the NSW.
jurisdiction. This study also included a cohort of participants who were graduates from a Master of Inclusive Education as well as a cohort who were about to graduate from a degree in exercise physiology. The latter two comparison groups served a number of purposes. The master’s cohort was included to determine whether the instrument was sensitive to the schema development of an expert group of teachers, while the exercise physiology group was employed to provide a comparative baseline with a group of graduates who would not be expected to possess a professional schema for teaching in an inclusive classroom. The inclusion of these groups was intended to provide a relative response range that could be used to place the responses of the PSTs in context. The exercise physiology cohort also served in helping to address potential threats to validity (e.g. maturation effects).

The outcomes for each of the studies are discussed below.

8.2 Discussion of the research findings for Study 1: Instrument development

A number of researchers have sought to measure the schema development of individuals engaged in programs of PST preparation (Adams & Krockover, 1997; Hollingsworth, 1989; Kettle & Sellars, 1996; Wilson et al., 2002). These studies, however, have exhibited a number of limitations, including those directly associated with the data-collection procedures. Primary among these limitations is that previous studies have implemented data-collection techniques requiring high degrees of inference. In her review of studies examining the professional growth of pre-service and beginning teachers, Kagan (1992) found that 36 out of 40 studies examined used approaches such as self-reporting, interview data and reflective writing as data-collection approaches, rather than a more objective measure such as the one developed for the current research.

Other studies not included in Kagan’s (1992) review showed similar limitations. Self-reporting of attitudes and beliefs was a common data-gathering methodology in studies by Grossman and Richert (1988), Hollingsworth (1989), and Kettle and Sellars (1996), and frequently through interviews (Adams & Krockover, 1997), even though some studies (e.g. Kettle & Sellars, 1996) also involved small-scale observational data. Stone et al. (2009) describe such data-gathering techniques as being potentially challenging in that they present a number of issues and are difficult to accurately verify. The use and need for well-validated external measures as a complement has been described as a
source of significant improvement in the accuracy of such research (Fan et al., 2006), especially when participants are required to go beyond recall of events into inference and prediction (Podsakoff & Organ, 1986).

While recognising that measuring cognitive processes always requires some degree of inference, the current research aimed to develop a methodology that reduced this inference with a more objective measure. This measure allowed participants to provide a response that was more indicative of schema development, using an approach to data collection through written responses to scenarios, that has (along with observational data) been described by Marshall (1995) and Goldfried and D’Zurilla (1969) as appropriate for examining schema development. Implementing such a measure was significant in overcoming the limitations of previous approaches, identified above.

Study 1 used the BAM (Goldfried & D’Zurilla, 1969) in developing an authentic scenario-based problem and a REF allowing the schema development of participants to be objectively measured in a valid and reliable manner as an approach to address the limitations of previous studies. The BAM has been used for developing measures, such as the one developed for this research, aimed at exploring behaviour-environment interactions (Goldfried & D’Zurilla, 1969, p. 163). Studies by Bain (1991), Loumidis (1993) and Obrusnikova and Dillon (2011) are examples of the successful implementation of the approach.

The REF developed to facilitate judgements as to the level of schema development exhibited by participants drew on research, graduate standards (AITSL, 2011) and the well-established SOLO taxonomy (Biggs & Collis, 1982) in its development. The combination of the BAM (Goldfried & D’Zurilla, 1969) to frame the instrument development, Marshall’s (1995) work on schema development and SOLO (Biggs & Collis, 1982) was crucial in contributing to the content validity of the study. At the same time, construct validity was established by the use of comparison cohorts. Although there was some initial concern with the instrument due to the low levels of schema evidenced in PST cohorts, the instrument proved to be robust in being able to detect schema in a master’s degree cohort as well as the cohort of participants at the end of their third year of preparation. The detection of more sophisticated schema development in both of these samples showed that the instrument was capable of producing variability in scores where the features assessed were present. The sensitivity of the instrument was also supported by its capacity to detect minimal schema in the non-
teaching comparison group. Examination of the validity and reliability characteristics indicated strong construct validity in relation to the differential scores obtained, while content validity was enhanced by use of the BAM (Goldfried & D’Zurilla, 1969) for the instrument development, coupled with the existing research on effective teaching and standards. The reliability measures reported in Chapter 7 indicate a robust level of test-retest reliability, as well as strong inter-rater reliability.

From the perspective of validation, few previous studies have used data-collection methods or instruments that have been subjected to the level of validation that would ensure a strong level of validity and reliability, and none have conducted research at the scale of this study. While Kam et al. (2012) used practitioner consultation in the early stages of a scenario approach in law, no other validity or reliability measures were reported for their data collection. Their sample consisted of four undergraduate law students and six practitioners. In Janing’s (1997) study with paramedics, the researcher recognised validity issues associated with maturation as being a significant threat to the measurement methods adopted. With Janing’s study, the inclusion of 55 participants did, however, strengthen the methodology adopted. Gahan and Lawrie’s (2011) study with undergraduate science students developed scenarios and marking criteria, with no reported validation steps for the scenario or scoring criteria, apart from trialling scenarios aimed at undergraduate science students with available post-graduate students.

This study addresses these concerns in several ways. First, in terms of scale, it has reported results drawn from a total of 346 participants from multiple settings, all engaged in activities related to the independent variables used to support its validity. Data on this scale are far more likely to be generalisable to other settings and programs than the small-scale studies previously described.

The second major concern involves having a more direct indicator of the environment-behaviour interaction. This study provides the latter, albeit mediated through written responses. Such responses are described by Marshall (1995) and Goldfried and D’Zurilla, (1969) as being a strong method of data gathering where direct observation is not feasible.

Further, Study 1 adopted a disciplined framework (the BAM) within which to develop the instrument. This framework allowed for an approach that recognised and addressed potential threats to validity, while at the same time applying recognised approaches to instrument development in terms of ensuring psychometric properties.
Given the conditions discussed above and the approach described in the methodology, the instrument was deemed appropriate and robust for the conduct of Study 2 and Study 3.

The following sections will discuss how the findings of this research relate to the research questions described for each study.

8.3 Discussion of the research findings for Study 2: The cohort study

Study 2 examined the degree to which participants entering PST education had already developed a schema for practice, the impact of preparation programs on the evolution of that schema, and evidence of the evolution of pattern language as a result of engagement with preparation programs. In the literature review, it was established that a body of research existed on which a schema could be based, including evidence-based teaching practice, and the existence of standards that guide the design, development and delivery of teacher-preparation programs. These standards represent efficacious practice in those programs.

Each of the research questions examined is discussed in the following sections.

8.3.1 Research Question 1

To what extent do students entering PST education courses possess a schema for professional practice with respect to teaching students with diverse learning needs in mainstream classrooms, based upon responses to the STS?

Research on cognition describes how individuals build schema through their interactions with the world around them (Kirschner et al., 2006; Marshall, 1995; Piaget, 1936). This building of knowledge structures, or learning, allows individuals to function within their environment, as schema are developed within long-term memory, thus allowing for individuals to focus on what is happening around them, without processing structures being ‘cluttered’ with day-to-day material (Sweller, 1994). These schema influence the behaviours of individuals within their environments.

Borg (2003, 2015) describes how the prior influences of individuals undergoing programs of PST preparation are important in designing programs. As described above, all PSTs have attended school, and therefore have had an experience of school
environments. As a result of this engagement with education, PSTs have significant ideas about aspects of teaching practice, the role of the teacher and the implementation of this role in classrooms (Bullough, 1987; Calderhead & Robson, 1991; Grossman, 1989; McDaniel, 1991).

The scores achieved by this cohort (indicating an SDL in the 0–1 range) are indicative of minimal knowledge or strategies expected of a professional working in classrooms. While this cohort of PSTs has, as described, been immersed in an educational environment for a significant timeframe, this has been in their role as learners. This immersion as a learner, while contributing to some preconceptions about teaching, was not aimed at developing the professional knowledge and skills of a classroom practitioner. Without deliberative approaches to deconstructing these prior conceptions within teacher-preparation programs (Adams & Krockover, 1997; Lim, Thaver & Slee, 2008), PSTs maintain them as the major basis of their beliefs about teaching (Borg, 2003; Calderhead & Robinson, 1991; Kagan, 1992). Hence, the results indicating PSTs enter their programs with no effective schema for practice is unsurprising. Similarly, it would not be expected, for example, that being a patient would translate into sophisticated competency within the professional knowledge of medicine. It would be unrealistic to expect a fully professional, well-developed response on entry to a preparation program, although it would perhaps be expected that PSTs possess some ideas about classroom practice based on their experiences as school students.

This research question raises the issue of whether, as learners in classrooms, the PSTs in this study have experienced sufficient consistency with standards-referenced professional teaching practice to enable them to gain an understanding of these practices. Bain (2007) describes a longitudinal research program in a school setting that showed when exposed sufficiently to evidence-based practices in a setting where these were being used by all (or most) classroom teachers, students built an understanding of these practices from their perspective as learners. This understanding was sufficient to allow students to provide feedback on the integrity with which teaching practices were employed, as they became familiar with the structures of each approach. However, this set of circumstances emerged from an intense reform effort where students experienced evidence-based practice by their teachers consistently over a multi-year period. Existing research on schools and school reform suggests that this kind of experience with research-based practice at whole-of-school scale is unlikely in the normal school experience of students (Goodlad, 1984; McLaughlin & Talbert, 2001). This finding also
clarifies the distinction between perceptions of teaching by students as opposed to an understanding of teaching as a professional endeavour.

### 8.3.2 Research Question 2

To what extent is there evidence of the development of a schema for teaching students with diverse learning needs in mainstream classrooms of PSTs from a baseline to the end of each year, as they progress annually through their course?

In examining the year-on-year development of schema resulting from engagement in a PST preparation program, a number of perspectives require consideration. Research on the effect of PST preparation on the cognition and behaviours of graduates has been somewhat inconclusive, with some studies indicating little impact (Kagan, 1992), while other studies indicate that these programs do influence the behaviours of beginning teachers (Adams & Krockover, 1997; Hollingsworth, 1989).

Borg (2003) describes a number of influences on the cognition of teachers, including their own schooling (as previously mentioned), the professional coursework in which they had engaged and their classroom practice experiences. The knowledge about how individuals develop schema was described in Section 8.3.1. It would be reasonable to assume that individuals, even with a minimal schema development on entry to a preparation program, would, on completion of their program possess a schema for practice allowing them to operate at a professional entry level. Further, a gradual development of this level of professional schema would be expected to develop in a year-on-year fashion, as PSTs progressively engage with more complex materials within their program, and given the program’s referencing to standards of practice.

