AN EXAMINATION OF SPELLING
ACQUISITION IN THE MIDDLE AND
UPPER PRIMARY SCHOOL YEARS

VOLUME I of II

Thesis submitted to Charles Sturt University for the
Doctor of Philosophy

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LMusA, BM(Hons1), BEd(Prim)

March, 2016
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I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma at Charles Sturt University or any other educational institution, except where due acknowledgment is made in the thesis.

Any contribution made to the research by colleagues with whom I have worked at Charles Sturt University or elsewhere during my candidature is fully acknowledged. I agree that this thesis be accessible for the purpose of study and research in accordance with the normal conditions established by the Executive Director, Library Services or nominee, for the care, loan and reproduction of theses.

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SIGNATURE:

DATE: 30th March, 2016
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ETHICS APPROVALS

This thesis reports on research involving humans. Approval to conduct the research was obtained from the following institutions:


2. Archdiocese of Canberra and Goulburn Catholic Education Office. Reference number: R205976 2013/7


Copies of approval letters are located in Volume II (Appendices A and B).
LIST OF RELATED PUBLICATIONS AND PRESENTATIONS

Publications:


Conference Presentations:

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Daffern, T., & Mackenzie, N. M. *Does Triple Word Form Theory provide a useful framework from which to assess proficiency in spelling?* European Conference on Educational Research, Budapest (September, 2015)

Daffern, T. *Spelling out assessment: The development and testing of an innovative tool*. European Conference for Research on Learning and Instruction, Cyprus (August, 2015)

Daffern, T., & Mackenzie, N. M. *Does proficiency in spelling, grammar and punctuation predict success in writing?* European Conference for Research on Learning and Instruction, Cyprus (August, 2015)

Daffern, T. *Nurturing a personal curiosity of words: A focus on spelling*. ALEA/AATE National Conference Canberra (July, 2015)

Daffern, T., & Mackenzie, N. M. *Explicitly teaching spelling strategies: Does it lead to compliance or curiosity?* ALEA/AATE National Conference Canberra (July, 2015)


Daffern, T. *Spelling in the primary school years: An Australian context*. ALEA/AATE National Conference Darwin (July, 2014)

Mackenzie, N. M., & Daffern, T. *Building strong writers: Creating a balance between the authorial and secretarial elements of*
Other Presentations:


Three Minute Thesis Competition. Winner of the CSU Judges’ Choice Award and Winner of the People’s Choice Award. Represented CSU at the Trans-Tasman 3MT, Perth WA (November, 2014)

Doubleday, R., Murrell, L., & Daffern, T. *Protect your work!* *Intellectual property, commercialisation of your research and legal issues* DocFest, Charles Sturt University (June, 2014)

Daffern, T. *An examination of spelling in the middle and upper primary years of school.* Higher Degree by Research Forum, Charles Sturt University, Bathurst (September, 2013)

Media Coverage:


ABC 702 Radio Perth Afternoon Program with Diana Darmody. *Discussion on the teaching and learning of spelling in Australia* (22nd September, 2015)


ABC Radio Riverina Morning Program with Chris Coleman and ABC Goulburn Murray Morning Program with Joseph Thomsen. *Interviews and commentary on PhD research* (3rd August, 2015)


ABC 666 Radio Canberra Morning Breakfast Program with Georgia Stynes. *Discussion of PhD research project in spelling and conversations about spelling with listeners* (27th November, 2013)

ABC 702 Sydney Radio Drive Show with Richard Glover. *Interview on PhD research* (27th November, 2013)

ABC Radio Riverina Morning Program with Simon Wallace. *Interview on PhD research* (2nd October, 2013)

ABC 666 Radio Canberra Drive Show with Adam Sherley. *Interview on PhD research* (2nd October, 2013)

ABSTRACT

Research has offered various perspectives on the acquisition of spelling competency; however, it is unclear whether knowledge progresses in successive stages, or in more complex ways. While assumptions regarding the relevance of learning to spell in contemporary classrooms undoubtedly influence instructional practices and priorities, research is needed to determine the extent to which proficiency in spelling influences compositional writing when compared to grammar and punctuation. It is imperative that school teachers adopt evidence-based practice; however, there is relatively little research available on the teaching and learning of spelling, particularly beyond the early childhood education years.

The present study draws on data from 1,389 students to capitalise on a specific context that has not been rigorously explored, namely the Australian-English spelling system as represented by students in Years 3 to 6 from the Australian Capital Territory (ACT). The theoretical framework underpinning this study is Triple Word Form Theory (TWFT) which conceptualises proficiency in Standard English spelling according to an individual’s capacity to efficiently and automatically coordinate three linguistic skills: phonology, orthography and morphology (Richards, Aylward, Field, et al., 2006). The present research began with a Pilot Study (n=198) to develop and test an innovative spelling assessment tool informed by TWFT: the Components of Spelling Test (CoST). Reliability results demonstrate
strong internal consistency in all three subscales: the Phonological Component; Orthographic Component; and Morphological Component.

Following the Pilot Study, a Major Study was undertaken and adopted an explanatory sequential mixed methods design. Phase One aimed to: (i) understand the relationship between three language convention variables (spelling, grammar and punctuation) and written composition (n=819), as measured by the NAPLAN Language Conventions Test and the Writing Test; (ii) examine students’ median performance levels of the linguistic spelling components (n=1,198), as measured by the CoST; and (iii) explore the relationships between the NAPLAN spelling results and the CoST scores, for low-achieving spellers (n=237) compared with high-achieving spellers (n=275). Phase Two aimed to provide rich, descriptive comparisons of the spelling strategies used by low-achieving spellers and high-achieving spellers across Years 3 to 6. This final phase involved qualitative content analysis and triangulation of a range of data. Qualitative data included narrative and persuasive texts, composed by eight low-achieving spellers and eight high-achieving spellers in Years 3 to 6, as well as transcripts from semi-structured interviews, conducted with those students and their class teachers.

In Phase One, results indicate that spelling, grammar and punctuation jointly influenced written composition, and that spelling was the main predictor of performance in written composition. From
Years 3 to 6, concurrent increases in the median performance levels for the phonological, orthographic and morphological subscale scores of the CoST were found, albeit to varying degrees. While year level differences in scores were significant, the effects for gender and the interaction of year level and gender were non-significant. Additionally, significant positive correlations between the NAPLAN spelling results and the three subscale scores of the CoST were observed across the four cohorts, for low-achieving spellers and high-achieving spellers.

The results of Phase Two show that high-achieving spellers utilise a broad range of spelling strategies and tend to coordinate multiple linguistic processes when spelling a single word. On the other hand, low-achieving spellers heavily rely on phonological processing and some inaccurate orthographic processing. Importantly, the findings suggest that spelling competency is not manifested in linear stages, and that explicit instruction in the coordination of phonological, orthographic and morphological processing is essential in enabling autonomous and accurate spelling.

The view that knowledge of the English spelling system develops in distinct and sequential stages is refuted in the present study, while unequivocal support for TWFT is evidenced in the findings. By presenting much needed clarity about the nature of spelling acquisition in Years 3 to 6, implications for curriculum and approaches to the teaching and learning of spelling are discussed.
<table>
<thead>
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<th><strong>GLOSSARY OF TERMS</strong></th>
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<tr>
<td><strong>Acquisition</strong></td>
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<td><strong>ACARA</strong></td>
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<td><strong>ACT</strong></td>
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<tr>
<td><strong>Affix</strong></td>
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<tr>
<td><strong>Alveolar ridge</strong></td>
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<tr>
<td><strong>Autonomous lexicon</strong></td>
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<td><strong>CoST</strong></td>
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<tr>
<td><strong>Derivational suffix</strong></td>
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<td><strong>Digraph</strong></td>
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<td><strong>Dual-route Model</strong></td>
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phonological route involves the translation of sound-to-spelling, and the lexical route automatically accesses stored information from a learned repository.

**Dyslexia**
Dyslexia is characterised as an unexplained difficulty in learning to read and/or spell, and is known to relate to several factors including the structure of the brain, processing speed, working memory difficulties, a phonological deficit.

**EAL**
English as an Additional Language

**ES**
Effect size

**Etymology**
The historical and cultural origin of a word.

**fMRI**
Functional magnetic resonance imaging

**Grapheme**
An alphabetic letter that represents a speech sound in a word.

**Homophones**
Words that sound alike but have different spelling and meaning (e.g., mussel/muscle).

**ICSEA**
Index of Community Socio-educational Advantage

**IECs**
Introductory English Centres (IECs) are for students who require full-time English language instruction. There are three in the ACT primary sector.

**Inflected endings**
Suffixes that change the tense of a word (e.g., shout/shouted) or number (e.g., dog/dogs).
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>LQH</td>
<td>Lexical Quality Hypothesis.</td>
</tr>
<tr>
<td>Matthew effect</td>
<td>An accumulative advantage over a period of time. This phenomenon has also been described metaphorically as 'the rich get richer and the poor get poorer'. For example, high-achieving spellers may learn to use an increasing number of spelling strategies over time, while low-achieving spellers may not broaden their repertoire of spelling strategies.</td>
</tr>
<tr>
<td>ML</td>
<td>Maximum Likelihood. A statistical method used to treat missing cases.</td>
</tr>
<tr>
<td>MCEETYA</td>
<td>Ministerial Council on Education, Employment, Training and Youth Affairs</td>
</tr>
<tr>
<td>Morpheme</td>
<td>The smallest unit of meaning within a word.</td>
</tr>
<tr>
<td>Morphology</td>
<td>The study of parts within words that signal meaning and/or grammar.</td>
</tr>
<tr>
<td>MI</td>
<td>Multiple Imputation. A statistical method used to treat missing cases.</td>
</tr>
<tr>
<td>MRA</td>
<td>Multiple Regression Analysis</td>
</tr>
<tr>
<td>NAPLAN</td>
<td>National Assessment Program-Literacy and Numeracy. Introduced in 2008, this is an annual testing scheme culminating four tests that are administered in May to all Australian students in Year 3, 5, 7, and 9. A national achievement scale for each test is made up of 10 bands and all</td>
</tr>
</tbody>
</table>
year levels are reported on the same scale.

**NAPLAN Language Conventions**
A 40 minute NAPLAN test designed to measure student achievement in spelling, grammar and punctuation.

**NAPLAN Reading**
A 45 minute NAPLAN test for Year 3 students, 50 minute test for Year 5 students, and 65 minute test for Year 7 and 9 students, designed to measure reading comprehension.

**NAPLAN Writing**
A 40 minute NAPLAN test designed to measure student achievement in the quality and control of written composition.

**NEAF**
National Ethics Application Form

**NZ**
New Zealand

**Orthography**
The study of a system of conventional letter sequences at the word level. The word “orthography” derives from Greek language roots: *orthos* translates as “correct” and *graphein* translates as “to write”. Literally, orthography refers to “correct writing” (Apel, 2011, p. 592).

**Phoneme**
The smallest unit of speech.

**Phonemic awareness**
The ability to consciously manipulate individual phonemes, such as segmenting each sound in the word *cat* as *c*-a-t.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td><strong>Phonics</strong></td>
<td>The systematic relationship between speech sounds and letters.</td>
</tr>
<tr>
<td><strong>Phonological awareness</strong></td>
<td>An awareness of the different speech sounds, including phonemes, syllables, and rhymes.</td>
</tr>
<tr>
<td><strong>Phonology</strong></td>
<td>The study of sounds in speech.</td>
</tr>
<tr>
<td><strong>Prefix</strong></td>
<td>An affix included at the beginning of a base word to change its meaning.</td>
</tr>
<tr>
<td><strong>PIRLS</strong></td>
<td>Progress in International Reading Literacy Studies</td>
</tr>
<tr>
<td><strong>PISA</strong></td>
<td>Programme for International Student Assessment</td>
</tr>
<tr>
<td><strong>Semantic processing</strong></td>
<td>Thinking about the relation between signifiers embedded in a text such as words and phrases, and what they mean.</td>
</tr>
<tr>
<td><strong>Specialist schools</strong></td>
<td>Schools catering for students with a moderate to profound intellectual disability, severe Autism Spectrum Disorder or multiple disabilities who require intensive support. There are four specialist schools in the ACT.</td>
</tr>
<tr>
<td><strong>SPSS</strong></td>
<td>Statistical Package for the Social Sciences</td>
</tr>
<tr>
<td><strong>Suffix</strong></td>
<td>An affix included at the end of a base word.</td>
</tr>
<tr>
<td><strong>Syllable juncture</strong></td>
<td>The point of shift from one syllable to another within a word.</td>
</tr>
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| TWFT | Triple Word Form Theory  
(Richards, Aylward, Field, et al., 2006) |
<table>
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<tbody>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>Velum</td>
<td>The soft palate inside the mouth, extending from the rear of the hard palate towards the back of the throat.</td>
</tr>
</tbody>
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1 INTRODUCTION

1.1 Becoming proficient in Standard English spelling

Whilst spelling is regularly tested in primary schools, it is not often taught and, even when it is taught, the approach used is usually not informed by recent research or seen as connected to and contributing to other literacy skills. This thesis presents evidence that proficiency in spelling is an influential factor in compositional writing. Spelling is a visible, cultural sign system of communication and a problem solving word formation process (Bahr, 2015). In Standard English, spelling is the representation of “word-level language using written symbols in conventional sequences (orthography) that represent speech sounds (phonology) and word parts that signal meaning and grammar (morphology)” (Garcia, Abbott, & Berninger, 2010, p. 63). However, much of the English spelling system derives from culturally and historically diverse linguistic origins; consequently, spelling often requires the processing of etymological word parts (Devonshire, Morris, & Fluck, 2013; Invernizzi & Hayes, 2004; Venezky, 2004).

Becoming a proficient speller can support the development of writing and reading skills (Bowers, Kirby, & Deacon, 2010). On the other hand, difficulty with spelling can interrupt the reading and writing processes, ultimately compromising fluency, comprehension, lexical precision, cohesion and richness of a written text (Kim, Al Otaiba, & Wanzek, 2015; Kohnen, Nickels, & Castles, 2009).
Proficiency in spelling can also enhance opportunities for employment and higher education in adult life (National Commission on Writing, 2004), and is considered important by parents, school-based professionals, tertiary institutions, employers, governments and the media (Westwood, 2008a, 2008b). Further, as demonstrated by Varnhagen (2000), written texts abundant in spelling errors may be perceived, at least by primary school children, as “less well constructed, less comprehensible, less interesting, and less memorable” (p. 122) than texts containing accurately spelled words. While inaccurate spelling may result in an unfavourable effect on the overall impression of a text and its author (Varnhagen, 2000), inadequate spelling skills may also negatively impact an individual’s motivation to write (Perfetti, 1997) and confidence to write (Snowling, 2000). Indeed, individuals experiencing difficulty with spelling at school can be disadvantaged as they may be less inclined to use writing to support and extend their learning across several disciplines (Cutler & Graham, 2008).

1.2 The context for examining spelling acquisition

This study examined the complex nature of becoming proficient in Standard English spelling in an Australian setting. While seminal literature has explained how young children may start to explore concepts of print, including aspects of spelling, even before formal schooling begins (see, for example, Bissex, 1980; Clay, 2013), less is known about spelling acquisition later in schooling. Therefore,
the context for this study is the acquisition of Standard Australian-English spelling in the middle and upper primary school years. As this study was conducted in Australia, the terms ‘year level’ or ‘year’ are used throughout the thesis to refer to a group of Australian students who commenced formal schooling at the same point in time. In Australia, children are not mandated to start school until the age of six years; however, it is possible for them to start school as young as four and a half years of age. Therefore, this immediately creates a potential age difference of up to two years within a school year level. Indeed, a broad age range within a given year level reflects a typical mainstream Australian classroom setting, and it does not necessarily indicate that some students have repeated a year of schooling.

The present research began with a Pilot Study, which was followed by a mixed-method Major Study. Overall, the research involved 17 mainstream co-educational schools in the Australian Capital Territory (ACT). Quantitative and qualitative data were collected from almost 1,400 students, enrolled in Years 3 to 6 during 2013. In addition, qualitative data were collected from 16 classroom teachers during the same year.

1.3 Significance of the research

The extent to which proficiency in spelling predicts success with writing, beyond the first few years of formal schooling, has not been adequately evidenced in the literature. This study is possibly the first study to conduct correlational and regression analyses using
students’ individual raw scores for spelling, grammar, punctuation and persuasive writing, obtained from the National Assessment Program-Literacy and Numeracy (NAPLAN). The results may have potentially important implications for pedagogy and curriculum as they provide impetus for systematic and effective instruction in spelling.

Further, this research addresses issues relating to the measurement of spelling competency. In determining the efficacy of an instructional approach, or identifying strengths and weaknesses in students’ knowledge, assessment regimes that reliably and validly yield detailed diagnostic information are critical (Kohnen et al., 2009; Westwood, 2005). In the Pilot Study, the Components of Spelling Test (CoST) was developed and tested with this goal in mind. Importantly, the CoST is informed by Triple Word Form Theory (TWFT) (Bahr, Silliman, Berninger, & Dow, 2012; Garcia et al., 2010; Richards, Aylward, Field, et al., 2006), and has been designed to measure students’ knowledge of phonological, orthographic and morphological word formations. The development of the CoST may prove significant for educators and educational researchers as it can be used to inform curriculum development and pedagogy in ways that might enhance student learning in spelling.

Current understandings of spelling acquisition, particularly in the middle and upper primary years of schooling, are neither sufficiently substantive nor conclusive. For several decades, some researchers have assumed that spelling knowledge develops in
sequential stages or phases (Bear & Templeton, 1998; Ehri, 1985; Frith, 1980); however, a growing body of research supports the view that learning to spell may not follow a developmental, linear trajectory (Devonshire et al., 2013; Garcia et al., 2010; Kohnen et al., 2009; Rittle-Johnson & Siegler, 1999; Sharp, Sinatra, & Reynolds, 2008; Varnhagen, McCallum, & Burstow, 1997). Indeed, recent propositions indicate that learning to spell is a process of learning to abstract, apply and interconnect phonological, orthographic and morphological knowledge from the beginning of learning to write (Bahr, 2015) and that this requires explicit teaching (Adoniou, 2014). The study discussed here aimed to examine, in a comprehensive and systematic way, students’ linguistic processes underlying their spelling and determine whether changes occur as a function of year level and/or gender. The findings provide valuable insights for educators, as they need to understand why, what and when specific linguistic skills and processes could be taught, and how linguistic instruction might be effectively implemented. The evidence provided in this study should also inform curriculum development in the area of spelling.

Mixed-methods research has the potential to offer the comprehensive insights needed to advance instructional practice in the area of spelling (see, for example, Sharp et al., 2008). However, the combined use of quantitative and qualitative research methods has been under-utilised in research which has explored the teaching and learning of spelling in mainstream school contexts (Sharp et al.,
The present research draws on quantitative and qualitative research methods so that educators and curricular administrators can confidently use the evidence from this research to develop appropriate curriculum and implement effective pedagogy in spelling.

1.4 Research aims and questions

The research began with a Pilot Study which aimed to develop and test a spelling assessment tool informed by the literature on the teaching and learning of spelling. Specifically, TWFT was identified as an appropriate framework for the development and testing of the CoST. This tool became pivotal in the Major Study which followed. The first phase of the Major Study sought to: i) examine the extent to which spelling, grammar and punctuation jointly and independently relate to written composition in Year 3 and Year 5, and determine whether gender and/or age are influential factors; ii) inspect median performance levels in the linguistic components of spelling, and determine if differences exist on the basis of gender and year level; and iii) explore relationships between the NAPLAN spelling results and the CoST results for low-achieving spellers and high-achieving spellers, and establish whether the relationships are affected by gender and/or year level. In the second research phase, the aim was to provide rich descriptions of the strategies students use to spell, and explain how these strategies differ between low-achieving spellers and high-achieving spellers. Table 1.1 presents the research questions for the Pilot Study and the Major Study:
Table 1.1  
*Research Questions*

<table>
<thead>
<tr>
<th>Pilot Study</th>
<th>1. Does the <em>Components of Spelling Test</em> (CoST) provide a reliable and valid measure of Phonological, Orthographic and Morphological knowledge?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Study: Phase One</td>
<td>1. What is the relationship between the three dimensions measured by the NAPLAN Language Conventions Test (spelling, grammar and punctuation) and written composition? Is this relationship influenced by gender and/or age?</td>
</tr>
<tr>
<td></td>
<td>2. What are the median performance levels for students across different years on the linguistic spelling components in the CoST? Does performance on these spelling components in the CoST differ on the basis of gender and/or year level?</td>
</tr>
<tr>
<td></td>
<td>3. What are the relationships between the NAPLAN spelling results and the linguistic components of spelling for low-achieving spellers compared with high-achieving spellers? Are these relationships affected by gender and/or year level?</td>
</tr>
<tr>
<td>Major Study: Phase Two</td>
<td>4. What spelling strategies are used by low-achieving spellers compared with high-achieving spellers? Are students able to explain the spelling strategies they use?</td>
</tr>
</tbody>
</table>

**1.5 Structure of thesis**

The thesis comprises two volumes. The first volume consists of nine chapters that contain the body of the thesis, while the second volume constitutes the appendix. This chapter has introduced the study by describing the background, purpose and significance of this research. Chapter 2 provides a review of the relevant literature, highlighting current understandings of the teaching and learning of spelling. Chapter 3 presents a theoretical framework for an examination of students’ spelling achievements in Years 3 to 6.
Chapter 4 describes the design and methodology for the Pilot Study and the Major Study. The results of the Pilot Study are reported in Chapter 5, while Chapters 6 and 7 report the results of Phase One and Phase Two of the Major Study, respectively. In Chapter 8, an overall discussion of the research findings are presented. Chapter 9 concludes with a summary of the key findings of the research and the implications for instructional practice, curriculum and pre-service and in-service teacher education courses. This final chapter also acknowledges the limitations of the research and presents recommendations for future research.
2 REVIEW OF LITERATURE

2.1 Introduction

The literature discussed in this review is focussed on the teaching and learning of Standard English spelling in the primary school years. The review begins by highlighting the significance of literacy learning, with a particular focus on what it means to be a literate writer and a competent speller. After establishing connections between spelling competence and other aspects of being literate, scholarly research on the acquisition of spelling competence is interrogated. Considering the present research has been conducted within an Australian context, contributions of Australian research to current understandings of the nature of spelling development are also presented. The chapter concludes with a discussion of issues relating to pedagogy in spelling, followed by a summary of key themes emerging from the literature reviewed.

2.2 Conceptualising literacy

Literacy has been narrowly conceptualised in the past as the ability to read and write; however, it is “now understood as a plural set of social practices” (Norris, 2014, p. 62). Moreover, a contemporary perspective of being literate proposes that meaning can be constructed and interpreted within a given sociocultural context using ‘oral, visual, audio, gestural, tactile and/or spatial patterns’ (Kalantzis & Cope, 2012, p. 2). Indeed, the Australian Curriculum,
Assessment and Reporting Authority’s (ACARA, 2015a) definition of literacy reflects this broader view:

   Literacy encompasses the knowledge and skills students need to access, understand, analyse and evaluate information, make meaning, express thoughts and emotions, present ideas and opinions, interact with others and participate in activities at school and in their lives beyond school. (ACARA, 2015, ‘Scope of the Literacy Capability’, para. 1)

The importance of being literate is reflected in the politicised and public view that literate individuals are those who are able to effectively “take their rightful place in a globalised world, socially, culturally and economically” (Gonski et al., 2011, p. 22). Becoming literate is undoubtedly vital to overall success in school and in adult life (Hutcheon, Campbell, & Stewart, 2012). On the contrary, illiteracy can potentially exclude individuals from full engagement in society, and has been linked to poor health and well-being (Erin, 2006).

School teachers are held accountable for the development of students’ literacy by the education community, policy administrators, parent bodies and the media (Snyder, 2008, 2009). The teaching of literacy is shaped by “individuals’ understandings of what literacy and learning” entails, as well as by mandated curricula and by what teachers do to achieve their pedagogic goals (Fisher, 2012, p. 300).
The literature discussed, however, is specifically concerned with Standard English language and some of the associated skills and knowledge needed to be able to “create, locate, analyse, comprehend and use a variety of written, visual, aural and multimodal texts for a range of purposes, audiences and contexts” (Wing Jan, 2009, p. 3). While literacy is socially contextualised and encompasses multiple communicative objectives, and literacies, being able to accurately and critically decode and encode a socially situated written language system is one of the fundamental characteristics of being literate.

2.3 The significance of becoming a literate writer

Being a literate writer encompasses an important set of skills that facilitate communication and expression (Cutler & Graham, 2008; Elbow, 2004; Penner-Williams, Smith, & Gartin, 2009). Writing is a fundamental communication tool that provides a means of understanding our collective past, present, and future. Becoming a writer is a complex cognitive, physical, social and cultural endeavour (Bromley, 2007; Love, Burns, & Buell, 2007). It requires an understanding of a culturally specific sign system and use of this system in a way that has communicative intent (S. Larkin, 2009).

Interactions between several different skills and metacognitive and cognitive processes are required when writing (Berninger & Abbott, 2010; Berninger, Nagy, & Beers, 2011). Interactions may involve skills such as handwriting, touch-typing, spelling, grammar, punctuation and vocabulary (Penner-Williams et al., 2009; Puranik &
Al Otaiba, 2012; Read, 2009; Ritchey, 2007); and processes such as planning, problem solving, sequencing and categorising (Frith, 1980; S. Larkin, 2009; Martello, 2001). Although writing is a complex phenomenon, it is a personal and creative endeavour, and can empower individuals to tap into their intellectual curiosity and sense of inquiry (Cutler & Graham, 2008).

To describe the complexities involved in the task of writing, Hayes and Berninger (2014) proposed a three-tiered framework which captures the social, cultural, cognitive and linguistic interactions involved in writing. As illustrated in Figure 2.1, their framework consists of i) the Resource Level; ii) the Process Level; and iii) the Control Level. Hayes and Berninger (2014) explain that the three levels are interdependent and influence one another during the task of writing, and that strengthening the interaction of all three levels over time is crucial to building capacity for effective writing. In Figure 2.1, the arrows have been used to illustrate a few examples of the potential relations in compositional writing.
Figure 2.1 Three-tiered writing framework proposed by Hayes and Berninger (2014)
Educators, policy makers, media organisations and business enterprises acknowledge that writing competence is an essential literacy skill. Yet, according to Fisher (2012, p. 299), “primary school students’ progress in writing lags behind that of reading and many children fail to achieve standards of writing to support their personal and academic needs at secondary school and beyond”. Writing is integral to learning (Mackenzie & Hemmings, 2014), and up to half of a student’s school day may constitute some form of writing by the time they reach eight years of age (Bromley, 2007). Students who experience difficulty with writing are disadvantaged as they are less likely to use writing to support and extend their learning across several disciplines (Cutler & Graham, 2008). Further, Abbott, Berninger and Fayol (2010, p. 281) posit that students who experience difficulty with writing “are at risk for grade retention and may not graduate” because they are unable to successfully participate in written assignments and complete formal testing.

Writing is also regarded as a gateway for employment and higher education in adult life (National Commission on Writing, 2004). For example, research has indicated that poorly written job application materials are often not considered, while businesses in the USA reportedly need to allocate substantial funds, annually, for adult writing remediation, as approximately two-thirds of salaried employees in large companies are required to effectively write official documents (National Commission on Writing, 2004).
2.4 A dominance of reading over writing

Learning to read at school has often been prioritised over learning to write (Elbow, 2004; Westwood, 2013). Instructional practice in reading has also been a dominating topic in educational research (Myhill & Locke, 2007) and government policies (Snyder, 2008), compared to writing pedagogy. Indeed, an absence of research in the area of writing compared to reading is highlighted in Hattie’s (2009) seminal synthesis regarding student achievement, which draws on over 2,000 original studies related to reading, but only 262 studies related to writing and none specifically focused on spelling. There is an abundance of studies reporting aspects of developmental reading and the effects of instructional approaches on achievement in reading, particularly from the USA and the UK (de Lemos, 2002; Ehri, Nunes, Stahl, & Willows, 2012; Read, 2009). Conversely, studies examining the acquisition of spelling and its relationship to compositional writing are very limited (Abbott et al., 2010; Brown & Ellis, 1994). Specifically, research focusing on spelling predominantly stems from several decades ago (Bear & Templeton, 1998; Chomsky, 1970; Frith, 1980; Henderson, 1981); largely employs quantitative methods, and involves non-Australian participants in the early years of schooling (Berninger et al., 1998; Berninger et al., 2002; Coker & Ritchey, 2010; Crittenden, 2007; Graham, Harris, & Chorzempa, 2002; Nunes, Bryant, & Olsson, 2003; Puranik & Al Otaiba, 2012).

Research on students’ acquisition of reading skills has offered insights which can inform future investigations into the nature of
learning to spell. For example, Clay (2013) explains that “as readers become proficient, more of the processing is hidden from view, worked out in the child’s head before a response is made” (p. 57).

The same may apply to children’s processing while they write in a particular orthographic system, such as the Standard Australian-English spelling system. Specifically, it is possible that as children become proficient in spelling, they may increasingly internalise their thinking. Additionally, the errors young readers make when decoding words could apply to errors made when young writers encode (spell) words during compositional writing. For example, according to Clay (2013, p. 57), a text considered to be “hard” for a reader is one in which as many as 11% of the words are incorrectly decoded. When a reader makes this proportion of errors, Clay (2013) suggests that “the meaning of the text” (p. 68) tends to get lost. A parallel could be made when a similar proportion of words are incorrectly spelled in a written composition, making it difficult for the reader of the erroneous written text to make effective meaningful connections.

Furthermore, research on the development of word knowledge (particularly oral vocabulary acquisition) has largely stemmed from research in reading, and although it has been conceptualised in alternative ways in the past (Phythian-Sence & Wagner, 2007), the accumulated research may provide useful insights needed to investigate the nature of acquiring spelling knowledge. For instance, Beck, McKeown, and Omanson proposed in 1987 that word knowledge could be represented on a continuum of five levels, as
shown in Figure 2.2. Applying this continuum to the acquisition of spelling knowledge may be plausible; however, such conceptualisation may be constrained to specific words, rather than to cognitive processes which may underlie spelling.

![Figure 2.2 Development of word knowledge in reading (Phythian-Sence & Wagner, 2007, p. 9).](image)

If the continuum of knowledge acquisition, as presented in Figure 2.2, were to be applied to spelling, the lowest level would assume that knowledge of a word’s spelling may be completely absent because the writer may have no experience in writing that word. The second level may be characterised by the correct use of some graphemes within a given word, such as the initial and final letters, albeit with some incorrect letter sequencing throughout. The third level may be represented by inconsistent spelling of a word and only within the context in which it has been learned, for example
within an isolated list of rote learned words. The fourth level may be demonstrated when sub-lexical features of an encoded word may be used, but sometimes confused (e.g., slopel/sloap), and there is some inconsistent application across a range of related word families (e.g., stop, stopped, stopping) and/or semantic contexts (e.g., I ate eight lollies). Finally, in the fifth level, consistently accurate spelling of a word may be present across different semantic contexts and related word families. Research is needed, however, to explore the possibility of conceptualising spelling development in this way.

More recently, it has been argued that repeated encounters with word meanings and linguistic word forms through reading, writing and oral language experiences can result in greater word-specific spellings of higher lexical quality (Davis & Drouin, 2010; Silliman, Bahr, Nagy, & Berninger, in press). Word specific spellings reflect an individual’s capacity to accurately encode the spelling patterns that are unique to specific words. According to Silliman et al. (in press), word-specific spelling involves cohesive integration of word pronunciation, awareness of permissible orthographic sequences and morphology. Hence, spelling patterns that are unique to words can become represented in a mental lexicon (or vocabulary storehouse) through exposure and experience with words over time, and these spelling patterns can then be retrieved during spelling and word reading (Silliman et al., in press).
It has been suggested that the emphasis in research on the acquisition of reading skills is possibly attributed to “the fact that standardised assessments are more easily applied to reading than to writing, which makes the acquisition of reading skills more amenable to scientific study than the acquisition of writing skills” (de Lemos, 2002, p. 8). If this explanation holds true, the barriers that have inhibited research endeavours on the acquisition of writing literacy may be overcome by considering different research paradigms in future studies. Moreover, the current political climate favours evidence-based scientific research that employs quantitative methods over qualitative methods, despite the argument that the mixed use of quantitative and qualitative methods can capture the rich and complex nature of becoming a literate writer (Bahr et al., 2012; Dreher, 2012; Snook, O'Neill, Clark, O'Neill, & Openshaw, 2009; Snyder, 2008).

2.5 A focus on spelling

English orthographic systems can be identified as culturally-situated, “correct” writing systems (Apel, 2011, p. 592), which gradually evolve among English speaking societies around the world (Fritz, 2010). Standard spelling systems among English speaking parts of the world, such as Australia, the UK, Canada and the USA, for example, are each subtly unique. Additionally, digital communication technologies of the 21st century have been facilitating the evolution of an alternate orthographic system, namely, textism (Bushnell, Kemp, & Martin, 2011). Expanding global cultural exchange and rapid technological development is experienced by
many societies, and this is influencing the ways in which the various English orthographies are evolving and being applied (Fritz, 2010; Zedda-Sampson, 2013). Current digital communication mediums, such as mobile phones and social media have propelled text-messaging practices, generating an additional language of abbreviations, acronyms, word combinations, and punctuation (Bushnell et al., 2011; Varnhagen et al., 2010; Yvon, 2010).

Consequently, literate citizens are expected to consciously control and manipulate alternative language systems that are perpetually emerging and evolving across different social contexts. Therefore, teaching students to become proficient spellers is still important in the current digital age, even though spell checks may be used for self-monitoring and revising (Figueredo & Varnhagen, 2006; Varnhagen et al., 2009). Above all, if students are expected to appropriately apply and adapt ‘spellings’ to different social and cultural contexts, they need to become autonomous and critical spellers. In considering the intrinsic diversity and evolving nature of the English orthographic systems, it is problematic that research on the teaching and learning of the various systems has been limited (Treiman, Seidenberg, & Kessler, 2014).

Spelling is one of the essential secretarial processes and products of the written language (Bahr, Silliman, Danzak, & Wilkinson, 2015; Graham et al., 2002; Puranik & Al Otaiba, 2012). Indeed, it has been argued that generating quality written texts is partly dependent on being able to accurately spell words (Abbott et
al., 2010; Berninger et al., 1998; Hutcheon et al., 2012; Nauman, Stirling, & Borthwick, 2011; Puranik & Al Otaiba, 2012; Schlagal, 2007). When students have inadequate spelling skills, they consciously devote attention to the task of spelling rather than other cognitive resources required for composing quality texts (Berninger et al., 1998; Graham et al., 2002; Singer & Bashir, 2004). Competence in spelling may also influence the words a writer chooses to use. Specifically, if spelling is a laborious and cognitively demanding process, the writer is less likely to use words that cannot be confidently, automatically and accurately encoded (Apel, Masterson, & Hart, 2004; Graham & Santangelo, 2014). Research has also suggested that middle and upper primary school students may be less inclined than younger writers to take informed risks with written vocabulary when writing, often resorting to words that they can confidently spell, which may then undermine the quality and precision of their compositional writing (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Kohnen et al., 2009; Lowe & Bormann, 2012).

Learning to spell is known to support metalinguistic skills, such as phonological awareness (Ehri, 1985) and morphological awareness (Nagy, Berninger, & Abbott, 2006), which in turn positively influences writing competence (Graham, Gillespie, & McKeown, 2013; Martello, 2001), and general enjoyment, fluency and comprehension in reading (Berninger, Cartwright, Yates, Swanson, & Abbott, 1994; Graham et al., 2013; Martin-Chang,
Ouellette, & Madden, 2014; Perfetti, 1997; Treiman, 1998). Students who experience difficulty in spelling throughout the primary school years are likely to continue to struggle in high school, where spelling has not been commonly taught (Snowling, 2000). Although the newly implemented Australian Curriculum: English acknowledges the importance of spelling in the secondary school years, as Westwood (2013) points out, it is currently unknown whether or not this curriculum expectation is beginning to translate into Australian classroom practices. In turn, without improved instruction and where difficulty in spelling continues, students’ self-confidence and overall literacy achievement may be negatively impacted. Indeed, evidence from empirical research has indicated that low-achieving spellers in the primary years of school have greater levels of anxiety, avoid written-related tasks and are less motivated to learn than higher-achieving spellers (Sideridis, 2005). In support of such claims, Graham and Santangelo (2014) assert that individuals who continue to experience difficulty with spelling may avoid writing and “develop a mindset that they cannot write”, which may then lead to “arrested writing development” (p. 1704).

Proficiency in spelling is undoubtedly an important constituent of writing competence. Indeed, research has indicated that from the beginning of formal schooling, transcription skills, namely spelling and handwriting, predict competence in writing (Connelly, Dockrell, Walter, & Critten, 2012; Puranik & Al Otaiba, 2012). It needs to be acknowledged, however, that other factors are
also known to predict success with writing. For example, research by Dunsmuir and Blatchford (2004) demonstrates that a child’s attitude towards writing when commencing school, as well as his/her oral vocabulary and pre-reading skills (knowledge of concepts about print and letter identification) are among the factors that predict writing competence at seven years of age. Consistent with these findings, recent research conducted within an Australian context provides evidence that oral language development, as well as phonemic awareness, predict writing vocabulary in the first year of school (Mackenzie & Hemmings, 2014). Moreover, a child’s experiences with drawing prior to commencing formal schooling has been found to contribute to success with writing (Mackenzie & Veresov, 2013).

Research which examines the relationship between spelling and compositional writing achievements of students in the middle and upper primary school context is sparse; however, an important longitudinal study, conducted in the USA, provides evidence to suggest that in Years 3 to 6, spelling and writing are reciprocally related (Abbott et al., 2010). This study also demonstrates that individual differences in spelling across Years 1 to 7 consistently explain unique variance in “word-level spelling” and “text-level composition” (Abbott et al., 2010, p. 294). This particular period of schooling has been identified as critical for learning in all areas (Farmer-Dougan & Alferink, 2013). Specifically, although a large portion of cognitive, language and emotional development is known to occur in the early childhood years, particularly between birth and
three years of age, “the brain undergoes additional critical development during the middle and adolescent years” (Farmer-Dougan & Alferink, 2013, p. 60). As neural development is influenced by a vast array of life experiences such as exposure to print, immersion in various modes of language and quality of instruction received at school (Farmer-Dougan & Alferink, 2013), individual differences in cognitive and language development are inevitable.

Working memory plays a crucial role in learning to write. For example, a relationship between word-level working memory and writing related skills, including spelling, was found in the early childhood schooling years, while working memory at the sentence-level (as opposed to the word-level) was related to writing related skills in the upper primary years (Berninger, Abbott, Swanson, et al., 2010). Established as a predictive factor in writing success, working memory is described by Gathercole (2007, p. 234) as a “workspace capable of storing and processing information in the course of ongoing cognitive activities”.

Among the factors known to predict writing competence, considerably less is known about the predictive capacity of spelling. Additional research is still needed to determine whether spelling predicts writing competence in the middle and upper primary school years when compared to other language convention skills such as grammar and punctuation. It is also unclear whether relationships
that may exist between the language conventions (spelling, grammar and punctuation) and written composition are influenced by gender and/or age.

2.6 Gender disparities in student literacy achievement

Gender differences have been found in literacy achievements, both in Australia (ACARA, 2012b; Comber, 2004; Limbrick, Wheldall, & Madelaine, 2010) and internationally (Allred, 1990; Berninger, Nielsen, Abbott, Wijsman, & Raskind, 2008; Mullis, Martin, Foy, & Crucker, 2012; Watson, Kehler, & Martino, 2010). According to successive assessments administered by the Progress in International Reading Literacy Studies (PIRLS), Year 4 girls achieve much higher average reading comprehension scores than boys in most countries (Mullis et al., 2012). Similarly, statistics from successive Australian national standardised tests, administered since 1999, report that a greater proportion of girls than boys achieve the minimum national benchmarks in reading and writing (see, for example, ACARA, 2012b; MCEETYA, 2007). An analysis of 2008 National Assessment Program-Literacy and Numeracy (NAPLAN) data, conducted by Limbrick et al. (2010), also provides evidence that girls significantly outperform boys, Australia-wide, for reading, writing, spelling, grammar and punctuation. Specifically, the highest reported gender ratio (6.75:1) was found in the Writing Test for the ACT cohort in Year 3. Although the reported effect sizes were in the small to moderate range, slight increases in effect size with year level were evident (Limbrick et al., 2010). In particular, the research of
Limbrick and colleagues (2010) suggests that learning to write may be more problematic for boys than girls, especially in Year 3. Similarly, while Berninger, Nielsen, et al. (2008) hypothesise that boys “may be losing relative ground in writing proficiency” (p. 168), they also suggest that consistently poorer orthographic skills in male boys (and adults), compared with females, “may be the sources of gender differences in writing, but not motor skills” (p. 151).

Figure 2.3 presents longitudinal achievement trends using biennial NAPLAN (persuasive) Writing Test data spanning three testing periods: i) Year 3, 2009; ii) Year 5, 2011; and iii) Year 7, 2013). Although the percentages presented in the figure need to be interpreted with a degree of caution, it is interesting to note that the observed gender differences in percentages are consistent with the research of Limbrick et al. (2010). Moreover, it is worth noting the apparent longitudinal decline from Year 3 to Year 5 to Year 7 in the percentage of students reaching at or above the national minimum benchmark for writing, both nationally and in the ACT.
Scholarly publications have also reported that girls tend to write more than boys and have better orthographic fluency; however, boys often excel in verbal fluency (Berninger & Fuller, 1992; Puranik & Al Otaiba, 2012). Further, Allred (1990) has reported that primary school girls attain significantly higher scores than boys in spelling achievement measures. Figure 2.4 illustrates that this trend has occurred in Australia, as measured by the spelling construct within the NAPLAN Language Conventions Test.
Figure 2.4 Percentage of students achieving at or above the minimum national benchmark for NAPLAN Spelling (ACARA, 2009, 2011; 2013c).

On the contrary, Hattie (2009) argues that there is greater variation in overall academic achievement among girls and boys than there are differences between girls and boys, and suggests that gender differences “should not be of major concern to educators” (p. 55). It should be pointed out that in Hattie’s (2009) synthesis of over 800 meta-analyses of academic achievement, no study focussed exclusively on achievements in spelling.

Aligning with Hattie (2009), Mills, Martino, and Lingard (2006) also suggest that not all boys underachieve in literacy. Further, Chipere (2013) studied gender differences in phonological awareness and reading ability in 140 children in Kindergarten through
to 2nd grade. While differences found in Chipere’s study were initially small, with girls outperforming boys, an increasing discrepancy in performance was observed between Kindergarten and Grade 2, but differences were “magnified by social and psychological forces” (Chipere, 2013, p. 287). Resonating with Chipere’s (2013) findings, Mohd Arif and Hashim (2010) found limited gender differences, with girls marginally outperforming boys in terms of visual literacy practices. Importantly, differences were attributed to social and cultural influences above and beyond gender (Mohd Arif & Hashim, 2010). Following Skelton (2001) and Collins, Kenway, and McLeod (2000), Watson et al. (2010) “contend that the way gender is socially and culturally constructed must be given greater consideration” (p. 358).

Evidently, continued research is needed to resolve the gender debate, particularly in relation to literacy achievements. In particular, scholarly articles have not focussed on the ways in which girls and boys differ in their application and development of the linguistic components of spelling, even though this can potentially offer rich educational insights.

2.7 Acquiring competence in spelling

Research on the processes involved in learning to spell is not well developed when compared to the processes involved in learning to read (Treiman et al., 2014). There is a particular need to understand whether proficiency in Standard English spelling develops
in a predictable way, and as Read (2009) asserts, “the more consistency and depth we can find ... , the more spelling can tell us about the nature of development in literacy generally” (p. 268). In particular, current research presents conflicting perspectives regarding the ways in which competence in spelling is acquired. Broadly, there are two schools of thought regarding the nature of spelling development. The first position refers to linear theories of spelling development, which originate from a Piagetian perspective of learning, and essentially proposes that spelling knowledge develops in a sequential manner. The second view draws on several non-linear models of spelling development, collectively advocating that spelling knowledge is not acquired in a sequential or hierarchical way. The following two sections of this chapter discuss literature on linear and non-linear understandings of spelling development, respectively.

2.7.1 Linear perspectives of spelling acquisition

Developmental stage theories derive from “Piagetian theory and the notion that aspects of cognitive development proceed by way of qualitative stage-like change” (Gentry, 2000, p. 319). The assumption underlining linear theories of spelling development is that spelling difficulties reflect an “inability to move on to the next stage” of development (Kohnen, Nickels, & Castles, 2009, p. 116). The analysis of spelling errors students make have enabled stage theorists (Bear & Templeton, 1998; Cataldo & Ellis, 1988; Chomsky, 1970; Ehri, 1985; Frith, 1980; Gentry, 2012; Henderson, 1981) to produce a linguistic index that has subsequently led to the categorisation of the
development of spelling into stages. Error analysis has become an established methodological approach to elicit strategies used when spelling (Lennox & Siegler, 1994). Using this analytical method, stage theorists have postulated that students pass through different developmental stages in spelling throughout schooling. For example, according to Gentry (2000), students progress through five distinct stages of spelling, namely: ‘precommunicative’, ‘semiphonetic’, ‘phonetic’, ‘transitional’ and ‘correct’ (or ‘conventional’). According to Bear, Invernizzi, Templeton, and Johnston (2012), the stages are termed as ‘emergent’, ‘letter-name’, ‘within word’, ‘syllables and affixes’ and ‘derivational’, as seen in Table 2.1. Both models of stage theory are essentially characterised by similar qualitatively descriptive and fine-grained categories that aim to “capture the key understandings that distinguish them among the layers of English orthography” (Bear et al., 2012, p. 9).

An example of a commercial spelling test that is based on an error analysis method, and one that involves the categorisation of a student’s performance into a particular ‘stage’ of development, is the Words Their Way Inventory (Bear et al., 2012). While this spelling test also utilises a dictation format in the same way that the South Australian Spelling Test (Westwood, 2005) does, it cannot fully capture the range of difficulties that students are likely to encounter as they learn to refine and apply phonological, orthographic and morphological knowledge with increasing accuracy. Indeed, in critiquing commonly used spelling tests, Kohnen et al. (2009, p. 116)
argue that “that a child’s spelling errors at a single point in time can reflect processing that would be attributed to several developmental stages”.

Table 2.1
Theories of Developmental Spelling Stages

<table>
<thead>
<tr>
<th>Stages described by Gentry (2000)</th>
<th>Stages described by Bear et al. (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spelling Stages</strong></td>
<td><strong>Characteristics</strong></td>
</tr>
<tr>
<td>1. Precommunicative</td>
<td>Some knowledge of the alphabet but no sound to letter correspondence. Spelling is random.</td>
</tr>
<tr>
<td>Spelling example: SSHIDCA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Semiphonetic</td>
<td>Partial left to right mapping of phonetic representation.</td>
</tr>
<tr>
<td>Spelling example: GABI (Garbage)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Phonetic</td>
<td>Total mapping of phonetic representation.</td>
</tr>
<tr>
<td>Spelling example: Can u opn kaz (Can you open cans)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Transitional</td>
<td>Basic orthographic conventions and a shift from phonetic to morphological spelling.</td>
</tr>
<tr>
<td>Spelling example: Thes afternewn it’s going to rain (This afternoon it’s going to rain)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Correct (Conventional)</td>
<td>Orthographic rules firmly established, including word origins and morphological structures.</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

*Note. Table 2.1 adapted from Bear et al. (2012, p. 7)*

A specific developmental stage may be determined by the kinds of error that are made in an encoded word; however, it is
possible that different linguistic processes might be operative in
different parts of the same word (Perfetti & Hart, 2002; Willows &
Scott, 1994). It has been argued that by calculating percentages of
words that fit into each stage, a child’s developmental stage is
determined “without consideration for whether a child’s stage may
reflect the relative difficulty of the words the child is attempting to
spell” (Willows & Scott, 1994, p. 200). As children’s oral vocabulary
and experiences with words are bound to be uniquely different, it is
likely that their spelling knowledge of the same set of words may not
be alike. Further, Kohnen and colleagues (2009) assert that there is
“no evidence” to suggest that knowledge transitions from “one stage
to the next by shifting from the signature strategy of one stage to the
strategy that is characteristic of the next stage” (p. 116).

Ehri (2005) also refutes the stringent assumption of stage
theory, but takes a somewhat neutral position, maintaining that
competence in spelling (and sight word reading) does follow a linear
trajectory. Specifically, Ehri (2005) explains that spelling (and
reading) knowledge emerges ‘successively’ and in four ‘phases’
(rather than ‘stages’), namely ‘prealphabetic’, ‘partial alphabetic’,
‘full alphabetic’, and finally, ‘consolidated alphabetic’. The
descriptors of each phase, as described by Ehri (2005), broadly imply
that knowledge builds successively from a phonological base
(phoneme to grapheme correspondence) to a mix of phonological and
orthographic knowledge (awareness and capacity to manipulate
phonemes and letter sequences within words), and finally to a
combination of phonological, orthographic and morphological knowledge (awareness and capacity to manipulate phonemes, letter sequences and meaningful units within words). In distinguishing the difference between ‘stages’ and ‘phases’, Ehri (2005) asserts that students may make connections from more than one phase when learning but the phase in which a student is in at a given time is characterised by the predominant type of linguistic knowledge being used. Stage and phase-like theories essentially offer sequential descriptions of the trajectory of spelling acquisition. Although linear perspectives have provided educators with a framework from which to plan for instruction and assessment in a given classroom, emerging evidence refutes the view that spelling knowledge is acquired in a stage-like or phase-like manner (Varnhagen et al., 1997).

Assumptions underlining the nature of learning to spell have implications for the teaching of spelling, yet consensus regarding the trajectory of learning to spell has not yet been reached.

Critten, Pine, and Messer (2013) propose a rather different lineal model to that proposed by stage and phase theorists. In their study (2013), six ‘representational levels’ of spelling were identified by analysing data from four to six year old students (n=101) who completed a recognition task and a production task. In the recognition task, students were asked to identify and justify the correct spelling among sets of regular verbs (e.g., filled, filed and filld), irregular past tense verbs (e.g., lost, losted, losted), and non-verbs (e.g., sofi) (Critten et al., 2013). In the production task, students
used magnetic letters to create four prescribed words (cold, cook, bat, day) and were then asked to change the spelling of each word to make a new word (sold, book, fat, may). They repeated this process using non-words (lold/wold, dook/pook, dat/jat, cay/tay). For each production attempt students were asked to explain their actions. The production task in the study, described above, required the students to use magnetic letters to ‘make’ one-syllable words only, none of which included regular past tense verbs (those words ending with the suffix, ed). A handwritten production task was not included. By drawing on Karmiloff-Smith’s Representational Redescription Model (1992) to analyse students’ responses to the tasks, Critten and her colleagues (2013, p. 209) concluded that spelling development can be described along a continuum of “explicitation” (see Table 2.2). Broadly, the RR Model considers “learning as a process whereby initial implicit representations are redescribed to become increasingly explicit. Therefore knowledge gradually becomes consciously accessible and verbalisable until more explicit formats allow it to be generalised across and within domains of learning” (Critten & Pine, 2009, p. 97).
Table 2.2
Representational Levels of Spelling Identified by Critten et al. (2013)

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-implicit</strong></td>
<td>Rudimentary understanding of letters and sounds. Total inability to justify spelling choices.</td>
</tr>
<tr>
<td><strong>Implicit</strong></td>
<td>High accuracy in recognition of spelling choices but inability to justify or explain choices.</td>
</tr>
<tr>
<td><strong>Explicit 1A</strong></td>
<td>Explains some phonological errors but no past tense verb errors.</td>
</tr>
<tr>
<td><strong>Explicit 1B</strong></td>
<td>Recognises some past tense verbs but cannot always explain why words are correct.</td>
</tr>
<tr>
<td><strong>Explicit 2</strong></td>
<td>More explicit verbal explanations of phonological knowledge and <em>ed</em> rule; however, some inconsistencies and overgeneralisations are present.</td>
</tr>
<tr>
<td><strong>Explicit 3</strong></td>
<td>Complete understanding of phonology and <em>ed</em> rule. Ability to fully verbalise.</td>
</tr>
</tbody>
</table>

*Note. Table 2.2 adapted from Critten et al. (2013, p. 203)*

Considering that there are linguistic and motor-related limitations inherent in the production task employed by Critten et al. (2013), it could be argued that the students’ responses to the prescribed tasks do not provide conclusive evidence to support the representational levels proposed. Indeed, Critten et al. (2013) acknowledge that the recognition and production tasks are inherently different, and that the cognitive demands are undoubtedly greater in the latter (Critten et al., 2013). Therefore, it is not surprising that the continuum of spelling representation was not found to be consistently parallel in the recognition and production tasks. It seems that the descriptions for each representational level predominantly refer to evidence from the recognition task, rather than the production task;
hence, greater caution is needed in asserting the conclusions made about the continuum of representational levels of spelling.

2.7.2 Non-linear perspectives of spelling acquisition

A growing body of research provides evidence to suggest that spelling does not develop in distinct stages or in linear phases, and that these perspectives provide an overly simplistic account of learning to spell as they cannot capture the range of difficulties or experiential advantages students encounter throughout their journey towards proficient spelling (Berninger & Abbott, 2010; Devonshire & Fluck, 2010; Devonshire et al., 2013; Goswami, 1992; Sharp et al., 2008; Snowling, 1994; Treiman & Kessler, 2006; Varnhagen et al., 1997). The research of Lennox and Siegler (1994) has also suggested that students use all strategies that are available to them to spell and that these skills develop continuously and in parallel. Other research has found that students begin to develop morphological awareness early in schooling (Apel, Brimo, Diehm, & Apel, 2013; Critten et al., 2013; Nunes et al., 2003; Treiman, Cassar, & Zukowski, 1994), but its overall development has a much longer span than other kinds of linguistic awareness, such as phonological and orthographic awareness (Berninger, Abbott, Nagy, & Carlisle, 2010). This body of research resonates with the work of Paris (2005), who asserts that “alphabetic knowledge” and “phonemic awareness” … are constrained” skills because “they all develop from non-existent to high or ceiling levels in childhood” (p. 187). Consequently, alternative models of the spelling trajectory have been proposed,
collectively suggesting that spelling acquisition does not follow a linear path.

**2.7.2.1 Overlapping Waves Theory**

The *Overlapping Waves Theory* was originally developed to account for the strategy choices made in arithmetic tasks but it suggested that it could also account for the strategies students employ when spelling (Kwong & Varnhagen, 2005; Rittle-Johnson & Siegler, 1999). According to this theory, the strategies students use when spelling, as identified in two separate studies involving students in Year 1 (Rittle-Johnson & Siegler, 1999; Sharp et al., 2008), are influenced by their experiences and adapt over time in a wave-like manner, as illustrated in Figure 2.5. Moreover, it assumes that students may alternate between strategies within a single task. In both these studies, a different methodological approach was used to that typically adopted by stage theorists: students’ overt behaviours and retrospective self-reports were analysed to identify the specific strategies used to spell individual words. The researchers in both studies also explored changes in strategies (Rittle-Johnson & Siegler, 1999; Sharp et al., 2008). It is worth noting that their findings parallel Clay’s (2013) observation that young readers can learn to efficiently draw on a range of strategies and sources of information to solve reading challenges.
Rittle-Johnson and Siegler (1999) found that all the students in their study (n=30) used multiple spelling strategies when writing isolated words, with six distinct spelling strategies being identified: ‘retrieval’, ‘sounding out’, ‘retrieve/sounding out’, ‘drawing analogies’, ‘relying on rules’, and ‘visual checking’ (1999). When the students used the ‘retrieve/sound out’ strategy, this involved a combination of “automatically retrieving part of a word’s spelling and sounding out the remaining parts” (p. 338). The process of “analogizing involved reference to knowledge of another word’s spelling as the basis for spelling the presented word”, while “rule use involved using conventional formulas such as the silent e rule for marking long vowels or the \textit{ing} or \textit{ed} rule for words having those endings” (p. 338). ‘Visual checking’ involved writing the word in multiple ways, “seeing” whether it “looked right,” and “repeating the cycle if necessary” (p. 338). Rittle-Johnson and Siegler (1999) also
found that the students combined ‘rule use’ and ‘visual checking’ with other strategies when spelling different words. The students used between two and five strategies when they were in Year 1, with the most frequently used strategies being “retrieval and sounding out”, while “a significant minority used analogies or rules” (p. 339).

When the students were in Year 2, up to six strategies were used by individual students. Almost all the students used “retrieval, sounding out, and rules”, while “most also used retrieve/sound out and visual checking, and almost half drew analogies” (p. 339). The use of ‘retrieval’ and ‘sounding out’ remained as the most common strategies.

Extending on the study by Rittle-Johnson and Siegler (1999), a mixed methods design was employed by Sharp et al. (2008) to elicit the spelling behaviours of Year 1 students (n=31) as they engaged in written composition. The findings of their study were limited to those identified as being “at risk for reading failure” (2008, p. 210). Sharp et al. (2008, p. 213) observed the student’s writing of a range of prescribed individual and decontextualised words, and also gathered responses from students’ retrospective self-reports, by asking them two questions: "How did you spell _ ?" and "What did you do to decide on those letters?". The coding and analysis of the data resulted in the identification of two types of behaviours: “accessing memory” and “using overt spelling strategies” (Sharp et al., 2008, p. 215).

Sharp et al. (2008) describe ‘accessing memory’ as the direct retrieval of a spelling pattern from memory, while overt strategies were those
that could be articulated by the students, and were categorised as ‘guessing’, ‘sounding out’, ‘rule use’, ‘analogy’, ‘visual checking’, ‘copying’ and ‘chunking’. Also from an Overlapping Waves perspective, Kwong and Varnhagen (2005) compared how children (aged approximately 6 years) and adults develop automaticity in spelling. They found that both children and adults demonstrate variable and adaptive strategy use and that a shift from “effortful backup strategies”, such as sounding out, to rapid “retrieval” of novel (pseudo) words from memory is a gradual process, regardless of age (Kwong & Varnhagen, 2005, p. 157). They posit that “there are multiple means to accomplish” the correct spelling of a word and that “not all people use the same spelling strategies or use them in the same sequence” (Kwong & Varnhagen, 2005, p. 158).

Providing evidence in support of the Overlapping Waves Theory, the studies described above collectively suggest that substantial variability exists in the spelling strategies a student might use throughout a period of several months, and that students may not exclusively use a single strategy to spell (Kwong & Varnhagen, 2005; Rittle-Johnson & Siegler, 1999; Sharp et al., 2008). Additionally, Rittle-Johnson and Siegler (1999) report an overall increase over time in more efficient strategy use, such as ‘analogies’ and ‘rules’, rather than an over-reliance on the ‘sounding out’ strategy. This finding parallels Clay’s (2013) observations of emerging readers. Sharp et al. (2008) also suggested the possibility of a Matthew effect occurring, in
regards to the spelling strategies observed in the Year 1 students, over
the course of their five month study.

Although several studies provide evidence of the complex
nature of spelling development, their findings are limited because
they derive from students in the early years of schooling (Kwong &
Varnhagen, 2005; Rittle-Johnson & Siegler, 1999; Sharp et al., 2008).
Furthermore, these studies did not include interview data from the
students’ teachers, specifically to ascertain detailed information
regarding the spelling pedagogies adopted leading up to and during
the study, and to elicit teachers’ perspectives of the spelling strategies
their students use. Methodologically, these limitations have been
addressed in the present study through the triangulation of
quantitative and qualitative data gathered from students and their
teachers.

An earlier study conducted by Varnhagen and colleagues
(1997) did, however, involve an analysis of spelling samples from
narrative texts written by students in Years 1 to 6. The researchers
found that those children’s representations of the silent e long vowels
(in words such as home, made and time) and ed past tense words (e.g.,
played, tried and dragged) did not follow a strong and consistent
“developmental progression of qualitatively distinct stages”,
concluding that there is “no empirical support” for developmental
stage theory (Varnhagen et al., 1997, p. 160). Indeed, they argue that
developmental stages are too broad to adequately characterise the
development of spelling ability.
2.7.2.2 Dual-route Model

An alternative non-linear model of the spelling trajectory has been explained from an information processing perspective: the Dual-route Model stems from research involving individuals who acquired reading problems following brain damage (Altmann, 2001; Castles & Coltheart, 1993) and individuals with dyslexia (Peterson, Pennington, & Olson, 2013). Dyslexia is characterised as an unexplained difficulty in learning to read and/or spell, and is said to relate to several factors including the structure of the brain, processing speed, working memory difficulties, a phonological deficit (Reid, 2009; Snowling, 2000), and more recently, difficulty with “letter position encoding” (Kohnen, Nickels, Castles, Friedmann, & McArthur, 2012, p. 3682). This body of research is consistent with Holmes and Malone (2004), who suggest that “some form of phonological memory might be important for spelling development” (p. 562). The Dual-route Model asserts that there are two different mechanisms or ‘routes’ involved in spelling a word. One route involves the translation of sound-to-spelling, which “encodes information about the correspondences between sound patterns and spelling patterns” (Brown & Ellis, 1994, p. 6). This phonological route enables the production of phonetically plausible pseudo words and unfamiliar words, but it cannot be used to accurately spell unpredictable or irregular words. The second route that enables the production of spellings is the lexical route, which involves directly and automatically accessing stored information from a “learned
repository” of known words (Barry, 1994, p. 27). Lennox and Siegler (1994) draw on the Dual-route Model to explain differences between high-achieving spellers and low-achieving spellers and conclude that low-achieving spellers rely on their visual memory skills and orthographic conventions, rather than phonological skills, whilst high-achieving spellers use a combination of phonological and visual skills, as well as the use of analogy. The Dual-route Model does not specify how the two routes are combined to produce a single orthographic output and it does not account for other linguistic skills that may contribute to the spelling of a word (Barry, 1994; Brown & Ellis, 1994). It is likely that there are several other routes or connections that a child may access when spelling a word, as suggested by other non-linear models of spelling development.

2.7.2.3 Lexical Quality Hypothesis (LQH)

A relatively recent theoretical proposition has emerged and is known as the Lexical Quality Hypothesis (LQH) (Perfetti & Hart, 2002). This theorising originates from research in reading development and proposes that spelling development is dependent on the integration and interaction of three closely connected constituents: orthography, phonology, and semantics (Perfetti & Hart, 2002). It has been argued that poor readers and spellers experience difficulty integrating orthographic and semantic knowledge in an efficient manner and tend to rely merely on phonological knowledge (Perfetti & Hart, 2002). Lennox and Siegler (1994) suggest that good spellers and poor spellers do use different strategies but it is unclear what
these strategies are and how they manifest over time (Treiman, 1994).

Worth noting, Treiman et al. (2014, p. 10) maintain that “research on
the processes involved in spelling is less well developed than research
on the processes involved in reading, and much work remains to be
done”. 

Neuro-cognitive studies relating to reading and writing skills
have emerged throughout the last decade and provide further evidence
that the spelling trajectory may not be linear, as observed in children
and adults with and without specific learning difficulties (Berninger
& Abbott, 2010; Richards, Aylward, Berninger, et al., 2006;
Richards, Aylward, Field, et al., 2006; Richards, Berninger, Winn, et
al., 2009). This body of research refutes the 1970s stage-like models
of spelling and offers new insights into the function of the brain and
its plasticity during language acquisition.

2.7.2.4 Triple Word Form Theory (TWFT)

Triple Word Form Theory (TWFT) resonates closely with the
LQH and originates from studies conducted on samples of individuals
diagnosed with dyslexia that employed instructional methods and
brain imaging (Garcia et al., 2010; Richards, Aylward, Field, et al.,
2006; Richards, Berninger, Winn, et al., 2009). TWFT assumes that
“learning to spell or read draws on storing and analysing in memory”
three interrelated linguistic word forms: phonological; orthographic;
and morphological (Garcia et al., 2010, p. 62). Several neuro-
cognitive studies have involved comparisons of individuals with and
without dyslexia, providing converging evidence that unique and common brain regions are activated during spelling and reading related tasks (Berninger & Abbott, 2010; Berninger, Abbott, Nagy, et al., 2010; Garcia et al., 2010; Richards, Aylward, Berninger, et al., 2006; Richards, Aylward, Field, et al., 2006). Table 2.3 summarises the unique and common brain regions that were found to be activated during specific linguistic tasks during an intervention study involving 38 students in Years 4 to 6 (Richards, Aylward, Berninger, et al., 2006). More specifically, brain imaging analyses have provided evidence that brain plasticity is responsive to instruction in the three linguistic word forms in children and adults (Richards, Aylward, Field, et al., 2006).

Table 2.3

<table>
<thead>
<tr>
<th>Linguistic Word Forms</th>
<th>Location of Unique Brain Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonological</td>
<td>Left inferior temporal gyrus, left middle temporal gyrus</td>
</tr>
<tr>
<td>Orthographic</td>
<td>Left superior temporal gyrus</td>
</tr>
<tr>
<td>Morphological</td>
<td>Left cerebellum, bilateral striatal and occipital regions, right posterior parietal</td>
</tr>
<tr>
<td>Common brain regions across all word forms</td>
<td>Left middle frontal gyrus, left posterior parietal regions, right lingual</td>
</tr>
</tbody>
</table>

Note: Table 2.3 is taken from Richards, Aylward, Berninger, et al. (2006, p. 564)

Further, by drawing on neurocognitive research, Richards, Berninger, and Fayol (2009, p. 344) propose that low-achieving
spellers (when compared to high-achieving spellers) “differ not only in their spelling ability … but also in the underlying process of translating ideas or concepts into word spellings”. This group of researchers explain that specific brain regions such as the “left superior frontal” and the “left lingual” regions “are overly activated” by low-achieving spellers “during idea generation and spelling decisions”, suggesting that they have “anomalies … in the idea-to-spelling translation process” (Richards, Berninger, & Fayol, 2009, p. 344). Importantly, the “left lingual” region is known to be “part of the neural networks that process [the] … orthographic word form” (Richards, Berninger, & Fayol, 2009, p. 344).

Evidence from intervention studies has also offered important insights into spelling acquisition. For example, Bowers, Kirby and Deacon (2010) reviewed morphological intervention studies (n=22), which collectively provided evidence of the important role of morphological understanding throughout spelling development. In refuting the principles of stage theory, their study found that morphological instruction was “at least as effective for students in the early stages of formal literacy instruction as it was for students in later grades” (Bowers et al., 2010, p. 171). Additionally, Bowers et al. (2010) found that explicit instruction about “morphological structures and how they link to other linguistic skills, such as orthographic, semantic, phonological and grammatical” (p. 170) was more effective than instruction provided in morphological structures without the
integration of other linguistic skills. This finding closely resonates with the principles underlying TFWT.

Bahr et al. (2012) quantitatively analysed phonological, orthographic and morphological errors in expository and narrative writing samples of students in Years 1 to 9. Their research identified evidence of a non-linear growth in spelling development, with particular support for TWFT. In their study, Bahr and colleagues (2012) noted that while “orthographic errors predominated” (p. 1596), errors reflecting breakdowns in phonological, orthographic and morphological processing were noted across all year levels. Importantly, these researchers suggest that “it takes a long time to develop a robust … lexicon that coordinates phonology, orthography and morphology and supports word-specific, conventional spelling” (Bahr et al., 2012, p. 1587).

In another study, functional magnetic resonance imaging (fMRI) scans were used to examine how the brain responds to intervention programs, and the findings suggest that specific activated regions associated with the three linguistic forms may change during the course of a child’s development in learning how to spell (Richards, Aylward, Berninger, et al., 2006). These researchers delivered a morphological treatment program to a group of primary school students identified with dyslexia and found that no significant changes in brain activation and improvements in spelling occurred after treatment. It was predicted that the reason students in this study did not make significant gains in morphological understanding may
have been because they had not initially mastered or reached “reasonable proficiency in the earlier phonological encoding and orthographic stages”, due to their dyslexic impairment (Richards, Aylward, Berninger, et al., 2006, p. 82). This prediction seems to contradict a non-linear perspective of spelling development.

Clearly, research is needed to determine whether stages of spelling are in fact discrete or whether they overlap in a cascading progression, from phonological to orthographic to morphological processing. Moreover, studies need to consider the development of spelling skills in students without specific learning difficulties. Further research could also explore how strategy-use may change on the basis of lexical difficulty, and whether children are able to access relevant information as needed. It is anticipated that stage theories and various non-linear models of spelling may potentially be reconcilable through subsequent studies employing the TWFT theoretical lens (Berninger, Abbott, Nagy, et al., 2010).

Studies providing evidence for TWFT have been conducted in the USA and predominantly from a neuro-cognitive perspective; however, there is a need to extend on the valuable insights they offer, particularly with other student populations and by employing cross-sectional and longitudinal designs. To date, no Australian educational study examining the spelling trajectory has utilised recent neuro-cognitive theoretical frameworks, even though they have the potential to facilitate rich insights into how students become proficient spellers.
TWFT is well grounded and stipulates a more robust theoretical framework than the LQH from which to explore how linguistic components of spelling interact and integrate over time. A further extension to TWFT can be manifested by considering the role of etymology as an interacting linguistic skill during spelling. The current English orthography is based on a “pastiche” of different “tendencies at different time periods” and cultures (Venezky, 2004, p. 148). For example, the phonetic orthography of the Old English language changed after the Norman conquest in 1066, resulting in a massive influx of French words and pronunciations through bilingual Anglo-Norman speakers (Bear et al., 2012). Throughout the Renaissance period, the use of Greek and Latin words expanded the English vocabulary to accommodate knowledge growth of the time (Bear et al., 2012). It has been reported that approximately 75% of the words in the English language derive from Greek or Latin roots (Nancy, Newton, Rasinski, & Newton, 2008). The cultural influences over the last several centuries have resulted in an English orthography that is perceived to be irregular due to its rampant “alternations” and phonetic deviations (Venezky, 2004, p. 147). For example, the etymologically complex nature of the English language is evident in the English words mechanism and machine. These words were borrowed from the Greek origin, via Latin and Norman French roots; hence both retain the letters ch as reflected by their Greek and Latin origins, while the pronunciation of machine is influenced by the
French language, but the pronunciation of *mechanic* is influenced by the Latin language (Venezky, 2004).

Etymology is an important principle of the written English language and is central to understanding the way in which more difficult words are spelled (Venezky, 2004). This is where TWFT is limited; it does not consider that etymological awareness may be a factor in learning to spell. Students may perceive some word spellings as arbitrary and irrational, even though they may carry etymological regularity and logic (Devonshire et al., 2013; Venezky, 2004). An example of the dilemma many individuals face, as they develop proficiency in spelling, occurs with words in which silent letters occur such as the silent e in the word *muscle*: the pronunciation of its related words, *muscular* and *musculature* retain the *kuh* pronunciation because all three words derive from the Latin word *musculus*, pronounced with a *kuh* in Latin (Bear et al., 2012; Venezky, 2004).

Clearly, the *Triple Word Form* theoretical lens is promising; however, it could be expanded to consider etymological principles of the written English language. Indeed, incorporating etymology as a morphological constituent is a justifiable proposition. An extension of this theoretical framework to include etymological considerations can then be justified in examining the linguistic connections individuals make when spelling and how these may compare between high-achieving spellers and low-achieving spellers and between
females and males, throughout the middle and upper primary school years. In comparison to the early primary school years, considerably less is known about the nature of learning to spell in the middle primary school years and beyond (Mullock, 2012).

2.8 Spelling pedagogies

It has been argued that the teaching of spelling has been neglected for several decades (Westwood, 2008a). However, Devonshire et al. (2013, p. 85) claim that spelling has been taught and that “the most frequently used method in many countries is phonics”, which involves teaching students to match alphabetic letters (graphemes) with speech sounds (phonemes). Others maintain that spelling is taught using a variety of teaching strategies (Bouffler, 1997; Snyder, 2008), but that instruction in spelling is largely “guided by tradition rather than by current research” (Apel et al., 2004, p. 297). For example, results from a national survey of a random sample of primary school teachers in the USA (n=355) found that 72% predominantly rely on a traditional instructional method, which, according to Fresch (2003), is characterised by non-differentiated lists of words, often deriving from commercial resources, and administered weekly using a pre-test, rote learn, post-test regime. Despite the popular practice of rote learning lists of decontextualised words, Beckham-Hungler and Williams (2003, p. 300) observed that the Year 2 students in their study, “rarely used these spelling words in their writing, and when they did, they misspelled these words 50% of the time, despite having spelled them correctly on the weekly tests”. 

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According to Bouffler (1997, p. 145), while many whole language teachers do not teach spelling through “rules”, they encourage peer proofreading and “use every opportunity to focus students on words in text as opposed to words in isolation”. Indeed, some researchers argue that spelling instruction should be integrated across many disciplines (Apel et al., 2004), while others believe that spelling should be taught as the need arises (Wilde, 1990). A widely recognised view on pedagogy also maintains that students’ progression through stages of development must be closely monitored and that instruction is targeted at an individual’s developmental stage (Bear et al., 2012; Ganske, 1999).

More recently, growing evidence suggests that all the components of spelling should be taught explicitly (Devonshire et al., 2013) and through the study of words in the context of authentic writing experiences and quality literature (Adoniou, 2014). Adoniou (2014) has also claimed that the teaching of spelling should include an exploration of the history of the language. Research demonstrates that, with explicit instruction in “morphology, etymology, phonology and form rules”, children as young as 5 years of age have the capacity to significantly improve in their spelling (and word reading), more so than when a phonics instructional approach is used (Devonshire et al., 2013, p. 91). Specifically, the intervention study of five to seven year-old students (n=120) conducted by Devonshire and colleagues (2013), indicates that students in this age group are “able to make use of a variety of strategies when learning to spell” (p. 92); however,
they need to be given opportunities to learn how to use strategies beyond phonological processing. Devonshire et al. (2013) found that the students in their study who were provided with explicit instruction in multiple strategy-use were able to learn morphological terms, such as base-word and suffix, and were able to apply morphological and etymological generalisations when spelling, rather than relying on their pre-instructional phonological-based “default strategy” (Devonshire et al., 2013, p. 91). Indeed, Deacon, Whalen, and Kirby (2011) demonstrated that some of the children in their study (n=85), aged nine to 14 years, were capable of accessing the base forms of morphologically complex (derived) words. Clearly, learning to spell should involve considerably more than learning to encode words by making phoneme to grapheme correspondences (Apel et al., 2004).