The results from Study 2 show that when such a schema is framed using existing best practice and standards as terms of reference, as would be the case in most fields and given the literature validating standards of practice as a driver for teacher-preparation programs, this was not the case.

While there were some statistically significant differences detected by the ANOVA, what stands out is the lack of any sequential and progressive pattern of schema development (Kirschner et al., 2006; Marshall, 1995). Further, while statistically significant, the scores achieved by each of the groups were not of any practical significance in terms of functional schema development. Indeed, the cohort that showed statistically significant differences from all other groups was one that had recently
completed a dedicated inclusive education subject – skills that were not evident over the following 12 months for the cohort about to graduate. What stands out from the data collected is that no PST cohort from this study attained what would be considered to be a functional level of schema development. At the same time (as will be described in the discussion for Study 3) the results from the master’s comparison cohort showed that the instrument could detect a schema from responses, when such a schema was present.

These findings are important because, while the literature on schema development indicates that PSTs may have strong perceptions of traditional typologies for successful classroom practice (Borg, 2003; 2015; Weinstein, 1990; Wilson et al., 2002), as noted previously, these perceptions should not be confused with possessing a depth of professional knowledge based upon the research and standards that students are expected to meet to be effective classroom practitioners. This is particularly so with respect to being an effective practitioner with the capacity to meet the needs of students with disabilities in inclusive classrooms. The results of Study 2 show the importance of challenging these preconceptions within programs and creating the cognitive dissonance necessary for the development of a professional schema for practice (Holt-Reynolds, 1992; Kagan, 1992; Weinstein, 1990).

While not an evaluation of teacher-preparation programs, which is beyond the scope of this research, the results raise questions about how a program can meet accreditation requirements without producing graduates that meet the standards on which accreditation is based, especially as a similar lack of outcomes was demonstrated across three sites.

8.3.3 Research Question 3

To what extent does the frequency of pattern language associated with teaching students with diverse learning needs in mainstream classrooms of PSTs develop from a baseline as they progress through their course?

In discussing the findings for pattern language use within this study, it is important to give consideration to the role of professional language in transacting the business of a profession. From a theoretical perspective, both communities of practice (Lave & Wenger, 1991) and self-organising systems (Bain, 2007; Davis & Sumara, 2006) would expect the evolution of a capacity to use the language of a field as an individual engages with and progresses through a program, moving from novice to expert (Drengenberg &
Pattern language allows for discussion about the shared practice, as well as allowing individuals to build relationships with others within the community. Evolution of pattern language occurs in conjunction with that of an individual’s schema development, as discussed in previously.

Existing research (Bain et al., 2009; Lancaster & Auhl, 2013) indicates that it is possible to build skills in professional pattern language, although the present study shows little evidence of pattern language development. While close examination of the results for this research question indicates that there are some statistically significant differences between cohorts (with the end of Year 3 cohort again attaining the highest results, as with the STS outcome), the low base is the most prominent finding. While the results (as with schema development) may indicate statistical significance, they are not of practical significance. With no evidence of pattern language development until the third year of engagement with the program (with this possibly due to recent instruction through the inclusive education subject material), and then only a small usage detected, graduates would be unlikely to have the capacity to engage in conversations with their peers based on professional language.

This finding further reinforces the result for schema development, where knowledge and understanding of a field develop in concert with the language of the field. Here, both schema and pattern language are absent. As such, these findings for pattern language demonstrate little evidence that the programs are building capacities that Bowker and Star (2000) would consider to be evidence of professional practice that reflects the graduate standards on which preparation programs are based.

8.4 Discussion of the findings from Study 3: The comparison study

This study examined a number of aspects associated with schema development for graduates from PST preparation programs. It examined the schema development of final-year PSTs (just prior to graduation) across three major providers including the provider in Study 2, before extending this examination to graduates from a Master of Inclusive Education and to final-year undergraduates studying in a different professional field (in this case, a degree in exercise physiology). The study then examined any differences that were apparent across the three institutions represented. Finally, it examined evidence for any development of pattern language development in final-year
PSTs across all institutions, and any differences that were apparent between these institutions.

Each of the research questions examined is discussed in the following sections.

8.4.1 Research Question 4

Have PSTs in their final year of university, in any of the institutions represented in Study 3, developed a functioning, professionally developed schema for teaching students with diverse learning needs in mainstream classrooms? This schema equates to a Level 3 (a score of 30) or above from the STS, derived from Marshall’s (1995) definition of planning knowledge schema and Biggs and Collis’ (1982) relational level within the SOLO taxonomy.

This question examined whether final-year PSTs, just prior to graduation from their program, had developed a functional schema for practice, with respect to teaching students with disabilities in mainstream classrooms. The instrument developed to gather data to respond to this question was established within a disciplined framework (the BAM), based on an extensive body of literature describing what constitutes best practice in education, generally (Fraser et al., 1987; Hattie, 2003, 2009; Marzano, 1998, 2000), and in inclusive education more specifically (Ashman & Elkins, 2012; Florian & Black-Hawkins, 2011; Jordan et al., 2009). Further, the instrument was developed using the same set of graduate-level teaching standards against which programs of initial teacher education offered by providers are accredited and against which graduates are judged (AITSL, 2011).

Literature on what has been termed “human cognitive architecture” (Kirschner et al., 2006, p. 76), indicate an expectation that as individuals are exposed to scaffolded, progressively more complex ideas in a given field, schema development takes place, such that responses to familiar situations do not require working memory and an individual can respond in a known situation without effort (Kleider et al., 2008; Paas et al., 2010). These schemas are described as being essential for practitioners to operate in their field effectively, as without them the cognitive load associated with problem solving in a field is too great to allow practitioners to attend to newer, novel situations (Marshall, 1995; Sweller, 1988, 1999).

The results for this research question indicate that for the participants in Study 3 there is little evidence of the expected schema development having taken place. With mean STS
scores of 9.17, 8.33 and 6.97 respectively from each of the sites from which participants were obtained, each of the cohorts lies in the schema development range of 0–1 (described in Table 7.4). This range is such that there is little evidence of an understanding of an appropriate professional response to the scenario and little indication of an understanding of valid strategies to address the scenario – a scenario that has been validated as one the PSTs from this study will shortly confront.

This research question allows the conclusion to be drawn that final-year PSTs have not developed a functional schema for practice around the construct examined in this research, and extends the finding from the cohort involved in Study 2 to other institutions. The findings of Study 3 support concerns about the preparation experienced by participants from a number of major providers in NSW. None of the pre-service teacher program providers from which data were collected for this research indicated evidence of functional schema development by graduates. This is despite all participants having engaged with course based materials associated with meeting the needs of diverse learners (as required by the jurisdiction), including differentiation, assessment of learning, approaches to tiered learning, collaboration and teamwork and the creation of inclusive learning environments.

This finding may indicate that there is inadequate consideration given to the depth of treatment, scope and sequence of different aspects of the program content and scaffolding skill development at a program level. It may also bring into question whether these programs have enough focus, depth and continuity for schema development to occur related to the standards of practice they are designed to meet. Perhaps, further, it raises questions as to the teaching standards themselves, around which these courses have been constructed, and whether or not these standards reflect sufficient explication and evidence-based protocols around practice to give the comparability and visibility described by Bowker and Star (2000) as being essential for a profession to develop within an evidence-based framework.

**8.4.2 Research Question 5**

Are there statistically significant differences in the schema development of PSTs for teaching students with diverse learning needs in mainstream classrooms in comparison to graduates of a Master of Inclusive Education?
In examining the differences in schema development between PSTs in their final year and graduates from a Master of Inclusive Education, the design of the master’s level program must be considered. This program is based on an approach that is explicitly aimed at developing a well-scaffolded, sequential program. Zundans-Fraser (2014) describes how programs based in theory and carefully built around desired graduation outcomes prove efficacious when building the knowledge and skill bases of their graduates.

A similar body of literature as has been described for the Research Question 4 is also relevant here. What must also be considered is that the master’s level graduates had all completed undergraduate teacher-preparation programs, and had recently completed their post-graduate studies after significant experience as classroom practitioners in inclusive settings. At the same time, it must be recognised that the task was constructed around expectations for graduate-level teachers, thus should present as an example of basic common practice for this cohort.

As described earlier, the literature on schema development and human learning describes how exposure to well-scaffolded information in a given area progressively shapes schema, as new ideas are built into existing knowledge (Marshall, 1995; Paas et al., 2010; Sweller, 1988, 1999). Graduates from the master’s cohort had extensive classroom experience engaged with a purposeful program of study in the field of inclusive education. The design of the program focussed on building capacity with the professional knowledge and skills described in literature as being required for effective inclusive practice (Zundans-Fraser, 2014). This cohort showed evidence of having undergone this schema development process and having built a purposeful schema for practice.

The data informing this question clearly show that the mean result for graduates from the master’s cohort (30.15) places them on average in the highest category of schema development, Level 4. This is a level that would be considered functional for addressing the scenario described and is indicative of a capacity to respond appropriately, with numerous valid strategies and a clear plan of action. This stands in stark contrast to the undergraduate PST cohort, where no functional schema was apparent. This result would indicate that the evidence of schema development shown in the results is due to either the experience these participants have had since they moved into classroom practice, their post-graduate program, or some combination of these two factors.
There are a number of conclusions that can be drawn from this finding. The first of these is around the instrument itself and its capacity to detect schema, as has been discussed earlier. This cohort provided evidence that the instrument is sensitive to the full range of possible scores, and no floor effect was apparent. The second, more important conclusion that can be drawn is that individuals, when engaged in a theory-based degree structure intentionally designed to scaffold mastery of essential knowledge and skills and building capacity of practitioners as change agents (Zundans-Fraser, 2014), have the capacity to develop the knowledge and skills necessary to ensure that the education of all students within an inclusive setting is a positive learning experience.

### 8.4.3 Research Question 6

Are there statistically significant differences in the schema development for teaching students with diverse learning needs in mainstream classrooms of pre-service educators in comparison to those studying in another professional field?

This research question examined the schema development of a cohort of pre-service exercise physiologists using the STS. It was expected that this cohort, not having engaged in any PST education, would have a schema that was statistically significantly different to participants whose program had been in the field of teacher preparation.