While it has been argued that spelling can more effectively develop naturally and incidentally through extensive reading throughout the early years, rather than through formal teaching (Krashen, 1989), more recent views strongly contend that explicit instruction is essential (Graham & Santangelo, 2014). It is critical, however, that spelling pedagogies are founded on current understandings of the nature of spelling development across different student populations, so that the diverse needs of students are adequately met.

A review of literature relating to pedagogy specific to spelling reveals unequivocal evidence that (i) many teachers do not have adequate content knowledge and confidence to teach spelling; (ii) that
various pedagogies exist; (iii) that there is considerable disagreement about the most effective method of acquiring spelling competence; and (iv) that there is inconsistency between teachers’ beliefs about the teaching and learning of spelling and their practice (Adoniou, 2014; Apel et al., 2004; Exley, 2014; Fresch, 2003; Graham & Santangelo, 2014; Johnston, 2001; Westwood, 2013). In a study by Johnston (2001), 73% of the participating teachers (n=42) believed that their pedagogy in spelling was inadequate. Similarly, Adoniou (2014) revealed that the Australian primary school teachers involved in her study (n=14) felt dissatisfied with the way they were teaching spelling.

Hammond (2004) examined the spelling pedagogies of 15 primary school teachers from one school in Western Australia. She observed that two distinct pedagogies were used interchangeably among the teachers: sometimes a “child-centred approach” was used, where students were involved in decision making, problem solving, and inventing spellings; and other times an “instruction-centred approach” was adopted, where the learning was directed by the teacher, who provided lists of words and organised rote learning activities (Hammond, 2004, p. 16). While most teachers in Hammond’s study (2004) reported using a phonics approach and taught spelling as a “separate subject”, some described their approach as “balanced” as they also addressed spelling “in the context of real reading and writing” (p. 15).
In a study conducted with teachers in New Zealand (n=405), McNeill and Kirk (2014) found that 64% implemented aspects of a developmental approach to spelling instruction; however, discrepancies between teachers’ theoretical beliefs on learning to spell and their instructional practices were found. The discrepancy between beliefs and practice were largely attributed to a lack of professional knowledge. In Adoniou’s (2014) observation of spelling programmes implemented by the primary school teachers in her study, it was concluded that spelling was characteristically taught as a “discrete activity” (p. 148) and that instruction focussed on the phonology and rote learning of words. Similarly, Herrington and Macken-Horarik (2015) observed that “teachers tend to approach spelling as a task of rote memorisation or drill” (p. 62), through the predominant use of a Look, Say, Cover, Write, Check strategy.

Schlagal (2002) rightly notes that spelling pedagogies have been transformed into a “bewildering array of approaches” (p. 45) as a result of controversy surrounding effective spelling pedagogies. It seems that teachers’ dissatisfaction with what they teach, how they teach, and with their students’ outcomes, has resulted in a haphazard use of a range of approaches and improvisations of programs, perhaps in an attempt to manage their sense of dissatisfaction and uncertainty about the teaching and learning of spelling (Adoniou, 2014; Schlagal, 2002).

Since the turn of this century, studies examining effective literacy pedagogies (Ehri et al., 2012; Hattie, 2009) appear to have
coincided with a popularisation of various phonics-based spelling pedagogies being adopted in schools (Devonshire et al., 2013). Despite ongoing controversy regarding the most effective way to teach spelling (Graham & Santangelo, 2014), teachers are being allured by the commercialisation of phonics programs and seem particularly urged to adopt a phonics approach (Adoniou, 2013), which aims to teach students to translate graphemes into phonemes and synthesise or blend phonemes to form recognisable words.

In a recent meta-analytic review of experimental and quasi-experimental studies on the effect of formal instruction on spelling performance, Graham and Santangelo (2014) provide evidence to support the view that formal spelling instruction improves spelling performance (ES= 0.54) when compared to no/unrelated instruction. They also found that increasing the amount of instruction improved spelling performance (ES=0.70), that gains were maintained (ES=0.54) and that frequent formal teaching of spelling resulted in greater spelling accuracy in students’ written compositions (ES=0.94). Although the findings of this research add to the growing body of research in support of explicit instruction, the research did not examine differences in specific spelling pedagogies.

Educators generally recognise the need to teach spelling; however, lack of consensus and confidence in what constitutes effective spelling pedagogy in a diverse classroom context is apparent (Johnston, 2001). What should be taught? When should it be taught? How should it be taught? These are the questions for which teachers
are seeking answers. Clearly, meta-analytic research is still needed to fully explore the effects of different instructional approaches on spelling performance; however, further insights can be gained by examining the complex nature of linguistic processing when spelling, particularly in the middle and upper primary school years.

2.8.1 Issues of catering for diverse student needs

At the core of ongoing uncertainties in spelling pedagogies, is the issue of diversity among individuals. Within the context of a mainstream school setting, students may present with a particular language need, or a particular cognitive, physical, emotional or social characteristic, that may impact on their learning of the spelling system. For example, students with poor motor skills often experience difficulty with handwriting, which in turn may impact fluency (speed) in written composition and automaticity in spelling (Berninger & Fuller, 1992; Puranik & Al Otaiba, 2012). Additionally, students who experience auditory and visual difficulties will usually have spelling difficulties because vision, hearing, memory, and auditory and visual processing are all involved in spelling (Roberts, 2001; Snowling, 2000). Despite inherent difficulties experienced by individuals with severe hearing impairments and limited phonological skills when learning to spell, it has been argued that these individuals are capable of using visual memory of letter patterns to produce orthographically correct spelling attempts (R. Larkin, Williams, & Blaggan, 2013). Moreover, an important factor in acquiring proficient spelling is working memory
or short term memory). Individual differences in working memory are known to vary by several years within a single regular class (Gathercole, 2007), as indicated in Figure 2.6. Further, difficulty in word learning likely stems from deficits in cognitive and linguistic processes (Carlisle, 2007). It is therefore crucial that teachers recognise the cognitive and linguistic demands involved in spelling and modify instruction according to individual differences.

Figure 2.6 Composite working memory span scores (from the Working Memory Test Battery for Children) as a function of age. (Taken from Gathercole, 2007, p. 235)

Note. Values show means, 10th and 90th percentile points. Scores are standardised, with a mean of 100 and a standard deviation of 15.

It is well established that phonological awareness is critically important for the development of spelling competence (Jongejan, Verhoeven, & Siegler, 2007); however, acquiring phonological knowledge alone is not sufficient. In particular, explicit instruction in morphological knowledge has been found to significantly improve the
spelling of adolescents identified with dyslexia (Tsesmeli & Seymour, 2009) and benefit English language learners (Tsesmeli, Douvalis, & Kyrou, 2011). While it has been reported that children identified with a “language learning disability” may follow a “delayed … spelling development rather than … a deviant development” (Silliman, Bahr, & Peters, 2006, p. 93), their persisting phonological difficulties and consistent omissions in inflectional morphology (such as regular and irregular past tense and plurals) highlights that instruction across multiple linguistic forms, including morphology, is particularly important for students with atypical language difficulties.

Where an individual engages with English as an additional language (EAL) and where classroom contexts represent cultural and linguistic diversity, learning to spell in English may present with unique and specific linguistic challenges (Jongejan et al., 2007; Roberts, 2001), but important opportunities for learning too (Exley, 2014). Teachers need to be adaptive and recognise that students’ cultural and linguistic knowledge funds can be utilised to enhance learning in spelling (Exley, 2014).

2.9 Insights from an Australian context

Little is known about how spelling skills are acquired and applied in the written compositions of middle and upper primary school students in Australia. However, some insights can be gleaned from Elliot’s Master’s thesis (1984), which reported on the spelling errors made by Australian students in Years 2 to 5 (n=360), and on
their use of metalinguistic concepts. Elliot (1984, p. 264) noted that the participating students’ progression of knowledge acquisition from a developmental perspective (that is, from “primitive” to “transitional” to “conventional”), was not always consistent and that increased proficiency did not positively correlate with efficiency in phonemic manipulation. Although Elliot’s (1984) study contributes to our understanding of the complex nature of the spelling trajectory and the notion that spelling involves a great deal more than phonological awareness, it was conducted several decades ago and did not examine the differences in spelling achievements and spelling strategies between females and males. Furthermore, insightful perspectives offered by recent findings in neuro-science provide potential to adopt new theoretical frameworks in educational research that may enrich and renew our understandings of spelling and its application to written composition.

More recently, Young (2007) adopted Gentry’s (2000) developmental stage theory as the theoretical framework for her case study involving six Year 3 students from Australia. To measure students’ developmental spelling stages, Young (2007) utilised a spelling inventory, sourced from a commercial resource, titled Words Their Way (Bear et al., 2012). Young (2007) sought to determine whether the students’ identified stages of development remained consistent across several spelling related tasks, including written word lists, written compositions, editing tasks and word sorting activities. Considering that several inconsistencies in stage-like spelling
development across the various tasks were noted by Young (2007),
and attributed to instructional influences, it is highly questionable that
she concludes by suggesting evidence from her study sufficiently
supports the stage theory of spelling. Further, it needs to be noted
that Young’s (2007) study was limited due to the small sample size.
Additionally, differences in identified developmental stages between
and among the spelling related tasks were not statistically analysed
for significance, hence, the findings of this case study are very
preliminary and cannot be generalised. Finally, alternative sources of
evidence that contest the stage-theory of spelling were not
acknowledged, nor were they considered as possible explanations for
inconsistencies found in students’ spelling knowledge.

In another Australian study, Leonard (2007) reported on a
quasi-experimental study involving 207 Year 5 and 6 students,
attending four schools, who were not achieving at an age appropriate
level of performance in literacy. The focus of her study was on the
effects of four spelling intervention programs on the spelling
performance of students who achieved below-average scores in a
standardised spelling test (Leonard, 2007). Although the study
provided evidence that students’ spelling performance levels can be
improved with minimal modifications to teaching practices,
particularly in female students, it did not investigate the ways in
which many of the females participating in the intervention programs
benefited more than the males in their spelling and why.
Furthermore, the study did not include students without learning difficulties.

Herrington and Macken-Horarik (2015) described a recent doctoral intervention study involving 10 Australian teachers and their students in Years 3 to 5 (n=223). Critically, teachers were guided by the principal researcher (first author of the study) to direct children’s attention to the phonological and morphological properties of words and to make explicit connections between morphemes and phonemes in words. In response to a revelation that all teachers in the study “required significant training, resources and support from the researcher to enable them to apply this kind of knowledge in their various classrooms” (Herrington & Macken-Horarik, 2015, p. 64), a ‘toolkit’ was developed and presented to the teachers, along with ongoing consultation throughout the 10 week intervention. The intervention study revealed statistically significant improvements in student’s morphological knowledge from pre- to post-testing (p<0.001, $d = 0.921$). While this finding is revealing, it needs to be interpreted with a degree of caution because the morphological measure developed for the study did not include a parallel test for use during post-testing and it was not standardised or empirically tested for reliability and validity prior to its use. Nevertheless, teachers’ lack of linguistic knowledge as observed by Herrington and Macken-Horarik (2015) resonates with Kennedy’s (2014) honours dissertation, which reported that the Australian teachers in her study (n=3) lacked content knowledge in spelling and relied on rote learning pedagogical
practices. As Herrington and Macken-Horarik (2015) explain, if teachers rely on superficial accounts of linguistic knowledge, their capacity to facilitate students’ spelling development is weakened.

Also in Australia, but with a rather different research focus, Bushnell et al. (2011) investigated the relationship between students’ (n=227) text-messaging practices and spelling achievement. The study reported that 82% of the participants, aged between 10 and 12 years were sending a median of five text-messages each day when the study took place in 2009; that Year 5 children had begun text-messaging practices as young as eight years of age; and that a minority of males in Year 6 claimed to be sending and receiving up to 600 messages per day (Bushnell et al., 2011). The study also reported significant positive correlations between mobile phone text-messaging frequency and spelling achievement. Interestingly, the study found that the greater a student’s spelling achievement, the more “textisms” he or she tended to produce, after controlling for length of texting experiences (Bushnell et al., 2011, p. 32).

Textisms are often characterised by phonological contractions, as evidenced by omissions of medial graphemes within words, particularly those graphemes representing vowel phonemes (e.g., txt msg for text message, plz for please, hmwrk for homework). In order to spontaneously contract a conventionally spelled word when texting, its inherent linguistic properties may need to be abstracted first; however, this is problematic if phonological processing skills are not well developed. Indeed, blending and encoding a series of
medial phonemes embedded in words requires considerably greater processing skill than encoding the initial and final phonemes in words, and the demand becomes greater when words are polysyllabic (Cassady & Smith, 2004; Cassady, Smith, & Putman, 2008). Further, in an investigation of word-specific knowledge and word-recognition strategies demonstrated by ‘poor’ and ‘good’ adult spellers in Australia, Holmes and Ng (1993) concluded that poor adult spellers’ processing of word parts is inefficient and that they experience particular difficulty analysing the medial parts of longer words. Therefore, individuals who are able to efficiently and accurately draw on phonological processing to spell may then find it easier to create textisms because they are able to logically and efficiently manipulate the phonemic constituents embedded in words. It seems reasonable that high-achieving spellers are equipped with greater linguistic agency than low-achieving spellers, potentially empowering them to engage in texting more frequently than low-achieving spellers, as highlighted by Bushnell and colleagues (2011).

The technology driven 21st century provides impetus for research into the behaviours of spelling acquisition and its application to students’ writing. Perhaps young students are contributing to technologically-driven orthographic systems, which in turn may be influencing the ways in which orthographic knowledge is acquired. Learning to appropriately use English orthographic systems (conventional and alternate) is important. Moreover, given the changes which have been occurring in language usages, there is a
sense of urgency to understand the English spelling trajectory of the 21st century, particularly from primary school students’ perspectives. After all, children are the shareholders of an information communication technology phenomenon, and the keepers of cultural diversity, who will inevitably shape and dictate future orthographic systems around the world.

2.10 Chapter Summary

This review has focussed on the literature pertinent to the learning and teaching of spelling in the 21st century, and has highlighted what is known about the impact spelling competence has on overall literacy and, in turn, on the capacity of students to succeed in school and to fully engage in society. Literature regarding the nature of spelling acquisition presents both linear and non-linear perspectives. Consequently, consensus regarding the nature of learning to spell has not yet been reached, and controversy and some confusion among educators regarding effective pedagogical practice in spelling remains.

In this chapter, gaps in our current understandings of spelling acquisition have been identified. To summarise, research has mostly focussed on spelling acquisition in the first few years of formal schooling, and has largely drawn on data from non-Australian student populations, as well as on children with spelling difficulties. It has also been pointed out that further insights need to be gained by
comprehensively examining the skills and strategies used by low-achieving spellers compared with high-achieving spellers.

Additionally, the review of literature has indicated that complexities of learning to spell can be examined by analysing students’ spelling errors; however, when combined with an analysis of interviews with the students and their teachers, rich insights into students’ spelling strategies and any underlying challenges with spelling, may be elicited. Research which triangulates quantitative and qualitative data collected from middle and upper primary school students as well as their teachers is needed, as it has the capacity to yield comprehensive knowledge about the nature of learning to spell.

Finally, TWFT has been identified in this review as a promising theoretical framework for research aiming to examine the complexities of learning to spell. Although grounded in neuro-cognitive research, TWFT needs to incorporate etymology as a morphological dimension of the English language. The next chapter provides a discussion on the theoretical framework adopted for the present research project.
3 THEORETICAL FRAMEWORK

3.1 Introduction

Having established in the literature review that TWFT is informed by a growing body of neuro-cognitive and behavioural research, this chapter presents TWFT as the theoretical framework underpinning the present study. TWFT has been chosen as a theoretical framework because it reflects current research evidence about the complex processes involved in the acquisition of spelling competency. Specifically, an examination of learning to spell needs to consider ways in which specific linguistic skills interact during the spelling process (Richards, Aylward, Field, et al., 2006; Venezky, 2004), and TWFT provides a robust framework for such analysis (Bahr, 2015; Bahr, Silliman, & Berninger, 2009; Bahr et al., 2012; Bahr et al., 2015). This chapter begins by briefly describing the function of the brain in learning to spell, and then by explaining the three word forms which underpin TWFT (namely, phonological, orthographic and morphological). Building on the principles of TWFT, etymological considerations are also presented in this chapter as an important aspect of morphological processing. This chapter concludes with a discussion on the ways in which the three word forms are known to interact during the spelling process, laying the ground for the resultant methodological approach adopted in the study.
3.2 Functions of the brain and its relevance to TWFT

Drawing on neuro-cognitive research, Lyons (2003) presents a succinct, albeit simplistic, description of the human brain and its function in language acquisition. Lyons (2003) explains that when electrical impulses in the brain are repeatedly transmitted to neurons, via neurotransmitters, they gradually become faster, stronger and more efficient over time. As a consequence, the axons develop a surrounding insulating substance called myelin, which has been associated with memory functioning. Following Lyons’ (2003) account, it is plausible that repetitive exposure through the decoding and encoding of words and/or word parts may eventually lead to increasingly accurate and efficient spelling. Indeed, Richards, Aylward, Berninger, et al. (2006) argue that with sufficient practice in spelling, components of words become represented in long-term memory, resulting in automatic spelling of whole words. This proposition has relevance to TWFT, which assumes that “learning to spell requires learning how to code into memory, analyse, and coordinate three words forms [phonological, orthographic and morphological] and their parts into unified representations” (Bahr et al., 2015, p. 74).

In a recent study examining the spelling patterns produced by Spanish-American English bilingual adolescents (n=160), TWFT was adopted as a framework for analysis (Bahr et al., 2015). Critically, Bahr and colleagues (2015) explain that:
1) The phonological code … functions as an analyser of phonemes in spoken words;

2) The orthographic code … serves to analyse letters, letter groups, and larger letter patterns in written words; [and]

3) The morphological code … analyses root words, prefixes, and inflectional and derivational suffixes in both spoken and written words. (p. 74).

TWFT assumes that when a word is efficiently stored and analysed in the mind, interrelationships among phonological, orthographic and morphological word forms are computed and connected (mapped) through neural transmitters (Richards, Aylward, Field, et al., 2006). The ways in which students construct mental maps to coordinate the three word forms when spelling a word has been explored using fMRI in an intervention study conducted on upper primary year students (n=10) who were identified with dyslexia (Richards, Aylward, Field, et al., 2006). The findings of this study suggest that the “mental maps of written words stored in the lexicon may depend to a large degree on the … interrelationships … within and across phonological, morphological, and orthographic word forms” (Richards, Aylward, Field, et al., 2006, p. 565). Caution is needed, however, in interpreting the findings of the study, particularly because of the limited sample. Nevertheless, findings from other studies have supported the assumption that phonological, orthographic and
morphological word forms contribute independently and in coordination with each other during the spelling process (Berninger, Raskind, Richards, Abbott, & Stock, 2008; Nagy et al., 2006).

The following sections in this chapter present a more detailed discussion of the phonological, orthographic and morphological word forms, respectively. In addition, etymological considerations are addressed as an important morphological feature of Standard English spelling. Finally, the chapter concludes by explaining how the phonological, orthographic and morphological word forms may interact concurrently during the spelling process.

3.3 The phonological word form

Phonological processing of words involves the encoding of phonemes (sounds in speech) into one or two grapheme units (Garcia et al., 2010). For example, individual letters in the words rob or mash are written as each phoneme is individually encoded using a corresponding letter r-o-b or letters m-a-sh. With repeated encoding, students may begin to create phonological representations of all the constituent letters in a written word, regardless of whether or not a word relates phonologically in a one-to-one way (Richards, Aylward, Berninger, et al., 2006). When young students learn to spell words, their spelling attempts may be phonologically plausible, but orthographically incorrect (Garcia et al., 2010). For example, the long vowel phoneme in words (such as coach, grow, slope or dough) can be represented using a multitude of grapheme combinations (e.g.,
oa, ow, o-e or ough), and the prevalence of such orthographic alternations could lead to misspellings (such as slowp or sloap, instead of slope). Hence, while phonological mapping is useful when spelling some words, it is not suitable for the spelling of all words in the English language.

With sufficient practice, phonological representations in long-term memory can be accessed automatically without the intervening phonological encoding process (Kwong & Varnhagen, 2005; Richards, Aylward, Berninger, et al., 2006). For example, when initially learning to spell the word bed, the three phonemes may be individually encoded whilst the word is simultaneously stored in working memory. Over time and with repetition, the representation of the whole word enters the long-term memory whereby the process of writing bed simply requires whole-word automatic retrieval. This means that the word, bed, can be visualised in the mind as one whole unit rather than as three separate phonological constituents.

Although phonological mapping is a critical component of the spelling process, it cannot be relied upon to accurately spell all Standard English words. For example, complex and polysyllabic words may contain components that are phonologically regular (e.g., the medial consonant graphemes in the word recognition require accurate phonological blending across syllables); however, other parts of the word may require orthographic and/or morphological mapping (e.g., the suffix, tion requires morphological processing).
3.4 The orthographic word form

The orthographic word form is concerned with the visible language, and more specifically, how letters are sequenced within a word (Garcia et al., 2010). Explicit orthographic coding involves storing a written word in working memory while analysing the orthographic parts, such as individual letters or letter strings (units). The region of the brain responsible for processing the orthographic word form is thought to be sensitive to letter sequences rather than the visual shapes of individual letters (Richards, Aylward, Berninger, et al., 2006). Brain imaging studies have identified regions of the brain that are uniquely activated during tasks that involve storing the orthographic word form in working memory whilst analysing its parts (Berninger, Raskind, et al., 2008).

Developing heightened orthographic sensitivity requires knowledge of the ‘legal’ (conventional) letter patterns within words (Conrad, Harris, & Williams, 2013). Not all words in the English language contain one-to-one phonological correspondence, but they do follow orthographic conventions. Specifically, ‘positional constraints’ is a term often used to explain how the positioning of a particular phoneme within a word determines how the phoneme is likely to be orthographically represented (Bahr, 2015; Holmes & Ng, 1993; Treiman & Kessler, 2006). For example, in words that are not phonologically regular such as love, dove, give, have and sieve, orthographic regularity is evident because the convention demands that the grapheme v is never used in the final position of an English
word (Elliott, 1984). Instead, when the final consonant phoneme in a word is \( r \), it is always followed by the grapheme \( e \). Likewise, the words *cereal* and *city* are also not phonologically regular, but are orthographically regular because of the convention that permits the grapheme \( e \) to represent the \( s \) phoneme when followed by the grapheme \( i \) or \( e \) (Elliott, 1984). Orthographic generalisations can also be made with many words containing vowel phonemes that may otherwise appear ambiguous or arbitrary in their spelling. For instance, the *ou* diphthong (in words such as *owl*, *clown*, *count* and *loud*) typically requires the graphemes *ow* if the diphthong is present at the end of a syllable (as in *cow*, *how* and *now*) or if followed by the grapheme *l* (as in *owl*), or a single *n* (as in *clown*, *town* and *brown*). For most other words containing the same diphthong, the graphemes *ou* are typically needed instead (in words such as *found*, *shout*, *trout* and *cloud*). Further, Read and Treimen (2013) explain that vowel doublets can plausibly appear in initial, medial or final positions of words, as in *eel*, *seem* and *bee*, while consonant doublets commonly occur in the medial positions (as in the word, *pillow*) and final positions (as in the word, *ball*) but very rarely in the initial position of words (as in the word, *llama*).

While orthographic coding is known to contribute to reading and spelling development (Conrad et al., 2013; Richards, Aylward, Berninger, et al., 2006; Rothe, Schulte-Körne, & Ise, 2014), Bahr (2015) proposes that knowledge of orthographic generalisations is “generally strengthened through experiences with reading and
writing” (p. 194). Moreover, Garcia et al. (2010) demonstrated that students as young as five can correctly identify and reproduce plausible letter sequences and write novel words after only minimal exposure. Explicit practice in orthographic mapping of specific words is known to contribute to correct spelling of those taught words and correct transfer to untaught words in dictated spelling tests, as well as in spontaneous composing and reading (Garcia et al., 2010).

3.5 The morphological word form

In addition to phonological and orthographic mapping, morphological processing is important in Standard English spelling. Morphemes are the smallest units of meaning within a word and are used either to express particular meanings or to fill particular grammatical roles. The morphological word form is a linguistic component that contributes to understanding word meaning and demands awareness of base words and related affixes (Richards, Aylward, Berninger, et al., 2006). Developing morphological knowledge entails increasing “sensitivity to the internal, meaning-related structure of words” (Green et al., 2003, p. 752). As the English spelling system contains morphophonemic elements (Venezky, 2004), correct spelling of words often relies on knowing morphological rules and analysing vowel and consonant patterns at the end of base words to determine whether letters need to be dropped or added for suffixes. According to Green et al. (2003), inflectional and derivational morphemes are two types of morphological structures. Inflectional endings mark tense in base words (e.g., *jump*
becomes *jumped*) or plurality (e.g., *toy* becomes *toys*), while derivational forms involve transforming the base word from one grammatical category to another (e.g., *quick* to *quickly* or *recognise* to *recognition*).

The development of inflectional morphemes is known to occur more rapidly than derivational morphemes throughout the primary school years (Green et al., 2003). In addition, Bahr and colleagues (2012, 2015) have reported that among the morphological errors present in students’ written compositions, homonyms are most frequently misspelled. Following Mazzocco, Myers, Thompson and Desai (2003), Bahr et al. (2015) conclude that “homonym errors reflect shallow semantic processing of the specific linguistic context” (p. 86).

Heightened morphological awareness enables information to be efficiently stored in the mental lexicon, which in turn may help to generate new words by stringing previously learned morphemes together (Garcia et al., 2010). Additionally, it may also enable processing beyond phoneme to grapheme correspondences, particularly when morphologically complex words are encoded (Griva & Anastasiou, 2009). Indeed, morphological awareness can assist in detecting and understanding orthographic units within words that may not necessarily be understood solely through phonological or orthographic awareness. Moreover, morphological awareness can positively impact on reading comprehension and writing composition,
as it assists in coordinating syntactic structures within sentences (Green et al., 2003; Kirk & Gillon, 2009).

3.6 Etymological consideration

The English language is not transparent in the sense that only 56% of its words can be decoded and encoded through phonological mapping (Devonshire et al., 2013). Many words in the English language retain etymological features, and these often dictate the spelling of those words (Venezky, 2004). For example, the words science, conscience, and conscious all contain the same Latin root, sei, which means to know and is pronounced in Latin with a sh phoneme (as in the word shop). Although studies in support of TWFT examined participants’ morphological processing when spelling (see, for example, Bahr et al., 2012; Bahr et al., 2015), consideration was not given to the etymological complexities inherent in many morphemes of the English language (Venezky, 2004). Hence it is imperative that future studies examining spelling development consider etymology as a metalinguistic feature of morphological relevance.

Students who receive systematic instruction on the etymological features of Standard English spelling are likely to make significant overall spelling improvements, as evidenced in an Australian intervention study involving 11 year old students (n=23) (Hutcheon et al., 2012). In this intervention, a group of students studied words categorised according to common etymological
features. Significant overall spelling improvements were found for
the group of students who received explicit etymological instruction.
It needs to be acknowledged, however, that the findings of this study
should be interpreted cautiously due to the small sample size and the
ceiling effects recorded in the spelling measure that was used. In
England, Devonshire and colleagues’ (2013) intervention study
involving 5 to 7 year old students (n=120) demonstrated the
importance of explicitly and concurrently teaching phonology,
orthography and morphology (including etymology). Specifically,
when compared to a control group (who received phonics instruction
only) significant improvements in spelling and reading were
demonstrated in the group of students who received instruction in
multiple word forms.

It has been argued that students will use the strategies that
they have been taught as their default strategy to spell novel words
(Devonshire & Fluck, 2010). If students are taught to spell by
predominantly using a phonological process, it is likely that this
approach may become over-relied upon. Clearly, etymology is a
powerful metalinguistic feature that needs to be considered when
examining the complex nature of spelling development. Older
students are more likely than younger students to come across words
that are etymologically complex in their reading and writing;
however, the extent to which their etymological awareness is explicit,
is dependent on the instruction they have received (Devonshire et al.,
2013; Hutcheon et al., 2012). Whilst research has shown that
etymological awareness impacts on the development of spelling, it is not clear how students might integrate etymology with other metalinguistic features during the spelling process and in their contextualised writing, and how any observed integration might differ between high-achieving spellers and low-achieving spellers.

3.7 Linguistic connections in learning to spell

Learning to coordinate the phonological, orthographic, and morphological word forms when spelling is the central tenet of TWFT, as validated in a series of brain imaging studies (Berninger, Abbott, Nagy, et al., 2010; Richards, Aylward, Berninger, et al., 2006; Richards, Berninger, & Fayol, 2009) and behavioural studies (Bahr, 2015; Bahr et al., 2009; Berninger, Raskind, et al., 2008; Garcia et al., 2010; Nagy et al., 2006). These studies provide evidence that phonological, orthographic, and morphological processes are associated with common and unique brain activation. Moreover, through instructional interventions and brain imaging methods, these studies have provided converging evidence of cross-mapping between either two word forms, or three word forms. Cross-mapping can be explained in relation to learning words that require knowledge of how phonemes, letter sequences and morphemic properties are interrelated in predictable, though not always in one-to-one ways (Garcia et al., 2010). An example of this can be demonstrated in the homophones bred and bread, in which the set of allowable grapheme choices (e or ea) for the medial vowel phoneme
are connected to the meaning of the words. The cognitive processes involved in spelling words with such alternations require mapping across multiple word forms.

In the research reported by Richards, Aylward, Berninger, et al. (2006), fMRI measures were used to determine which brain regions correspond to tasks relating to the three word forms. The goal of their research was to investigate how the brain responds to instructional interventions. For the phonological word form mapping task, students were required to identify differences and similarities in phonemes contained in pseudo-words. The orthographic word form task required participants to distinguish differences and similarities between pairs of letter combinations (e.g., szpy and sxpy), and to determine correctly spelled words (e.g., bead or feal). The morphological word form task included two measures using base words with derivational suffixes: one involved the identification of words where the base word maintained the same pronunciation, despite the inclusion of the suffix; and one that involved words containing a ‘phonological shift’, which occurs when the pronunciation of the base word changes as the result of the addition of a suffix (Richards, Aylward, Berninger, et al., 2006, p. 65). For example, in the word nation, the pronunciation of the first vowel (nation) changes when the suffix al is added to create the word national. In words where a ‘phonological shift’ occurs, the coordination of both morphological and phonological word forms is
required, while words without a phonological shift require morphological processing only.

Before and after the intervention in the study described above, common and unique brain activation, as measured by fMRI, was associated with each mapping task. Greater activation in many regions of the brain was observed after the intervention, suggesting that students were potentially able to make more connections between the different word forms following intervention (Richards, Aylward, Berninger, et al., 2006). These researchers found that many of the common and unique regions of activation on the word form tasks, before and after the intervention, were located in the posterior regions of the brain, but activation also occurred in the frontal and sub-cortical regions. Moreover, the regions were sometimes activated on the left of the brain, sometimes on the right and sometimes bilaterally. Richards, Aylward, Berninger, et al. (2006) suggest that phonological, orthographic and morphological word forms that are represented in the brain are not synonymous with stage theories of spelling development.

By synthesising findings from several neuro-cognitive and behavioural studies that culminate part of a larger research program in the USA, support for TWFT has emerged (Berninger, Raskind, et al., 2008). Drawing on data from several studies, Berninger et al. (2008) used structural equation modelling to show how phonology, orthography and morphology are interrelated during the spelling process and how they contribute to literacy learning in young
students. They identified that: a) phonological awareness is interrelated with orthographic and morphological awareness; b) orthographic awareness is interrelated with phonological and morphological awareness; and c) morphological awareness is interrelated with orthographic and phonological awareness (Berninger, Raskind, et al., 2008).

Richards, Aylward, and Berninger, et al. (2006) demonstrated that TWFT is relevant to understanding how automatic spelling emerges from an early reliance on only phonological and orthographic mappings, to increasing efficiency in phonological, orthographic and morphological mapping. Their findings were supported and extended in a longitudinal study conducted in the USA involving 241 students across the primary school years (Berninger, Abbott, Nagy, et al., 2010). This study showed that substantial growth does occur in phonological, orthographic and morphological awareness in the first three years of school, while morphological awareness, including its relationships to orthographic, phonological and syntactic awareness, grows at a significantly more rapid rate from the fourth year of schooling. This may to some extent be an artefact of the way it is taught in schools.

Richards, Berninger, and Fayol (2009) explain that “with multiple exposures, self-teaching episodes, and creation of [word form] links, an internal lexicon develops” (p. 328). Specifically, an “autonomous orthographic lexicon” can become established when “durable, multifaceted … representations can be directly and …
Consequently, it may no longer be necessary to rely on effortful,
strategic encoding when composing written texts.

The case put forward by TWFT theorists is that all three kinds
of linguistic awareness develop and interact throughout the primary
school years. The implication of this is that phonological awareness,
while necessary, is not sufficient for learning to read and spell.
Berninger, Abbott, Nagy, et al. (2010, p. 156) posit that “as exposure
to language expands from the high frequency words that serve as the
foundation for learning phonological decoding and encoding of
written words to exposure to ... words that are ... morphologically
more complex, knowledge of word-formation processes becomes
necessary for reading and spelling words”. Indeed, Bahr et al. (2015)
posit that the process of cross-mapping when spelling may “influence
the richness of vocabulary development in linking new meanings to
their corresponding written forms” (p. 74). Therefore, learning to
spell is a process of becoming increasingly aware of different
linguistic forms and being able to efficiently coordinate them.

TWFT assumes that phonological, orthographic and
morphological word forms are involved in learning to spell from the
early stages of learning to write words, and that changes occur in the
ways in which these linguistic forms interact, largely as a result of
instructional priorities and approaches (Richards, Aylward,
Berninger, et al., 2006). The view that young students “draw on
phonology, orthography, and morphology from the beginning of
spelling development”, and gain increasing explicit control over these skills (Garcia et al., 2010, p. 88) is very different from the view held by stage theorists who assume that spelling knowledge generally progresses from phonology to orthography to morphology.

In a line of thought that resonates with TWFT, Critten (2007) examined the spelling development of four to seven year old students (n=73) and described it in relation to an implicit-explicit continuum. She proposed that young students begin with either no or little implicit linguistic awareness and develop increasingly explicit levels of linguistic awareness over time (Critten, 2007). While Critten’s study demonstrates that students have the capacity to develop explicit levels of morphological awareness from a very young age, the implicit-explicit continuum cannot be generalised to all linguistic skills. In her study, the students’ developmental level along an implicit to explicit continuum was ascertained by the verbal explanations provided by the students in relation to the ed morpheme spelling rule only. Moreover, Critten did not report on the ways in which several linguistic skills strengthen and integrate over time and how they can influence the development of student understanding and knowledge of the spelling system across the primary school years.

The assumption that students are able to draw on multiple linguistic skills from a very young age aligns with the stance held by Martello (2004) concerning the strategies young writers refer to when learning to spell. Martello argues that all young students possess certain competencies in their knowledge about spelling, but the ways
in which they articulate these are based on their explicit and conscious understanding of the spelling process, and how they perceive themselves as learners. Martello (2004, p. 276) asserts that if students receive systematic and explicit instruction whereby an “ever-growing repertoire” of strategies is offered to them, they may be less likely to perceive themselves as “precompetent learners” who rely solely on “trying” to spell as their strategy towards competency in spelling. Martello (2004) construes that if a student has limited language, the process they use when spelling “requires constant effort, is bound by constrictions … and is almost out of … control” (p. 218).

It has been argued that some students in the primary school years are “underperforming” because they are “likely to be exposed to a large number of spelling programs, often based around phoneme to grapheme correspondence … but with no focus on higher level skills such as orthography and etymology” (Hutcheon et al., 2012, p. 61). Indeed, spelling errors can reflect breakdowns in phonological, orthographic and morphological processes, indicating that multiple linguistic components contribute to spelling (Bahr, 2015; Bahr et al., 2009; Silliman et al., 2006). Further, Bahr et al. (2015) postulate that “phonology, orthography and morphology become unified … as literacy develops” (p. 74) and that this can be illuminated by discerning patterns of misspellings. With this in mind, approaches to instruction and assessment generally fail to systematically consider the multiple linguistic processes involved in spelling.
Garcia et al. (2010) provided evidence that students in the primary school years are capable of drawing on several language processes to varying degrees from the beginning of spelling development; however, their study did not examine how high-achieving spellers and low-achieving spellers differ in the ways in which they may coordinate the different linguistic components. Integration of multiple linguistic skills may be involved in learning to spell new words from the beginning but even more so during middle childhood and early adolescence when students are expected to learn and use more complex words (Garcia et al., 2010). Research is needed in this area. Importantly, an understanding of how phonological, orthographic and morphological processes may or may not differ as a function of age, year level and/or gender has the potential to inform future directions in spelling pedagogy and curriculum.

3.7 Conclusion

This chapter has developed the argument that TWFT provides a suitable theoretical framework in which to explore and understand the ways in which phonology, orthography and morphology may contribute independently and interactively in Standard English spelling. TWFT assumes that proficiency in spelling entails learning to coordinate phonology, orthography and morphology with increasing efficiency and autonomy. The next chapter presents the methodology for the present study, which uses TWFT as a lens from which to interrogate the spelling patterns and behaviours produced by
Australian students in the middle and upper primary years of schooling.
4 RESEARCH METHODOLOGY AND DESIGN

4.1 Overview

Having established the theoretical framework underpinning this research project, this chapter describes the design and methodology used in the various research phases. The research began with a Pilot Study, which aimed to develop and test a spelling assessment tool informed by TWFT. A sequential mixed methods study followed, comprising a quantitative phase (Phase One) then a qualitative phase (Phase Two). Chapter 4 explains and justifies the methodology used for the Pilot Study, followed by Phase One and Phase Two, respectively, of the Major Study.

A pragmatic paradigm was embraced in this multifaceted inquiry whereby quantitative and qualitative methods were employed in order to understand the research problems identified (Creswell, 2012; Tashakkori & Teddlie, 2010). Mertens (2015, p. 37) explains that within a pragmatic ontology, “there is no problem with asserting both that there is a single ‘real world’ and that all individuals have their own unique interpretation of that world”. Further, as a pragmatist, relationships in the research were determined by what was deemed by the researcher as appropriate to the particular inquiry (Mertens, 2015). Rather than being positioned as a distant observer, the researcher sought to study what was of personal value and to
study it in ways that were deemed as appropriate in achieving its purpose. Under this epistemological assumption, this chapter demonstrates how an explanatory sequential mixed methods design was appropriate for achieving the aims of the study. Although “there is a recognition that quantitative and qualitative research are each connected with distinctive epistemological and ontological assumptions … the connections are not viewed as fixed and ineluctable” (Bryman, 2008, p. 606). Indeed, Creswell (2012) argues that “some methods are more closely associated with one worldview than the other”, and that categorising them as “belonging to one worldview more than another creates an unrealistic situation” (p. 537). This chapter demonstrates the compatibility of the combined use of quantitative and qualitative methods in the research design.

4.2 Pilot Study: Developing and Testing the Components of Spelling Test (CoST)

The purpose of the Pilot Study was to design a spelling assessment tool based on TWFT. Specifically, a valid and reliable measure of phonological, orthographic and morphological spelling representations, in the context of Standard Australian English words needed to be developed for the Major Study because no suitable instrument was available for use in this context. As such, the CoST was developed, tested and refined in the Pilot Study to ensure its suitability in the Major Study.
The development of the CoST started from a preliminary compilation of words characterised by diverse lexical complexity. This compilation process involved reviewing the range of words used in popular existing assessment tools such as the *South Australian Spelling Test* (Westwood, 2005) and the inventories from *Words Their Way Spelling* (Bear et al., 2012). In addition, high-frequency words and “demon words”, as identified by Roberts (2001, p. 52), were inspected. Some of these words were considered for inclusion in the preliminary list. Attention was also given to Willett and Gardner’s (2009) analysis of the spelling errors reportedly made by students in the *National Assessment Program of Literacy and Numeracy* (NAPLAN) Language Conventions Test. As a result of the compilation process, 90 words were identified as having potential utility.

The next step involved the identification of appropriate linguistic feature/s for each word. In the CoST, each linguistic feature embedded within a word constituted a potentially measurable item. To inform this item identification process, existing measures of phonological, orthographic and morphological processing of pseudo words were inspected first. Specifically, these included the *Comprehensive Test of Phonological Processing* (Wagner, Torgesen, Rashotte, & Pearson, 2013); a pseudo word orthographic processing measure developed by Conrad et al. (2013); and a measure of pseudo base word and suffix manipulation, used by Nunes et al. (2003). In addition, the POMAS (Bahr et al., 2012) served as an additional
source of information to assist in the preliminary classification of word parts according to their phonological, orthographic and morphological properties.

Further informing this item identification process was the list of linguistic features provided in the *Words Their Way Spelling* inventories (Bear et al., 2012), as well as those identified by Ganske (2000). In particular, the linguistic features listed in the inventories from *Words Their Way Spelling* were used as reliable and valid exemplars for the scoring of spelling errors (Sterbinsky, 2007). Each item was then aligned to one of the three overarching components that underpin TWFT (that is, phonological, orthographic and morphological). It should be pointed out that some of the identified words in the CoST were assigned more than one linguistic feature (item). For each word, a corresponding dictation sentence was then created.

An expert review process (Creswell, 2012) with the doctoral supervisory team was then undertaken. In the review, the list of words, their corresponding linguistic features and dictation passages were critiqued, refined and further condensed to ensure the tool was ready for testing in several school contexts (Daffern, Mackenzie, & Hemmings, 2015). The revised version of the CoST was made up of 78 words and 111 items across the three components. Following test administration in school contexts, an empirical analysis of the
constructs within the components of the CoST led to a further refinement of the tool.

The next section outlines the sampling technique employed for the school-based testing of the Pilot Study. This section is followed by an explanation of the final analyses conducted. The results of the school-based testing and the finalised version of the CoST are presented in Chapter 5.

4.2.1 Pilot Study: Sample

Approval to conduct the pilot study was granted by the Charles Sturt University (CSU) Human Research Ethics Committee (HREC), the Archdiocese of Canberra and Goulburn Catholic Education Office and the Australian Capital Territory (ACT) Education and Training Directorate, following submission of the National Ethics Application Form (NEAF) (Appendix A). Testing the CoST focussed on students in Year 3 and Year 5 from four schools in the ACT, Australia. To ensure the sample of students was broadly representative of ACT primary schools, all three school sectors (that is, public, Catholic and independent schools) were included in the study (Johanson & Brooks, 2010; Macmillan & Schumacher, 2006). First, all mainstream primary schools in the ACT were identified using data available on ACARA’s My School website (ACARA, 2013a). The schools were then clustered according to sector and then into three bands based on the Index of Community Socio-educational Advantage (ICSEA), namely, i) low,
(ii) middle and (iii) high (ACARA, 2013a). It needs to be noted that all independent schools in the ACT were identified as ‘high’. Four schools were then randomly selected within those clusters and invited to participate. Two of those schools were public schools (one low and one high); one was a Catholic school (middle); and one was an independent school (high). The principals of all four selected schools agreed to participate in the study. The average ICSEA for the participating schools (1099) was marginally higher than the ACT average (1087). Prior to administering the test, informed written consent was obtained from the participating school principals, teachers, students and their parents (Appendix A). Convenience sampling (Bryman, 2008; Macmillan & Schumacher, 2006) of students within the four participating schools was then employed. Across the four schools, 163 students from Year 3 and 176 students from Year 5 were invited to take part in the study. Of the students who were invited to participate, 94 from Year 3 classes and 97 from Year 5 classes agreed to take part in the study, as indicated in Table 4.1.

Table 4.1
Sample by School Sector, School ICSEA and Year Level

<table>
<thead>
<tr>
<th>Schools</th>
<th>ICSEA</th>
<th>Year 3 (n)</th>
<th>Year 5 (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Schools (n=2)</td>
<td>1149</td>
<td>21</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>968</td>
<td>18</td>
<td>25</td>
</tr>
<tr>
<td>Catholic School (n=1)</td>
<td>1077</td>
<td>25</td>
<td>23</td>
</tr>
<tr>
<td>Independent School (n=1)</td>
<td>1201</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Total Schools (n=4)</td>
<td></td>
<td>94</td>
<td>97</td>
</tr>
</tbody>
</table>
4.2.2 Pilot Study: Test administration

The researcher administered the draft CoST to participating students during regular class times in Third Term, 2013 at their respective school sites. Administration required students to write 78 target words without assistance. The researcher dictated each word once, repeated it in the context of a sentence, and then restated it one more time. The duration of in-class testing did not exceed 30 minutes. Students’ written responses were then collected, scored and analysed by the researcher.

4.2.3 Pilot Study: Analyses and refinement of the CoST

Students’ CoST data were entered into an Excel spreadsheet for transfer to the Statistical Package for the Social Sciences (SPSS, Version 20). Data were then visually inspected for accuracy. Next, the reliability of each of the three subscales or components (namely, Phonological Component, Orthographic Component and Morphological Component) was determined. This involved standardisation of the raw scores, followed by an analysis using estimates of item difficulty (See Appendix M) and internal consistency. Analyses of the data from the Year 3 and Year 5 cohorts were conducted separately. For each subscale, the item difficulty index was calculated by identifying the percentage of Year 3 students who accurately spelled each item (linguistic feature) of a word. The same procedure was then repeated with the Year 5 data.
The distribution of scores, for each subscale, were inspected using the *Descriptives* command in SPSS (Buckingham & Saunders, 2004). In order to determine if all items in the subscales were adequate measures, the spread of scores needed to be checked. Macmillan and Schumacher (2006) advise that if the results for an item are too alike, it may be difficult to distinguish whether or not the item is adequate and whether the subscale actually lacks variability.

Next, a test of scale reliability was conducted using the *Reliability Analysis* command in SPSS. This test examined internal consistency by verifying whether the items included to measure each construct in all three subscales had good overall inter-correlation. Testing internal consistency required a calculation using Cronbach’s alpha to ascertain how homogenous the items of each subscale are (Colman & Pulford, 2008). Cronbach’s alpha is a suitable statistic because the CoST’s items are dichotomous (e.g., the score for each item is either correct or incorrect). Muijs (2004) asserts that an alpha of over 0.75 provides a strong case for reliability. Calculations on each subscale were conducted separately by school year.

Items yielding negative or low correlations and items with inadequate spread of scores were considered for deletion from the instrument. In light of the results, the draft CoST was then revised and prepared for use in the Major Study. Results for the Pilot Study, including the revised version of the CoST, are presented in Chapter 5.
4.3 Major Study: An explanatory sequential mixed methods design

On completion of the Pilot Study, the Major Study was able to proceed. The structure of the Major Study is best described as an “explanatory sequential mixed methods design” because data were collected and analysed sequentially, with one form of data informing the other (Creswell, 2012, p. 543). Mixed methods research provides the capacity to generate statistical information regarding trends and relationships through the use of quantitative data, and create rich and complex explanations and descriptions offered by qualitative data (Bryman, 2008; Creswell, 2012). The value of combining quantitative and qualitative methods within one investigation was observed by Merton and Kendall, as early as 1946, who claimed that “social scientists have come to abandon the spurious choice between qualitative and quantitative data” and are concerned with using “the most valuable features of each” (cited in Cohen, Manion, & Morrison, 2007, p. 47).

The rationale for using an explanatory sequential mixed methods design is that the quantitative data provide statistical trends relating to specific spelling achievements, gender and age, while the qualitative data serve to specifically explore the spelling strategies that characterise low-achieving spellers and high-achieving spellers. Abbott and Berninger (1993, p. 484) maintain that a reliable understanding of students’ spelling achievements, including a “complete picture of the child’s spelling” can be obtained by
examining the spelling skills and strategies that students adopt when words are dictated to them, as well as examining the spelling that students apply when they engage in the craft of writing larger texts. Moreover, it has been contended that a mixed methods design provides the means to adopt a fine-grained analysis of spelling, even though it is a relatively untapped methodological approach in this area of educational research (Sharp et al., 2008).

The Major Study was designed in two phases. In the first phase, quantitative methods were used to address the first three research questions. In the second phase, the final research question was addressed by selecting cases based on the results of the first phase. A complementary strengths stance was adopted to draw on the strengths offered by quantitative methods during Phase One and the strengths offered by qualitative methods (Creswell, 2010; Tashakkori & Teddlie, 2010) during Phase Two. Figure 4.1 presents an overview of the explanatory sequential mixed methods design.
4.4 Major Study Phase One: Sampling and recruitment

When formulating a sampling technique for Phase One, feasibility needed to be considered. Feasibility considerations for this study design included cost and time constraints associated with accessing data from schools across large geographic areas within Australia (Bryman, 2008). Therefore, obtaining data from a nationally representative sample of students was not realistic.

A stratified random sampling technique (Macmillan & Schumacher, 2006) was employed, providing the necessary data for
Phase One. The study design was limited to a sample of students in Years 3 to 6, enrolled in public and Catholic mainstream primary schools in the Australian Capital Territory (ACT). It needs to be noted that no independent schools in the ACT agreed to take part in the Major Study.

Students were selected within stratified bands to ensure the schools were broadly representative of the particular ACT school sector. This form of probability sampling was feasible, minimised sampling error and reduced the threat of external validity (Bryman, 2008; Macmillan & Schumacher, 2006). Specifically, all schools were stratified according to bands (low, middle and high) based on the ICSEA (ACARA, 2013a). Across all mainstream primary schools in the ACT, in 2013, the average ICSEA was 1087, with a minimum of 914 and a maximum of 1201 (ACARA, 2013a). It is important to acknowledge that the national average ICSEA value is always 1000, and that the ACT had the highest average ICSEA value compared to all states and territories in Australia in 2013.

In the present study, the year of recruitment was 2013. ACT school census data for 2013 indicate that there were 91 mainstream, co-educational primary schools registered in the ACT. Of these schools, there were 57 public schools, 23 Catholic systemic schools and 11 independent schools. These data exclude three Introductory English Centres (IECs) in the ACT, which enrol students requiring intensive full-time English language instruction. In 2013, 18,327
students across Years 3 to 6 were enrolled in ACT schools, excluding IECs and specialist schools (Table 4.2). Of these enrolments, 62% \( (n=10,646) \) of students attended public schools, 26% \( (n=4,487) \) attended Catholic schools, and 12% \( (n=3,194) \) attended independent schools. Inclusivity and diversity are valued and encouraged in Australian mainstream schools leading to the inclusion of children with learning difficulties or disabilities in mainstream classroom settings. A decision was made to not restrict statistical analyses to typically developing students in the study as it was important that the results would reflect a typical Australian mainstream classroom setting. Any child, from within the mainstream classrooms in the volunteer schools, who agreed to participation and whose parents provided consent, was included in the study.

Table 4.2

<table>
<thead>
<tr>
<th>Level of Schooling</th>
<th>Public School</th>
<th>Catholic School</th>
<th>Independent School</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 3</td>
<td>2,792</td>
<td>1,205</td>
<td>630</td>
<td>4,627</td>
</tr>
<tr>
<td>Year 4</td>
<td>2,778</td>
<td>1,142</td>
<td>832</td>
<td>4,752</td>
</tr>
<tr>
<td>Year 5</td>
<td>2,536</td>
<td>1,133</td>
<td>862</td>
<td>4,531</td>
</tr>
<tr>
<td>Year 6</td>
<td>2,540</td>
<td>1,007</td>
<td>870</td>
<td>4,417</td>
</tr>
<tr>
<td>Total</td>
<td>10,646</td>
<td>4,487</td>
<td>3,194</td>
<td>18,327</td>
</tr>
</tbody>
</table>

There was a relatively even distribution of male and female students in ACT primary schools during 2013. Table 4.3 indicates that the male population was marginally higher across Years 3 to 6,
with the greatest proportional difference evident in Years 3 and 4, which both consisted of 3.2% more males than females.

Table 4.3
Number of ACT Student Enrolments by School Level and Gender, 2013

<table>
<thead>
<tr>
<th>Level of Schooling</th>
<th>Females (%)</th>
<th>Males (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 3</td>
<td>48.4</td>
<td>51.6</td>
</tr>
<tr>
<td>Year 4</td>
<td>48.4</td>
<td>51.6</td>
</tr>
<tr>
<td>Year 5</td>
<td>49.1</td>
<td>50.9</td>
</tr>
<tr>
<td>Year 6</td>
<td>49.3</td>
<td>50.7</td>
</tr>
<tr>
<td>Total</td>
<td>48.8</td>
<td>51.2</td>
</tr>
</tbody>
</table>

Approval to conduct the Major Study was granted from the following institutional bodies, following submission of the NEAF: the CSU HREC, the ACT Government Education and Training Directorate, and the Archdiocese of Canberra and Goulburn Catholic Education Office (Appendix B). Principals of 51 schools were contacted to seek their expressions of interest and availability for participation. Of those school principals, 13 agreed for their schools to take part. Three participating schools were categorised as ‘high’, according to the ICSEA bands; seven as ‘middle’; and three as ‘low’. Unfortunately, it was not possible to obtain an equal distribution across the stratified bands due to the high number of schools that did not agree to participate. Despite this limitation, it is worth noting that the average ICSEA of the stratified sample of participating schools, at
1086, was extremely close to the ACT school ICSEA average, albeit with a somewhat smaller range (1018-1163) (Appendix C).

Informed written consent was first obtained from the participating school principals and their teachers. The researcher then visited the participating schools to talk to the students about the nature of the research and answer any questions, in collaboration with the respective classroom teachers and other relevant school personnel. During the visit, interested students were provided with an information package that was addressed to their parents. In addition, a simplified written statement about the research was given to the students (Appendix B). Informed written consent was obtained from the parents before written assent was obtained from the students. Across the 13 participating schools, 2,747 students (Years 3 to 6) were invited to take part; however, less than half of those students (n=1,274) agreed to participate in Phase One (Appendix N).

4.4.1 Phase One: Data collection

When the parents were initially informed about the research, and consent forms were issued, a demographic questionnaire (Appendix D) was also included in their information package. The purpose of the questionnaire was to obtain demographic information about the participating students, including their date of birth, gender,
school enrolment and special needs status. Demographic data were entered into SPSS (Version 20) using identification numbers, rather than student names, to ensure that confidentiality and anonymity were maintained.

### Literacy related achievement data sets

Following the collection of demographic data, several literacy achievement data sets were collected from the four cohorts of students (Table 4.4).

#### Table 4.4
**Phase One Data (Literacy achievement tests)**

<table>
<thead>
<tr>
<th>2013 Cohorts</th>
<th>Test Administration Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>May 2012</td>
</tr>
<tr>
<td>Year 3</td>
<td>■</td>
</tr>
<tr>
<td>Year 4</td>
<td>■</td>
</tr>
<tr>
<td>Year 5</td>
<td></td>
</tr>
<tr>
<td>Year 6</td>
<td>●</td>
</tr>
</tbody>
</table>

**Notes.**

- ● Year 5 NAPLAN: Writing Test and Language Conventions Test (Raw scores for Spelling, Grammar and Punctuation)
- ■ Year 3 NAPLAN: Writing Test and Language Conventions Test (Raw scores for Spelling, Grammar and Punctuation)
- ♦ CoST

Australian national standardised test data were collected, namely the NAPLAN Language Conventions Test and the NAPLAN Writing Test (2012 and 2013). These data were gathered from school
databases or directly from the parents of the participating student/s if the school did not hold the records. In addition to the collection of NAPLAN data, the CoST was administered to participating students in October, 2013, by the researcher in collaboration with the respective school principals and teachers. All achievement data sets were entered into SPSS, in preparation for quantitative analyses.

The NAPLAN Language Conventions Test is part of a series of national standardised tests administered annually in May to all Australian students in Years 3, 5, 7 and 9 (ACARA, 2013b). In September, parents and caregivers are provided feedback in the format of an Additional Student Report NAPLAN and this contains student results for the series of tests. This report provided data pertinent to the study.

The NAPLAN Language Conventions Test and the Writing Test are both 40 minutes in duration and students are tested under the same conditions, as stipulated by ACARA. The test development is managed by ACARA in consultation with teachers and education authorities in all the states and territories, across the Australian government and the non-government school sectors (ACARA, 2013b). Every year, potential test questions are trialled on representative samples of students from each state and territory. NAPLAN data have been extensively used as a means of offering feedback to a range of stakeholders, including school administrators, teachers and parents. ACARA (2015b, p. 2) claims in their My School Fact Sheet that the “reliability of NAPLAN tests is high and
that the tests can be used with confidence and are fit for purpose. The rigorous processes that are carried out during the development of NAPLAN each year ensure that the results are reliable and comparable between years. A detailed technical report on the testing that was conducted as part of the development of the NAPLAN has been published by ACARA (2014b).

The Language Conventions Test assesses student achievement in spelling, grammar and punctuation. The Additional Student Report for the Language Conventions Test provides parents with raw scores for all of three conventions. The NAPLAN Language Conventions Test included visually oriented tasks, decontextualised from compositional writing processes. Specifically, the test required students to identify and edit spelling errors in one-syllable and two-syllable words presented either in isolation or within a short phrase, as well as identify and label some common grammatical and punctuation conventions such as the correct use of pronouns, conjunctions and verb forms. As proofreading and editing processes were inherent in the tasks (as opposed to dictation, for instance), it is important to recognise that the NAPLAN Language Conventions Test may be limited in its capacity to fully encapsulate and measure the complex processes and skills associated with these three language conventions, and in particular spelling (Willett & Gardiner, 2009). Indeed, in critiquing the spelling construct within the NAPLAN Language Conventions Test, Willett and Gardiner (2009, p. 17) assert
that “research into the relationship between proofreading and the other dimensions of spelling” is needed.

For the NAPLAN Writing Test, students were required to respond to a specified topic by writing a persuasive composition. In 2012, the stimulus topic was, “All children should be able to cook”, and in 2013, “Hero award”. The Writing Test measures students’ capacity to combine and apply specific linguistic devices in order to craft a persuasive argument. These include, for example, the range and precision of contextually appropriate vocabulary; persuasive devices; elaboration of ideas; and text cohesion. It needs to be noted that handwriting fluency was not included as a construct in this measure. All markers of the Writing Test were required to undertake training prior to marking. The writing scripts were scored and cross-checked by supervisors in order to maximise marking consistency.

The accumulated raw score for the Writing Test was collected by the researcher from the feedback report that was provided by ACARA to the parents and the schools.

Obtaining approved access to NAPLAN data from an adequate sample of students across each year level posed significant challenges and explains why a large number of schools and students were recruited in Phase One. As stipulated by the ACT Education and Training Directorate (ACT public school authority), the use of NAPLAN data obtained for research purposes, from students in the public sector, is not permitted. Consequently, results for questions
one and three are based on data gathered from students enrolled in ACT systemic Catholic sector schools only. Results for question two were formulated using data collected from students across ACT public and Catholic sector schools.

The possibility of attrition and the absence of some NAPLAN data records were predicted and this raised potential threats to validity that needed to be addressed. In particular, it became necessary to recruit more schools and students than originally anticipated to ensure adequate data were available to conduct valid inferential analyses (Bryman, 2008; Creswell, 2012). Particular treatment of missing cases was necessary and is discussed later in this chapter.

The final set of data collected for Phase One was the CoST, a dictation spelling test developed and tested by the researcher for this study. As previously explained, the CoST is a tool that measures knowledge of the linguistic components of the Australian English spelling system (phonological, orthographic and morphological). Administering the CoST to a group or class of students required approximately 30 minutes. Arrangements were made with the respective classroom teachers to conduct the tests in a location that best suited the needs of all participants. All CoST data were later analysed and scored by the researcher, and some test papers were randomly cross-checked by the supervisory panel. The CoST data were then made available to the parents and teachers of the participating students, on request.
4.4.2 Phase One: Treating missing cases

NAPLAN and CoST data were entered into an Excel spreadsheet for transfer to SPSS and then inspected for accuracy and for patterns of missing data. Incomplete data sets were inevitable and predominantly the result of attrition and student absence from school on the day of testing. Missing NAPLAN data from the participating students enrolled in the Catholic sector were observed in circumstances where students relocated schools, subsequently resulting in irretrievable data from the respective school files. For example, the highest percentage of missing NAPLAN data sets was observed in Year 4, in which 11.9% of cases contained missing full NAPLAN data sets (Appendix E). Missing CoST data were collected across most schools by arranging follow-up administration sessions; however, despite attempts to collect all CoST data, missing data sets could not be retrieved because of time constraints within some school contexts. The most prominent set of missing data was recorded in Year 5, in which 9.3% of cases contained missing CoST data (Appendix E).

Although Maximum Likelihood (ML) and Multiple Imputation (MI) were considered as methods to treat missing cases (Willis, 2006), neither were appropriate because all the missing values were found in one of two patterns. Specifically, either all of the NAPLAN scores were missing for a particular individual or all of the CoST scores were missing. As the use of the ML and MI methods was questionable due to the observed patterns of missing values, it
was appropriate to test whether a significant difference was observed between those cases with missing data sets and those with full data sets using independent-samples *t*-tests for each year level. In the case of missing CoST data, a stringent probability level, involving a correction for multiple testing, was set. This level was based on a Bonferroni adjustment and was .0125. Across the CoST and NAPLAN measures from Year 3 to Year 6, only one of the twenty tests revealed a significant difference. In the Year 5 NAPLAN Writing Test measure there was a significant difference in scores with missing data sets (M=23.6, SD=4.2) and full data sets (M=26.8, SD=4.5); *t*(212)=−.2.97, *p*= .003 (Appendix F).

Based on these observations, listwise deletion was an appropriate method to use in subsequent analyses as it produces complete data sets (Creswell, 2012). Although this method does reduce the total sample size as a result of restricting cases that contain complete data (Willis, 2006), complete data sets were required for the analysis techniques employed in the present study.

4.4.3 Phase One: Data analyses

The first analyses provided descriptive statistics using several univariate analyses to determine frequencies, means, standard deviations and distributions for normality, in the spelling, punctuation, grammar and writing results, as measured by NAPLAN, as well as the CoST results for each year level (cohort). Descriptive analyses of demographic data were also conducted. Table 4.5
outlines the univariate analyses that were planned and carried out for this study.

Table 4.5

*Univariate Descriptive Analyses*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Year Level</td>
<td>Frequencies for Years 3, 4, 5 and 6</td>
</tr>
<tr>
<td>Age Group (Months)</td>
<td>Frequencies, means, standard deviations, kurtosis and skewness</td>
</tr>
<tr>
<td>Gender</td>
<td>Frequencies for Years 3, 4, 5 and 6</td>
</tr>
<tr>
<td>Special Needs Status</td>
<td>Frequencies, means, standard deviations, kurtosis and skewness</td>
</tr>
<tr>
<td>NAPLAN and CoST Raw Scores</td>
<td>Frequencies, means, standard deviations, kurtosis and skewness</td>
</tr>
</tbody>
</table>

To examine the relationship between the three dimensions measured by the NAPLAN Language Conventions Test (spelling, punctuation and grammar) and the Writing Test, a series of multiple linear regression analyses (MRAs) were employed, using SPSS (Colman & Pulford, 2008). This was the focus of the first research question (see Section 1.4, Table 1.1). Four different models were examined using NAPLAN data. Specifically, two sets of Year 3 NAPLAN data (gathered from students in the Year 3 and Year 4 cohorts) and two sets of Year 5 NAPLAN data (gathered from students in the Year 5 and Year 6 cohorts) were used for the MRAs. This statistical technique examined the separate and joint influences of the independent (predictor) variables (namely, spelling, punctuation and grammar) on the dependent variable, which was
written composition. Separate analyses for girls and boys were then carried out to explore the influence of gender. Further analysis using age (in months) was also carried out to determine whether or not age was a factor in written composition.

To address the second research question (see Section 1.4, Table 1.1), descriptive profiles of median CoST scores across the various year levels were determined. Medians, as opposed to means, were used as the distributions were anticipated to be asymmetrical. A factorial multivariate analysis of variance (MANOVA) was also conducted to test the significance of group differences (Tabachnick & Fidell, 2001) relating to year level and gender in the three dependent variables (namely, the phonological, orthographic and morphological subscales). Prior to conducting a factorial MANOVA, Pearson correlations between all of the dependent variables (that is, the CoST subscales) were obtained in order to test the assumption underpinning MANOVA that the dependent variables would be correlated with each other in the moderate range (Colman & Pulford, 2008). The MANOVA model was analysed for main effects of year level and gender, their interactions, repeated contrasts for year level and simple differences for gender.

For the third research question (see Section 1.4, Table 1.1), Pearson’s bivariate correlation analyses (Bryman, 2008) were conducted to establish the relationships between NAPLAN spelling and the three linguistic components of spelling, as measured by the
CoST, for low-achieving spellers and high-achieving spellers. Low-achieving students and high-achieving students were identified as those who performed in the bottom third and top third, respectively, in the spelling measure of the NAPLAN Language Conventions Test. MRAs were also performed to determine whether these relationships were affected by gender and/or year level.

Specifically, for Years 3 and 4, bivariate correlations were carried out to examine the relationships between the Year 3 NAPLAN spelling scores and the CoST subscale scores for low-achieving and high-achieving students. This procedure was repeated for Years 5 and 6, however, only the students’ Year 5 NAPLAN Language Conventions Test spelling scores were used for these correlations. Separate bivariate correlation analyses for males and females were conducted to examine gender differences. MRAs were then used to test if the three components of spelling, as measured by the CoST, predict NAPLAN spelling for low-achieving and high-achieving students in Years 3 to 6. These were followed by another series of MRAs that were carried out to see if gender was predictive of NAPLAN spelling for low-achieving and high-achieving students in Years 3 to 6.

The findings derived from Phase One of the present study then informed the selection of 16 students and their teachers, who were then invited to participate in the second research phase. The
remaining section of this chapter describes the method used for Phase Two of the Major Study.

4.5 Major Study Phase Two: Rationale and sample

Phase Two provides rich descriptions of the spelling strategies students employ, and explains how these strategies might differ between low-achieving spellers and high-achieving spellers. In Phase Two, narrative and persuasive written texts were crafted by 16 students, and semi-structured interviews were conducted by the researcher with each of the students and their teachers, individually. These data provided the context for a qualitative examination of the spelling strategies students use. Rich insights were gained through critical analysis of what the participants said about the spelling process, as well as an examination of students’ spelling in their written compositions. Errors made in their CoST score were also reviewed and compared, both quantitatively and qualitatively.

The following sections outline the method adopted in Phase Two. Guided by Sproule’s (2006) methodological framework for qualitative content analysis, as well as specific techniques described by Willis (2006) and Elo and Kyngäs (2008), Phase Two involved nine stages, each of which is sequentially articulated.

Stage 1: Decide the rationale and its level of analysis.
In Phase Two, the researcher sought to answer the following questions: What are the spelling strategies used by low-achieving spellers compared with high-achieving spellers? Are students able to explain the spelling strategies they use?

Contributions of significant mixed method studies to the domain of spelling are limited (Bahr et al., 2012; Sharp et al., 2008), and few relevant studies utilise participants’ verbal reports of strategy use as a data source, despite the rich insights that can be gained (Critton et al., 2013; Elliott, 1984; Rittle-Johnson & Siegler, 1999; Sharp et al., 2008). With this in mind, a reflective and interpretive stance was adopted during Phase Two of the study, whereby the researcher aimed to make sense of and construct meaning from a range of qualitative data (Gay, Mills, & Airasian, 2006). For this to occur, qualitative content analysis was appropriate “on the assumption that an analysis of language in use can reveal meanings, priorities and understandings, and ways of organising and seeing the world” (Wilkinson & Birmingham, 2003, p. 68).

Qualitative content analysis enabled the researcher to gain new insights into the spelling strategies students (Year 3 to 6) use when they engage in written composition. Elo and Kyngäs (2008, p. 107) describe content analysis as a “method of analysing written, verbal or visual communication messages”. In the present study, content analysis does not stand alone. Rather, it serves to support and extend on the findings from Phase One, with a focus on low-
achieving spellers and high-achieving spellers, as identified in the first phase of the mixed method study.

To identify patterns in these data, elements of inductive content analysis were used to make inferences by moving “from the specific to the general” and particular instances were “observed and then combined into a larger whole” (Elo & Kyngäs, 2008, p. 109). Krippendorff (2013, p. 384) describes inductive inference as a “process of proceeding from particular propositions, such as a sample of observations, to general propositions, … accounting for these observations in most if not all respects”. Analysis required data reduction, beginning with familiarisation of the content through a close reading of all textual matter, and progressively narrowing this matter into small and important groups by identifying patterns and concepts as they emerged (Krippendorff, 2013; Wilkinson & Birmingham, 2003).

**Stage 2: Identify appropriate sample, data and specify the units of analysis.**

Eight cases were under examination during Phase Two and were chosen based on the results of Phase One. Each case is defined by two students, identified either as low-achieving spellers (bottom third percentile) or as high-achieving spellers (top third percentile) in each year level, as measured by the CoST (see Table 4.6). In total, the student sample consists of 16 students. The sample was drawn
from three public schools and two Catholic schools using a purposive sampling technique. This ensured that those sampled were likely to be responsive to the research and were relevant to the research question (Bryman, 2008).

Table 4.6

*Purposive Sampling of Students*

<table>
<thead>
<tr>
<th>Year Level</th>
<th>Year 3 (n=4)</th>
<th>Year 4 (n=4)</th>
<th>Year 5 (n=4)</th>
<th>Year 6 (n=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases Low-achieving</td>
<td>1 (n=2)</td>
<td>2 (n=2)</td>
<td>3 (n=2)</td>
<td>4 (n=2)</td>
</tr>
<tr>
<td></td>
<td>male</td>
<td>female</td>
<td>male</td>
<td>female</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cases High-achieving</td>
<td>5 (n=2)</td>
<td>6 (n=2)</td>
<td>7 (n=2)</td>
<td>8 (n=2)</td>
</tr>
<tr>
<td></td>
<td>male</td>
<td>female</td>
<td>male</td>
<td>female</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

In order to supplement the student data, the respective teachers of the students (n=16) also contributed information. It needs to be noted that teachers not only provided information about the individual student in the case, but also offered insights about the spelling strategies used by low-achieving spellers compared with high-achieving spellers in their respective year level. Both students and teachers were invited to take part in this phase, and once agreement was reached, informed written consent was obtained in accordance with all ethical requirements stipulated by the University’s HREC (Appendix B).
4.5.1 Phase Two: Data collection

Throughout the final school term in 2013, two writing samples from each student were obtained, and semi-structured interviews with the students and their respective teachers were conducted to facilitate triangulation of the data, and to enhance the reliability of the findings (Bryman, 2008; O’Toole & Beckett, 2010). First, the researcher liaised with the classroom teachers to arrange a convenient time for each student to be withdrawn from class to complete a 30-minute narrative writing task and 30-minute persuasive writing task, respectively, with a 15-minute break in between (Appendix G). The narrative task was a creative story written in response to visual stimulus material provided. The persuasive writing task required students to convince a reader which season of the year they believed was best. Students were encouraged to attempt the task but be creative in their ideas; however, they were not assisted with the conventions of print, the generation of ideas and structure of the text. During the administration of all writing tasks, the well-being of each student was closely monitored by the researcher and the classroom teacher, or an executive staff member. Every student participated willingly and utilised the entire allocated time.

An interview with each student was then conducted in order to understand their perspectives on the strategies they use to spell. The interviews (Appendix H) were open-ended and semi-structured in
nature (Wilkinson & Birmingham, 2003); however, they were guided by the words, phrases and spelling errors observed in both the student’s writing scripts and CoST results obtained in Phase One. The insights elicited from these interviews were enriched by interviewing the respective classroom teachers, who were asked open-ended questions in a semi-structured manner. The interviews with teachers were focussed on their approaches to spelling pedagogy throughout the course of the school year, and on the spelling strategies they observed their students use, albeit with an emphasis on their own participating student (Appendix H). The duration of interviews ranged between 20 and 30 minutes each, and permission from all participants to audio-record each interview was granted. The interview recordings were of high quality, specifically at 320kbps (stereo), 44.100 kHz, and the recordings were later listened to using the Sound Forge Pro10 software.

Transcribing the interviews is an important part of the analytical process whereby insights into the data were developed. Indeed, Willis (2006) argues that a critical first step in data immersion is the transcription of the interview recordings. To maximise integrity and become immersed in the data, the researcher recorded and transcribed all interview recordings. High quality audio recordings ensured that nuances of speech, including mispronunciation of phonemes or words, were accurately heard and transcribed.
The form of transcription included verbal and some nonverbal responses (Willis, 2006). For example, the participants were asked to orally articulate each alphabetic letter that they wrote and this provided verification of what was written during the interviews. If a participant stated the specific name of an alphabetic letter (e.g., when asked to spell a word or a word part aloud), this was indicated in the transcripts as [states letter name/s]. Participants also frequently articulated specific phonemes during the interviews and these were recorded using italicised conventional alphabetic letter symbols, presented in bold font and, where necessary, a supporting exemplary word was included (e.g., [o as in the word on]).

Nonverbal responses were noted and these included pauses, utterances, such as *umm*, and written spelling attempts. For example, the duration of pauses was documented using one full stop/period per second, if three to five seconds long. Pauses greater than five seconds were documented in italics and in square brackets. The researcher anticipated that pauses could potentially indicate a participants’ (student and/or teacher) lack of understanding of the skills and/or strategies associated with spelling. Instances where spelling attempts were written onto paper while a participant was speaking were also documented in italics and in square brackets (e.g., [word correctly written as dropped]). It needs to be noted that the researcher retained a copy of all participants’ written responses that were produced during the interviews as supplementary evidence of what was articulated during the interviews.
4.5.2 Phase Two: Data analysis

Deciding on the units of analysis was pivotal in dictating how the data needed to be organised and managed (Elo & Kyngäs, 2008; Willis, 2006). The unit of analysis for the interview transcriptions consisted of a sentence or a phrase; however, this was balanced with a finer-grained unit of analysis in the writing samples and this consisted of a single word. In the interview transcripts, each question and response was numbered; while in the writing samples, individual words were assigned a number. An index was then developed to assist with the management of all data (Table 4.7).