The literature describing the ways in which individuals learn and develop schema has previously been described in discussing the research questions related to schema development above (Marshall, 1995; Paas et al., 2010; Sweller, 1988, 1999). Primarily, this literature indicates that individuals build cognitive structures as a result of their experiences. Given the differences in the experience of exercise physiology and the nature of the STS it was expected that pre-service professionals in exercise physiology would build a schema for practice in their field, rather than in teaching, by engaging in progressively more complex and scaffolded learning experiences, carefully developed throughout the duration of their program.

The data reported in the results indicate that this statistical difference was observed between the exercise physiology group and participants from Sites 1 and 2, but not, however for Site 3. While it would be expected that the mean for the exercise physiology cohort (5.28) would indicate little schema development in teaching for this group of participants, of note is the finding showing the performance of the PSTs was not functionally different from the students who had studied exercise physiology.
The practical implications are that there are no meaningful differences between any of the cohorts. This finding indicates that there are significant concerns with the outcomes of existing teacher-preparation programs related to the extent to which they are meeting the standards against which both they and their graduates are accredited.

8.4.4 Research Question 7

Are there statistically significant differences in schema development for teaching students with diverse learning needs in mainstream classrooms of PSTs in their final year of university across the institutions represented in this study?

This research question sought to determine if there were any statistically significant differences between any of the institutions from which participants were drawn for this study. The appearance of any such differences may allow for the identification of institutions where the program being followed by PSTs is designed in a way that produces greater schema development. Given that all PST preparation programs within the jurisdiction are governed by the same set of accreditation standards (and that these are also the same set used in developing the instrument developed for data gathering), such differences could also be an outcome of a higher level of embedding of the standards in the learning experiences of the program, or possibly the implementation of a better approach to treating the content related to those standards resulting in more effective schema development. This study sought to identify whether any such idiosyncrasies were able to be identified. The findings of this study did not find any such idiosyncratic results, suggesting that there is the potential for the factors causing such low levels of schema development to be consistent, more widely, across other teacher-preparation programs within the jurisdiction.

Research describing the ways in which individuals develop schema has been described in discussing previous research questions. Researchers such as Marshall (1995), Paas et al. (2010) and Sweller (1988, 1999) all delineate how individuals construct schema as a result of the different experiences they encounter in their environment. The data reported in the results for this study indicate that there were no university-based differences apparent from any participants just prior to graduation from PST programs. As has been reported and discussed above, the outcomes for participants from all sites in the study indicate that there was no functional level of schema development apparent.
The perhaps unfortunate conclusion that can be reached from the answer to this research question is that, based on the sites represented in the study, none of the institutions involved is presenting programs that produce differences in schema development at a level expected from a four-year engagement with a standards-based teacher-preparation program.

8.4.4.1 Research Question 8

To what extent is there evidence of pattern language use associated with teaching students with diverse learning needs in mainstream classrooms of PSTs on completion of their preparation program across all institutions represented in this study?

This research question investigated the extent to which there was evidence of pattern language use across all cohorts of graduate-level PSTs, just prior to their graduation. As discussed in Study 2, pattern language is important in helping individuals engage with others in the field. The development of pattern language occurs alongside that of schema, in a reciprocal manner, as practitioners move from novices within a field to becoming experts (Sweller, 1988). That is, pattern language develops through use and needs a community to allow this usage.

The development of schema, and its associated pattern language, is also described within the literature on self-organising systems. While Elmore (1996) comments that very few teachers have developed sufficient schema knowledge to instantiate a complex pattern language, research has found that proficiency with pattern language use can be developed when it is deliberately designed into programs as a specific outcome (Bain, 2007; Bain et al., 2009; Lancaster & Auhl, 2013).

In the case of a profession, schema exist not only as an individual construct, but are also associated with the field of practice at an organisational level (Bain, 2007; Morrison, 2002). For graduate-level teachers to be effective practitioners, engaged with others within the profession, this individual schema needs to resonate with the organisational schema of the community and be supported by a high level of pattern language proficiency.

What the data clearly illustrate is the absence of any significant usage of pattern language from any of the final-year cohorts from this study. In addition, the data show that there were no statistically significant differences in the frequency of pattern language use between graduates of PST preparation programs and graduates from a
program preparing individuals to practice as exercise physiologists. Further, based on the outcome for the master’s cohort discussed below, it appears unlikely that this capacity will be developed in the course of their professional experience.

While there was a statistically significant difference between graduates from the master’s level cohort and all undergraduate groups, it should also be noted that this difference is grounded on a very small baseline mean (1.47) for the master’s cohort.

This discussion leads to the conclusion that the frequency of professional pattern language use from all cohorts from whom data was obtained for this study is negligible. None of the undergraduate cohorts displayed sufficient frequency to engage meaningfully in a professional community, while the mean level for master’s graduates was also minimal. This lack of professional pattern language has the potential to have a significant impact on the graduate teachers studied, limiting their capacity in being able to function successfully in collaborative groups engaged in professional problem solving. Clearly, current PST preparation programs do little to develop the capacity of graduates to engage in professional conversations in a consistent manner, while for the master’s graduates, if a significant level of pattern language use has existed, there has been insufficient use and reinforcement in their current settings for that to be maintained. The research-to-practice gap has been identified in the literature review as problematic within teacher-preparation programs (e.g. Grima-Farrell, 2012). The results of this study suggest that there may be a lack of adequate drivers within the field to reinforce pattern language use, such that even practitioners with a well-developed schema for practice are not encouraged to persist with its usage. Further research into the use of pattern language with teaching practice would be worthwhile to further explore this finding.

8.4.5 Research Question 9

Are there statistically significant differences in pattern language development for teaching students with diverse learning needs in mainstream classrooms of PSTs in their final year of university, based on the institutions represented in this study?

From the perspective of pattern language development, the literature relevant to this question is described in Research Question 8. The question was designed to permit investigation of any differences that may be apparent in the programs offered from
different settings. Was, for example, one institution offering a program that resulted in significant differences from other programs?

The data clearly report that there are no statistically significant differences between the graduates from any of the PST preparation programs with regard to the frequency of their professional pattern language use. This result is consistent with other findings in the cohort study (Study 2) and the findings from the previous question. None of the sites produced mean values that would constitute sufficient frequency to effectively engage in professional conversations (mean values of 0.1, 0.04 and 0.03 from a maximum of 4 from Sites 1, 2 and 3 respectively).

This finding affirms the low likelihood that graduates would be able to actively participate in collaborative problem solving using shared professional language. For the graduates, this inability limits their capacity to learn from, and contribute to, the field within a practice community (Lave & Wenger, 1991; Wenger et al., 2002), while for the field, it limits the capacity to progress toward a shared ideas of the practice and the characteristics described in the literature as necessary for a profession (Bain & Drengenberg, 2016; Bowker & Star, 2000).

As with the previous research question, the conclusion that can be reached from this finding is that none of the programs from the institutions participating in this study showed a capacity to build a body of professional pattern language within their graduates. This lack of capacity calls into question whether graduates of the programs studied can meet the requirements of successful functioning normally associated with communities of practice, and indeed the characteristics of a professional field.

8.5 Implications for practice

What is clear from this study is that, first and foremost, a need exists to understand why the programs undertaken across the sites used for this study could not produce the graduate-level schema development that would be expected. Arising from the findings are questions about what kind of scope, depth and coherence in program design and delivery is required to ensure that students have basic practical professional knowledge, the language to express their ideas in a manner consistent within the field and the capacity to create more professional control of their teaching practice. This is particularly so should this work be replicated by the findings of similar studies. These questions are not unlike the conclusions of reports into initial teacher-education.
programs such as those described by Craven et al. (2014) and Ingvarson et al. (2014). In re-examining programs of teacher preparation in a manner that may have a greater impact on professional schema development, consideration needs to be given to designing curricula from the program level down, rather than focussing effort at the subject level without necessarily considering the necessity to connect these appropriately. The type of knowledge and skills indicated by the professional standards, such as the capacity to differentiate learning, scaffold learning materials, select teaching strategies and manage the complexities of inclusive environments need to be progressively revisited and built across courses. Doing so would help in ensuring that the depth of treatment along with the scope and the sequence of different aspects of the program content are carefully and deliberately scaffolded to facilitate their progressive development.

The question must also be asked as to the level of guidance provided by the standards and their efficacy in assuring the development of graduate capacity. The finding that none of the undergraduate cohorts developed a functional level of schema suggests that work needs to be done (at least in the programs represented) to ensure that standards are underpinned by a clear understanding of the practices they represent and that those practices find their way into the repertoire of graduate teachers and/or that the process and approaches for translating standards into the extant practice of teacher preparation is improved. The latter also suggests the need to consider the extent to which accreditation processes (in the institutions studied) are genuinely working to assure graduate outcomes, and in this case schema development.

8.6 Limitations and suggestions for further research

There are a number of limitations of this research that need to be acknowledged. Shadish et al. (2002) indicate that the results of cohort studies, as implemented in Study 2 of this research, must be interpreted carefully. While they are described by these authors as useful for the establishment of association between variables, showing causality is described as difficult to establish as the design lacks randomisation. As a cohort study, by its nature, is not longitudinal, not following the same group throughout the study serves to limit the findings. For the purposes of this study, the limitation is somewhat ameliorated by the nature of the research. The study sought to establish the existence of a set of conditions, called a schema, at particular points in time, and whether change in this could be observed over time. In making these observations, it
sought to investigate whether student schema development covaried with participation in programs of study that should reasonably be expected to produce such development, rather than seeking to make any specific comparisons of the programs implemented in the differing sites.

A further limitation is the restricted geographic area from which participants were obtained. All of the institutions represented within the study were drawn from NSW, Australia. Follow-up research in other jurisdictions, both nationally and internationally, would prove worthwhile in examining teacher-preparation outcomes more broadly. At the same time, this study only examined one aspect of the teaching standards established by AITSL (2011) for graduate-level teachers. The discussion has been careful to limit conclusions specifically to the institutions studied. An obvious target for future research is establishing the extent to which the need/problem identified here is common to other jurisdictions. Further research could also validate scenarios for other areas of the standards and implement the methodology to determine a schema for practice in other aspects of teacher preparation.

As described for the master’s cohort, while a functional schema was apparent for participants, professional pattern language was not. While one possible reason for that has been discussed, further research is indicated to investigate the phenomenon of schema existing with an apparent absence of the professional language of the field.

A further limitation of the research is that it did not include observational data by watching what PSTs could do in classrooms. The data were predicated on the reasonable assumption, supported by the literature, that participants could describe their intentions, and that the description was an indicator of what they could do. This means that for this study, a level of inference exists in the methodology developed. At the same time, the level of inference in the methodology developed for this study is considerably less than that described for previous studies. Further research could criterion-validate schema development with a follow-on study of actual classroom practice. Associated with this limitation is the potential for the instrument itself to have boundaries on the data it could provide. Despite having used a recognised structure within which to develop strong validity for both the scenario and the response evaluation framework, there is potential for some measurement error, as is the case with all assessment devices.

Additional research is also indicated by application of the instrument to practicing teachers. It is widely recognised that graduate teachers continue to learn and develop
their skills as they transition into the workforce (State of NSW, 2013). Investigation of the capacity of teachers to respond to the scenario after several years of classroom practice would be informative. Likewise, application of the instrument to a program of teacher preparation that had been intentionally designed with the goal of building schema would be informative. Such an investigation would add to knowledge of what is required to develop such a program, as well as providing additional evidence of the content validity of the instrument developed.

From the perspective of follow-up studies based on the methodology, using a scenario-based approach to examine schema development across professional fields would prove informative, particularly in comparison to graduate teachers. It would be assumed that in developing a scenario-based investigation for more professionally controlled fields, such as the medical or allied health arenas, a clearer schema for practice would be apparent. Further research in this area is needed to determine the accuracy of this assumption.

### 8.7 Conclusions

In conclusion, the results of this study have produced evidence related to the capacity of PST preparation programs to produce measurable impacts on the cognitive development of graduates. In particular:

1. The study produced a robust instrument with high validity and reliability capable of measuring schema development – the STS. The instrument showed a capacity to discriminate between different levels of schema development within a wide range of cohorts, from pre-service teachers prior to engagement with any discipline based input, through a cohort from a different professional field to participants who had graduated from a master’s degree in the field. Further, it showed a high level of consistency across the institutions from whom data were gathered.

2. Application of the instrument to a well-validated classroom scenario showed that engagement with a program of PST preparation did little in a year-on-year manner to develop a functional schema for teaching with respect to students with disabilities in mainstream settings. The cohort study implemented indicated that participants at the end of their third year of study showed statistically significant differences to other cohorts, however this may be due to this group having had subject based instruction in Inclusive Education. Further, the low achievement base for all cohorts stands out strongly as a more significant outcome.
3. Final year PSTs, just prior to graduation, from a range of institutions within NSW showed no evidence of having developed a functional schema for teaching with respect to students with disabilities in mainstream settings. The findings here show mean scores for all settings well below what should be expected from a cohesive, well sequenced program of study.

4. The results indicate that student graduates of the PST preparation programs included in this study do not possess a level of pattern language development necessary for professional conversations about the specific features of evidence-based practice.

The intertwined studies reported here show that the degree to which current pre-service education programs adequately prepare graduates for practice may be questionable. Despite a strong literature base describing what works in classrooms, perhaps it could further be argued that current standards may lack sufficient specificity to allow for the comparability and visibility of practice necessary to promote the professionalism of the field. As such, the study provides an impetus for the jurisdiction to revisit the way teacher-preparation programs are constructed to meet standards, and to address questions of whether their scope, coherence and depth is adequate to ensure that students graduate with basic schemas for practice that represent those standards.
References


AITSL – see Australian Institute for Teaching and School Leadership

Alexander, J. (2001). *Concerns of middle and high school teachers toward inclusion of students with exceptional education needs*. Menomonie, WI: Graduate College, University of Wisconsin-Stout.


Drengenberg, N. & Bain, A. (2016). If all you have is a hammer, everything begins to look like a nail – how wicked is the problem of measuring productivity in higher education? Higher Education Research & Development (online). doi: 10.1080/07294360.2016.1208640


NCATE – see National Council for Accreditation of Teacher Education


Tomkins, R., & Delaney P. (1985). *Rural students at risk in Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.* Austin TX: Southwest Educational Development Laboratory.


Appendix 1: Low-level threats to internal validity

1. Ambiguous temporal procedure
This threat can be an issue where the direction of causation is unclear. While for many correlational studies, this threat is not an issue, as “one direction of causal influence is relatively implausible” (Cook & Campbell, 1979, p. 54) for others, it must be considered. For this study, given that the vast majority of participants have completed 13 years of education, it is plausible that some existing understandings of teaching may exist. In the context of this study, however, it is more plausible to consider that participation in a teacher-education course helps develop a schema for teaching than is the reverse. In addition, the implementation of the cohort study and in particular the pre-test for the group entering the first year of their course, will provide an indication of any pre-existing schema that may exist.

2. Instrumentation
This can be a threat when some change in a measuring instrument, or its implementation, occurs between two occasions of testing. Such a change can seriously compromise the validity of the data collected as it then becomes not comparable to that collected on the first occasion. Again, in the context of this study, as data collection using the instrument developed occurs on one occasion for each group from whom information is obtained, the overall research design and the structured validation process assists in addressing this concern.

3. Testing
Testing refers to any threats that occur due to the number of times a response is measured. This can occur when the same instrument is used on a number of occasions, so that familiarity can enhance results as individuals ‘learn’ the answers. Data using the instrument primarily being collected on one occasion and the use of the Study 2 cohort design assists in addressing this threat in this research.

4. Regression artefact
This threat can be an issue in pre-test/post-test designs due to the tendency of extreme scores to regress toward the mean of a distribution on a second testing. This threat is important as, given the number of variables that influence an individual’s test taking ability on a given day, pre-test and post-test measures are rarely perfectly correlated. This can result in differences in scores being, at times, difficult to interpret as being due to experimental effects or to regression phenomena. For this study the research design assists in addressing such concerns as only a post-test is administered.
### Appendix 2: Comparison of course structure across pre-service sites and structure for master’s degree

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**Curriculum studies**

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**Practicum requirements**

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**Other**

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The Master of Inclusive Education consists of 64 units of study. There are four core subjects (32 units) within the course aiming to build knowledge and capacity for inclusive settings, including the professional language of the field. These core units are:

- ESS440 Teaching & Learning in the Differentiated Classroom
- ESS422 Assessment & Evaluation for Learning
- ESS423 Designing & Managing the Inclusive Learning Environment
- ESS426 Collaboration & Teamwork in the Inclusive School.

This is followed by a further 32 units in one of three strands available within the course:

- A teaching strand, which focusses on subjects for graduates to enhance their capacity as classroom practitioners. This stream allows choice of four electives from:
  - ESS512 Programming for Students with High Support Needs
  - ESS513 Meeting the Needs of Students with Communication Difficulties
  - ESS599 Inclusive Education Legislation, Policy & Resourcing
  - ESS508 Early Intervention and Inclusion
  - ESG504 Providing Challenging Learning for Gifted Students
  - ESS518 Reading difficulties: Prevention and intervention
  - ESS515 Preventing Reading Difficulties in the Primary Classroom: A Schoolwide Approach
  - ESS516 Understanding Mathematical Difficulties
  - EPT505 Inclusive Education Practicum.

- A leadership strand, which focusses on subjects for graduates to enhance their capacity as educational leaders at school level and above. This stream allows choice of four electives from:
  - ESS512 Programming for Students with High Support Needs
  - ESS513 Meeting the Needs of Students with Communication Difficulties
  - ESS599 Inclusive Education Legislation, Policy & Resourcing
  - EEB504 Data Informed Practice
  - EMT503 Leadership and ICT Integration
  - ESS515 Preventing Reading Difficulties in the Primary Classroom: A Schoolwide Approach
  - ESS540 Developing the Inclusive School

- A project strand, which focusses on subjects for graduates to enhance their capacity as users and developers of evidence-based practice. This stream consists of:
  - EEB504 Data informed practice
  - ESS540 Developing the Inclusive School and
  - ESS527 Inclusive Education Project (16-point subject).
Appendix 3: Showing degree of concordance for cases in the development of inter-rater reliability

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### Summary data

- **112 cases**
- **65 disagreements**
- **94.2% agreement**

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<th>6b</th>
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<td>R</td>
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<td>321</td>
<td>2</td>
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<td>+1</td>
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<td>2</td>
<td>2</td>
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</tr>
</tbody>
</table>

**Cohort Y0:**
- 1–10
- Site 2

**Cohort Y02:**
- 39–49
- Site 3 Primary

**Cohort Y1:**
- 92–102
- Site 3 Secondary

**Cohort Y2:**
- 133–143
- Undergraduate comparison

**Cohort Y3:**
- 169–179
- Master’s comparison

**Cohort Y4:**
- 192–202
Appendix 4: Item statistics, inter-item correlation matrix and scale statistics for Cronbach’s alpha

Table A4-1: Item statistics

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cri1</td>
<td>1.38</td>
<td>0.734</td>
<td>346</td>
</tr>
<tr>
<td>Cri2a</td>
<td>0.94</td>
<td>0.759</td>
<td>346</td>
</tr>
<tr>
<td>Cri2b</td>
<td>0.68</td>
<td>0.998</td>
<td>346</td>
</tr>
<tr>
<td>Cri3</td>
<td>1.06</td>
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</tr>
<tr>
<td>Cri4a</td>
<td>0.98</td>
<td>0.945</td>
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</tr>
<tr>
<td>Cri4b</td>
<td>0.80</td>
<td>0.876</td>
<td>346</td>
</tr>
<tr>
<td>Cri5</td>
<td>0.99</td>
<td>0.834</td>
<td>346</td>
</tr>
<tr>
<td>Cri6a</td>
<td>1.12</td>
<td>0.921</td>
<td>346</td>
</tr>
<tr>
<td>Cri6b</td>
<td>1.11</td>
<td>0.895</td>
<td>346</td>
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### Table A4-2: Inter-item correlation matrix