Table 4.7
Data and Participant Index

<table>
<thead>
<tr>
<th>Data and Participant Index</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement Level</td>
<td>Low (L)</td>
<td>High (H)</td>
<td>Low (L)</td>
<td>High (H)</td>
</tr>
<tr>
<td>Narrative Writing (NW)</td>
<td>3LNW</td>
<td>3HNW</td>
<td>4LNW</td>
<td>4HNW</td>
</tr>
<tr>
<td>Persuasive Writing (PW)</td>
<td>3LPW</td>
<td>3HPW</td>
<td>4LPW</td>
<td>4HPW</td>
</tr>
<tr>
<td>Student Interview (Std)</td>
<td>3LStd</td>
<td>3HStd</td>
<td>4LStd</td>
<td>4HStd</td>
</tr>
<tr>
<td>Teacher Interview (Tch)</td>
<td>3LTch</td>
<td>3HTch</td>
<td>4LTch</td>
<td>4HTch</td>
</tr>
<tr>
<td>Students</td>
<td>Lucy</td>
<td>Zoe</td>
<td>Rose</td>
<td>Jane</td>
</tr>
<tr>
<td></td>
<td>Mick</td>
<td>Ryan</td>
<td>Bob</td>
<td>Ed</td>
</tr>
<tr>
<td>Teacher (Student’s nameT)</td>
<td>LucyT</td>
<td>ZoeT</td>
<td>RoseT</td>
<td>JaneT</td>
</tr>
<tr>
<td></td>
<td>Mick T</td>
<td>Ryan T</td>
<td>BobT</td>
<td>EdT</td>
</tr>
</tbody>
</table>
In developing the index, the interview transcripts and writing samples were assigned a reference code. To further assist with the analysis and subsequent reporting, all participants were assigned with pseudonyms, and these were included in the index. In summary, references were coded according to Year Level; Achievement Level; Data; Participant; Sentence/Word Number.

Stage 3: Decide on the parameters of analysis.

A decision was made on the degree of flexibility that was to be permitted in the coding of data. Coding requires an interaction with the data, provides a “systematic way in which to condense extensive data sets into smaller and analysable units”, and facilitates the “organisation, retrieval, and interpretation of data” (Lockyer, 2004, p. 138). Specifically, the researcher is required to decide how to categorically mark or reference units of text (Gay et al., 2006; Sproule, 2006). The process of content analysis has been minimally discussed in the literature, particularly with regard to coding (Elo & Kyngäs, 2008); however, it has been claimed that “in practice, much research is a combination of both a priori and inductive coding” (Willis, 2006, p. 266). In this study, analysis required a combination of a priori codes (pre-identified and deemed as significant according to existing literature) and inductive (or open) codes, which were additional or alternative codes that emerged from the data (Willis, 2006). Consequently, Elo and Kyngäs’ (2008) description of
inductive content analysis was adapted, as the study involved
inductive coding, as well as a priori coding, followed by
categorisation and abstraction. The underlining tenet is that
flexibility “permits new, important material to be incorporated into
the coding process” (Sproule, 2006, p. 124). By combining a priori
and inductive coding in the study, it was possible to include codes
that were exhaustive, exclusive and enlightening (Sproule, 2006;
Willis, 2006).

In the present study, a priori codes were derived from the
structure of the CoST. Specifically, all of the spelling features
(constructs) from within the three subscales of the CoST constituted
individual codes. Inductive coding was also used to indicate
additional emerging concepts in the data. The written material was
read through several times, and as many notes and headings as
necessary were written down in the right hand columns, to describe
all aspects of the content (see, for example, Appendix I). The
headings were then moved from the columns of the interview
transcriptions onto coding sheets and preliminary categories were
then freely generated for each case (see, for example, Appendix J). A
linguistic analysis technique was also used to develop categories from
the students’ written compositions (see, for example, Appendix K).
Words written by the students in the context of their written
compositions were classified in terms of lexical difficulty, as defined
in the marking guide that was developed and used by ACARA for the
assessment of NAPLAN Writing (ACARA, 2012a) (Appendix K).
Codes were recorded by type and by frequency of spelling representations. Specifically, the operationalisation of key concepts was achieved by coding for frequency according to types of skills and strategies, and whether they were accurately represented or not. During this process, the researcher was required to return to existing literature for clarification. Of particular use were the insights into the students’ (aged 4 to 6 years) spelling representational levels, as identified by Critten and her colleagues (2013), as well as the coding of spelling strategies adopted by Devonshire and Fluck (2010), Rittle-Johnson and Siegler (1999), Sharp et al. (2008) and Bahr et al. (2012).

The researcher made a decision about the level of generalisation that was permissible. This involved conferring with the doctoral supervisory team as well as consulting literature regarding processes underlying spelling (see, for example, Bahr et al., 2012; Rittle-Johnson & Siegler, 1999). Results of the Pilot Study and Phase One of the Major Study also informed this process. Concepts were grouped together when they appeared in different forms but only if the implied meaning was very closely related. For example, “sound
it out” and “hear all the different sounds” were grouped together, as they carried almost the same meaning.

**Stage 6: Develop rules for coding while coding the texts.**

A set of rules was refined during the coding process. This involved identifying and translating the allocation of codes into different concepts. The codebooks were developed and refined through a recursive process during several stages to guide the researcher and to ensure consistency was maintained in the explanations of emerging concepts as advocated by Sproule (2006).

**Stage 7: Decide what to do with ‘surplus’ information.**

During the coding process, all contents were considered potentially relevant and important, even if they appeared trivial at the time. Codes were assigned for these, such as: ‘avid reader’ and ‘reluctant writer’.

**Stage 8: Perform frequency analyses and triangulate concepts.**
Once the data were coded, the next step was to quantify the presence of the concepts within the texts (Sproule, 2006). The students’ CoST results, obtained during Phase One, were also revisited to ensure all evidence of spelling difficulties was captured. Kohnen et al. (2009) point out that it may be difficult “to gain a complete picture of the student’s spelling difficulties from free writing because the analysis is restricted to what the student” chooses to write “in terms not only of topic focus but also choice of words” (p. 114).

Descriptive profiles were then developed for each student (Appendix L). Themes emerging from the profiles were then grouped and reduced into broad higher order categories for each case, by “collapsing” those that were “similar or dissimilar” (Elo & Kyngäs, 2008, p. 111). During this process, data were classified as belonging to a specific group by comparing those to other observations that did not belong to the same category.

Data were triangulated systematically through a process of “abstraction” (Elo & Kyngäs, 2008, p. 111). The purpose of abstracting concepts is to “provide a means of describing the phenomenon, to increase understanding and to generate knowledge” (Elo & Kyngäs, 2008, p. 111). Emerging categories were fully explored to the point of saturation (Bryman, 2008). Figure 4.2 illustrates the process of triangulation of the data pertaining to students identified as low-achieving spellers across each school year.
level (Cases One to Four). This process was repeated with data concerning the high-achieving spellers (Cases Five to Eight).
What strategies do low-achieving spellers use in Years 3 to 6?

### Across-case analyses (Low-achieving Spellers)

<table>
<thead>
<tr>
<th>Year</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 3</td>
<td></td>
</tr>
<tr>
<td>Year 4</td>
<td></td>
</tr>
<tr>
<td>Year 5</td>
<td></td>
</tr>
<tr>
<td>Year 6</td>
<td></td>
</tr>
</tbody>
</table>

### Major Themes (Low-achieving Spellers)

Strategies used by low-achieving spellers across Years 3 to 6

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*Figure 4.2. Triangulating data: Low-achieving spellers (Cases 1 to 4).*
The final stage of content analysis, as suggested by Sproule (2006), was to identify trends or major themes, and explain how they fit with the theoretical framework. A rich description was formulated, explicating the strategies employed by low-achieving spellers compared with high-achieving spellers and whether the students were able to explain the spelling strategies they use. This involved a direct comparison of the major themes that emerged from the analyses (see Figure 4.3). The findings were interpreted by exploring the similarities and differences in the strategies used to spell during written composition between low-achieving spellers and high-achieving spellers.

**Figure 4.3.** Comparison of strategies used by low-achieving and high-achieving spellers (Years 3 to 6).
4.6 Chapter Summary

This chapter has described the research design and methods used for the various phases of the research. First, the methodology adopted for the Pilot Study was discussed. This part of the research used a theoretical framework based on TWFT and aimed to develop and test the CoST. Importantly, the use of the CoST as a measure of spelling proficiency was pivotal in the Major Study. This chapter has also presented the research design and methodology for the Major Study that employed a sequential mixed methods design, comprising a quantitative phase followed by a qualitative phase. Chapter 5 presents the results from the Pilot Study while Chapters 6 and 7 report the results from the first and second phases of the Major Study, respectively.
5 RESULTS FROM THE PILOT STUDY

5.1 Introduction

This chapter reports the results from the school-based testing and empirical analyses of the CoST, which culminated in a revised version of the instrument. Specifically, results for the testing and analysis stage of the Pilot Study revealed item difficulty as well as internal consistency in three subscales: the Phonological Component, Orthographic Component and Morphological Component. These results informed the final review and refinement of the CoST. Chapter 5 concludes by presenting the finalised structure of the CoST. The final version of the CoST, including instructions for test administration and scoring, is located in Volume II, Appendix M.

5.2 Item difficulty

Within the three subscales of the draft CoST, the distribution of scores for each item was examined first. Higher scores (approximately 80% or higher) identified items that were easier, whereas lower scores (approximately 20% or lower) identified items that were more difficult (See Appendix M). In the phonological measure, some evidence of ceiling effects was detected. Specifically, four items and their related words were considered for deletion. These items measured the phonological representations of short vowels and final consonants in one-syllable words. Typically developing students acquire knowledge of beginning and final
consonant letters and short vowel phoneme to grapheme
correspondences from the early stages of learning to read and write
(Cassady & Smith, 2004; Paris, 2005). Hence, it was anticipated that
some related items would likely yield high percentages. A decision
was made, however, to preserve some items which measure
phonological encoding of short vowels and final consonants in one-
syllable words. The rationale for inclusion was to offer participating
students an opportunity to begin the spelling test with five one-
syllable words containing common and regular phoneme to grapheme
correspondences. It was deemed important to maximise students’
confidence and make them feel at ease in a test situation. Words
which were not deleted, despite the relative simplicity inherent in
their respective items, include tag, gum, rob and stick. There was
also some evidence of ceiling effects in the original orthographic
measure, resulting in several items and their related words (favour
and shower) being considered for deletion. These words and their
associated items were deleted in the final revision of the CoST. In the
morphological measure, adequate distribution of scores was present in
the items tested.

5.3 Internal consistency results

A test of scale reliability was also undertaken to determine
which items needed to be removed due to negative or low
correlations. In the phonological measure, one item classified as a
consonant digraph was deemed problematic (sh in the word wish) as
it did not yield a statistically reliable result in Year 3. Consequently, the word *wish* was removed from the instrument. In the orthographic measure, three items were deleted to strengthen the overall reliability. These included a common long vowel grapheme (*o-e* in *rope*), a diphthong (*ow* in *shower*), and an unaccented final syllable (*er* in *shower*). To improve the overall alpha in the morphological measure, six items were also deleted. These items included a derivational suffix (*able* in *innumerable*), a homophone (*torque*), an assimilated prefix (*nn* in *innumerable*), and three root words (*arch* in *monarchy*; *psych* in *psychology*; and *equi* in *equilibrium*).

In total, eight words and 10 items were removed from the original (draft) version of the CoST. Table 5.1 presents descriptive statistics for the finalised version of the CoST. As can be seen, the maximum score of the revised phonological measure was 29, recorded in Year 3, and 31 in Year 5. The respective means in this subscale were 20.9 and 23.0. In the orthographic subscale, the respective means for Year 3 and Year 5 were 18.1 and 23.4. In the morphological subscale, a marked improvement was evident from Year 3 to Year 5, with scores in the revised version of the CoST ranging from 2 to 28 in Year 3 and 1 to 39 in Year 5, indicating greater difficulty in this area. The overall scores in the revised version of the CoST were lower for Year 3 than they were for Year 5.
Table 5.1
*Descriptive Measures for CoST Scores*

<table>
<thead>
<tr>
<th></th>
<th>Phonological Component (31 Items)</th>
<th>Orthographic Component (29 Items)</th>
<th>Morphological Component (41 Items)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 3</strong> (n=94)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>8</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Maximum</td>
<td>29</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>Mean</td>
<td>20.91</td>
<td>18.12</td>
<td>12.96</td>
</tr>
<tr>
<td>SD</td>
<td>3.94</td>
<td>7.17</td>
<td>6.63</td>
</tr>
<tr>
<td><strong>Year 5</strong> (n=97)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>9</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Maximum</td>
<td>31</td>
<td>29</td>
<td>39</td>
</tr>
<tr>
<td>Mean</td>
<td>23.01</td>
<td>23.36</td>
<td>20.39</td>
</tr>
<tr>
<td>SD</td>
<td>4.39</td>
<td>6.07</td>
<td>9.12</td>
</tr>
</tbody>
</table>

With a revised total of 70 words and 101 items, the internal consistency results of the finalised CoST were strong, as indicated in Table 5.2.

Table 5.2
*Internal Consistency of the CoST*

<table>
<thead>
<tr>
<th></th>
<th>Phonological Component</th>
<th>Orthographic Component</th>
<th>Morphological Component</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 3</strong> (n=94)</td>
<td>.78</td>
<td>.93</td>
<td>.89</td>
</tr>
<tr>
<td><strong>Year 5</strong> (n=97)</td>
<td>.84</td>
<td>.93</td>
<td>.94</td>
</tr>
</tbody>
</table>
5.4 The revised structure of the CoST

Across the three components (subscales), there are a total of 15 linguistic constructs (spelling features) and 101 individual items, across 70 words. A summary of the CoST’s finalised structure is presented in Table 5.3. In addition, the complete assessment tool, including administration and scoring instructions can be located in Appendix M.

Table 5.3
Summary of the Components of Spelling Test (CoST)

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Phonological Component</th>
<th>Orthographic Component</th>
<th>Morphological Component</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Items</td>
<td>No. of Items</td>
<td>No. of Items</td>
</tr>
<tr>
<td>Initial &amp; Final Consonant</td>
<td></td>
<td></td>
<td>Inflected Suffixes</td>
</tr>
<tr>
<td>Consonant Grapheme</td>
<td>5</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Short Vowel Grapheme</td>
<td>5</td>
<td>7</td>
<td>Derivational Suffixes</td>
</tr>
<tr>
<td></td>
<td>Ambiguous Vowel</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Graphemes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consonant Digraphs</td>
<td>5</td>
<td>5</td>
<td>Morpheme Schwa Vowels</td>
</tr>
<tr>
<td></td>
<td>Complex Consonant</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Patterns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polysyllabic-word Medial</td>
<td>16</td>
<td>5</td>
<td>Homophone</td>
</tr>
<tr>
<td>Blends</td>
<td></td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Syllable Juncture</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Consonants</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unaccented Final</td>
<td>5</td>
<td>Greek and Latin Roots</td>
</tr>
<tr>
<td></td>
<td>Syllables</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Assimilated Prefixes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subscale Items (n) 31 29 41
5.4.1 The Phonological Component

The Phonological Component in the CoST is designed to measure phonological (speech sound to alphabetic letter) encoding. The constructs measure accurate spelling of (i) initial and final consonant grapheme, (ii) regular short medial vowel grapheme, (iii) common consonant digraphs and (iv) medial blending within polysyllabic words. Importantly, a measure of accurate phonological encoding within the medial parts of complex polysyllabic words is one particular innovation of this subscale. Specifically, existing spelling assessment tools neglect to measure accuracy in encoded blending of multiple phonemes embedded within polysyllabic words. Research has shown that medial phonemes typically require considerably more skill than beginning and ending phonemes (Cassady & Smith, 2004). Cassady et al. (2008, p. 515) also contend that phonological encoding is likely to be more complicated “when a phonetic unit carries information regarding two adjacent phonemes rather than one”. For example, encoding the medial vowel in the word stomping may be difficult because of the adjacent consonant blends (st and mp). In contrast, encoding the medial vowel in a word such as top requires less processing because the vowel is adjoined by a single consonant on either side. Therefore, it is plausible that the process of blending multiple phonemic units within medial parts of disyllabic or polysyllabic words may pose even greater challenges.
Popular existing spelling assessment tools (see, for example, Bear et al., 2012) include an analysis of errors a student may make when spelling consonant blends in the initial parts of monosyllabic and disyllabic words (e.g., *st* in *stop*, or *pl* in *plan*). However, in line with the work of Cassady and colleagues (2004, 2008), the CoST presents an important shift in the conceptualisation of blends, pertinent especially to students in the middle and upper primary school years. Rather than measuring representations of initial consonant blends, a construct is included to measure errors a student may make when blending and encoding more than two phonemes, including consonants and short vowels, in the middle parts of longer and more complex words (e.g., *equilibrium*).

Table 5.4 defines the four constructs comprising the *Phonological Component*. In this tool, specific phonological features within words are dichotomously measured in terms of whether or not they are accurately represented.
### Table 5.4  
**Phonological Component Constructs**

<table>
<thead>
<tr>
<th>Construct</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial and Final Consonant Grapheme</strong></td>
<td>An initial consonant grapheme is a single non-vowel letter that is positioned at the beginning of a word to directly represent the first phoneme (<em>rob</em>). A final consonant is a single non-vowel letter that is positioned at the end of a word to directly represent the last phoneme (<em>rob</em>).</td>
</tr>
<tr>
<td><strong>Short Vowel Grapheme</strong></td>
<td>A single letter (<em>a; e; i; o; u</em>) that is positioned in the middle of a word to directly represent a lax phoneme, which is produced when the vocal chords are more relaxed (<em>rob</em>) (Bear et al., 2012).</td>
</tr>
<tr>
<td><strong>Consonant Digraph</strong></td>
<td>Consonant digraphs are two letters that represent one phoneme (Bear et al., 2012; Ganske, 2000). Common consonant digraphs are included in this measure and are positioned in the initial part of words (<em>chew; thorn; why</em>) and the final part of words (<em>smooth; coach</em>).</td>
</tr>
<tr>
<td><strong>Polysyllabic-word Medial Blend</strong></td>
<td>Medial blends include two or more letters in the middle of a polysyllabic word that are highly regular and phonologically represented. These blends may intersect syllables and may represent a combination of consonant and short vowel phonemes. Each letter represents a single regular phoneme. Examples of medial blending include: <em>agnosti</em> (<em>diagnostician</em>); <em>ubstan</em> (<em>substantial</em>); <em>libri</em> (<em>equilibrium</em>).</td>
</tr>
</tbody>
</table>

*Note.* Table 5.4 adapted from Daffern et al. (2015)
5.4.2 The Orthographic Component

The Orthographic Component in the CoST is designed to measure knowledge of correct (ortho) letter sequences within written (graphy) words. In the English orthographic system, a single phoneme may be represented by varying letter combinations because 26 letters of the alphabet (graphemes) are relied upon to represent at least 44 phonemes (Bear et al., 2012). An orthographic unit consists of a combination of legitimate letter sequences or patterns. In order to accurately encode an orthographic unit within a word, visual sensitivity to letter patterns is needed (Richards, Berninger, & Fayol, 2009). For example, to be able to efficiently and accurately spell the word, thought, the grapheme combination, ough, needs to be visualised as a whole orthographic unit rather than as individual graphemes (o-u-g-h). Moreover, accurate spelling requires knowledge of plausible orthographic features within words. For example, it is critical to know that the letter pattern, ck (in words such as luck or kick) is a plausible sequence, and that kc for example, is not. Additionally, knowledge that ck, as an orthographic unit, is never positioned at the start of a word, ensures words (such as kick) are not misspelled (as cik, for example). Treiman and Kessler (2006, p. 642) explain the importance and benefits of learning plausible and common orthographic features within words, describing this as ‘statistical learning’. 
The Orthographic Component in the CoST considers the visual representation of conventional letter sequences as a measure of orthographic knowledge. In the CoST, the Orthographic Component consists of five constructs (see Table 5.5), each of which measures the spelling accuracy in specific orthographic features within words.

Table 5.5
Orthographic Component Constructs

<table>
<thead>
<tr>
<th>Construct</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Long Vowel</td>
<td>Common letter patterns that represent long vowel sounds (stripe, moat).</td>
</tr>
<tr>
<td>Graphemes</td>
<td></td>
</tr>
<tr>
<td>Ambiguous Vowel</td>
<td>Letter patterns that represent ambiguous vowels such as diphthongs, in which</td>
</tr>
<tr>
<td>Graphemes</td>
<td>the sound produced by one vowel glides into another (shouted and boil), and r</td>
</tr>
<tr>
<td></td>
<td>influenced vowels (marched).</td>
</tr>
<tr>
<td>Complex Consonant</td>
<td>Consonant letter sequences occurring in any part of a word. Letter clusters</td>
</tr>
<tr>
<td>Cluster</td>
<td>include several letters to represent several phonemes (stripe) as well as less</td>
</tr>
<tr>
<td></td>
<td>common digraphs and trigraphs, which are letter combinations that represent one</td>
</tr>
<tr>
<td></td>
<td>phoneme (smudged, scratches and knotted).</td>
</tr>
<tr>
<td>Syllable Juncture</td>
<td>Consonants are sometimes doubled at the juncture between two syllables in a</td>
</tr>
<tr>
<td>Consonants</td>
<td>word (bottle).</td>
</tr>
<tr>
<td>Unaccented Final</td>
<td>Letter sequences found in words where the last syllable is not stressed</td>
</tr>
<tr>
<td>Syllables</td>
<td>(bottle and tunnel).</td>
</tr>
</tbody>
</table>

*Note. Table 5.5 adapted from Daffern et al. (2015)*
5.4.3 The Morphological Component

The *Morphological Component* in the CoST is concerned with the internal structure of words and is designed to assess spelling accuracy of the morphemic units in words. Specifically, morphemic units are the recognisable word parts which cannot be further meaningfully condensed, and can include affixes, base words or root words (Akmajian, Demers, Farmer, & Harnish, 2010). Morphemes are classified into two classes: *bound* and *free* (Ganske, 2000). A *bound morpheme* is a meaningful, dependent unit as it cannot be used as an isolated word. *Bound* morphemes commonly include prefixes and suffixes such as *pre, in, un, re, ful, ing,* and *es.* On the other hand, a *free morpheme* acts as an independent word, is often referred to as a base word, and is the smallest meaningful unit, such as *serve* and *speak.*

Various combinations of morphemes can be used to express specific meanings or to function in particular grammatical roles; hence, the spelling of a word may be dependent on its morphemic constituents (Carlisle, McBride-Chang, Nagy, & Nunes, 2010). Some words might contain one free morpheme and one bound morpheme (*speak-ing*), while many compound words contain two free morphemes (*sun-shine*). Other words may comprise numerous combinations of morphemes (*in-cred-ible*). The CoST takes into consideration that an awareness of morphemes and knowledge of
morphological generalisations is important in spelling (Bowers et al., 2010; Devonshire et al., 2013; Tsesmeli & Seymour, 2009).

The inclusion of homophones as a specific construct has been largely overlooked in existing spelling assessment tools, yet this morphological feature seems to present ongoing challenges to school-aged students (Kohnen et al., 2009). Considering homophones are abundant in the English language, it is vital to include this linguistic feature as a measure in a spelling assessment such as the CoST.

Root words also warrant inclusion in a spelling assessment tool. These words carry etymological significance and can be classed as either free morphemes (as in *aqua*) or bound morphemes (as in *psych* in the word *psychology*); however, it should be pointed out that most root words constitute bound morphemes. The current English language is the product of extensive transformation, stemming from the middle of the 5th century AD (Akmajian et al., 2010). Although much of the English language derives from French (as a result of the Norman invasion of England in the 11th century), many words originate from other languages, particularly Latin and Greek (stemming from the Renaissance period), with very few Celtic words preserved today (Akmajian et al., 2010). While the spelling of some root words have withstood the test of time, their pronunciations and/or semantic representations have not. As such, it is widely acknowledged that etymological knowledge assists with spelling (Bear et al., 2012; Devonshire et al., 2013; Ganske, 2000; Hashemi &
Aziznezhad, 2011; Hutcheon et al., 2012). Hence, in the CoST, the morphological subscale includes a construct which measures spelling accuracy within etymologically complex words.

In the *Morphological Component*, six constructs are included to measure the spelling accuracy of specific morphemic elements within words. These constructs are described in Table 5.6.

### Table 5.6
*Morphological Component Constructs*

<table>
<thead>
<tr>
<th>Construct</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflected Suffix</td>
<td>Suffixes that change the verb tense (<em>marched</em>) or number (<em>serving</em>).</td>
</tr>
<tr>
<td>Derivational Suffix</td>
<td>Morphemes added to the end of base words that affect the meaning and/or part of speech (<em>dominance</em>).</td>
</tr>
<tr>
<td>Morpheme Juncture Schwa</td>
<td>The unstressed syllable in morphologically complex words contains a reduced vowel sound (<em>opposition</em>). These words contain a phonological shift at the morpheme juncture.</td>
</tr>
<tr>
<td>Homophone</td>
<td>The meaning of the homophone is understood in the context of a sentence and it is represented using correct letters sequences (<em>mussel/muscle</em>).</td>
</tr>
<tr>
<td>Greek and Latin Root</td>
<td>A unit of meaning deriving from Greek or Latin origin in which prefixes and suffixes are added (<em>perspiration</em>: in Latin, <em>perspirare</em>. Means to ‘blow’ or ‘breathe constantly’). Most roots are <em>bound</em> morphemes, or incomplete words.</td>
</tr>
<tr>
<td>Assimilated</td>
<td>Also known as <em>absorbed prefixes</em>. The sound and spelling of the final consonant is ‘absorbed’ into the</td>
</tr>
<tr>
<td><strong>Prefix</strong></td>
<td>initial consonant of a base word or root to which the prefix is affixed (<em>annotate</em>).</td>
</tr>
</tbody>
</table>

*Note.* Table 5.6 adapted from Daffern et al. (2015)

### 5.5 Conclusion

The CoST closely aligns with TWFT and provides a means from which to interrogate student knowledge of the spelling system without confining spelling achievement into a specific stage of development. Using the CoST, proficiency in spelling can be assessed in terms of accurate encoding of the phonological, orthographic and morphological features in words.

The aim of the Pilot Study was to develop and refine an assessment tool informed by TWFT before its utilisation in the Major Study. The results demonstrate adequate support and potential for the CoST as a valid and reliable measure of phonological, orthographic and morphological knowledge in the context of spelling in the English language. It needs to be noted that further empirical analysis conducted during Phase One of the Major Study provided evidence of criterion-related validity (see Section 6.3).

Although the findings of the Pilot Study cannot be generalised to the broader mainstream primary school population of students, empirical testing can be replicated with different student populations in different settings to further validate the CoST. The results of the study also provide the foundation for potential future research aiming
to develop parallel tests and to undertake further validity testing by using other measures of phonological, orthographic and morphological knowledge, perhaps based on pseudo words. These research endeavours are essential in enhancing the CoST’s utility and validity, especially within school contexts. An elaboration of future directions regarding the CoST is presented in the concluding chapter of this thesis.

This chapter has reported the results of the development, testing and refinement of the CoST; one of the key measures used in the following Major Study. An innovative methodological foundation presents itself through the development and refinement of the CoST, initiating an important avenue from which to investigate students’ accomplishments in spelling as part of the Major Study. Chapter 6 presents the results for the first phase of the Major Study. In this phase, CoST and NAPLAN data were used.
6 RESULTS FROM THE MAIN STUDY:

PHASE ONE

This chapter presents the results for the first research phase, specifically pertaining to research questions one, two and three. Response to question one (see section 6.1) is based on a series of MRAs conducted using the NAPLAN Language Conventions Test and Writing Test data (2010 to 2013). For question two (see section 6.2), results derive from descriptive analyses and a MANOVA conducted using the CoST measure. Finally, question three (see section 6.3) draws on results from a series of bivariate correlations and MRAs using the CoST data from low-achieving and high-achieving students.

6.1 Results for Research Question 1

**Question 1:** What is the relationship between the three dimensions measured by the NAPLAN Language Conventions Test (spelling, grammar and punctuation) and written composition? Is this relationship influenced by gender or age (in months)?

In order to determine the separate and joint influences of spelling, grammar and punctuation on written composition, four models (Years 3 to 6 cohorts) were examined using Year 3 and Year 5 NAPLAN data gathered across 2010 to 2013 from students enrolled within the ACT Catholic school sector. A multiple regression
analysis was performed for each cohort under investigation using the
Regression program in SPSS. Separate analyses for males and
females were then carried out to explore the influence of gender.
Further analyses within each of the year cohorts using age (in months)
were also undertaken, employing the hierarchical entry method, to
determine whether or not age was an influential factor with respect to
written composition.

The results in Table 6.1 illustrate the separate and joint
influences of the independent (predictor) variables (viz., spelling,
grammar and punctuation) on the dependent variable, which is written
composition. It needs to be noted that the adjusted \( R^2 \) values which,
because they take account of model complexity and sample size, are
always lower than the original \( R^2 \) values, are reported in these results,
rather than the original \( R^2 \) values. According to Colman and Pulford
(2008), the original \( R^2 \) value is generally an overestimate if the
regression equations have been specifically tailored to fit a particular
sample of data, and does not necessarily fit well if applied to a new
sample. Colman and Pulford (2008, p. 127) advise that “the adjusted
\( R^2 \) is designed to correct for this optimistic bias”.

Across the four cohorts, spelling, grammar and punctuation
jointly influence, to varying degrees, written composition. Overall,
results from the analyses of the various models indicate that between
approximately 24 and 43 percent of the variance in written
composition is explained by the three language convention measures
and that spelling is the main predictor of written composition (as indicated by the $\beta$) for each cohort. It needs to be noted that the results of separate MRAs for the four cohorts demonstrate that the separate and joint influences of spelling, grammar and punctuation on written composition are not significantly influenced by age.

Table 6.1
*NAPLAN Language Conventions (spelling, grammar and punctuation) as Predictors of NAPLAN Writing (written composition)*

<table>
<thead>
<tr>
<th>Cohort</th>
<th>N</th>
<th>Spelling $\beta$</th>
<th>Grammar $\beta$</th>
<th>Punctuation $\beta$</th>
<th>Total $R^2_{adj}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>226</td>
<td>.341 (.000)</td>
<td>.188 (.018)</td>
<td>.156 (.025)</td>
<td>.352</td>
</tr>
<tr>
<td>males</td>
<td>107</td>
<td>.279 (.019)</td>
<td>ns</td>
<td>ns</td>
<td>.271</td>
</tr>
<tr>
<td>females</td>
<td>119</td>
<td>.358 (.001)</td>
<td>ns</td>
<td>ns</td>
<td>.434</td>
</tr>
<tr>
<td><strong>Year 4</strong></td>
<td>199</td>
<td>.369 (.000)</td>
<td>.279 (.000)</td>
<td>ns</td>
<td>.417</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>males</td>
<td>75</td>
<td>.467 (.000)</td>
<td>ns</td>
<td>ns</td>
<td>.434</td>
</tr>
<tr>
<td>females</td>
<td>124</td>
<td>.290 (.004)</td>
<td>.321 (.001)</td>
<td>ns</td>
<td>.386</td>
</tr>
<tr>
<td><strong>Year 5</strong></td>
<td>215</td>
<td>.471 (.000)</td>
<td>ns</td>
<td>ns</td>
<td>.387</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>males</td>
<td>92</td>
<td>.543 (.000)</td>
<td>ns</td>
<td>ns</td>
<td>.406</td>
</tr>
<tr>
<td>females</td>
<td>123</td>
<td>.425 (.000)</td>
<td>ns</td>
<td>ns</td>
<td>.361</td>
</tr>
<tr>
<td><strong>Year 6</strong></td>
<td>179</td>
<td>.330 (.000)</td>
<td>ns</td>
<td>.194 (.013)</td>
<td>.274</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>males</td>
<td>65</td>
<td>ns*</td>
<td>ns</td>
<td>ns</td>
<td>.265</td>
</tr>
<tr>
<td>females</td>
<td>114</td>
<td>.344 (.001)</td>
<td>ns</td>
<td>ns</td>
<td>.242</td>
</tr>
</tbody>
</table>

*Note.*
Reported results are significant at $p< .05$ unless:
ns = Not significant
ns* $\beta = .285, p = .058$

In the Year 3 cohort, about 35 percent of the variance in written composition is accounted for by the three independent variables (spelling, grammar and punctuation), $R^2_{adj}=.352$. 

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For males in the Year 3 cohort, the explained variance is approximately 27 percent, $R^2_{adj}=.271$, $F(3,103)=14.11, p<.001$, and larger for females, $R^2_{adj} = .434$, $F(3,115)=31.14, p<.001$.

In the Year 4 cohort, about 42 percent of the variance in written composition is accounted for by spelling, grammar and punctuation, $R^2_{adj} = .417$, $F(3,195)=48.22, p<.001$. For the Year 4 males and females, the variance is relatively large, with respective proportions yielding about 46 percent, $R^2_{adj} = .434$, $F(3,71)=19.90, p<.001$, and 40 percent, $R^2_{adj} = .386$, $F(3,120)=26.80, p<.001$.

In the Year 5 cohort, about 39 percent of the variance in written composition is explained by spelling, grammar and punctuation, $R^2_{adj} = .387$, $F(3,110)=45.88, p<.001$. For males in the Year 5 cohort the variance is relatively large, $R^2_{adj} = .406$, $F(3,88)=21.75, p<.001$, and somewhat less for females, $R^2_{adj} = .361$, $F(3,118)=23.82, p<.001$.

Spelling, grammar and punctuation are least influential in the Year 6 cohort; however, the contribution is still considered relatively large with about 27 percent of the variance in written composition predicted by spelling, grammar and punctuation, $R^2_{adj} = .274$, $F(3,174)=23.22, p<.001$. In regards to gender, the variance in written composition for males in the Year 6 cohort is about 27 percent, $R^2_{adj} = .265$, $F(3,60)=8.56, p<.001$, and for females, about 24 percent, $R^2_{adj} = .242$, $F(3,110)=13.00, p<.001$. 

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Across the four cohorts, spelling is significantly influential for both males and females in terms of written composition, with the single exception of Year 6 males. In the Year 3 and Year 6 cohorts, spelling is a somewhat more important predictor for females than males, while in Year 4 and Year 5, spelling is more influential for males than females. In the Year 3 and Year 4 cohorts, grammar is significantly predictive of written composition for females but not for males, while punctuation is not predictive for both males and females across any of the four cohorts; however, it needs to be noted that punctuation is a significant predictor for the Year 3 and Year 6 cohorts. This result is at least partly due to sample size, that is, gender groups are smaller than total cohort size.

6.2 Results for Research Question 2

**Question 2:** What are the median performance levels for students across different years on the linguistic components of spelling in the CoST? Does performance on these spelling components in the CoST differ on the basis of gender and/or year level?

Using the *Frequencies* command in SPSS, median scores for the three linguistic components of spelling were obtained from a representative sample of students in Years 3 to 6 (n= 1,198) from thirteen schools representing the ACT public and Catholic sectors. Taken together, these results demonstrate an increase in the median
levels across the phonological, orthographic and morphological component scores (or the subscale totals) from Years 3 to 6, albeit to varying degrees (see Appendix N).

Figure 6.1 shows the progression of scores in the three linguistic components of spelling between Years 3 and 6; however, it is worth noting the substantial development in the morphological subscale, particularly between Year 5 and Year 6. The results also indicate that the general rate of overall orthographic score steadily increases between Year 3 and Year 6. Interestingly, although minimal growth in the phonological subscale occurs between Year 3 and Year 5, a considerable increase is evident between Year 5 and Year 6.

Figure 6.1. CoST subscale median scores (Years 3 to 6, n=1,198)

A comparison of the percentile performance levels within each of the three subscales is indicative of a particularly concerning trend
in the trajectory for very low-achieving (10th percentile) students. Specifically, in the phonological and orthographic subscales, this group of Year 6 students failed to reach scores equivalent to Year 3 students performing in the 50th percentile (see Figures 6.2 and 6.3).

Figure 6.2. Median levels for the phonological subscale (Years 3 to 6, n=1,198)

In the phonological subscale, there is noticeable improvement in the 50th percentile between Year 5 and Year 6; however, overall
development is minimal across the four years in the 90\textsuperscript{th} percentile (see Figure 6.2). It is worth noting the relatively constant gap that remains between the percentiles in the phonological total score across the various year levels, with the exception between the 70\textsuperscript{th} and 90\textsuperscript{th} percentiles, whereby the gap considerably narrows between Year 5 and Year 6.