<table>
<thead>
<tr>
<th></th>
<th>Cri1</th>
<th>Cri2a</th>
<th>Cri2b</th>
<th>Cri3</th>
<th>Cri4a</th>
<th>Cri4b</th>
<th>Cri5</th>
<th>Cri6a</th>
<th>Cri6b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cri1</td>
<td>1.000</td>
<td>0.649</td>
<td>0.553</td>
<td>0.629</td>
<td>0.653</td>
<td>0.640</td>
<td>0.620</td>
<td>0.652</td>
<td>0.645</td>
</tr>
<tr>
<td>Cri2a</td>
<td>0.649</td>
<td>1.000</td>
<td>0.744</td>
<td>0.650</td>
<td>0.560</td>
<td>0.563</td>
<td>0.650</td>
<td>0.648</td>
<td>0.607</td>
</tr>
<tr>
<td>Cri2b</td>
<td>0.553</td>
<td>0.744</td>
<td>1.000</td>
<td>0.712</td>
<td>0.539</td>
<td>0.491</td>
<td>0.565</td>
<td>0.736</td>
<td>0.673</td>
</tr>
<tr>
<td>Cri3</td>
<td>0.629</td>
<td>0.650</td>
<td>0.712</td>
<td>1.000</td>
<td>0.580</td>
<td>0.538</td>
<td>0.592</td>
<td>0.828</td>
<td>0.772</td>
</tr>
<tr>
<td>Cri4a</td>
<td>0.653</td>
<td>0.560</td>
<td>0.539</td>
<td>0.580</td>
<td>1.000</td>
<td>0.646</td>
<td>0.714</td>
<td>0.646</td>
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</tr>
<tr>
<td>Cri4b</td>
<td>0.640</td>
<td>0.563</td>
<td>0.491</td>
<td>0.538</td>
<td>0.646</td>
<td>1.000</td>
<td>0.613</td>
<td>0.554</td>
<td>0.579</td>
</tr>
<tr>
<td>Cri5</td>
<td>0.620</td>
<td>0.650</td>
<td>0.565</td>
<td>0.592</td>
<td>0.714</td>
<td>0.613</td>
<td>1.000</td>
<td>0.631</td>
<td>0.672</td>
</tr>
<tr>
<td>Cri6a</td>
<td>0.652</td>
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<td>0.736</td>
<td>0.828</td>
<td>0.646</td>
<td>0.554</td>
<td>0.631</td>
<td>1.000</td>
<td>0.827</td>
</tr>
<tr>
<td>Cri6b</td>
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<td>0.607</td>
<td>0.673</td>
<td>0.772</td>
<td>0.641</td>
<td>0.579</td>
<td>0.672</td>
<td>0.827</td>
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</table>

### Table A4-3: Scale statistics

<table>
<thead>
<tr>
<th>Mean</th>
<th>Variance</th>
<th>Std. Deviation</th>
<th>Number of items</th>
</tr>
</thead>
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<tr>
<td>9.07</td>
<td>42.378</td>
<td>6.510</td>
<td>9</td>
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</tbody>
</table>
Appendix 5: Example standards from different jurisdictions against literature determined elements of effective practice

<table>
<thead>
<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective teaching skills and practices</td>
<td>Australia</td>
<td>1.1.1 Demonstrate knowledge and understanding of physical, social and intellectual development and characteristics of students and how these may affect learning.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2.1 Demonstrate knowledge and understanding of research into how students learn and the implications for teaching.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5.1 Demonstrate knowledge and understanding of strategies for differentiating teaching to meet the specific learning needs of students across the full range of abilities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.6.1 Demonstrate broad knowledge and understanding of legislative requirements and teaching strategies that support participation and learning of students with disability.</td>
</tr>
<tr>
<td>Domain</td>
<td>Jurisdiction</td>
<td>Example standards</td>
</tr>
<tr>
<td>--------</td>
<td>--------------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>
| United States | 1.2 Beginning special education professionals use understanding of development and individual differences to respond to the needs of individuals with exceptionalities. | 3.1 Beginning special education professionals understand the central concepts, structures of the discipline, and tools of inquiry of the content areas they teach, and can organize this knowledge, integrate cross-disciplinary skills, and develop meaningful learning progressions for individuals with exceptionalities.  
3.3 Beginning special education professionals modify general and specialized curricula to make them accessible to individuals with exceptionalities.  
5.1 Beginning special education professionals consider an individual's abilities, interests, learning environments, and cultural and linguistic factors in the selection, development, and adaptation of learning experiences for individual with exceptionalities. |
<table>
<thead>
<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>England</td>
<td>1. Set high expectations which inspire, motivate and challenge pupils:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set goals that stretch and challenge pupils of all backgrounds, abilities and dispositions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Promote good progress and outcomes by pupils:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Be aware of pupils’ capabilities and their prior knowledge, and plan teaching to build on these</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Adapt teaching to respond to the strengths and needs of all pupils:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Know when and how to differentiate appropriately, using approaches which enable pupils to be taught effectively</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demonstrate an awareness of the physical, social and intellectual development of children, and know how to adapt teaching to support pupils’ education at different stages of development</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Have a clear understanding of the needs of all pupils, including those with special educational needs; those of high ability; those with English as an additional language; those with disabilities; and be able to use and evaluate distinctive teaching approaches to engage and support them.</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td>3.5.1 Demonstrate a range of verbal and non-verbal communication strategies to support student engagement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.3.1 Demonstrate knowledge of practical approaches to manage challenging behaviour.</td>
</tr>
</tbody>
</table>

Classroom management skills
<table>
<thead>
<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>United States</td>
<td>2.2 Beginning special education professionals use motivational and instructional interventions to teach individuals with exceptionalities how to adapt to different environments.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.3 Beginning special education professionals know how to intervene safely and appropriately with individuals with exceptionalities in crisis.</td>
</tr>
<tr>
<td></td>
<td>England</td>
<td>7. Manage behaviour effectively to ensure a good and safe learning environment:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Have clear rules and routines for behaviour in classrooms, and take responsibility for promoting good and courteous behaviour both in classrooms and around the school, in accordance with the school's behaviour policy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manage classes effectively, using approaches which are appropriate to pupils' needs in order to involve and motivate them.</td>
</tr>
<tr>
<td>Collaboration and communication skills</td>
<td>Australia</td>
<td>3.7.1 Describe a broad range of strategies for involving parents/carers in the educative process.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.4.1 Understand the role of external professionals and community representatives in broadening teachers’ professional knowledge and practice.</td>
</tr>
<tr>
<td></td>
<td>United States</td>
<td>7.1 Beginning special education professionals use the theory and elements of effective collaboration.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.3 Beginning special education professionals use collaboration to promote the well-being of individuals with exceptionalities across a wide range of settings and collaborators.</td>
</tr>
<tr>
<td>Domain</td>
<td>Jurisdiction</td>
<td>Example standards</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Monitoring student progress and providing feedback</td>
<td>England</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td>2.3.1 Use curriculum, assessment and reporting knowledge to design learning sequences and lesson plans.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.1.1 Demonstrate understanding of assessment strategies, including informal and formal, diagnostic, formative and summative approaches to assess student learning.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.2.1 Demonstrate an understanding of the purpose of providing timely and appropriate feedback to students about their learning.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.4.1 Demonstrate the capacity to interpret student assessment data to evaluate student learning and modify teaching practice.</td>
</tr>
<tr>
<td></td>
<td>United States</td>
<td>4.2 Beginning special education professionals use knowledge of measurement principles and practices to interpret assessment results and guide educational decisions for individuals with exceptionalities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.3 Beginning special education professionals in collaboration with colleagues and families use multiple types of assessment information in making decisions about individuals with exceptionalities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.4 Beginning special education professionals engage individuals with exceptionalities to work toward quality learning and performance and provide feedback to guide them.</td>
</tr>
<tr>
<td>Domain</td>
<td>Jurisdiction</td>
<td>Example standards</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>--------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Domain</td>
<td>England</td>
<td>6. Make accurate and productive use of assessment:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Know and understand how to assess the relevant subject and curriculum areas, including statutory assessment requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Make use of formative and summative assessment to secure pupils’ progress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use relevant data to monitor progress, set targets, and plan subsequent lessons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Give pupils regular feedback, both orally and through accurate marking, and encourage pupils to respond to the feedback.</td>
</tr>
<tr>
<td>Communication with parents and</td>
<td>Australia</td>
<td>3.7.1 Describe a broad range of strategies for involving parents/carers in the educative process.</td>
</tr>
<tr>
<td>caregivers</td>
<td></td>
<td>5.5.1 Demonstrate understanding of a range of strategies for reporting to students and parents/carers and the purpose of keeping accurate and reliable records of student achievement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.3.1 Understand strategies for working effectively, sensitively and confidentially with parents/carers.</td>
</tr>
<tr>
<td>Domain</td>
<td>Jurisdiction</td>
<td>Example standards</td>
</tr>
<tr>
<td>--------</td>
<td>--------------</td>
<td>-------------------</td>
</tr>
<tr>
<td></td>
<td>United States</td>
<td>4.3 Beginning special education professionals in collaboration with colleagues and families use multiple types of assessment information in making decisions about individuals with exceptionalities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.5 Beginning special education professionals develop and implement a variety of education and transition plans for individuals with exceptionalities across a wide range of settings and different learning experiences in collaboration with individuals, families, and teams.</td>
</tr>
<tr>
<td></td>
<td>England</td>
<td>8. Fulfil wider professional responsibilities:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communicate effectively with parents with regard to pupils’ achievements and well-being.</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td>3.1.1 Set learning goals that provide achievable challenges for students of varying abilities and characteristics.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.5.1 Demonstrate a range of verbal and non-verbal communication strategies to support student engagement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.4.1 Describe strategies that support students’ wellbeing and safety working within school and/or system, curriculum and legislative requirements.</td>
</tr>
<tr>
<td></td>
<td>United States</td>
<td>2.1 Beginning special education professionals through collaboration with general educators and other colleagues create safe, inclusive, culturally responsive learning environments to engage individuals with exceptionalities in meaningful learning activities and social interactions.</td>
</tr>
<tr>
<td>Domain</td>
<td>Jurisdiction</td>
<td>Example standards</td>
</tr>
<tr>
<td>--------</td>
<td>--------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>England</td>
<td>7. Manage behaviour effectively to ensure a good and safe learning environment:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Have high expectations of behaviour, and establish a framework for discipline with a range of strategies, using praise, sanctions and rewards consistently and fairly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintain good relationships with pupils, exercise appropriate authority, and act decisively when necessary.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 6: Examples of areas of study in initial teacher preparation from a variety of jurisdictions matched to example standards