In the orthographic subscale, minimal improvement is notable in the 90\textsuperscript{th} percentile; however, ceiling was reached for this group of students by the end of Year 5 (see Figure 6.3). It is also clear that, despite substantial improvement in the 10\textsuperscript{th} percentile over the four years, Year 6 students at the 10\textsuperscript{th} percentile mirrored Year 3 students achieving at the 50\textsuperscript{th} percentile. Figure 6.3 also shows that from Year 3 to Year 6, the gap between the 10\textsuperscript{th} and 90\textsuperscript{th} percentiles narrows markedly.
Relatively parallel development across the different median levels in the morphological subscale is observed between Year 3 and Year 5 (see Figure 6.4); however, between Year 5 and Year 6, distinguishable rapid development is evident in the $30^{th}$ and $50^{th}$ percentiles. Year 6 students performing at the $10^{th}$ percentile have marginally exceeded Year 3 students achieving at the $90^{th}$ percentile. Moreover, the gap between the $10^{th}$ and $90^{th}$ percentiles appears to widen slightly as the students proceed from Year 3 to Year 6.
Figure 6.4. Median levels for the morphological subscale (Years 3 to 6, n=1,198)

It needs to be noted that across the three subscale scores, the phonological and morphological subscale scores did not reach ceiling, even for the Year 6 students at the 90th percentile group. By contrast, the orthographic subscale score did reach ceiling as early as Year 5, but only for students at the 90th percentile group.
Ceiling effects in students’ application of three of the four phonological skills associated with the phonological subscale are observed in Year 3 for initial and final consonants, short vowels and consonant digraphs. Although the students mastered these three specific phonological skills by the end of Year 3 (and possibly earlier), their representation of blends in the medial parts of polysyllabic words continues to develop throughout the middle and upper primary school years, and potentially beyond (see Figure 6.5).

*Figure 6.5. Median scores for phonological component measures (Years 3 to 6, n=1,198)*
Figure 6.6 shows that students at the 50th percentile accurately represented syllable juncture consonants by the time they completed Year 4 schooling, suggesting this may be the easiest of the five orthographic sub-skills. Correct application of ambiguous vowels, such as diphthongs, is notable between Year 4 and Year 5, while correct representation of complex consonant patterns appears to have a longer and later developmental span (between Year 4 and Year 6). Unaccented final syllables and common long vowel patterns are likely to be the most challenging orthographic sub-skills for students in the 50th percentile group, as neither of these scores reached ceiling by the time students completed Year 6.

*Figure 6.6. Median scores for orthographic component measures (Years 3 to 6, n=1,198)*
Although the morphological subscale (total) score did not reach ceiling at any year level, nor at any percentile level, it is worthy of note that the inflected suffix sub-skill score did reach ceiling, and this was evident at the 50th percentile level in Year 5 (see Figure 6.7). The results clearly demonstrate that students at the 50th percentile completed Year 6 without having completely mastered five of the six morphological sub-skills. Specifically, results show that inflected suffixes were easier for students to grasp than derivational suffixes. Additionally, the homophone sub-skill was the least developed score at the 50th percentile, closely followed by morpheme juncture schwas and assimilated prefixes, as can be seen in Figure 6.7.

![Figure 6.7. Median scores for morphological component measures (Years 3 to 6, n=1,198)](image-url)
A factorial multivariate analysis of variance (MANOVA) was conducted to test the significance of group differences related to year level and gender on the three dependent variables (namely, the phonological, orthographic and morphological subscales). Prior to conducting a factorial MANOVA, Pearson correlations between the dependent variables were obtained in order to test the MANOVA assumption that they would be at least moderately correlated with each other (Colman & Pulford, 2008). As can be seen in Table 6.2, a strong pattern of correlations was observed among the dependent variables, suggesting the appropriateness of a MANOVA.

Table 6.2
*Pearson Correlations, Means, and Standard Deviations Associated with the CoST Subscales*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Phonological</strong>&lt;br&gt;subscales</td>
<td>1.00</td>
<td></td>
<td></td>
<td>22.48</td>
<td>4.58</td>
</tr>
<tr>
<td><strong>2 Orthographic</strong>&lt;br&gt;subscales</td>
<td>.773</td>
<td>1.00</td>
<td></td>
<td>21.81</td>
<td>6.92</td>
</tr>
<tr>
<td><strong>3 Morphological</strong>&lt;br&gt;subscales</td>
<td>.809</td>
<td>.784</td>
<td>1.00</td>
<td>18.86</td>
<td>9.76</td>
</tr>
</tbody>
</table>

*Note.*<br>n=1,198; correlations >.10 are statistically significant (p<.01)

Table 6.3 summarises the CoST subscale mean scores and standard deviations across the year groups, for males and females. A preliminary inspection of these results suggested that there was an overall increase in scores from Year 3 to Year 6; however differences between males and females were not obvious.
Table 6.3
Means and Standard Deviations for CoST Subscales (Years 3 to 6)

<table>
<thead>
<tr>
<th>Year Level</th>
<th>Gender</th>
<th>N</th>
<th>Phonological Subscale</th>
<th>Orthographic Subscale</th>
<th>Morphological Subscale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>3</td>
<td>Male</td>
<td>158</td>
<td>20.70</td>
<td>4.46</td>
<td>18.41</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>165</td>
<td>20.28</td>
<td>4.45</td>
<td>18.09</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>187</td>
<td>21.79</td>
<td>4.29</td>
<td>21.34</td>
</tr>
<tr>
<td>5</td>
<td>Male</td>
<td>122</td>
<td>23.31</td>
<td>4.19</td>
<td>23.10</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>159</td>
<td>23.04</td>
<td>4.32</td>
<td>23.03</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>99</td>
<td>24.85</td>
<td>4.02</td>
<td>25.34</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>172</td>
<td>25.13</td>
<td>3.76</td>
<td>25.44</td>
</tr>
</tbody>
</table>

As shown in Table 6.4, the results of the MANOVA indicated that year level had a significant main effect, Pillai’s Trace = .229, $F(9,3570)=32.73$, $p<.001$.

Table 6.4
Main Effects of Year Level, Gender, and their Interactions in the CoST Subscales

<table>
<thead>
<tr>
<th></th>
<th>$F$</th>
<th>df</th>
<th>Pillai’s Trace</th>
<th>Significance</th>
<th>Partial Eta²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Level</td>
<td>32.732</td>
<td>9,3570</td>
<td>.229</td>
<td>.000</td>
<td>.076</td>
</tr>
<tr>
<td>Gender</td>
<td>.085</td>
<td>3,1188</td>
<td>.000</td>
<td>.968</td>
<td>.000</td>
</tr>
<tr>
<td>Year Level x Gender</td>
<td>.316</td>
<td>9,3570</td>
<td>.002</td>
<td>.970</td>
<td>.001</td>
</tr>
</tbody>
</table>

The multivariate effect size was estimated at .076, implying that 7.6% of the variance in the dependent variables was accounted for by year level (see Table 6.4). The effects for gender and the interaction of year level and gender were non-significant.
Subsequent testing using repeated contrasts found that at each year level contrast, that is Year 3 vs Year 4, Year 4 vs Year 5, and Year 5 vs Year 6, there was a significant difference ($p \leq .001$) on each of the three CoST measures, as indicated in Table 6.5. The significance level was adopted using a Bonferroni adjustment of $0.05/9$ (.006). No significant differences were found for gender using the same contrasts.

Table 6.5

<table>
<thead>
<tr>
<th>CoST Subscales</th>
<th>Repeated Contrasts</th>
<th>Year 3 v Year 4</th>
<th>Year 4 v Year 5</th>
<th>Year 5 v Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phonological Subscale</strong></td>
<td><strong>Contrast Estimate</strong></td>
<td>-1.24</td>
<td>-1.45</td>
<td>-1.81</td>
</tr>
<tr>
<td></td>
<td><strong>Significance</strong></td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td><strong>95% Confidence Interval</strong></td>
<td>Lower Bound</td>
<td>-1.90</td>
<td>-2.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper Bound</td>
<td>-.57</td>
<td>-.76</td>
</tr>
<tr>
<td><strong>Orthographic Subscale</strong></td>
<td><strong>Contrast Estimate</strong></td>
<td>-2.99</td>
<td>-1.82</td>
<td>-2.33</td>
</tr>
<tr>
<td></td>
<td><strong>Significance</strong></td>
<td>.000</td>
<td>.001</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td><strong>95% Confidence Interval</strong></td>
<td>Lower Bound</td>
<td>-3.99</td>
<td>-2.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper Bound</td>
<td>-1.10</td>
<td>-.78</td>
</tr>
<tr>
<td><strong>Morphological Subscale</strong></td>
<td><strong>Contrast Estimate</strong></td>
<td>-4.04</td>
<td>-3.38</td>
<td>-5.20</td>
</tr>
<tr>
<td></td>
<td><strong>Significance</strong></td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td><strong>95% Confidence Interval</strong></td>
<td>Lower Bound</td>
<td>-5.38</td>
<td>-4.78</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper Bound</td>
<td>-2.70</td>
<td>-1.99</td>
</tr>
</tbody>
</table>
6.3 Results for Research Question 3

**Question 3:** What are the relationships between the NAPLAN spelling results and the linguistic components of spelling for low-achieving spellers and high-achieving spellers? Are these relationships affected by gender and/or year level?

Low-achieving spellers and high-achieving spellers were identified as those who performed in the bottom third and top third, respectively, in the spelling measure of the NAPLAN Language Conventions Test. For Years 3 and 4, bivariate correlations were conducted to examine the relationships between the Year 3 NAPLAN spelling scores and the CoST subscale scores for low-achieving and high-achieving spellers. This procedure was repeated for Years 5 and 6, however, the students’ Year 5 NAPLAN Language Conventions Test spelling scores were used for these correlations. It needs to be noted that this component of the research involved the analysis of truncated scores obtained from data collected from students enrolled within the ACT Catholic sector.

Results for low-achievers and high-achievers across the four cohorts indicate significant positive correlations between the NAPLAN spelling results and the three subscales (components) of spelling, as measured by the CoST (see Table 6.6). For low-achieving spellers across all year levels, the strongest correlation was
between NAPLAN spelling and the orthographic subscale, \( r = .64, p < .001 \) (Year 3); \( r = .69, p < .001 \) (Year 4); \( r = .67, p < .001 \) (Year 5); and \( r = .64, p < .001 \) (Year 6). It is worth noting, however, that in the Year 6 low-achieving group an equally strong relationship was observed with the morphological subscale. For the high-achieving spellers, the strongest relationship was between the NAPLAN spelling and the morphological subscale, with the exception of Year 5, in which the relationship with the phonological subscale was marginally stronger, \( r = .51, p < .001 \), than the morphological subscale, \( r = .50, p < .001 \).

Table 6.6

<table>
<thead>
<tr>
<th>Year Level</th>
<th>Phonological Subscale ( r )</th>
<th>Orthographic Subscale ( r )</th>
<th>Morphological Subscale ( r )</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>.54*</td>
<td>.64*</td>
<td>.51*</td>
<td>71</td>
</tr>
<tr>
<td>High</td>
<td>.31*</td>
<td>.38*</td>
<td>.57*</td>
<td>74</td>
</tr>
<tr>
<td><strong>Year 4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>.42*</td>
<td>.69*</td>
<td>.49*</td>
<td>56</td>
</tr>
<tr>
<td>High</td>
<td>.37*</td>
<td>.35*</td>
<td>.45*</td>
<td>61</td>
</tr>
<tr>
<td><strong>Year 5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>.50*</td>
<td>.67*</td>
<td>.51*</td>
<td>55</td>
</tr>
<tr>
<td>High</td>
<td>.51*</td>
<td>.48*</td>
<td>.50*</td>
<td>78</td>
</tr>
<tr>
<td><strong>Year 6</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>.54*</td>
<td>.64*</td>
<td>.64*</td>
<td>55</td>
</tr>
<tr>
<td>High</td>
<td>.41*</td>
<td>.43*</td>
<td>.51*</td>
<td>62</td>
</tr>
</tbody>
</table>

**Note.**
Low        Low-achieving group [bottom third] as measured by NAPLAN Spelling
High       High-achieving group [top third] as measured by NAPLAN Spelling
*          Significant at the 0.01 level (2-tailed)
Separate bivariate correlation analyses for males and females were also conducted to examine gender differences (see Appendix O). A testing of the significance of the CoST subscale correlations between males and females, using the low- and high-achieving spelling groups, revealed no significant findings. This testing was based on a two-tailed $t$-test with a Bonferroni correction of .05/3. It needs to be noted, however, that there were some high correlations in spite of the truncated NAPLAN spelling scores in both spelling groups. A comparison of gender in the low-achieving and high-achieving spelling groups by year level revealed a dominance of females in the high achieving groups; however, there was no obvious pattern of gender difference in the low-achieving groups (see Table 6.7).

Table 6.7
Numbers of Males and Females in the Low- and High-achieving Spelling Groups by Year

<table>
<thead>
<tr>
<th></th>
<th>Year 3 (n)</th>
<th>Year 4 (n)</th>
<th>Year 5 (n)</th>
<th>Year 6 (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low-achieving</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>37</td>
<td>28</td>
<td>25</td>
<td>24</td>
</tr>
<tr>
<td>Female</td>
<td>34</td>
<td>27</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td><strong>High-achieving</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>31</td>
<td>20</td>
<td>28</td>
<td>20</td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td>41</td>
<td>50</td>
<td>42</td>
</tr>
</tbody>
</table>

MRAs were used to test if the three components of spelling, as measured by the CoST, predict NAPLAN spelling for low-achieving and high-achieving students in Years 3 to 6. The results of the
analyses indicated that the three CoST subscales, across all year levels, for low-achieving students and high-achieving students are significantly associated with NAPLAN spelling (see Table 6.8). For example, for low-achievers in Year 3 about 41% of the variance was explained by the CoST, $R^2_{adj}=.413$, $F(3,67)=17.43$, $p<.001$; and 30% for high-achievers, $R^2_{adj}=.299$, $F(3,70)=11.40$, $p<.001$.

As can be seen in Table 6.8, the results of the MRAs for the Year 3 cohort indicate that the orthographic subscale score is the only significant predictor in this model at $p=.002$, while for the high-achievers, the morphological subscale score is the only significant predictor at $p<.001$. For low-achieving students in Years 4 and 5, the only significant predictor of the three CoST subscale scores is the orthographic score. For high achieving students in Year 5, the orthographic subscale is the strongest predictor, followed by the phonological subscale. Although no CoST subscale scores independently predict NAPLAN spelling in Year 6, the overall model is a good fit, with about 42 percent of the variance in NAPLAN spelling jointly explained by the CoST for low-achievers and 24 percent for the high-achievers.
Table 6.8  
CoST Subscale Scores for Low- and High-achieving Groups as Predictors of overall CoST model (Years 3 to 6)

<table>
<thead>
<tr>
<th>Year Level</th>
<th>n</th>
<th>Phonological Subscale $\beta$</th>
<th>Orthographic Subscale $\beta$</th>
<th>Morphological Subscale $\beta$</th>
<th>Overall CoST Model $R^2_{adj}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>71</td>
<td>ns</td>
<td>.266*</td>
<td>ns</td>
<td>.413</td>
</tr>
<tr>
<td>High</td>
<td>74</td>
<td>ns</td>
<td>ns</td>
<td>.18*</td>
<td>.299</td>
</tr>
<tr>
<td><strong>Year 4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>56</td>
<td>ns</td>
<td>.359*</td>
<td>ns</td>
<td>.451</td>
</tr>
<tr>
<td>High</td>
<td>61</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>.176</td>
</tr>
<tr>
<td><strong>Year 5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>55</td>
<td>ns</td>
<td>.302*</td>
<td>ns</td>
<td>.425</td>
</tr>
<tr>
<td>High</td>
<td>78</td>
<td>.234</td>
<td>.382</td>
<td>ns</td>
<td>.388</td>
</tr>
<tr>
<td><strong>Year 6</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>55</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>.415</td>
</tr>
<tr>
<td>High</td>
<td>62</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>.241</td>
</tr>
</tbody>
</table>

* $\beta$ coefficient is significant at the 0.01 level (2-tailed)

Note.  
Low-achieving group [bottom third] as measured by NAPLAN Spelling  
High-achieving group [top third] as measured by NAPLAN Spelling

While significant, these results do suggest, particularly for high-achieving spellers, that NAPLAN spelling involves other competencies not measured by the CoST. It also needs to be kept in mind that the spelling component of the NAPLAN Language Conventions Test is based on a proofreading and editing task, whereas the CoST uses a dictation procedure.

Another series of MRAs were carried out to see if gender was predictive of NAPLAN spelling for low-achieving and high-achieving spellers in Years 3 to 6. When gender was entered in step one (that is,
as a control variable) for the MRAs, none of the $R^2$ values reached a significant level (that is $p < .05$). As a second step, the three CoST subscale scores for each year level were entered. This second step not only showed that the model for each year level was significant, but permitted calculation of an $R^2$ change value for each MRA (see Table 6.9). The $R^2$ change was calculated by subtracting the $R^2_{adj}$ value (for gender in step one of the MRA) from the $R^2_{adj}$ value (for gender, phonological subscale, orthographic subscale and the morphological subscale measures in step two of the MRA). In cases where the $R^2_{adj}$ value, for step one, was less than zero, the $R^2_{adj}$ value was treated as zero. The recording of a negative $R^2_{adj}$ value occurs when only one variable is entered and this step leads to a very low value (Tabachnick & Fidell, 2001).

Table 6.9

$R^2$ Change Values for Low- and High-achieving Groups (Years 3 to 6) for a Two-step Entry

<table>
<thead>
<tr>
<th>Year</th>
<th>Low-achieving group</th>
<th>High-achieving group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$R^2$ change</td>
<td>Significant IV</td>
</tr>
<tr>
<td>3</td>
<td>.405</td>
<td>Orthographic</td>
</tr>
<tr>
<td>4</td>
<td>.444</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>.421</td>
<td>Orthographic</td>
</tr>
<tr>
<td>6</td>
<td>.429</td>
<td>Orthographic</td>
</tr>
</tbody>
</table>

*Note.*

| IV   | Independent variables (CoST subscale totals) |

As can be seen in Table 6.9, results indicate that for the low-achieving groups of students across the year levels, the $R^2$ change
values are relatively large, while for the high-achieving spelling groups the $R^2$ change values are somewhat smaller. Further, the orthographic subscale was generally the main predictor of NAPLAN spelling across year levels, with the exception of the Year 6 high-achieving group and both Year 4 groups, where no individual subscale was a significant predictor. In addition to the orthographic subscale, the phonological subscale was a significant predictor, but only in the Year 5 high-achieving group.

### 6.4 Summary of results

This chapter has reported the results for the first research phase of the Major Study. For question one, a series of MRAs using NAPLAN Language Conventions Test and Writing Test data (2010 to 2013) showed that, across the four cohorts, spelling, grammar and punctuation jointly influenced written composition, and that spelling was the main predictor of written composition. Additionally, it was found that the separate and joint influences of spelling, grammar and punctuation on written composition were not significantly influenced by age. For question two, the median performance levels for students across Years 3 to 6 on the phonological, orthographic and morphological components of the CoST were determined. As well, results of the MANOVA showed that there were significant differences related to year level on the three CoST components. The effects for gender and the interaction of year level and gender were non-significant. The results of the MRA for question three indicated
significant relationships between the NAPLAN spelling results and the three subscale scores of the CoST, for low-achieving and high-achieving spellers, across the four cohorts. In addition, the orthographic subscale was generally the main predictor of NAPLAN spelling across year levels, and further analysis indicated that gender was not an influential factor.

The results presented in this chapter build on the literature regarding the acquisition of spelling competency and in particular TWFT. It is critical, however, to extend on these quantitative results by offering rich insights into the ways in which low-achieving and high-achieving spellers in Years 3 to 6 may differ in their approach to spelling. The next chapter reports on this important final phase of the investigation by presenting the results of a qualitative comparison of the spelling strategies used by low-achieving and high-achieving spellers in Years 3 to 6.
7 RESULTS FROM THE MAIN STUDY: PHASE TWO

This chapter presents the results pertaining to Phase Two, which addresses the final research question:

**Question 4:** What spelling strategies are used by high-achieving spellers compared with low-achieving spellers? Are students able to explain the spelling strategies they use?

First, descriptive statistics are presented for the 16 students’ written compositions and their CoST scores. As these results yielded preliminary insights into the spelling strategies used, and they informed analysis of the interview transcription data and subsequent triangulation, they are positioned as an introduction to the findings presented in this chapter. Second, a summary of the spelling strategies emerging from the triangulated data is presented as this provides the backbone for the rich descriptions which follow. The next section of the chapter offers rich descriptions of the strategies used and discussed by the low-achieving spellers and high-achieving spellers in the study, respectively. The chapter concludes with a comparative summation of the key findings.
7.1 Descriptive statistics for the written compositions and CoST results

An analysis of the students’ written compositions was conducted first to provide a broad overview of the words written by each student (in terms of density and sophistication), as well as to expose trends in spelling errors. Importantly, the results revealed specific breakdowns in linguistic processing, which in turn provided some initial insights into the strategies used and whether or not they may have been effective.

Table 7.1 presents descriptive statistics for the students’ written compositions. Specifically, frequencies are presented for words written (classified by lexical difficulty) (ACARA, 2012a); whole-word spelling errors; and errors categorised as phonological, orthographic or morphological. As expected, these results indicate that the high-achieving spellers make fewer spelling errors than the low-achieving spellers at each year level. This suggests that linguistic processing is more efficient and reliable for the high-achieving spellers. Higher proportions of word errors observed in the low-achieving spellers’ written compositions also suggest that the low-achieving spellers are limited in their capacity to create meaningful written texts, when compared to the high-achieving spellers. This finding strengthens the results relating to Question 1 (Phase One), which showed spelling to be the strongest predictor of written composition.
## Table 7.1

*Frequencies for Words Written and Errors Made in Written Compositions, by Low- and High-achieving Spellers (Years 3 to 6)*

<table>
<thead>
<tr>
<th></th>
<th>Total no. words written</th>
<th>Word errors n (%)</th>
<th>No. whole words written (by lexical difficulty)</th>
<th>No. linguistic errors made</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Simple</td>
<td>Common</td>
</tr>
<tr>
<td><strong>Yr 3</strong></td>
<td><strong>Low</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mick 317</td>
<td>94 (30)</td>
<td>196</td>
<td>118</td>
</tr>
<tr>
<td></td>
<td>Lucy 371</td>
<td>64 (17)</td>
<td>242</td>
<td>111</td>
</tr>
<tr>
<td><strong>Yr 3</strong></td>
<td><strong>High</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ryan 230</td>
<td>5 ( 2)</td>
<td>122</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Zoe 396</td>
<td>1 (&lt;1)</td>
<td>223</td>
<td>159</td>
</tr>
<tr>
<td><strong>Yr 4</strong></td>
<td><strong>Low</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bob 138</td>
<td>42 (30)</td>
<td>58</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Rose 501</td>
<td>53 (11)</td>
<td>292</td>
<td>182</td>
</tr>
<tr>
<td><strong>Yr 4</strong></td>
<td><strong>High</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ed 325</td>
<td>10 ( 3)</td>
<td>167</td>
<td>143</td>
</tr>
<tr>
<td></td>
<td>Jane 306</td>
<td>17 ( 6)</td>
<td>145</td>
<td>140</td>
</tr>
<tr>
<td><strong>Yr 5</strong></td>
<td><strong>Low</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Harry 283</td>
<td>60 (21)</td>
<td>161</td>
<td>118</td>
</tr>
<tr>
<td></td>
<td>Gabby 423</td>
<td>40 ( 9)</td>
<td>247</td>
<td>166</td>
</tr>
<tr>
<td><strong>Yr 5</strong></td>
<td><strong>High</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fred 413</td>
<td>4 ( 1)</td>
<td>219</td>
<td>162</td>
</tr>
<tr>
<td></td>
<td>Amy 500</td>
<td>1 (&lt;1)</td>
<td>236</td>
<td>231</td>
</tr>
<tr>
<td><strong>Yr 6</strong></td>
<td><strong>Low</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ian 545</td>
<td>50 ( 9)</td>
<td>285</td>
<td>238</td>
</tr>
<tr>
<td></td>
<td>Kate 460</td>
<td>59 (13)</td>
<td>246</td>
<td>194</td>
</tr>
<tr>
<td><strong>Yr 6</strong></td>
<td><strong>High</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dom 448</td>
<td>1 (&lt;1)</td>
<td>244</td>
<td>187</td>
</tr>
<tr>
<td></td>
<td>Chloe 516</td>
<td>8 ( 2)</td>
<td>276</td>
<td>218</td>
</tr>
</tbody>
</table>

*Note.* Phonological errors (Phon); Orthographic errors (Orth); and Morphological errors (Morph)

In terms of the errors classified in Table 7.1 as phonological, orthographic or morphological, the results demonstrate that the low-achieving spellers make more errors than the high-achieving spellers across all three word forms. This suggests that the high-achieving
spellers in the study are able to draw on phonological, orthographic and morphological processing with greater accuracy and efficiency than the low-achieving spellers. Throughout this chapter, further references to these results are made, particularly in relation to evidence gathered from participants’ interview transcriptions.

The students’ CoST results (derived from Phase One) were also inspected. In particular, results in the Phonological Component offered preliminary comparative trends, particularly regarding students’ medial blending of polysyllabic words. These differences in phonological processing between the low-achieving spellers and the high-achieving spellers are presented in Table 7.2. It needs to be noted that the results indicate that the observed difference in Year 6 is markedly narrower.

Table 7.2
Low-achieving and High-achieving Spellers’ Scores in the Polysyllabic-word Medial Blend Construct of the CoST: Phonological Subscale (Years 3 to 6)

<table>
<thead>
<tr>
<th></th>
<th>Year 3 Score</th>
<th>Year 4 Score</th>
<th>Year 5 Score</th>
<th>Year 6 Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>2/16</td>
<td>5/16</td>
<td>8/16</td>
<td>13/16</td>
</tr>
<tr>
<td>Mick</td>
<td>2/16</td>
<td>5/16</td>
<td>8/16</td>
<td>13/16</td>
</tr>
<tr>
<td>Lucy</td>
<td>4/16</td>
<td>3/16</td>
<td>1/16</td>
<td>10/16</td>
</tr>
<tr>
<td>High</td>
<td>10/16</td>
<td>11/16</td>
<td>13/16</td>
<td>15/16</td>
</tr>
<tr>
<td>Ryan</td>
<td>10/16</td>
<td>11/16</td>
<td>13/16</td>
<td>15/16</td>
</tr>
<tr>
<td>Zoe</td>
<td>7/16</td>
<td>6/16</td>
<td>16/16</td>
<td>13/16</td>
</tr>
<tr>
<td>Ed</td>
<td>11/16</td>
<td>13/16</td>
<td>15/16</td>
<td>13/16</td>
</tr>
<tr>
<td>Jane</td>
<td>6/16</td>
<td>16/16</td>
<td>13/16</td>
<td>13/16</td>
</tr>
<tr>
<td>Harry</td>
<td>8/16</td>
<td>1/16</td>
<td>10/16</td>
<td>13/16</td>
</tr>
<tr>
<td>Gabby</td>
<td>1/16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ian</td>
<td>13/16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kate</td>
<td>10/16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dom</td>
<td>15/16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloe</td>
<td>13/16</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results also signal that phonological blending is substantially more efficient for the Year 6 low-achieving spellers than it is for the low-achieving spellers in Year 3 to Year 5. Further, the data suggest that the low-achieving spellers’ phonological processing
is generally less efficient and less reliable than it is for the high-achieving spellers in the study.

In terms of orthographic errors, stark differences are evident between the low-achieving spellers and high-achieving spellers, with the exception in Year 6 where the gap is much narrower (see Table 7.3). The data suggest that these low-achieving spellers have weaker orthographic sensitivity than the high-achieving spellers, and therefore encode letter sequences with less accuracy and efficiency.

Table 7.3
*Low-achieving and High-achieving Spellers’ Scores in the Orthographic Subscale of the CoST (Years 3 to 6)*

<table>
<thead>
<tr>
<th>Year</th>
<th>Score</th>
<th>Year</th>
<th>Score</th>
<th>Year</th>
<th>Score</th>
<th>Year</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4</td>
<td>4</td>
<td>11</td>
<td>5</td>
<td>12</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>Low</td>
<td>Mick</td>
<td>Bob</td>
<td>Harry</td>
<td>Ian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Lucy</td>
<td>Rose</td>
<td>Gabby</td>
<td>Kate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Ryan</td>
<td>Ed</td>
<td>Fred</td>
<td>Dom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Zoe</td>
<td>Jane</td>
<td>Amy</td>
<td>Chloe</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The CoST data also indicate substantial differences in morphological knowledge between the low-achieving spellers and high-achieving spellers in the study (see Table 7.4). However, for the two low-achieving spellers in Year 6, notably higher scores are evident, when compared to the low-achieving spellers from Years 3 to 5 in this study. These results suggest that the low-achieving spellers in the study may not consciously utilise morphological processing when spelling.
Triangulation of data included analysis of the interview transcriptions. Interviews with the students and their teachers proved to be critical in yielding insights which could not be obtained by analysing the written compositions and CoST scores alone. By synthesising all available data pertinent to each student, comprehensive profiles were crafted (16 profiles in total; see Appendix L). Extracts from these profiles appear later in this chapter.

As a result of developing the profiles for each student, a total of 16 spelling strategies emerged. Using inductive content analysis, each strategy was then classed into one of five overarching categories, namely (i) phonological processing; (ii) orthographic processing; (iii) morphological processing; (iv) linguistic cross-mapping; and (v) behavioural. Table 7.5 presents the categorised strategies and their respective definitions, while Table 7.6 summarises the strategies demonstrated by each student.

<table>
<thead>
<tr>
<th></th>
<th>Year 3 Score</th>
<th>Year 4 Score</th>
<th>Year 5 Score</th>
<th>Year 6 Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low</strong></td>
<td>3</td>
<td>7</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Mick</td>
<td>3</td>
<td>Rose</td>
<td>Harry</td>
<td>Ian</td>
</tr>
<tr>
<td>Lucy</td>
<td></td>
<td></td>
<td>Gabby</td>
<td>Kate</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>29</td>
<td>27</td>
<td>33</td>
<td>39</td>
</tr>
<tr>
<td>Ryan</td>
<td></td>
<td></td>
<td>Fred</td>
<td>Dom</td>
</tr>
<tr>
<td>Zoe</td>
<td>16</td>
<td>Jane</td>
<td>Amy</td>
<td>Chloe</td>
</tr>
</tbody>
</table>
Table 7.5  
*Coded Repertoire of Spelling Strategies and their Definitions*

<table>
<thead>
<tr>
<th>Phonological processing (P)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P1</strong> Phoneme segmentation. This process involves phoneme to grapheme encoding only. It is commonly referred to as ‘sounding out’. This strategy is used in isolation and not in conjunction with another strategy.</td>
<td></td>
</tr>
<tr>
<td><strong>P2</strong> Syllabification. This process involves segmenting a word into syllables and encoding each syllable as separate lexical units. It is commonly referred to as ‘chunking’ and occurs in words containing two or more syllables. This strategy is used in isolation and not in conjunction with another strategy.</td>
<td></td>
</tr>
<tr>
<td><strong>P3</strong> Phonological hybrid. A fusion of syllabification and phoneme segmentation. This process involves segmenting a word into syllables and encoding individual phonemes to graphemes, one syllable at a time. It can occur in disyllabic and polysyllabic words, rather than monosyllabic words.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Orthographic processing (O)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>O1</strong> Visualising a cluster of letters as one unit rather than as individual letters (for example, the trigraph <em>igh</em> is visualised as a whole, rather than as <em>-i-g-h</em>-). A cluster may also be associated with the suffix, <em>ing</em>; however, there is complete absence of morphological awareness. The cluster is encoded automatically and no morphological association is made. Visual checking may also occur to ‘see’ if a word or a letter cluster ‘looks right’. An orthographic ‘rule’ might also be applied (e.g. ‘i before e except after c’).</td>
<td></td>
</tr>
<tr>
<td><strong>O2</strong> Automatic lexical retrieval. This process involves spontaneous spelling of a free morpheme within a word, or spontaneous spelling of a whole word.</td>
<td></td>
</tr>
<tr>
<td><strong>O3</strong> Mnemonic. A memory trick is used to facilitate orthographic processing of specific words, such as <em>because</em> and <em>beautiful</em>. This involves recalling an acronym to encode each letter of the word, one by one, sequentially (for example, <em>b</em> is for Big; <em>e</em> is for Elephant, etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>O4</strong> Lexical analogical processing. An orthographic analogy is made with a known word which contains an identical cluster of letters (for example, in <em>straight</em> reminds me of <em>light</em>).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Morphological processing (M)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M1</strong> Conscious thinking and application of a generalisation (‘rule’) associated with an affix. For example, knowing to double the final consonant letter in <em>swim</em> before adding <em>ing</em>; or not to double the final consonant letter in <em>jump</em> because of the preceding consonant letter (<em>m</em>), when adding <em>ed</em>. Evidence of conscious processing of the meaning and function of prefixes and/or suffixes exists (such as knowing the morphemic differences between the suffixes <em>tion</em> and <em>cian</em>).</td>
<td></td>
</tr>
</tbody>
</table>
Conscious thinking and application of etymological features within words when encoding. For example, knowing that chlorine derives from Latin, which explains the pronunciation of the initial consonant digraph.

Conscious thinking about the semantic context of a word. For example, the meaning and spelling of a word, such as a homophone, is considered within the context of a sentence.

**Linguistic cross-mapping (X)**

- **X1** Phonological and orthographic processing is combined when spelling a single word.
- **X2** Orthographic and morphological processing is combined when spelling a single word.
- **X3** Phonological and morphological processing is combined when spelling a single word.
- **X4** Triple word-form mapping. Coordination between phonological, orthographic and morphological thinking occurs when spelling a single word.

**Behavioural (B)**

- **B1** Consults an expert or resource such as a teacher, dictionary, computerised spell-check function, or a wall chart.
- **B2** Risk avoidance. Selects an easier word to spell.
Table 7.6  
Summary of Overt Spelling Strategies: Low-achieving Spellers and High-achieving Spellers (Years 3 to 6)

<table>
<thead>
<tr>
<th>STRATEGIES</th>
<th>Low-achieving spellers</th>
<th>High-achieving spellers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 3</td>
<td>Year 4</td>
</tr>
<tr>
<td>P 1</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>P 2</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>P 3</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>O 1</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>O 2</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>O 3</td>
<td>✓</td>
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<td>O 4</td>
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<tr>
<td>M 1</td>
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<td>M 2</td>
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<td>M 3</td>
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<td>X 1</td>
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<td>X 3</td>
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<tr>
<td>X 4</td>
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<tr>
<td>B 1</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>B 2</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

As can be seen in Table 7.6, there are distinct differences in terms of strategy-use among individuals and between the low-achieving spellers and the high-achieving spellers. Strategies which
were demonstrated and explicitly stated or described by the students and/or their teachers during the interviews were considered to be overt. Only those strategies which were overtly demonstrated or explained by each student are marked with a tick.

The strategies presented thus far are merely an abridged snapshot as they do not offer rich descriptions of the strategies used and explained by the students. Nor, do they fully capture the individual nature of the students’ thinking processes. Thus, the next two sections of this chapter provide a detailed narrative of the spelling strategies used by the students in the study. Respectively, the spelling strategies used and explained by the low-achieving spellers and high-achieving spellers are presented herein.

7.2 Spelling strategies used and explained by the low-achieving spellers

Low-achieving spellers in Years 3 to 6 relied heavily on phonological processing when spelling. Some unique differences were observed in the ways in which phonological processing was used and articulated among the low-achieving spellers. Typically, however, the process of phoneme segmentation was articulated by the students as “sounding out” or “stretching out”, while the process of syllabification was often referred to by the students as, “chunking out” or “breaking up bits”.

Phonological processing: Phoneme segmentation.
Bob (in Year 4, aged 10 years and 6 months), like all the low-achieving spellers in this study, used and articulated the “sounding out” strategy more than any other strategy. Although Bob was one of the few low-achieving spellers who could accurately segment phonemes in monosyllabic and disyllabic words, he found it difficult to consistently distinguish the difference between a long vowel phoneme and a short vowel phoneme. It is possible that Bob was not familiar with the term, ‘vowel’:

**Bob:** I would sound it out and see how much letters it has. … Try and count how many sounds … I think about what the sounds are and try and sound it out.

**Researcher:** What sounds do you hear in the word ‘jump’?

**Bob:** j-u-m-p [segments four phonemes]

**Researcher:** I want you to listen to this vowel sound and tell me if you think it is a short vowel sound or a long vowel sound. The sound is i as in the word ‘it’?

**Bob:** hmm [five second pause] shorter [hesitates]

**Researcher:** Is it short or long?

**Bob:** Longer, a bit [incorrect response]

**Researcher:** What about oo in the word ‘to’?

**Bob:** Long [correct response]

**Researcher:** What about oh as in the word ‘no’?

**Bob:** Short [incorrect response]

‘sounded out’ many words when writing, however, if he were given an opportunity to self-select words when crafting a written text, he was more likely to substitute a less familiar word with a simpler word; one that he felt he could confidently spell:
Interestingly, risk avoidance in terms of vocabulary choice was a strategy purportedly used by six of the eight low-achieving spellers, including Mick. Although the process of selecting an easier or familiar word to spell cannot be classified as a linguistic strategy, it can be classed as a behavioural strategy. Such risk avoidance is worth noting because it was so prevalent among the low-achieving spellers. For instance, Rose, a Year 4 student (aged 10 years and 6 months) stated that she would prefer to “pick an easy word”, and Harry (in Year 5, aged 10 years and 11 months) explained that he “would change the word to an easier word to spell”, adding that he uses this strategy “quite a lot” when writing. Similarly, Kate (in Year 6, aged 11 years and 8 months) admitted that she would “just use a different word that means [has] the same meaning”, if she was not sure how to spell a word.