<table>
<thead>
<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
<th>Example subject titles and descriptions/designated outcomes from preparation programs</th>
</tr>
</thead>
</table>
| Effective teaching skills and practices | Australia  | 1.1.1 Demonstrate knowledge and understanding of physical, social and intellectual development and characteristics of students and how these may affect learning.  
1.2.1 Demonstrate knowledge and understanding of research into how students learn and the implications for teaching.  
1.5.1 Demonstrate knowledge and understanding of strategies for differentiating teaching to meet the specific learning needs of students across the full range of abilities.  
1.6.1 Demonstrate broad knowledge and understanding of legislative requirements and teaching strategies that support participation and learning of students with disability. | 1. EPT125 Child development: Foundation to Year 6  
This subject introduces students to the physical, socio-emotional and intellectual development of children during the primary school years. Students explore how these major domains interact to influence learning. Students are required to review contemporary educational research, collect data and write a research report. Major theories of development (cognitive, constructivist, behavioural and ecological) will be examined and applied to educational contexts. An embedded professional experience in a school setting will provide an opportunity to: systematically observe children’s learning, use formal and informal assessment data, and develop effective verbal and non-verbal listening/communication skills. |
<table>
<thead>
<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
<th>Example subject titles and descriptions/designated outcomes from preparation programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>inclusive educators through the processes of research, design, reflection, and collaboration.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. EDUC1055 Foundations of child development</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Examines development from conception through to infancy and early childhood to age twelve. Students develop an understanding of developmental concepts, principles and processes and various theoretical perspectives relating to child development, and the implications for early childhood education. Particular attention is paid to critical engagement with research and theory within the Australian socio-cultural context.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. EDUC2186 Quality teaching and student learning K – 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This course is focused on students’ knowledge and skills in the areas of professional knowledge and professional practice. A key focus is on gathering evidence aligned with the Australian Institute for Teaching and School Leadership (AITSL) standards to demonstrate an intermediate understanding of the profession. This course builds on classroom observations of teaching and learning undertaken by students in the first year of their teacher education program. It also helps students to recognise and understand how coursework/research forms the foundation of high quality teaching and assessment practice by connecting what is studied at university and how that plays out in classrooms and schools</td>
</tr>
</tbody>
</table>
1.2 Beginning special education professionals use understanding of development and individual differences to respond to the needs of individuals with exceptionalities.

3.1 Beginning special education professionals understand the central concepts, structures of the discipline, and tools of inquiry of the content areas they teach, and can organise this knowledge, integrate cross-disciplinary skills, and develop meaningful learning progressions for individuals with exceptionalities.

3.3 Beginning special education professionals modify general and specialised curricula to make them accessible to individuals with exceptionalities.

5.1 Beginning special education professionals consider an individual’s abilities, interests, learning environments, and cultural and linguistic factors in the selection, development, and adaptation of learning experiences for individual with exceptionalities.

3. EDUC283: Child development in and beyond schools

What constitutes good teaching practices within a classroom is open to debate and so, the purpose of this course is to strengthen your understanding of how educational psychology and child development are involved in teaching so that you are able to make thoughtful choices in your classroom. Together we will explore how to make meaning of educational theory so that you can make informed and intentional decisions to best support your teaching and, ultimately, your students’ learning.

This class is designed to help prepare you as a teacher and a professional. Specifically, this course seeks: 1) to help you better understand how children develop in regard to their physical, cognitive, and social-emotional abilities, 2) to expose you with the theoretical roots and empirical research that support the many classroom practices you have previously experienced and will encounter throughout your development as a teacher, and 3) to provide you with the tools and background knowledge for you to pursue your own enquiries and decide on your own theoretical position about the learning and development process.

3. EDUC 246 Elementary teaching seminar (over duration of the course)

Our focus will be on Exploring the Teaching Profession, and we will address several big questions: Why teach? What is (good) teaching? What makes teaching so complex? And, Who do we serve and how?

4. SPED506 Advanced practices for children with disabilities in the elementary general education classroom
<table>
<thead>
<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
<th>Example subject titles and descriptions/designated outcomes from preparation programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>This course is designed to enable novice teachers to master and apply the instructional and communicative skills that will facilitate appropriate and productive inclusion of children and youth with exceptionalities within general education classrooms and other school settings. Specific research-based strategies in curriculum content acquisition (content enhancements, learning strategies, class-wide-peer tutoring), and specific research-based strategies in behaviour management will be learned and applied to real teaching experiences. Novice teachers will learn about collaborative structures found in schools to support student learning in general education settings (co-teaching, collaborative consultation, teacher/student support teams) and roles and responsibilities of teachers within these structures.</td>
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<td>Domain</td>
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<td>Example standards</td>
<td>Example subject titles and descriptions/designated outcomes from preparation programs</td>
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</tr>
<tr>
<td>England</td>
<td>1. Set high expectations which inspire, motivate and challenge pupils: Set goals that stretch and challenge pupils of all backgrounds, abilities and dispositions</td>
<td>5. Knowledge ED5619, ED5617, ED5618 Knowledge and understanding of the theoretical perspectives underpinning children's learning and development and how these can be applied to their own professional practice in the Foundation Stage and primary school sector Knowledge and understanding of the theory, practice and legislation related to inclusion (i) ability to identify, assess and provide for all pupils including those with SEN, drawing on academic literature, theory and practice (ii) awareness of common principles and practices of inclusive practice in the Foundation Stage and primary school sector Knowledge and understanding of the theoretical perspectives underpinning children's learning and development and how these can be applied to their own professional practice in the Foundation Stage and primary school sector</td>
<td>2. Promote good progress and outcomes by pupils: Be aware of pupils' capabilities and their prior knowledge, and plan teaching to build on these 5. Adapt teaching to respond to the strengths and needs of all pupils: Know when and how to differentiate appropriately, using approaches which enable pupils to be taught effectively Demonstrate an awareness of the physical, social and intellectual development of children, and know how to adapt teaching to support pupils' education at different stages of development Have a clear understanding of the needs of all pupils, including those with special educational needs; those of high ability; those with English as an additional language; those with disabilities; and be able to use and evaluate distinctive teaching approaches to engage and support them.</td>
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<td>Domain</td>
<td>Jurisdiction</td>
<td>Example standards</td>
<td>Example subject titles and descriptions/designated outcomes from preparation programs</td>
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</tbody>
</table>
| Classroom management skills          | Australia    | 3.5.1 Demonstrate a range of verbal and non-verbal communication strategies to support student engagement.  
4.3.1 Demonstrate knowledge of practical approaches to manage challenging behaviour. | 1. EEA202 Managing the classroom environment  
This subject is part of a suite of subjects focusing on young people. This subject involves understanding learning and creating a motivating learning environment. Recognising the impact of teacher behaviour in the classroom environment is a component of this subject. The importance of relationships within the classroom, of addressing management issues and of developing critical thinking around available resources and programs will be integral to student learning. Students will critically review policies and school discipline policy documentation in terms of learning management.  
2. EDUC2181 Managing the learning environment  
This course is focused on developing students’ knowledge and understanding in the field of student learning, encompassing the topics of: managing the student learning environment (including classroom management); inclusivity, especially that related to Aboriginal and Torres Strait Islander students and issues of diversity; and transformative pedagogies. These topics are explicitly connected to contemporary school settings across all key learning areas. This course provides a lead-in to the first and second secondary practicums. |
<table>
<thead>
<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
<th>Example subject titles and descriptions/designated outcomes from preparation programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>United States</td>
<td>2.2 Beginning special education professionals use motivational and instructional interventions to teach individuals with exceptionalities how to adapt to different environments.</td>
<td>3. EDUC244 Elementary classroom leadership and management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.3 Beginning special education professionals know how to intervene safely and appropriately with individuals with exceptionalities in crisis.</td>
<td>This course is designed to give teacher candidates a broad overview of classroom leadership and management through an equity lens. It includes research, theories, and applications in practice, in view of creating and sustaining positive and productive learning environments for all students. Teacher candidates will explore their own values and beliefs, observe and reflect on other teachers’ tactics, learn about a variety of current and past Methodologies of leadership and management, and explore working with diverse students. Finally, each candidate will begin to develop an individual approach to building an inclusive, productive and well-structured learning environment</td>
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<td>4. SPED661 Supporting children with significant learning and behavioural challenges</td>
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<td>Students in this course will gain knowledge of the causes, and intervention and support approaches for young children with multiple and significant disabilities including neurological impairments, physical disabilities, sensory impairments, significant developmental disabilities and challenging behaviour. Emphasis is placed on environmental adaptions and direct instructional techniques to maximize independence as determined through systematic ecological inventories tailored to the individual child's strengths and needs. Information is also provided on assistive technology designed to provide appropriate supports. Functional behavioural assessment procedures, proactive intervention strategies, and developing collaborative support plans will be studied.</td>
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<td>Domain</td>
<td>Jurisdiction</td>
<td>Example standards</td>
<td>Example subject titles and descriptions/designated outcomes from preparation programs</td>
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<tr>
<td></td>
<td>England</td>
<td>7. Manage behaviour effectively to ensure a good and safe learning environment:</td>
<td>5. Knowledge ED5619, ED5617, ED5618&lt;br&gt;Knowledge and understanding of the range of research relating to strategies for managing and organising a classroom for effective learning in the Foundation Stage and primary school sector, including planning and assessing for a range of abilities, the management of behaviour and managing other adults and theories about effective teaching skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Have clear rules and routines for behaviour in classrooms, and take responsibility for promoting good and courteous behaviour both in classrooms and around the school, in accordance with the school’s behaviour policy</td>
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<td>Manage classes effectively, using approaches which are appropriate to pupils’ needs in order to involve and motivate them.</td>
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</tr>
<tr>
<td>Collaboration and</td>
<td>Australia</td>
<td>3.7.1 Describe a broad range of strategies for involving parents/carers in the educative process.</td>
<td>1. EPT218 Student learning and engagement&lt;br&gt;This subject examines the nature of the school environment and introduces pre-service teachers to the way in which teachers communicate in this environment. Pre-service teachers will utilise the knowledge and experience that they have gained including observation and identification of learner needs and abilities. Pre-service teachers will undertake 17 days in a school setting, 15 days of placement and 2 introductory days to observe, evaluate, devise, and utilise a range of teaching strategies and resources that benefit school children.</td>
</tr>
<tr>
<td>communication skills</td>
<td></td>
<td>7.4.1 Understand the role of external professionals and community representatives in broadening teachers’ professional knowledge and practice.</td>
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<td>Domain</td>
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<td>Example subject titles and descriptions/designated outcomes from preparation programs</td>
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</tbody>
</table>
|          | United States| 7.1 Beginning special education professionals use the theory and elements of effective collaboration.  
7.3 Beginning special education professionals use collaboration to promote the well-being of individuals with exceptionalities across a wide range of settings and collaborators | 4. SPED854 Family and inter-professional collaboration in special education  
This course is designed to provide knowledge and skills to implement federal and state mandates for special education and related services programs as they relate to building and maintaining relationships with families of students with disabilities, and developing effective school programs. It covers procedures for developing, implementing, and evaluating (a) instructional accountability for special education students' participation in district and state assessment; (b) relationships between general and special education personnel and programs; (c) roles and responsibilities; (d) interdisciplinary team planning including families; (e) coordinating, educating, and supervising paraeducators; and (f) general management responsibilities associated with instruction of children and youth with disabilities. Course topics will include collaboration in schools, community systems and families, historical perspectives of family life and school involvement, effective relationships between home, school, community, and communication among professionals and with families, school-based programs, home-based programs, and multicultural considerations. |
<p>|          | England      | 5. Skills ED5619, ED5617, ED5618                                                   | Able to show inter-personal and presentation skills                                  |</p>
<table>
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<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
<th>Example subject titles and descriptions/designated outcomes from preparation programs</th>
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</thead>
</table>
| Monitoring student progress and providing feedback | Australia    | 2.3.1 Use curriculum, assessment and reporting knowledge to design learning sequences and lesson plans.  
5.1.1 Demonstrate understanding of assessment strategies, including informal and formal, diagnostic, formative and summative approaches to assess student learning.  
5.2.1 Demonstrate an understanding of the purpose of providing timely and appropriate feedback to students about their learning.  
5.4.1 Demonstrate the capacity to interpret student assessment data to evaluate student learning and modify teaching practice. | 1. Assessment and reporting  
Assessment and reporting are significant aspects of school education. Educational achievement and reporting of this is crucial to ongoing success for learners. Assessment monitors learning progress and reporting makes the results available to a range of audiences. Understanding the complexities surrounding assessment and reporting is essential for effective teaching. This subject compares and contrasts assessment and reporting strategies relevant to school education. Skills and practices required for effective assessing and reporting are explored with specific attention to identifying and understanding the challenges and complexities encountered by teachers when assessing and reporting on academic performance. |
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<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
<th>Example subject titles and descriptions/designated outcomes from preparation programs</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>United States</td>
<td><strong>4.2</strong> Beginning special education professionals use knowledge of measurement principles and practices to interpret assessment results and guide educational decisions for individuals with exceptionalities.</td>
<td>3. EDUC246 Elementary teaching seminar (over duration of the course)</td>
</tr>
<tr>
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<td></td>
<td><strong>4.3</strong> Beginning special education professionals in collaboration with colleagues and families:</td>
<td>We will focus our attention on TEACHING for LEARNING, exploring the topics of curriculum, planning, and assessment. We will explore strategies for developing effective curricula, we will learn to analyse curricula, and we will observe classrooms in light of theoretical principles and practical strategies.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use multiple types of assessment information in making decisions about individuals with exceptionalities.</td>
<td>We will focus our attention on assessment of and for learning and teaching. We will explore strategies for developing effective assessment practices and discuss some of the theoretical underpinnings of assessment decisions in the field.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>4.4</strong> Beginning special education professionals engage individuals with exceptionalities to work toward quality learning and performance and provide feedback to guide them.</td>
<td>4. SPED663 Assessment Strategies in Early Education</td>
</tr>
<tr>
<td></td>
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<td>Examines the practice of gathering information for the purpose of making individual referral and instructional decisions for infants, toddlers, and young children with and without special needs. Discusses effective informal assessment techniques and emphasizes an ecological approach to gathering information. Introduces standardized assessment and screening instruments and provides an overview of the purposes and limitations of such tests.</td>
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<tr>
<td>Domain</td>
<td>Jurisdiction</td>
<td>Example standards</td>
<td>Example subject titles and descriptions/designated outcomes from preparation programs</td>
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</tbody>
</table>
|                            | England      | 6. Make accurate and productive use of assessment:  
Know and understand how to assess the relevant subject and curriculum areas, including statutory assessment requirements  
Make use of formative and summative assessment to secure pupils’ progress  
Use relevant data to monitor progress, set targets, and plan subsequent lessons  
Give pupils regular feedback, both orally and through accurate marking, and encourage pupils to respond to the feedback.                                                                                                                                                              | 5. Cognitive skills ED5619, ED5617, ED5618  
Able to engage in critical review and evaluation of different models and theories of assessment, including for pupils with SEN, EAL and those considered Gifted & Talented                                                                                                                                                                     |
| Communication with parents and caregivers | Australia   | 3.7.1 Describe a broad range of strategies for involving parents/carers in the educative process.  
5.5.1 Demonstrate understanding of a range of strategies for reporting to students and parents/carers and the purpose of keeping accurate and reliable records of student achievement.  
7.3.1 Understand strategies for working effectively, sensitively and confidentially with parents/carers.                                                                                                                                                                                                                   | 1. EPT329 Working within the community  
In preparation for the professional placement, this subject will explore the benefits, challenges, and skills needed for fostering positive communication and educational partnerships with young people, parents and families within communities. The professional experience will enable pre-service teachers to observe interactions between school, home and community contexts, and recognise the pivotal role of education to the wellbeing of children, families and communities.                                                      |
<table>
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<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
<th>Example subject titles and descriptions/designated outcomes from preparation programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>4.3 Beginning special education professionals in collaboration with colleagues and families use multiple types of assessment information in making decisions about individuals with exceptionalities</td>
<td>3. EDUC246 Elementary teaching seminar (over duration of the course) We will take a look at schools as a reflection of society and the plethora of issues and dilemmas teacher leaders face in supporting equitable schools and classrooms. In additional we will explore important issues and practical strategies for building positive and productive relationships between home and school.</td>
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<td></td>
<td>5.5 Beginning special education professionals develop and implement a variety of education and transition plans for individuals with exceptionalities across a wide range of settings and different learning experiences in collaboration with individuals, families, and teams.</td>
<td>4. SPED261 Families and professional partnerships This course provides information on issues and practices related to working together in partnership with families of young children including those who have a young child with special needs. Emphasis will be placed on taking a family systems prospective and a family-centered approach to family support. Strategies for effective communication for the purpose of information sharing and collaborative planning with families are provided. Relevant current scientifically based evidence will be reviewed and discussed pertaining to these topics.</td>
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<tr>
<td>England</td>
<td>8. Fulfil wider professional responsibilities: Communicate effectively with parents with regard to pupils’ achievements and well-being.</td>
<td>5. Skills ED5619, ED5617, ED5618 Able to show inter-personal and presentation skills</td>
<td></td>
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<tr>
<td>Domain</td>
<td>Jurisdiction</td>
<td>Example standards</td>
<td>Example subject titles and descriptions/designated outcomes from preparation programs</td>
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</table>
| Creating positive learning environments | Australia    | 3.1.1 Set learning goals that provide achievable challenges for students of varying abilities and characteristics.  
3.5.1 Demonstrate a range of verbal and non-verbal communication strategies to support student engagement.  
4.4.1 Describe strategies that support students’ wellbeing and safety working within school and/or system, curriculum and legislative requirements. | 1. EPT218 Student learning and engagement  
This subject examines the nature of the school environment and introduces preservice teachers to the way in which teachers communicate in this environment. Preservice teachers will utilize the knowledge and experience that they have gained including observation and identification of learner needs and abilities. Preservice teachers will undertake 17 days in a school setting, 15 days of placement and 2 introductory days to observe, evaluate, devise, and utilise a range of teaching strategies and resources that benefit school children. |
|                                       | United States| 2.1 Beginning special education professionals through collaboration with general educators and other colleagues create safe, inclusive, culturally responsive learning environments to engage individuals with exceptionalities in meaningful learning activities and social interactions. | 3. EDUC244 Elementary classroom leadership and management  
This course is designed to give teacher candidates a broad overview of classroom leadership and management through an equity lens. It includes research, theories, and applications in practice, in view of creating and sustaining positive and productive learning environments for all students. Teacher candidates will explore their own values and beliefs, observe and reflect on other teachers’ tactics, learn about a variety of current and past Methodologies of leadership and management, and explore working with diverse students. Finally, each candidate will begin to develop an individual approach to building an inclusive, productive and well-structured learning environment. |
<table>
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<tr>
<th>Domain</th>
<th>Jurisdiction</th>
<th>Example standards</th>
<th>Example subject titles and descriptions/designated outcomes from preparation programs</th>
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</thead>
<tbody>
<tr>
<td>England</td>
<td>7. Manage behaviour effectively to ensure a good and safe learning environment: Have high expectations of behaviour, and establish a framework for discipline with a range of strategies, using praise, sanctions and rewards consistently and fairly Maintain good relationships with pupils, exercise appropriate authority, and act decisively when necessary.</td>
<td>5. Knowledge ED5619, ED5617, ED5618 Knowledge and understanding of the a range of research relating to strategies for managing and organising a classroom for effective learning in the Foundation Stage and primary school sector, including planning and assessing for a range of abilities, the management of behaviour and managing other adults and theories about effective teaching skills</td>
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</tbody>
</table>
## Appendix 7: Literature-based examples of pattern language terminology

<table>
<thead>
<tr>
<th>Cognitive strategies</th>
<th>Direct Instruction</th>
<th>Guided practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent practice</td>
<td>Assessment of outcomes</td>
<td>Self-monitoring</td>
</tr>
<tr>
<td>Metacognitive learning</td>
<td>Tutor</td>
<td>Tutee</td>
</tr>
<tr>
<td>Tutor procedures</td>
<td>Same age</td>
<td>Cross age</td>
</tr>
<tr>
<td>Independent</td>
<td>Supplemental practice</td>
<td>Interrelated</td>
</tr>
<tr>
<td>Structure</td>
<td>Sequence</td>
<td>Reinforcement</td>
</tr>
<tr>
<td>Practice</td>
<td>Feedback</td>
<td>Face to face interaction</td>
</tr>
<tr>
<td>Positive interdependence</td>
<td>Interpersonal skills</td>
<td>Focus on group process</td>
</tr>
<tr>
<td>Individual accountability</td>
<td>Social cohesion</td>
<td>Cognitive elaboration</td>
</tr>
<tr>
<td>Metacognition</td>
<td>Procedural knowledge</td>
<td>Declarative knowledge</td>
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<td>-----------------------</td>
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</tr>
<tr>
<td>All levels of learning</td>
<td>Differentiation</td>
<td>Motivation</td>
</tr>
<tr>
<td>Cognitive Strategy</td>
<td>Peer Tutoring</td>
<td>Cooperative Learning</td>
</tr>
<tr>
<td>Explicit Teaching</td>
<td>Outcomes/ objectives identified</td>
<td></td>
</tr>
<tr>
<td>Anticipatory set</td>
<td>Link to prior learning</td>
<td>Teacher model</td>
</tr>
<tr>
<td>Guided practice</td>
<td>Independent practice</td>
<td>Mastery learning</td>
</tr>
</tbody>
</table>
Appendix 8: Examples of responses to the scenario indicating different levels of schema development