Phoneme segmentation was more frequently used than syllabification.
The process of ‘sounding out’ words was more common among the low-achieving spellers, than ‘chunking out’ words into syllables. Of concern, these students used the descriptive phrases interchangeably and sometimes confused a phoneme and a syllable when encoding. Such confusion caused particular difficulties when phonologically processing polysyllabic words. For example, Rose (in Year 4, aged 10 years and 6 months) described phonological processing in three ways: “sounding it out”, “stretching it out” and “chunking it”, yet her descriptions of the three processes were inconsistent and somewhat unclear.

**Inconsistent phonological processing.**

In particular, Rose’s use of the phrase, “sounding it out”, was often interchanged indiscriminately with the phrase, “stretching it out”. Yet, when attempting to explain how to “stretch out” and “sound out” the word, *cooperation*, Rose segmented the word into syllables instead of individual phonemes:

**Rose:** You can stretch it out like chewing gum, like if I was saying *coperation* [mispronounces the word, ‘cooperation’]. *I would say COP-ER-AY-SHIN, like imagining that you have chewing gum in your mouf* [mispronounces the word, ‘mouth’] *and you could stretch it out and sound it out.*
Although Rose stated that “chunking it out” is a different strategy to “stretching it out”, she was not able to consistently and clearly demonstrate how they are different. When asked to elaborate on the process of “chunking”, Rose attempted to identify each syllable while encoding the corresponding letters. This strategy was not always successful, particularly if the word was polysyllabic and incorrectly articulated:

**Rose:** You can chunk it up.

**Researcher:** Is that different to stretching it out?

**Rose:** Yes ... You always have to find, umm, there’s always a ... fer ... no, umm, vowels in chunking out.

**Researcher:** Can you show me how you would chunk out the word that you said to me before [the word is ‘cooperation’]?

**Rose:** You can do it like …

[Rose attempts to visually represent the syllables]

\[co | pe | ra | ti | on\]

**Phonological processing: Syllabification.**

Rose’s class teacher encouraged her students to “stretch out the words”, “sound out the words” and “chunk the words” when spelling; however, neither Rose nor her teacher were consistent in their explanation of the differences between these phrases:
Rose’s teacher was not explicit in her explanation and
definition of the phonological strategies, which may explain why
Rose’s understanding and application of phoneme and syllable
segmentation was not reliable. Rose was confused with the term
‘syllable’ and often confused phoneme segmentation with
syllabification. This may be because Rose did not receive adequate
instruction with regard to the difference between a phoneme and a
syllable. Implicitly, the teacher suggested that “sounding out” and
“stretching out” is the same process: that is, a one-to-one or phoneme-
to-grapheme encoding of words. This appeared to be Rose’s most
frequently used linguistic process when spelling:

**Rose’s Teacher:** Well she [Rose] tends to sound out a lot of her
words so she would probably use the trying to stretch it out, you
know. ... I would say, sound it out and trying to stretch it out to
hear the phonemes.
In an attempt to clarify the difference between ‘stretching out’ and ‘chunking out’, the researcher probed Rose’s teacher throughout the interview; however, the teacher often changed the topic of conversation instead. The teacher’s description of syllabification appeared ambiguous, and paralleled Rose’s uncertainty when syllabifying words:

**Researcher:** What strategies or thinking processes do you encourage Rose to use?

**Rose’s Teacher:** Okay, so stretching it out. You know, most of them have sounding out .. they know that. Umm, syllibi .. syllib .. I can never say it .. syllibify [laughs, but means to say syllabify] .. you know, knowing that every chunk is going to have one vowel in it, because that’s often where they go wrong.

**Researcher:** So is a chunk a syllable?

**Rose’s Teacher:** A chunk, so when you’re clapping it out, each little bit will have one vowel … Umm. As I said, I really encourage the risk taking because I’ve got one child who just, at the beginning of the year, wouldn’t write anything …

Bob, Mick and Rose were not the only low-achieving spellers to confuse phonological processes in this study. Ian (aged 12 years and four months) also confused and incorrectly applied phoneme segmentation and syllabification. This was demonstrated in the quality of errors present in Ian’s written compositions and CoST results, but also reflected in the comments he made during the interview:
Given that Ian had almost completed Year 6 schooling when the interview took place, it is of concern that he appeared to not understand the differences between an alphabetic name, a phoneme and a syllable. This is in spite of being taught to spell at school through a popular commercially sourced phonics instructional program ("Sound Waves," 2013):
Non-standard Australian English pronunciation was observed among three of the eight low-achieving spellers (Mick, Rose and Gabby), even though they were not identified as English language learners, or as Aboriginal or Torres Strait Islander peoples. For these students, non-standard pronunciation was a likely contributing factor to their poor spelling, particularly considering they relied heavily on phonological processing to spell. For example, Gabby (in Year 5, aged 12 years and 2 months) did not use standard pronunciation for words such as use (“nuse”), usually (“nusually”), the (“veh”), either (“eever”) and three (“feree”). Further, Gabby’s teacher explained that speech and language assessments had not been administered.

Similarly, according to Rose’s teacher, Rose’s pronunciation was “fine”. Non-standard pronunciation was evident when Rose used words requiring the linguadental (tongue and teeth) for the production of th in think, thought, three, with and mouth. Specifically, Rose consistently pronounced these words as fink, fought, feree, wif, and mouf. Rose’s non-standard pronunciation was reflected in her phonological processing and resulted in the misspelling of the word, thought, as fought, in her narrative written text:” As there was no evidence of speech language assessment data available for either Gabby or Rose, and this was not part of the study, it is impossible for
the researcher to be fully confident as to the reasons for the non-standard pronunciations. What is relevant here is the possible impact of the non-standard pronunciations on spelling:

**Rose’s narrative text:**

She fought she should take it.

Interestingly, spelling accuracy was not necessarily always affected by poor articulation. This suggests that phonological processing may sometimes be replaced with another strategy. For instance, Mick’s incorrect articulation was observed in the inflected suffix, *ing*. He used the alveolar ridge instead of the velum when saying words such as *opening* (“openin”) and *jumping* (“jumpin”). When writing the inflected verbs, Mick segmented each morpheme, describing this process as “chunkin’ out”. However, Mick learnt to encode the inflected suffix (*ing*) by conceptualising it purely as an orthographic unit, despite his poor articulation. He remembered that ‘openin’ ends in the letter cluster *ing*, but he did not explicitly demonstrate morphological awareness, which requires knowledge of how to treat the base word (a free morpheme) when it is suffixed. Mick also automatically retrieved, from his long term memory, the base word (*open*) when encoding. *Open* and *ing* are the lexical units which he had learnt to spontaneously spell:
Immediately after Mick wrote the word, *opening*, he segmented the word by drawing lines around the morphemes. He did so without being prompted. His encoding of *ing* occurred through orthographic processing, rather than conscious morphological processing. First, Mick automatically (promptly and without any hesitation) spelled the base word, *open*, as a whole lexical unit. He then spontaneously wrote *ing*. Mick did not explicitly know whether or how *ing* functions as an inflected suffix. Nor did he consistently apply the associated generalisations for suffixed words, as demonstrated when he incorrectly wrote, *jumping*, among several other incorrectly suffixed words:

An absence of morphological processing was further reflected by Mick’s poor result in the Morphological Component of the CoST.
(a score of 3/41). Indeed, Morphological Component scores among the low-achieving spellers in the study were characteristically low. The low-achieving spellers in the study also substituted morphological processing with another type of linguistic processing when composing written texts.

In some instances, orthographic processing may be attempted, rather than morphological processing. When low-achieving spellers attempt to draw on their limited orthographic knowledge to spell less familiar words, processing may be unreliable and inefficient.

Unreliable and inefficient linguistic processing.

Unreliable orthographic processing was illustrated in Mick’s inappropriate use of the letter cluster, *ing*, when spelling the word, *mountain*, as well as in its inappropriate absence when writing the word *bring*:

**Mick:** Like, I write ‘big’ ... [writes the word /brig/] ... Like, for example, if I write ‘big’, like if I write ‘big’, like ‘b-ig’, it doesn’t look the same because it looks like [the word] /bring/.

[Mick believes that ‘brig’ looks like the word, bring]

**Mick’s Narrative Text:**
[Incorrectly writes ‘mountain’]

Difficulties with linguistic processing were compounded when the low-achieving spellers attempted to spell polysyllabic words. For
example, during the interview with Mick, he wrote the word, *aristocracy*, and revealed his approach to spelling this polysyllabic word. Mick attempted to retain the whole word (*aristocracy*) in working memory while making lexical analogies. His lexical analogical processing involved making associations with other known words: *arrow*, *stock* and *fee*. As Mick did not accurately hear and retain the word, *aristocracy*, in memory, his lexical analogies were ill-chosen. The word did not appear to be part of Mick’s receptive and expressive vocabulary and this may partly explain why he was not able produce an accurate result when encoding the word. It seems that the kind of processing he adopted when spelling the word *aristocracy* was cognitively demanding, particularly given it was an unfamiliar polysyllabic word:

[Mick attempts to write ‘aristocracy’]

Researcher: How did you go about spelling that really complicated word, it’s a very tricky word; what helped you?

Mick: These two letters [points to the two initial letters, *a* and *r*], like ‘arrow’, ... ‘arrow’ and ‘stock’ ... ‘cause I know them two ... and ‘fee’.

Researcher: Say the word for me again.

Mick: Arrowstockafee.

**Working memory may have influenced linguistic processing.**
Difficulty retaining unknown polysyllabic words in working memory can inhibit an individual’s capacity to spell efficiently and accurately. Indeed, an over-reliance on phonological processing is undoubtedly having a counterproductive effect, especially if memory functioning is not efficient. Bob (in Year 4) stated that spelling is particularly hard when he needs to write “big and long words … when the words get larger and larger”. This is not surprising, given that Bob’s phonological processing was highly inefficient:

**Bob:** *I would sound it out and see how much letters it has. … Try and count how many sounds ... I think about what the sounds are and try and sound it out.*

The demand placed on working memory when phonologically processing polysyllabic words was particularly noticeable in the low-achieving spellers, especially those in Years 3 to 5. This was exemplified when Lucy attempted to write the words *pollinating* and *pollinated*. Her attempt to blend the phonologically regular medial letters was unsuccessful, and was clearly reflected by the omission of an entire syllable in both words. The breakdown in phonological processing was present even though Lucy was able to correctly articulate the words, *pollinating* and *pollinated*, as was demonstrated when Lucy was asked to read the words from her persuasive text during the interview:
The low-achieving spellers performed poorly in the Phonological Component of the CoST, particularly in the construct measuring phonological blending in the medial parts of polysyllabic words which may not have been in their receptive and/or expressive vocabulary (see Table 7.2). Importantly, the results suggest that the low-achieving spellers’ phonological processing was less efficient and less reliable than it was for the high-achieving spellers. Of note, however, the Year 6 low-achieving spellers (Ian and Kate) displayed higher accuracy with medial phonological blending than the low-achieving spellers in Years 3 to 5. Overall, encoding polysyllabic words through phonological processing posed significant challenges for the low-achieving spellers. These observations parallel the results reported in the previous chapter, in relation to the second research question.

**Lucy’s Persuasive Text (‘pollinating’ and ‘pollinated’):**

![](image)

Hybrid phonological processing in polysyllabic words.

Lucy was known to attempt a hybrid of syllabification and phoneme segmentation, particularly if the word she was writing was polysyllabic. Specifically, Lucy tried to retain *diagnostician* as a
whole lexical unit, in working memory, while simultaneously making an analogy with another word (*die*). Finally, she phonologically processed the remaining word parts. When encoding, Lucy needed to be reminded twice of what the word was. This is not surprising, given she may not have had any prior contact with that particular word. Notably, Lucy wrote the word without considering the meaning of the word and its morphemic properties, particularly the derivational suffix (*tion*):

**Lucy:** [Lucy attempts to write the word, ‘diagnostician’] .. *What was the word?*

**[Researcher]** Diagnostician

**[Lucy]** Die-ag .. [Lucy begins writing the word, while segmenting out aloud]. *What was the word again?*

**[Researcher]** Diagnostician

**[Lucy]** -s-t-i-sh-n [continues to write the word, while segmenting aloud].

**[Lucy]** Die-ag-o-sti-sh-on. … *I was sounding out bits of it. … So, like the start of the word, it started with die, so I wrote die and then I wrote ag and then I wrote os and then I wrote stishen.*

Although it is not the focus of the study, it is important to acknowledge that memory functioning (both, working memory and long term memory) was referred to anecdotally by all the teachers as a contributing factor in spelling achievement. In addition, limited
vocabulary knowledge could have been a factor. At this point, it needs to be restated that not one of the participants in Phase Two had a known clinical cognitive (‘atypical’) diagnosis or speech and language impairment. Moreover, interview data suggest that low-achieving spellers may require repetitive instruction and multiple opportunities to revisit new concepts, but that rote learning, alone, does not necessarily guarantee new knowledge is permanently retained in memory:

**Bob’s Teacher:** Bob doesn’t have a long attention span.

**Rose’s Teacher:** She’s [Rose] got very poor memory. … So with her spelling … as I said, because we have the memory issues, that’s quite hard.

**Gabby’s Teacher:** She [Gabby] needs to practise them for a while and it needs to be taught and retaught and retaught again, with her practising it in between before she will be able to do it independently, and then three or four weeks later, she may not be able to do it again, unless it’s revised, unless it’s taught again.

**Harry’s Teacher:** I have found it very difficult. … It’s really difficult to make in-roads with him [Harry]. Just when I think, ok, we’ve done really well, we’ve learnt all of those words from the text; he’s starting to use it. If I was to come back, say two weeks later, … I would predict that most of those words would then be gone. … Scaffolding has to happen almost all the time with Harry. Some kids will just recall that, and with Harry, it will have to be, do you remember this, this is why we studied that.

**Orthographic processing:** Using a mnemonic.
Two of the low-achieving spellers (Mick and Lucy, both in Year 3) explicitly described the use of a mnemonic (a memory device) when spelling the word *because*. The type of mnemonic described by these students required orthographic processing and was exclusive to one word only. Mick recalled learning to spell this word when he was a Year 2 student:

<table>
<thead>
<tr>
<th>Mick: Big elephants can always understand small elephants ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big is for b, elephants is for e, [4 second pause] c is for can, [5 second pause] a is for always, u is for understand, s is for small and e is for elephants.</td>
</tr>
</tbody>
</table>

[Persuasive Text]

Mick and Lucy relied on thinking about one letter at a time when writing the word *because*. They were not yet able to conceptualise and encode the word as a whole lexical unit, or as two morphemic units (*be-cause*). This particular mnemonic is inefficient as it cannot be generalised or applied to other words. Interestingly, the use of this mnemonic did not necessarily guarantee that the word was efficiently and correctly spelled, as demonstrated in Mick’s writing of the word in his persuasive text. This process can also be unreliable. For instance, Lucy’s teacher described how a metathesis
(reversal of letter sequencing) might occur, despite the mnemonic being used by Lucy:

**Lucy’s Teacher:** She [Lucy] gets words confused. Like with [the word] ‘because’, she might put u, a [names the letters] instead of a, u, but at least she knows what letters are needed there, but they might be jumbled up.

Gabby (in Year 5) also mentioned the use of a mnemonic; however, her memory device was applicable to the word, beautiful, rather than because. Gabby’s acronym-like mnemonic was intended to help her remember the sequence of graphemes in the word beautiful; however, her mnemonic seemed illogical and this may potentially result in incorrect spelling.

**Gabby:** I had been taught like a ‘Letter Land’ [a commercial phonics program] thing and after I kept on using it I just learnt because it’s Ben Eats Apples On The Tree If You Like.

**Unreliable orthographic processing.**

Low-achieving spellers sometimes attempted to write a less familiar word multiple times until it ‘looked right’. This process involved changing grapheme/s within a word and/or rearranging some of the graphemes within a word:

**Ian:** I would write it down on a scrap piece of paper, or on the back of something and see if it looks right. If it doesn’t, I try and write it another way.
This strategy has been classified as an orthographic process. While it was less frequently used than phonological processing, it appeared unreliable for the low-achieving spellers. Indeed, among the low-achieving spellers, high proportions of orthographic errors in the written compositions and CoST confirmed the presence of unreliable orthographic processing. Poor orthographic sensitivity was prevalent and this may explain why orthographic processing was not usually a successful strategy among the low-achieving spellers in the study. These students experienced particular difficulty identifying whether a word ‘looked right’ (or wrong). It is important to note that error identification was one of the ways in which spelling was measured in the NAPLAN Language Conventions Test (see Section 4.4.1). The task of determining which words are incorrectly spelled as well as identifying those letters within a misspelled word that are not plausible clearly posed a challenge among the low-achieving spellers in the study. Bob was no exception:

**Bob’s Teacher:** If I ask him [Bob] to go and check it again, he still won’t find all his spelling mistakes.

To further exemplify, Kate (Year 6) conceded that it is “hard” to identify incorrectly spelled words, while Kate’s teacher described her student’s spelling as “erratic”. Taken together, the results suggest that some low-achieving spellers may not have yet developed adequate self-monitoring skills when writing.
Inadequate orthographic sensitivity typified the low-achieving spellers in this study, which may explain why their orthographic processing was unreliable. Harry, for instance, demonstrated unreliable orthographic processing when trying to remember how to encode the medial vowel digraph in the word *friend*. In the interview with Harry, the correct orthographic feature of the word (specifically, the medial vowel digraph) was discussed. Yet, he misspelled the word five minutes later. The researcher demonstrated the correct spelling again and asked Harry to distinguish orthographic differences between two versions of the encoded word. Harry hesitated in his response:

**Kate’s Teacher:** I see her spelling as being erratic and she will spell a word correctly in one situation and a few lines later on, spell it differently. ... She would probably not copy a word correctly. For example, in the spelling activities that we do, there will be a misspelling of a word that is two or three centimetres away, spelled correctly on a photocopied piece of paper. So she will not self-correct without a little bit of prompting.
Absent from the low-achieving spellers’ repertoire of strategies was conscious and accurate manipulation and representation of the smallest, meaningful units within words (morphological processing). Accurate morphological representations require knowledge of generalisations (or ‘rules’) associated with morphemic structures, as well as an understanding of the meanings and derivations of word parts.

Morphological processing was replaced by an over-reliance of phonological processing and some orthographic processing.
Overall, correct representation of morphemic units within words was minimal. For example, Mick’s difficulty with the inflected suffix, *ed*, was obvious in his written compositions because he either inappropriately omitted the suffix entirely or he used a phonologically plausible, yet morphologically incorrect representation. Interestingly, Lucy’s teacher reported that Lucy sometimes omitted suffixes. Further, when Lucy attempted to write less-familiar words containing inflected suffixes (e.g., *babies*) or derived suffixes (e.g., *properly*), her back-up strategy was to think about individual phonemes rather than morphological generalisations associated with those words:

**Lucy’s attempt at writing the inflected word, *babies*:**

```
babys
```

**Lucy’s attempt at writing the derived word, *properly*:**

```
propale
```

Explicit morphological processing was also absent in Rose’s repertoire of strategies. This absence was exposed by the prevalence of morphological errors in Rose’s written compositions and in her CoST results. The most prominent morphological errors noted in Rose’s written compositions were inflected and derived suffixes. These types of error signalled that Rose was not thinking about or drawing on these morphological aspects of spelling. Further,
problems may have been exacerbated by confusion with apostrophe use, as seen in the plural nouns (tops and colours):

<table>
<thead>
<tr>
<th>Errors with inflected and derived suffixes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>['swimming']</td>
</tr>
<tr>
<td>Swimming</td>
</tr>
<tr>
<td>['totally']</td>
</tr>
<tr>
<td>totally</td>
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<tr>
<td>['tried']</td>
</tr>
<tr>
<td>tried</td>
</tr>
<tr>
<td>['tops']</td>
</tr>
<tr>
<td>top's and bright colours</td>
</tr>
<tr>
<td>['colours']</td>
</tr>
</tbody>
</table>

Bob’s CoST results and written compositions also contained several linguistic errors which highlighted the absence of morphological processing. Illustrating this is a sample of inflected words containing errors at the morpheme juncture:

<table>
<thead>
<tr>
<th>Bob’s CoST:</th>
<th>carryy</th>
<th>carries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bob’s Narrative Text:</td>
<td>coming</td>
<td>coming</td>
</tr>
<tr>
<td>Bob’s Persuasive Text:</td>
<td>swimming</td>
<td>swimming</td>
</tr>
</tbody>
</table>

Similarly, Harry did not efficiently or accurately use morphological processing. For example, although Harry knew that
the letters *ed* can be used for suffixes marking past tense, written
application was not always consistent:

**Researcher:** How could I change the word ‘drop’ into ‘dropped’?

**Harry:** Add an *e* and *d* [names the letters]

**Researcher:** Can you write that down for me?

**Harry:** [Incorrectly writes the word, ‘dropped’]  
<mark>d</mark>r<mark>ope</mark>d

**Researcher:** Can you write the word, opened .. opened.

**Harry:** [Incorrectly writes the word, ‘opened’]

**Researcher:** Can you tell me what was going through your mind as you were writing that word?

**Harry:** Well, I know how to spell ‘end’, so I just put the [letter] *o* and the [letter] *p* in front of ‘end’.

It is not surprising that Harry was unable to consistently apply morphological processes when spelling, considering it seems that morphology had not been explicitly taught throughout the school year. Indeed, a lack of explicit instruction in spelling, more broadly, was evidenced by the teacher’s comment during the interview:

**Harry’s Teacher:** [A stage-based spelling program that had been adopted throughout the school in previous years] *kind of went out the window and then it was kind of up to us to make sure that it was being done in a way that reflected both the kids’ need for it and also that it wasn’t outweighing some of the other elements of English curriculums. So a lot of the time, spelling happens with their writing and a lot of the time it happens with their reading, so I don’t really teach it explicitly. That’s generally how it works in my class.*
Harry was unable to articulate common generalisations regarding the treatment of base words when they are suffixed. As such, the spelling of inflected words was often inaccurate. Further, Harry did not use linguistic metalanguage to justify his spelling of such words.

Limited metalanguage.

All the low-achieving spellers in the study demonstrated a lack of linguistic metalanguage needed to articulate generalisations associated with suffixes, as well as other linguistic components of spelling. Additionally, these students had limited opportunity to consciously consider the linguistic complexities within words, beyond a phonological lens. Encouraging students to rely solely on phonological processing to spell words (which are sometimes poorly articulated) may have been counter-productive. To exemplify, Kate (aged 11 years and 8 months) is a Year 6 low-achieving speller who was encouraged by her teacher to “sound out” words:

Kate’s Teacher: If they’re poor spellers, like Kate, I ask her: how do you pronounce this, how do you write this sound, and then try to lead them towards sounding it out.

In the interview data, Kate did not articulate any other strategies and did not use linguistic terminology. Despite probing by the researcher, Kate frequently made reference to this phonological strategy, mentioning it nine times during the 17-minute interview:
Ian (in Year 6) also appeared to have limited control of the metalanguage associated with spelling. Of the linguistic terminology used, poor understanding was demonstrated. Ian did use the word, *grapheme*, when talking about the activities in his phonics-based text book (*Sound Waves*); however, his understanding of the term was inaccurate:

**Ian:** A grapheme is if you have something, like the word ‘argument’, and you’re doing the letter u, it would be like the letter u, e or something like that. So then you would have the grapheme box [an activity in the Sound Waves textbook], and you write [the word] ‘argument’ in the box.

**Researcher:** Right, so a grapheme is?

**Ian:** A grapheme is .. a word .. a word ... A grapheme is a word that when you spell, it has two, has different letters than usual.

Low-achieving spellers in this study appeared to have a small bank of words that they could automatically retrieve from their long term memory, and spell correctly. It needs to be noted that in the
written texts of the low-achieving spellers in the study, the proportion of spelling errors was substantially larger than the proportion of errors made by the high-achieving spellers (see section 7.1, Table 7.1). Moreover, most of the words written by low-achieving spellers were commonly used words of one to three syllables. However, spontaneous retrieval and accurate encoding of whole words seemed to steadily improve at each year level. A maturation effect may be a contributing factor. Specifically, students’ accrued experiences with words (through speaking, listening, reading and writing) may eventually lead to some degree of automaticity when spelling.

While it seems that low-achieving spellers need to be provided with opportunities to improve articulation and phonological awareness, these alone are unlikely to be sufficient for developing competence in spelling. These students would also benefit from explicit and frequent instruction in orthographic awareness to facilitate improved orthographic sensitivity and automaticity when encoding grapheme clusters. Additionally, low-achieving spellers need to be explicitly taught how to think about morphological structures within words and how such structures explain the spelling of words that are not phonologically regular.

Teachers’ content knowledge and instructional approach may have influenced student learning.

All of the teachers of low-achieving spellers, interviewed for this study, relied on phonics-based commercial resources (such as
Sound Waves and Letter Land) to teach spelling. In addition, rote learning of words and weekly testing of those words was a typical instructional approach adopted by these teachers. Explicit teaching of spelling strategies seemed to be neglected when commercial textbooks were used to ‘teach’ spelling. This observation was exemplified in Ian’s case:

**Researcher:** When you are completing the Sound Waves activities, does the teacher ask you to do the activities on your own?

**Ian:** Yes

**Researcher:** So do you have to answer all the questions by yourself?

**Ian:** Yes

**Researcher:** How do you find that? Does that work for you?

**Ian:** Umm, sometimes. Like, when we got up to, you see we have Units, and so when I got up to the harder Units, there would be, like question six, would be the hard one.

**Researcher:** What is hard about it? Is it hard because you don’t understand the questions?

**Ian:** Yeah, just because they’re really complicated questions.

**Researcher:** Once you understand what the question means?

**Ian:** I fly through it.

As reinforced by Ian’s teacher, spelling instruction in some classrooms appeared to involve little discussion or problem solving, other than to “sound out” words and to interpret the textbook questions:
As illustrated earlier, Ian incorrectly defined the term grapheme. Ian’s misunderstanding of this term paralleled the teacher’s misconception of the same term, as indicated in the next vignette. Specifically, Ian’s teacher described alternative grapheme choices as “nearly exceptions to the rule”, even though alternative grapheme choices within a word may carry morphological explanations and, consequently, should not be considered as exceptions. Ian’s teacher appeared to lack knowledge and confidence in teaching spelling. This may explain confusion and potential lack of progress in students’ spelling. The comments made by Ian’s teacher epitomises the influence of teachers’ content knowledge, instructional approach, and indeed confidence, on student learning:

**Ian’s Teacher:** Through the book, it is quite independent because of time constraints and just they’re trying to get through all the activities for the week.

**Researcher:** When the students in your class talk about the way they go about spelling, what spelling skills or strategies do they actually use, have you been able to see whether they are able to articulate any other strategies, other than the sounding out strategy, for example?

**Ian’s Teacher:** I think they just rely on sounding out, and they say things like, ‘I know how to spell that’, or they either know it or they don’t. Umm, there’s not a lot of…there is more conversation about the activity than about the way the word is spelled and the linguistics behind it. So, it’s activity-based, as in book based. So, whatever they’re doing at the time is what the chat is about, rather than the actual rule behind it.
Mick’s teacher was also not confident when commenting on her own spelling. Her self-confessed difficulty with spelling may explain why she too relied on a commercial resource when teaching, and why her instructional approach was very limited:

**Mick’s Teacher:** Telling the kids that, and the kids seeing that, I am a shocking speller … and the fact that I make errors as well. … I try to get them to look at it first, or I’ll say, if they’re writing it, well if you don’t know what it is, underline it, and keep going. Don’t worry about trying to get it perfect, just sound it out as best you can.

Lucy’s teacher also was not confident with spelling and found it difficult to articulate the spelling strategies her students use. This was highlighted by her comments about Lucy’s spelling. From the interview it appeared that Lucy’s teacher had limited linguistic understanding of spelling and limited control over spelling metalanguage. Hence, it is not surprising that Lucy’s repertoire of spelling strategies was highly constrained:

**Ian’s Teacher:** So, at the top [of each page in the student textbook] it’s got a grapheme chart of nearly exceptions to the rule, and so when you’re going through the list and you’re highlighting the phonemic awareness for the week, then you can put those exceptions into the box. … So it can give you sort of that nearly exception to the rule.
It was not possible to conclusively elicit, from the interview transcriptions alone, distinct changes that may have occurred according to year level in terms of strategy use. However, an analysis of spelling errors in the students’ written compositions revealed insights into some changes. As presented in Table 7.1 (see section 7.1), the proportion of word errors made by the Year 3 and Year 4 low-achieving spellers in this study tended to be higher than the proportion of word errors made by the low-achieving spellers in Years 5 and 6. It is likely, therefore, that linguistic processing observed among the low-achieving spellers was more effective in Years 5 and 6 than it was in Years 3 and 4, or the older students’ spelling is supported by a more extensive vocabulary. Additionally, fewer errors in their written compositions may reflect greater unwillingness to select words that cannot be confidently and automatically encoded.

**Lucy’s Teacher:** I think for Lucy, because she is mostly phonetically, like, she spells things phonetically ... I think she needs to break them into syllables as well and sound out and things like that. ... [Lucy is] obviously using the sound out, phonetical rules.

**Linguistic processing among the low-achieving spellers appeared more effective in Years 5 and 6 than in Years 3 and 4.**
The proportion of phonological errors observed in the written compositions of the low-achieving spellers in the study declined substantially from Year 3 to Year 6, while the proportion of orthographic and morphological errors remained relatively constant. This suggests that, in terms of compositional writing for the low-achieving spellers, phonological processing may be increased in efficiency and reliability at each year level, more so than orthographic and morphological processing.

In terms of written compositions, phonological processing became increasingly efficient and reliable as a function of year level, more so than orthographic and morphological processing.

When comparing this finding to the results of Phase One (Question 2), it is intriguing that, for the low-achieving spellers (those in the 10th and 30th percentiles), the greatest overall gain appeared in the Orthographic Component, not the Phonological Component (see section 6.2, Figures 6.2 to 6.4). It has been observed that the low-achieving spellers in the study relied on phonological processing as their back-up strategy when composing texts. It may be that phonological processing becomes less cognitively demanding as students advance through school. Possible contributing factors may include individuals’ experiences with words and increased vocabulary, expanding memory functioning with age, and instructional priority on phonological processing. Given that the low-
achieving spellers in Phase Two predominantly received phonics-based instruction, and phonological encoding appeared to improve over the four schooling years, it is likely that phonics-based instruction enhanced efficiency and reliability in phonological processing to some extent. Over the four year levels, comparatively minimal improvement in orthographic and morphological representations was evidenced in the written compositions. This suggests that greater instructional attention to orthographic and morphological processing was required.

Finally, as indicated in the interview data, it seems that the low-achieving spellers in the study experienced notable difficulty with reading and were generally reluctant to read.

**Low-achieving spellers tended to demonstrate reluctance and difficulty with reading.**

Although reading was not the focus of this study, it is an important point to mention, considering its prevalence among the low-achieving spellers in this study. As highlighted below, several participants raised the topic of reading as an issue of concern. The evidence supports a view that spelling and reading have a reciprocal relationship:
7.3 Spelling strategies used and explained by the high-achieving spellers

The high-achieving spellers in the study were able to select from a comprehensive repertoire of spelling strategies. It seems that some processing occurred without conscious awareness. Although strategies were not always overt, some students were able to articulate their thinking using sophisticated metalanguage related to spelling. Importantly, some of the high-achieving spellers in the study were particularly curious about words and demonstrated a heightened level of linguistic awareness. Individual differences among the high-achieving spellers in the study were observed in terms of strategy use; however, five common attributes were discerned. Each will now be discussed in turn.

Firstly, all of the high-achieving spellers were described by their teachers as avid and very good readers, and most high-achieving spellers articulated pleasure in writing. These students developed a genuine interest in words, possibly because of their rich reading experiences. Dom (in Year 6, aged 11 years and 10 months) is representative of these linguistically inquisitive students:

**Rose’s Teacher:** She’s [Rose] low in reading.

**Bob’s Teacher:** He [Bob] is a low reader ... he is one of the lowest in the class in his ability.

**Harry:** I don’t like reading cause if I get really confused.

**Kate’s Teacher:** Kate doesn’t read much, no, no not at all.
Dom was genuinely intrigued by word origins, and his teacher nurtured such linguistic curiosity. By drawing on his etymological knowledge when spelling, Dom was able to justify why particular words are phonologically irregular in their spelling. For instance, Dom made a connection between the English and Italian language when justifying the spelling of the ch digraph (when it is produced as a plosive using the velar, as in the word, chlorine). He explained, albeit without using technical terms, that in the Italian language (which stems from Latin), the digraph ch is consistently articulated using the velar, rather than as a palatal affricative (as in the word, chip):

**Researcher:** Do you know why we have [the letters] c, h in the word, chlorine, instead of just [the letter] c or [the letter] k or [the letters] c, k?

**Dom:** Because they were made in another language. I’m learning Italian and I noticed that [the letters] c, h in words are pronounced kuh [as in kite] not ch [as in chip].

[Correctly writes the word, ‘chlorine’]
Ed (in Year 4, aged 10 years and 1 month) also expressed an interest in words and etymology. Specifically, he recalled conversations he had with his parents about word origins:

**Ed:** Tri means three in Latin ... like tricycle.

**Researcher:** How did you discover that tri comes from Latin?

**Ed:** My parents told me.

**Researcher:** Can you think of other similar examples that your parents have taught you?

**Ed:** Well, in ‘octagon’, it has eight sides and oct is eight in Latin.

Engagement with reading was considered by the high-achieving spellers and their teachers to be a contributing factor in learning to spell. Jane, a Year 4 high-achieving speller (aged 9 years and 6 months), also described her passion towards reading (and writing), and asserted that reading helps one learn to spell. Jane explained that she may choose to draw on her “reading strategies” when spelling. This approach requires semantic processing:

**Jane:** I learnt to read and write when I was four. ... There aren’t many words that I can’t spell. ... I do read a lot and write a lot, so it becomes part of my mind that I have to know all of these words. Like, I read everything, like if there’s a word, I pretty much read it.

**Researcher:** Do you have any tips on how to become a good speller?

**Jane:** [8 second pause] Umm, well, uhh, read. ... If there is a word that I really don’t quite know how to spell, I would use my reading strategies. You know, I would read over ... it might have something to do with the sentence.
Amy (in Year 5, aged 10 years and 9 months) was also a high-achieving speller and an avid reader. Comments made by Amy’s teacher further highlighted the notion that engagement with reading potentially supports proficiency in spelling:

Amy’s Teacher: She [Amy] reads independently, like on her own and if she’s got free time, she’ll read. … I think the reading has helped her. … I think it has a lot to do with constantly reading.

The second attribute observed among the high-achieving spellers in this study was their capacity to spontaneously spell a large bank of words. Rich lexical exposure and experience was a likely contributing factor in the development of automatic spelling. Low proportions of errors in the CoST scores among the high-achieving spellers in this study, as well as in their written compositions, imply elevated lexical knowledge, including receptive vocabulary, and subsequent automaticity when spelling.

Indeed, unequivocal evidence illustrates that automatic lexical retrieval was the most frequently used spelling strategy among the high-achieving spellers in this study. Fred’s teacher offered insight

Reading can support the acquisition of proficient spelling.
regarding the nature of automatic lexical retrieval as a legitimate and dominant strategy:

Fred’s Teacher: When he [Fred] writes, he just .. writes. I don’t ever see him pause to think about a word. He is probably just confident in his spelling, and I don’t know if I’ve ever had to edit his work and tell him to go back and re-look at it. I think I’ve pointed out one spelling mistake, and he’s gone, oh yeah, I know .. like straight away, as soon as he saw it. ... I don’t actually see him .. spell, like I just see him powering away. He just does it.

Further, Jane (in Year 4) stated that “memory” was a spelling strategy she used to write many of her words and that it was because her “mind takes a snapshot of them” when reading. It is clear that automatic lexical retrieval was a frequently used spelling strategy among the high-achieving spellers in the study, and that this form of visual memory processing was often reliable, as indicated by the high proportion of correctly spelled words in the written compositions.

The third attribute associated with the high-achieving spellers in the study regards their sub-lexical orthographic processing. All of the high-achieving spellers demonstrated acute sensitivity to orthographic features within words. They were able to efficiently and reliably draw on their substantive orthographic knowledge to select and encode plausible letter sequences within words. Although the low-achieving spellers in the study may have attempted to use some orthographic processing, the high-achieving spellers could do so with greater accuracy. Importantly, the high-achieving spellers could
effortlessly identify whether a word ‘looks right’ (or wrong). Rose’s teacher (in Year 4) stated that the “higher kids are also much more aware of the environmental print around the room and so they’ll know where they might have seen that word and go and search it out”.

High orthographic sensitivity was denoted by the relative absence of orthographic errors in the students’ written compositions (see section 7.1, Table 7.1), as well as the results of the CoST’s Orthographic Component (see section 7.1, Table 7.3). Results from Phase One and Phase Two of the present study clearly show that the high-achieving spellers demonstrated greater orthographic knowledge than the low-achieving spellers in the study.