1. Response indicating functional level of schema development (SDL4)

Classroom Scenario and Sample lesson plan

Topic: Literacy /Spelling Class: Year 1 (21 students)

Using the framework of the three tiered model (Walker, Horner, Sugai, Bullis, Sprague, Bricker & Kaufman, 1996), the class consists of:

1.16 students in the Primary Prevention level (Level 1 - these students require modest support and are making adequate progress)

2. 4 students in the Secondary Prevention level (Level 2 - these students are making adequate progress but require additional support particularly in literacy activities)

3. 1 student in the Tertiary Prevention level (Level 3 - this student does have learning difficulties and requires additional support in most curriculum areas)

All students will be involved in the spelling lesson as it has been noted by the supervising teacher that there is still some confusion with short vowel sounds occurring in the middle of words. Previous learning activities have included practice using short vowels. This lesson is further reinforcement of the work. Peer Assisted Learning will be incorporated as the teaching strategy as this has been utilised (by the supervising teacher) in the previous term. Peer Assisted Learning has been incorporated in the curriculum area of Mathematics, where students practised addition of algorithms. The strategy has not been used previously with spelling activities but all students are familiar with its structure.
Expected Learner Outcome: WS1.11 Uses knowledge of sight words and letter-sound correspondences and a variety of strategies to spell familiar words.

CORE OBJECTIVE:

Level 1:

Students will be able to recognize, differentiate and practise vowel sounds in cvc words (consonant vowel consonant), in cvcc words and ccvcc words with a peer (using a word document)

Level 2:

Students will be able to recognize, differentiate and practise vowel sounds in cvc words and ccvc words (using magnetic alphabet trays, letters/vowels with different colours to consonants and images of the word)
Level 3 Students will be able to recognize, differentiate and practise vowel sounds in cvc words (using magnetic alphabet trays, letters/vowels with different colours to consonants and images of the word) and the assistance of a teacher’s aide.

Students in the Primary Prevention level (16) will be ranked from highest to lowest ability according to pre-test in Spelling and the supervising teacher’s observations/record of Spelling in daily text and diary writing. These students are then be grouped into halves. The highest ability student (the tutor) in the first half will be paired with the highest ability student (the tutee) in the second half and so on.

Students in the Secondary Prevention level (4) will be paired in a similar manner to the Primary Prevention level.

The student (1) in the Tertiary Prevention level will be paired with a teacher’s aide and the tutoring will be reciprocal.

The tutoring will be reciprocal with all students during the lesson. The teacher will monitor students by observing each pair of students for at least 20 seconds. Participation and the fulfilling of the roles of tutor and tutee will be noted. Social interaction will also be monitored and noted. The teacher will check that the Assessment sheet is completed correctly by the tutor. The teacher will assist where the students are not understanding the process and will re-demonstrate if necessary. Praise and positive reinforcement will be given where appropriate.
Materials, words and groups are as follows:

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher ability students in one half of Primary level paired with higher ability in second half of Primary level (16 students)</td>
<td>Higher ability students in one half of Secondary level paired with higher ability in second half of Secondary level (4 students)</td>
<td>Student paired with Teacher’s Aide</td>
</tr>
</tbody>
</table>

Words:

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>splash quack shell spend</td>
<td>hand sand rest best</td>
<td>bat van men pet</td>
</tr>
<tr>
<td>which pinch choppy along</td>
<td>lift gift lost cost</td>
<td>hip pin hot mop</td>
</tr>
<tr>
<td>thumb scrub</td>
<td>Dust just</td>
<td>mug cut</td>
</tr>
</tbody>
</table>

Materials:

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of computer-Word Document</td>
<td>Alphabet tray/letters</td>
<td>Alphabet tray/letters</td>
</tr>
</tbody>
</table>
Description of Lesson

Level 1 students have had previous practice at typing words into a Word Document. This group will spell the word after seeing a picture.

Level 2 students have had practice using alphabet trays. The consonants are coloured red. The vowels are coloured yellow. This group will spell the word after seeing the picture and have the option of viewing the printed word.
Level 3 student has had practice using alphabet trays. The consonants are coloured red. The vowels are coloured yellow. This student will spell the word after seeing the picture and the printed word. The teacher’s aide will verbally prompt when required.

The teacher (the tutor) demonstrates the way in which the words will be treated with a student (the tutee). The tutor has the pictures of the ten objects and the Assessment chart with the ten words printed on it. The tutee has the magnetic tray with alphabet letters placed in front of him. The step-by-step instruction is also given to each pair of students. This is written using a visual to assist understanding. The process is then demonstrated by the teacher.

Demonstration

Tutor: The word is bat (shows picture and word on card)

Tutee:
1. Repeats the word bat
2. Sounds out the word b-a-t
3. Spells the word b-a-t
4. Makes the word with the letters on the alphabet tray without looking at card
5. If the word is spelt correctly by the tutee, the student is given immediate feedback from the tutor. The tutor says, “Yes, that’s right”. The correct word is ticked on the Assessment chart by the tutor.
6. If the word is spelt incorrectly by the tutee, the student is given immediate feedback from the tutor. The tutor says, “Try again”. The tutee then tries again. If the word is spelt incorrectly a second time, the tutor assists by showing the correct word. The tutor ticks under second attempt column. If there is a third attempt, the tutor ticks the 3rd column.
The Peer Assisted Task is begun by the teacher indicating students to move in to pre-arranged pairs. The timer is set for 10 minutes. Students work in pairs for 10 mins on the ten words. The students then reciprocate. Students work in pairs for another 10 mins. The lesson ceases at the end of 20mins.

*Formal evaluation will take place in the form of a written test for those students in level 1 and 2 using words that have been previously practised. The student in level 3 will be assessed by making the words using alphabet trays first then recording the word.*

The students will be monitored each day with the observation of the daily practice chart completed with the partner. Students who are having difficulties with particular vowels will be noted and further intervention will take place. Graphs will be made to note words that are spelt correctly/incorrectly by each student so that further intervention can take place if required. Both a pre-testing and post-testing of words (over a period of weeks) will take place so that improvements can be noted (with all students).

*The effectiveness of the lesson can be gauged by the improvement of the students’ use of the medial vowel in weekly spelling tests and the use of words in daily text and journal writing.*

The effectiveness of the use of Peer Assisted Learning in the curriculum area of Spelling could be evaluated by the use of a questionnaire for the students (as shown in Appendix B).
Appendix A

Daily SPELLING Practice Sheet

Week:_____ Date:_______

1. Tutee ________________ 2. Tutee ________________

Step 8

1st attempt 2nd attempt 3rd attempt
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<tr>
<th></th>
<th>Word</th>
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<tbody>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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<td>4.</td>
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Appendix B

Results of Student Questionnaire for 1G

<table>
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<tr>
<th>Question/Statement</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Did you enjoy having a partner for spelling?</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>NO</td>
</tr>
</tbody>
</table>
2. Using Peer Assisted Learning helps me learn my spelling words  
   YES
   NO

3. I liked being the tutor  
   YES
   NO

4. I liked being the tutee  
   YES
   NO

5. I think I am a better speller since I have been using Peer Assisted Learning  
   YES
   NO

6. I would like to continue using Peer Assisted Learning to help me learn my spelling words  
   YES
   NO
2. **Response indicating no functional level of schema (SDL.2)**

**Classroom Scenario**

1. This lesson will be focusing on stage 4, Movement skill and performance. Here the topic or unit will be team sports and the lesson will be based on basketball. Here students will refine and develop their shooting skills and also expand on their team working proficiency using both skill based approach and also the games sense approach.

2. The general lesson outcomes are that at the end of the lesson students should be able to:
   - Work collectively as a team
   - Use correct shooting technique when shooting a free throw
   - Show leadership in a team environment

Also to cater for the needs of 3 different sub categories outcomes would alter in change to meet the needs of these specific sub groups. For the severe learning difficulty I would cater for their needs by giving a variety of teaching strategies to enable them to grasp the new concepts. E.g. Give both verbal and physically examples and how to correctly shoot a basketball and also give them a learning card for them to refer back to in case they forget or have trouble. By giving the class 3 different modes of learning I will be catering to the needs of the different learning styles plus they will take away a diagram or prompt card of what they have just learnt.

3. **Content:**
   - the lesson would consist of a warm up(including a fun game and then dynamic stretching)
   - break down of the shooting skill (referring to learning cards, demonstration and verbal delivery of the shooting skill)
   - Skill acquisition game (golden child) which focuses on both shooting and team work
   - Another game called bump ball. During this game is where I will access the outcomes and provide feedback to the students on technique
   - Then a game of basketball to assess the team work and using their new skill in a game sense environment.
To once again cater for the needs the students will be given the opportunity to be assessed by showing a demonstration of the skill or telling me how they would do the skill or finally write out the skill. This allows the students of all different abilities and learning difficulties the opportunity to show they have achieved the lesson outcomes.

4. By assessing the students at different stages of the lesson I will be able to see if they students are grasping the key concepts and then I can change different aspects of the lesson to improve the lesson outcomes
5. Much of the same by looking at how the students are responding to the lesson and also how they are achieving the lesson outcomes.

3. **Response indicating no functional level of schema (SDL0)**

1. **ART - DOLLS**
   - Cut fabric
   - Tie dye
   - Sew
   - Stuff
   - Buttons/Clothes

2. Hand eye co-ordination
3. Vary outcomes, and expectations
4. Scaffolding, student enjoyment
5. Rubrics, Q and A