Efficient orthographic processing may involve conceptualisation of a letter cluster within a word as a single orthographic unit (\textit{ight}), rather than as individual graphemes (\textit{i-g-h-t}). It may further be demonstrated in an individual’s acute awareness of the likely positioning of an orthographic cluster within a word. An example of efficient orthographic processing is reflected in an individual’s knowledge of specific orthographic structures within words, as Ryan (in Year 3, aged 8 years and 11 months) demonstrated with the \textit{ck} digraph:
Jane (in Year 4) also demonstrated orthographic sensitivity with this digraph. Indeed, she was able to explain a range of specific orthographic patterns by recalling what she had learnt in class. It is worth noting that Jane accurately used a range of technical language throughout the interview, as highlighted in the vignette below. For example, Jane articulated her knowledge of the “\textit{ck} letter pattern” and the likely, plausible positions of this pattern within words:

\begin{quote}
\textbf{Researcher:} Where would you see the c, k letter pattern?

\textbf{Ryan:} In [the word] ‘duck’.

\textbf{Researcher:} Would you only see it at the end of a word, or would you see it in another part of a word?

\textbf{Ryan:} Sometimes you would see it in the middle. I don’t know of a word that you would have it at the start.
\end{quote}

\begin{quote}
\begin{tabular}{|l|}
\hline
\textbf{Researcher:} Tell me more about the orthographic knowledge that you are being taught at school. \\
\textbf{Jane:} Well, we’re reading books, like short listed and stuff like that, and our teacher’s pointing some letter patterns out to us. \\
\textbf{Researcher:} Can you give me some examples? \\
\textbf{Jane:} We’ve been learning some c, k [names letters] letter patterns ... like, ‘cluck’ or ‘duck’ [writes ‘cluck’ and ‘duck’], and stuff like that.
\end{tabular}
\end{quote}

You never see it [ck] at the beginning of a word. You only see it at the end or in the middle of a word. Like ‘background’ would be an example of one in the middle, so middles are usually compound words.
Jane’s knowledge and sensitivity to particular letter patterns was somewhat profound and, this may be partly due to the explicit orthographic instruction that had been provided to her in Year 4:

Jane’s Teacher: We were just doing letter patterns a couple of weeks ago, and we were looking at one, for instance, and we sorted them according to whether they were at the beginning, the middle or the end. So we spoke about, I think it was c, k [names letters] letter patterns, well hang on a second, that’s the kuh sound [as in cat], but you never see it [the digraph] at the beginning of a word.

High-achieving spellers also efficiently made lexical analogies when spelling. The process of making a lexical analogy can be described as orthographic in nature. Although lexical analogising was described by four of the eight high-achieving spellers in the study, it was also demonstrated by Mick (low-achieving speller), albeit inefficiently and inaccurately (e.g., Mick’s inaccurate spelling of aristocracy). Lexical analogical processing involves thinking about known words which contain a common letter cluster. For instance, Zoe is a Year 3 high-achieving speller (aged 8 years and 10 months) who demonstrated a lexical analogy when she associated the word straight with the word light:

Zoe: [writes the word, ‘straight’]

Researcher: Tell me as much as you can about this word.

Zoe: Well, I think of [the word] ‘light’ because it has the same last four letters.
Further, high-achieving spellers were able to articulate a specific orthographic generalisation (or ‘rule’) and use this knowledge when spelling. For instance, Fred (in Year 5) articulated a generalisation associated with the \textit{ei} vowel digraph in the context of the word, \textit{receive}:

\textbf{Fred:} It’s got the [letter] \textit{i} before \textit{e} except after \textit{c} rule. So, the \textit{i} goes before the \textit{e} unless there is \textit{c} in front, so then the \textit{e} goes in front.

\textit{receive}

\textbf{Researcher:} How did you learn about that?

\textbf{Fred:} My mum taught me. She says that she learnt it at her school and then she taught me, but then we did learn it at school a bit later on.

Chloe (in Year 6, aged 11 years and 7 months) also referred to this orthographic generalisation; however, in relation to the word, \textit{relief}. Further, she explained the importance of learning plausible orthographic patterns:

\textbf{Chloe:} If I’d seen the word written before, I’d … think, does that look right? … Think about letter patterns of other words I know that aren’t spelled how they sound. … There’s some that you just need to learn the letter patterns. … Like, um [the letter pattern] \textit{ou}, or [the letter pattern] \textit{io}.

\textbf{Researcher:} I am going to ask you to write the word, ‘relief’, as in a sigh of relief.

[Chloe correctly writes the word, ‘relief’]

\textbf{Researcher:} Tell me as much as you can about this word.

\textbf{Chloe:} Well, the letter pattern, the \textit{ie}. The rule for that is \textit{i} before \textit{e} except after \textit{c}. … I learnt that in school. I think in Year 2 or Year 3. … I use that one quite often.
Chloe articulated a number of orthographic strategies which she drew on when spelling. These included (i) thinking about “familiar letter patterns”; (ii) making lexical analogies; (iii) applying an orthographic rule, such as “i before e except after c”; and (iv) visual checking of a word to “see if it looks right”.

Fred (in Year 5) was also able to explain an orthographic generalisation; however, his example was in relation to the orthographic representation of a free morpheme ending in the letter $e$ and containing a medial long vowel phoneme (as in the words made or shape):

<table>
<thead>
<tr>
<th>Researcher: Are there other examples or tricks that you can tell me?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fred: When two vowels go walking, the first one does the talking. ... I think of all the possible outcomes or ways it could be.</td>
</tr>
</tbody>
</table>

High-achieving spellers in the study were able to understand that different letter combinations may represent a single phoneme, and they knew which grapheme choices were plausible. Although the low-achieving spellers may have attempted to apply some orthographic processing, it was less effective than it was for the high-achieving spellers in the study. This may be because orthographic knowledge was more established among the high-achieving spellers compared to the low-achieving spellers, as indicated by the CoST results from Phase One of the study and the students’ written
compositions from Phase Two. As Fred explained in the interview, he was able to effectively utilise his orthographic knowledge to experiment with plausible letter patterns until a word visually appeared correct:

**Researcher:** *What do you mean by all the possible ways?*

**Fred:** *The spellings of the word, like all the ways it could be spelled. ... I would use common, like what would work best, umm .. letter combinations. ... I would try the first time and if it didn’t look right I’d try it again until it did look right.*

Among the high-achieving spellers in the study, orthographic processing was highly efficient and reliable. If a spelling mistake was made, these students were generally capable of identifying the error and correcting it. At times, they could correct their spelling without consulting a reference such as a dictionary. Fred’s teacher alluded to this point:

**Fred’s Teacher:** *I said [to Fred], look, there is a word on here that’s not right. I didn’t tell him which one and he immediately saw it, so he was able to identify it. ... He just knew. He saw it on the page and said, it’s that word and I missed the [letter] e, or whatever it was, straight away.*

If orthographic sensitivity was high, it appeared that greater cognitive attention could be devoted to other linguistic processes when spelling. The high-achieving spellers’ elevated orthographic sensitivity observed in the study may partly explain why they were
able to simultaneously devote cognitive attention to other linguistic processes when spelling.

High-achieving spellers were able to linguistically cross-map when spelling a single word.

The fourth common attribute identified among the high-achieving spellers in the study was their capacity to coordinate (cross-map) more than one linguistic strategy when spelling a single word. Importantly, when the high-achieving spellers encoded an unfamiliar or complex word, they were able to think about it from multiple linguistic perspectives. This process is called linguistic cross-mapping. The high-achieving spellers did not rely solely on phonological processing. Instead, they tended to coordinate two or more linguistic strategies when spelling a complex or less familiar word.

In this study, linguistic cross-mapping seemed to occur in four combinations: (i) phonological and orthographic processing; (ii) orthographic and morphological processing; (iii) phonological and morphological processing; and (iv) phonological, orthographic and morphological processing. Applications of linguistic cross-mapping varied among the high-achieving spellers, and no distinct differences were observed at each year level. Moreover, cross-mapping was not always overt, particularly if students had not been taught to talk about the spelling strategies they were using. Indeed, it appeared that the
majority of the high-achieving spellers in the study internalised their thinking.

Among the high-achieving spellers in the study, Jane (in Year 4) most skilfully demonstrated and explained examples of linguistic cross-mapping. Jane was the only student in the study who had been systematically and explicitly taught to talk about the spelling strategies she used. Jane’s teacher encouraged and modelled the use of metacognition by teaching her students to use multiple linguistic strategies and sophisticated metalanguage. By the teacher’s account, the instructional approach also appeared to have had a positive effect on some of the low-achieving spellers in her class:

**Jane’s Teacher:** This year I’ve introduced the idea of talking about the different spelling knowledges, so I really do explicitly use that language with the kids. ... I talk about orthographic knowledge, the phonological knowledge, the etymological knowledge or the morphological. ... So, generally, in a given week I’ll focus usually on one or two strategies a week. Sometimes I mix them up a little bit because obviously they’re using multiple strategies, but at the start of the year, I would very explicitly say, ok this is morphological knowledge because we’re looking at suffixes. ... The kids know that the learning intention for spelling is that we are trying to learn to use a variety of different strategies to spell. And I will go, ok this is what we are going to do: what strategy do you think we’re using; what knowledge? and we can talk about it. ... I am noticing that they’re using the strategies a lot more. They’re actually able to say, well hang on a second, I know that I have to double the letter; they’re thinking more about their spelling and just the meanings of words, which is helping them as well. ... So, I’m finding also that with my really low spellers, they’re really moving on. That is really helping them a lot.
As a result of explicit and systematic teaching, Jane learnt to externalise her thinking with regard to spelling and she was able to articulate strategies with sophisticated metalanguage:

Explicit teaching of a range of strategies and using metalanguage enabled students to externalise their thinking.

Explicit teaching of linguistic processing, combined with the use of metalanguage enabled students, like Jane, to externalise their thinking as they embarked on spelling as a problem-solving process. Jane came to understand that learning to spell can be enhanced by building metalanguage and by learning to coordinate multiple linguistic strategies. It is possible that the development of appropriate metalanguage has potential to maximise student learning trajectories in spelling. Not all of the high-achieving spellers were as articulate as Jane; however, if they did have the opportunity to develop their
metalanguage to the same extent, learning in spelling may have been enhanced.

**Linguistic cross-mapping: Phonological and orthographic processing.**

Among the high-achieving spellers in the study, three participants described instances of phonological and orthographic cross-mapping when spelling. For instance, Dom (in Year 6) justified why he might choose to coordinate phonological processing with orthographic processing when spelling a single word. Specifically, Dom’s use of the phrase “sound it out” referred to phonological processing, while his reference to phrases such as “think of some other spelling rules” and “look at certain patterns in the word” referred to orthographic processing. Dom acknowledged that many words are not phonologically regular, and that alternative orthographic combinations need to be considered in addition to thinking about phonemes in word:

**Dom:** Normally I would think about ... how it sounds and if I, like, sound it out and then I write it down and I don’t think it’s right, I would normally think about if it’s a word that might be a word that’s not spelled how it sounds. So, you write it differently to how it sounds. ... I would normally think of some other spelling rules, so maybe, say in [the word] ‘know’, it’s [states each letter name] k, n, o, w; not just [the letters] n, o. ... I’ll look at certain patterns in the word. ... You can use different spelling rules and think about other rules that would apply to a sound.
When a word is phonologically and orthographically encoded, it may require rewriting of the word in order to determine which version “looks right”. During this process, the phonemic units within the word are also stored, processed and analysed in working memory. Familiarity with a specific word could make the encoding process more efficient. The coordination of phonological and orthographic processing was a strategy which Dom’s teacher observed her student use. She described this cross-mapping strategy in relation to the word, *penetrate*. The teacher also noted that this strategy was relied upon especially by Dom:

**Dom’s Teacher:** Dom, for example, in his writing, you’ll see on the side of his writing, say if it was a word, ‘penetrate’, [states the letter names] p, e, n, e, t, r, a, t, e and p, e, n, a, t, e, and he has a look at both and sees which one looks right. That’s one of his major strategies because he just goes penetrate.. penetrate.. pena ..pene [teacher emphasises the medial vowel phoneme] and he does that, while he looks at the word written down. So, it is the sound, but it’s also the look of it. That’s one that he relies heavily on.

Jane (in Year 4) also described how she coordinates phonological and orthographic processing. It needs to be acknowledged that Jane used the phrase, “visual knowledge”, interchangeably with “orthographic knowledge” (as did her teacher). Like Dom, it seems that Jane’s most commonly used cross-mapping strategy involved phonological and orthographic mapping:
Ed (in Year 4) also described how he might coordinate phonological and orthographic processing when spelling a less familiar word. He may have “look(ed) for other words” within the word being encoded (an orthographic process) but he also “sound(ed) out” and pronounced part (or all) of the word (a phonological process):

**Researcher:** What do you do when you want to write a word, but you are not very sure how to spell it?

**Ed:** I try and look for other words inside it. … Sometimes I sound out the parts that I don’t get. … So, finding different words in other words and sounding out. … I … try and spell the word with the other words inside it, and then pronouncing.

**Linguistic cross-mapping: Orthographic and morphological processing.**

Evidence of cross-mapping between orthographic and morphological processing was also found; however, this strategy was not necessarily overt among the high-achieving spellers. For instance, when Fred (in Year 5) wrote suffixed words (as in the
present progressive verb *writing*), he extracted and analysed the orthographic properties of the base word (a free morpheme, as in *write*) and also thought about the morphological generalisation (‘rule’) associated with the suffix (a bound morpheme, as in *ing*). It is possible that, for some high-achieving spellers, this processing may occur very rapidly and with minimal or no awareness, particularly if the word is somewhat familiar:

**Researcher:** How would you write the word, ‘writing’, as in writing with a pencil?

**Fred:** It would be [the letters] *w, r, i, t, e* but take away the *e* and add [the letters] *i, n, g*.

**Researcher:** How did you know that you have to take the [letter] *e* away?

**Fred:** Because [five second pause] it’s a rule. ... The rule goes, take away the *e* and add *i, n, g* [states letter names]. ... ‘Write’ ends in a vowel. ... The [letter] *i* says itself ... because of the [letter] *e*, which takes us back to the: when two vowels go walking, the first one does the talking.

Dom (in Year 6) demonstrated how he coordinates orthographic and morphological thinking when encoding the word, *diagnostician*. Specifically, Dom identified the adjoined suffix (*tician*) and thought about its function (a morphological process). He also identified the base word and made a plausible lexical analogy (an orthographic process), as indicated by his reference to the word *practician*.
Jane (in Year 4) also demonstrated orthographic and morphological processing when spelling homophones. Specifically, she considered the meaning of a given homophone within a semantic context. She coordinated semantic and morphemic thinking with the identification of appropriate grapheme sequences:

**Jane:** Words like ‘where’ [intentionally writes the word ‘were’], really needs to have a [letter] h in it [corrects the word by including the letter h], but that is correct [pointing to the word, ‘were’], it just depends on the sentence and how you’re using it. See there’s ‘where’, ‘wear’ and ‘were’ [writes the words while speaking]. Say if someone was saying, ‘where are you?’ [writes the question while speaking], then it would be ‘where’ as in a place. ... and then ‘wear’, as in ‘what are you wearing?’ [writes the question while speaking].
with the word *trilogy*) in coordination with morphological processing (by thinking about the meaning of the word and its morphemic units).

It seems that this was a self-taught strategy:

**Ed:** *I look at the word in my mind and I see about the other words inside to see if they could also make part of what it means and how the word is spelled.*

**Physiology** [handwritten]  **trilogy**

**Researcher:** *Is that a strategy that your teacher showed you, or did you figure that out yourself?*

**Ed:** *I figured it out myself.*

**Linguistic cross-mapping: Phonological and morphological processing.**

Evidence of phonological and morphological cross-mapping was also evident in the data. It was best demonstrated by Dom when he talked about the morphemic and phonological structures of the word *equilibrium*. Although Dom’s spelling of the word was not correct, he considered the morphemic elements of the word, *equilibrium*, by extracting and analysing the base word *equal* (a morphological process). Simultaneously, Dom thought about the phonological shift that occurred in the vowel of the second syllable in *equilibrium*, when compared to *equal* (a phonological process). Although probing was required by the researcher, Dom’s capacity to
identify the phonological shift consequently enabled him to determine whether the vowel should be represented by the letters *ua* or *ui* in the word *equilibrium*:

[Dom is asked to write the word, ‘equilibrium’]

**Researcher:** Tell me how you wrote the word, ‘equilibrium’.

**Dom:** You would think that equilibrium means keeping balance between some things. … You know that the ‘equal’ would be the same as balance, so you would start off with that.

**Researcher:** How do you spell the word equal, on its own?

**Dom:** *e, q, u, a, l* [states the letter names]

**Researcher:** Why did you put an i in the word ‘equilibrium’, even though ‘equal’ doesn’t have an i?

**Dom:** It’s kind of the way you say it: *equi*-librium, rather than *equa*-librium [Emphasises the vowel phoneme]. … The sound of that part changes.

**Triple word-form mapping:** Phonological, orthographic and morphological processing.

Cross-mapping between and among the three word forms also featured in the data (referred to as *triple word-form mapping*). Zoe (in Year 3) provided an example of phonological, orthographic and morphological cross-mapping when she wrote the word *wished*. It seems that Zoe automatically retrieved the base word (*wish*) from
memory while she attempted to distinguish the linguistic properties of the verbs *wish* and *wished*:

**Zoe:** [Writes the word, ‘wished’]

Zoe: If you like, wish for something and then the next day, uh, it wouldn’t make sense if you said I wish for something. You would have to have the /d/ at the end.

**Researcher:** But why can’t I write [the word] ‘wished’, like this [writes the word as ‘wisht’], with a [letter] t? Why is that wrong?

Zoe: Because it doesn’t make sense and you need a vowel in the middle.

**Researcher:** Do, I need a vowel before the t? So, if I wrote this [writes the word as ‘wishet’], wish – [names the letters] e, t, is that right?

Zoe: No, because it would be like wish-e-t. ... The [letter] t has a different sound than the [letter] d.

It needs to be noted that Zoe’s understanding of morphological generalisations appeared to be misconceived and not always reliable. This was evident in her attempted justification of the phoneme (“sound”) and its grapheme representation in the suffix. Interestingly, Zoe’s misconception did not appear to stop her from attempting to linguistically cross-map.

Ryan (in Year 3) also coordinated phonological, orthographic and morphological processes. For example, when writing the word, *knotted*, he began with rapid morphological processing by conceptualising the word according to its two morphemic units. He
then used orthographic processing by identifying the need to include the *kn* letter pattern at the start of the word. Ryan also made a morphological generalisation by recognising that a double consonant letter is needed before adding the inflected suffix to the verb. As Ryan considered the morphological generalisation, he also used phonological processing by recognising that the medial vowel letter in the word *knot* represents a short phoneme. In this example, Ryan was cross-mapping with a high degree of efficiency as he wrote the disyllabic word *knotted*. Ryan was also able to describe this particular cross-mapping strategy, albeit using minimal linguistic terminology:

<table>
<thead>
<tr>
<th>Researcher:</th>
<th>The word is 'knotted,' as in: the knotted shoe lace is hard to undo. Write 'knotted'.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ryan:</strong></td>
<td>Well I think it's [the letters] <em>k</em>, <em>n</em> because in 'knot' it has <em>k</em>, <em>n</em> instead of just [the letter] <em>n</em>. ... So I write 'knot' first and then add another [letter] <em>t</em> and then just put [the letters] <em>e, d</em> at the end.</td>
</tr>
<tr>
<td><strong>Researcher:</strong></td>
<td>Why did you add another [letter] <em>t</em>?</td>
</tr>
<tr>
<td><strong>Ryan:</strong></td>
<td>Because if I didn’t, the [letter] <em>e</em> would make the [letter] <em>o</em> say its own name.</td>
</tr>
</tbody>
</table>

Jane also demonstrated triple word-form mapping. This was evident in her attempt to write the word *diagnostician*. When writing the word, Jane said that she began by thinking about the meaning of *diagnostician* and the meaning of its noun form (*diagnosis*). She also created a mental image of a place where a diagnosis might occur (“a hospital”). Her encoding of *diagnosis* was extremely spontaneous,
albeit incorrect, as observed and noted at the time of the interview. Jane also acknowledged using her “memory” to orthographically encode the base word. Despite attempting to combine morphological processing with orthographic processing, Jane was unable to successfully coordinate these strategies with phonological processing when nominalising diagnosis. She successfully abstracted diagnosis and then transformed (or nominalised) it into diagnostician; however, a breakdown in phonological processing occurred and is exemplified by the inappropriate addition of letters (known as epenthesis). Inaccurate processing has also resulted in incorrect spelling of the inflected suffix:

**Jane:** *I think of a hospital ... I’ve never seen that word [the word, diagnostician] written down before. I’ve seen ‘diagnosis’ written down. ... I know it from memory.*

![diagnosis]

**Jane:** *I know ‘diagnog’, I think that part is right, but this part is a little bit harder, it’s got so many ‘stishons’.*

![diagnostician]

Jane could successfully encode monosyllabic and disyllabic words using phonological processing; however, it seems that a
breakdown in phonological processing occurred when polysyllabic words were encoded. Although high-achieving spellers can phonologically encode with greater efficiency and accuracy than the low-achieving spellers, evidence indicates that phonological encoding in polysyllabic words was still problematic for most high-achieving spellers in the study, particularly those in Years 3 to 5. Indeed, encoding polysyllabic words was quite a challenge for the high-achieving spellers. This challenge was expressed quite clearly by Jane (in Year 4) and Amy (in Year 5):

**Researcher:** What might you find difficult about spelling?

**Jane:** The higgledy-piggledy bits. Um, like you know, the really long words that are all jumbled up with the sounds that don’t match with the letters. Those kinds of words are a bit harder.

**Amy:** Some words are very long and it’s very hard to remember ... the beginning.

**Phonological encoding of polysyllabic words posed some challenges.**

High-achieving spellers likely apply phonological processing in coordination with other linguistic processes, yet a breakdown may still occur, particularly when polysyllabic words are encoded. Difficulty with phonological blending in the medial parts of polysyllabic words was expressed by Fred (in Year 5):
The fifth common attribute demonstrated by the high-achieving spellers was their elevated semantic and morphological awareness when spelling. Semantic processing is integral to morphological processing because it requires consideration of the meaning of words and word parts within the context of a sentence. It is likely that semantic processing is used alongside additional strategies when spelling. As illustrated earlier, Jane (in Year 4) semantically processed the homophones *where* and *wear*, and did so in coordination with orthographic processing. Ed (in Year 4) also referred to semantic processing as a strategy he may draw on when spelling:

**Researcher:** Do you break up the word at all into sounds or syllables?

**Fred:** I don’t usually break it up unless it’s a hard part and I have to pause to think about it.

**Researcher:** Which part of the word could be the hard part?

**Fred:** The middle, most likely.

**Researcher:** When you write a really long word, might you use more than one strategy to help you spell it?

**Fred:** Yes, it depends on what the word is.

[Attempts to write the word: *equilibrium*]

[Note the medial blending error: *librell (libri)*]
High-achieving spellers in the study appeared to draw on a range of morphological strategies. Importantly, semantic processing was used by the high-achieving spellers but not the low-achieving spellers in the study. Fred (in Year 5) stated, “I think about the meanings of words so that I know what would work”. When Dom (in Year 6) wrote homophones such as past or passed, he also adopted semantic processing. Specifically, Dom thought about the meaning of the words in the context of a sentence or phrase, as well as the morphological structure of the homophones:

**Dom:** I would think of phrases that you would use it in. ... There can be other ways to use ‘past’. Like there’s future and there’s past, so [states the letter names] p, a, s, t instead of [the letters] p, a, s, e, d. ... ‘Passed’, would be as in, he passed me as he was walking through the street.

[Correctly writes the word, ‘passed’]

But then ‘past’ is a time, so ‘past’, [states the letter names] p, a, s, t ... it’s saying that she had a wonderful past. ... In ‘past’, like [the letter names] p, a, s, t, when you write ‘past’, you don’t write ‘past’ to say she passed the street.
Semantic processing requires awareness of the morphemic structures in words. High-achieving spellers seem to be particularly aware of morphemes and how words function within a semantic context. For instance, Fred (in Year 5) demonstrated how he processes the morphemic structures of words within a semantic context:

**Fred:** Well, the root word is ‘zoo’ and then the ‘-ologist’ part would be a scientist, so adding it on would make it a person who studies something to do with the zoo, which of course is animals.

Fred was able to consider the grammatical functions of words when manipulating affixes to base words, as in the words *mystery,* *mysterious* and *mysteriously.* Clearly, Fred could use his knowledge of grammar and morphology when spelling. As highlighted in the following vignette, Fred also demonstrated accurate metalanguage when articulating strategies used.
Further, it seems that the high-achieving spellers in the study sometimes associated the process of spelling with grammar. This was especially highlighted by Dom:

**Dom:** ... Grammar is part of spelling.

**Researcher:** How is it part of spelling?

**Dom:** Because grammar has to do with the words and how you write them and how you use them in a sentence and so is spelling.
High-achieving spellers appeared autonomous in their approach to spelling. With relative ease, they were able to strategise when spelling, both linguistically and behaviourally. Consulting a reference (such as a dictionary), or consulting the teacher were behavioural strategies used by most of the high-achieving spellers in the study.

**Behavioural strategy: Consulting a reference.**

With the exception of Amy (in Year 5), all the high-achieving spellers explained that they may seek the correct spelling of a word by consulting a reference; most commonly, a dictionary. A selection of remarks made by the students exemplifies the use of this behavioural strategy:

- **Chloe:** *I use a dictionary sometimes.*
- **Fred:** *Sometimes with words I don't know, I look them up in the dictionary.*
- **Jane:** *Under some circumstances I might look it up in the dictionary.*
- **Ryan:** *If we get any spelling mistakes in our journal, we have to write them in our dictionary so we can look them up. ... When I was about to write [the word] 'extremely', I just remembered my dictionary and always did that and now I remember.*
- **Zoe:** *Sometimes I just look it up in the dictionary ... and then I can remember it for next time.*
Although dictionaries may have been utilised on some occasions by the majority of high-achieving spellers, it seems that three of the eight high-achieving spellers (Dom, Amy and Ed) might have avoided including words that they could not confidently spell in their written compositions. With the exception of these three students, however, the other (five) high-achieving spellers in the study appeared reasonably willing to take risks with vocabulary choice when crafting written texts:

<table>
<thead>
<tr>
<th>Name</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dom</td>
<td>I would probably choose a different word.</td>
</tr>
<tr>
<td>Amy</td>
<td>If I can’t figure out a word that’s hard, I don’t need to do the correct one, unless it’s a spelling test. ... I would pick a different word that I can spell, that means the same thing.</td>
</tr>
<tr>
<td>Ed’s Teacher</td>
<td>He generally plays it safe.</td>
</tr>
</tbody>
</table>

**7.4 Summary of results**

To summarise, the high-achieving spellers’ advanced knowledge of the components of spelling empowered them to efficiently and effectively draw on more strategies than the low-achieving spellers in the study. While the low-achieving spellers relied on phonological processing, the high-achieving spellers were able to coordinate more than one linguistic process when encoding a word. This is highlighted in the following comment made by Jane’s teacher:
The high-achieving spellers in the study also appeared to have a larger bank of words that they were able to automatically and accurately spell. It seemed that their vocabulary knowledge was also more sophisticated than that of the low-achieving spellers in the study. The high-achieving spellers were also more avid readers and linguistically inquisitive than the low-achieving spellers. As such, the high-achieving spellers did not need to rely on ‘sounding out’; instead they adapted the strategies of choice, depending on what word they were spelling. Unlike the low-achieving spellers, their strategising frequently appeared to encompass morphological processing in coordination with another linguistic process:

**Fred’s Teacher:** The high-achieving spellers just know the words and they usually just have that base knowledge of the key words, like the base words. So, that, and they know those rules about, you know, adding ... [the letters] t, i, o, n and all of those. So, they can rely on their knowledge and put it into practice. Whereas, the lower spellers probably don’t have all of those strategies in place. ... So, they don’t make the connection that a meteorologist studies meteorology. So having a more sophisticated ability to look at a word and say, oh, that’s what it means and all these words belong to it.
Dom’s teacher in Year 6 further reinforced the notion that phonological processing was prominent among the low-achieving spellers in her class, and compared this with the prominent use of morphological processing observed among the high-achieving spellers in her class:

**Dom’s Teacher:** I’ve got two quite low spellers, umm, but you can read what they write because it’s all phonetic, all phonetic. ... Sounding out is the only strategy the low spellers use.

**Researcher:** So, your lower-achieving spellers are relying on a phonological approach. Are your higher-achieving spellers able to utilise more strategies?

**Dom’s Teacher:** Yes and even looking at the roots of words and which words relate and how they, you know, the word, how do you say, word building, I suppose. So they can sit there and do it. ... So, when we’re doing the morphological side of it, they’re able to do that, and when we’re doing the etymological side they’re doing that, but they can do both when they need it. Whereas, the others are just doing the phonetic.

Having established that the high-achieving spellers in the study were able to draw on a broader range of spelling strategies compared to the low-achieving spellers in the study, it is important to consider pedagogical influences. As highlighted earlier, Jane (in Year 4) received explicit instruction in spelling. Jane was taught to use a variety of spelling strategies and to talk about the strategies using sophisticated metalanguage. Other students in the study did not seem to receive the same level of spelling instruction throughout the course of the school year.
Most teachers’ comments broadly suggested that their students had made little gain and that they may not have reached their individual potentials. Indeed, the teachers frequently commented that inadequate improvements observed in students’ spelling was an issue, which the schools were seeking to address. Ed’s teacher openly admitted that student improvements in spelling had been lacking. This teacher also experienced difficulty teaching spelling and had limited knowledge of the strategies Ed used:

**Ed’s Teacher:** It’s the same kids doing really well and the same kids that do poor. ... There hasn’t been an increase in the results. Having said that, I haven’t been putting a big focus on the tests because I have been trialling different things. But, yeah, it’s the same kids scoring low and the same kids scoring high. ... Yeah, like I said, I’m still battling with spelling a bit ...

**Researcher:** Can you tell me some of the strategies that you have observed Ed use when he is spelling?

**Ed’s Teacher:** ... oh, that’s tricky ... umm, he’s a bit of a rusher. ... He is quite messy and, I don’t know, his messiness I think affects it because he can’t ... I don’t know.

Zoe’s comment (in Year 3) further exemplifies the notion that high-achieving spellers may not be reaching their learning potential in the area of spelling. Zoe explained that she found the spelling activities easy and that she was able to complete them quickly and independently:
It seems that some students in the study may have acquired substantial spelling knowledge as a result of instruction they received from other teachers in previous school years. Additionally, some knowledge and processing appears self-taught or the possible result of guidance provided to the students by their parents or peers, albeit to a small degree.

Of concern, several teachers commented on their lack of knowledge and confidence in teaching spelling. These teachers appeared to rely on commercially sourced textbooks to teach spelling. They were not able to explicitly teach their students a range of spelling strategies or encourage their students to use relevant linguistic metalanguage. Indeed, data from the present study highlight that inadequate content knowledge on the teacher’s part was

\begin{dialogue}
\begin{quote}
\textbf{Zoe:} One group of people, they have to do it ['Sound Waves’ text book activities] with the teacher because they don’t know as much as the other people. Then there’s another group of people who are the better learners and they just rush ahead.

\textbf{Researcher:} Do you ever get to work with the teacher when you do Sound Waves?

\textbf{Zoe:} No

\textbf{Researcher:} How do you find the activities?

\textbf{Zoe:} They’re easy.

\textbf{Researcher:} What happens when you finish the activities quickly?

\textbf{Zoe:} I just wait and read a book while the rest of the class finishes.
\end{quote}
\end{dialogue}
widespread. To exemplify, Amy’s teacher acknowledged poor knowledge on her part:

**Amy’s Teacher:** I’m honest with the kids and I tell them that I’m not literacy minded. So, I talk to them about how I’m not a very good speller.

The majority of spelling instruction provided to the students in the study, apart from Jane (in Year 4) and, to some extent, Dom (in Year 6), focussed on weekly testing, rote learning of words (typically, as part of home learning requirements) and phonics-based textbook activities. It also seems that the high-achieving spellers were largely expected to work independently on spelling-related tasks.

In Chloe’s (Year 6) classroom, spelling instruction was not scheduled into the weekly program at all. If spelling was addressed, it appears to have been sporadic and implicit:

**Researcher:** Can we begin by talking about how spelling has been taught in your classroom throughout the year?

**Chloe’s Teacher:** Yes, well I don’t. … I don’t have specific spelling timetabled as a weekly activity to do. It comes up in conjunction with our writing. … I’m getting them to hear the sounds in words.

Although Chloe was identified as a high-achieving speller in this study, it seems that some of the knowledge she acquired about spelling was developed through self-initiated learning. From the interview data, one could infer that Chloe has been deprived of the
opportunity to reach her potential because explicit instruction from her teacher had been neglected:

**Chloe:** There’s quite a few words that are derived from Latin but I can’t think of any from the top of my head.

**Researcher:** Do you study that at school?

**Chloe:** No, not specifically.

**Researcher:** So, how have you come to know that then?

**Chloe:** Just using dictionaries, I guess, because it usually specifies if the word derives from Latin.

This chapter has presented the spelling strategies used by the 16 students who participated in Phase Two of the Major Study. Emerging from the data was a total of 17 spelling strategies, with some individual differences in strategy use being observed among the students. In particular, the spelling strategies used by the high-achieving spellers have been compared with the strategies used by the low-achieving spellers. The qualitative data have also revealed that students who are taught to talk about a range of spelling strategies using specific linguistic terminology may develop greater autonomy in their spelling. Additionally, the results presented in this chapter suggest that other factors may contribute to achievements in spelling. Potential factors identified in the data include (and are not necessarily absolute) memory functioning, experiences working with vocabulary through reading and writing, and support through home-learning. The next chapter presents a discussion on the spelling achievements of
students in Years 3 to 6 by drawing on the results of Phase One and Phase Two.
8 DISCUSSION OF THE RESULTS

Having presented the results from the Major Study in the previous two chapters, this chapter begins by discussing the influence of three fundamental language convention skills, namely spelling, grammar and punctuation, on compositional writing. As proficiency in spelling has been established in this study as a particularly critical and influential element in compositional writing, this chapter also draws on previous literature regarding spelling development to discuss students’ phonological, orthographic and morphological representations found in the present study. In addition, the relationships observed between students’ results in NAPLAN spelling and the CoST are discussed. This chapter concludes by discussing the spelling strategies used and articulated by low-achieving spellers and high-achieving spellers.

8.1 Predictors of compositional writing

The first research question sought to examine the relationship of the three dimensions, measured by the NAPLAN Language Conventions Test, (namely, spelling, grammar and punctuation) with written composition, and to determine whether this relationship was influenced by gender and/or age. All of these relationships were tested using MRA. The findings demonstrate that spelling, grammar and punctuation jointly influenced compositional writing for participating males and females in Year 3 and Year 5. Notably, spelling was more influential than grammar and punctuation, while
age (measured in months) was not an influential factor. These results build on the literature by providing an Australian context and an empirical substantiation of the view that learning to spell is critical to becoming a literate writer (Abbott et al., 2010; Berninger et al., 1998; Hutcheon et al., 2012; Puranik & Al Otaiba, 2012; Schlagal, 2007). In addition, the results resonate with literature reporting that even from the first year of formal schooling, “age has a diminishing effect over children’s ability to hear and record sounds in words and writing vocabulary development” (Mackenzie & Hemmings, 2014, p. 50).

A proficient writer understands the function of language and is able to use and manipulate it when composing a written text (Fang & Wang, 2011). With this in mind, it is not surprising that, in this study, as much as 43% of the variance in written composition was explained by the three language convention measures (namely, spelling, grammar and punctuation); however, spelling was the most influential factor of these three conventions. This finding extends the work of Abbott et al. (2010) who also found that spelling (and handwriting) relate to text composing, and assert that “spelling bridges idea generation and text generation” (p. 296). It also supports Kohnen and her colleagues’ (2009) proposition that low-achieving spellers “may have fewer attentional resources to devote to other aspects of writing” (p. 113).

The NAPLAN Language Conventions Test requires students to identify and edit spelling errors in one- and two-syllable words, as well as to identify and label some common grammatical and
punctuation conventions such as the correct use of pronouns, conjunctions and verb forms. It also seems that the NAPLAN Language Conventions Test is underpinned by a ‘traditional’ measure of grammar, whereby a finite collection of language rules and labels are disassociated with the notion that language can vary as a function of context (Derewianka, 2012). In contrast, the NAPLAN Writing Test measures students’ capacity to control and manipulate the multitude of resources needed to craft a meaningful text. With this in mind, the findings of the study suggest that there is a relationship between students’ ability to identify, correct and/or label a set of constrained or disassociated language conventions and their capacity to coordinate the multiple resources needed to compose a well-crafted written text.

In light of the findings, Richards, Berninger, and Fayol (2009) are justified in their assertion that “teaching spelling as a skill that draws on multiple language sources” is important because it “may provide the intellectual engagement that students need to become proficient at spelling the words they choose to use” when expressing their ideas in a written text (p. 346). Arguably, classroom educators often devote greater attention to identifying and correcting poor punctuation in students’ written compositions and place emphasis on reminding students about correct use of full stops and capitalisation, rather than focussing on the assessment and explicit teaching of other writing elements (Mackenzie, Scull, & Munsie, 2013). Accurate punctuation is one important secretarial element of writing; however,
the study highlights the need for teachers to more rigorously scrutinise other aspects of students’ writing and to systematically shift instruction to aspects which require greater priority. For some students, spelling may require more instructional attention, regardless of their age. Indeed, even though previous research has mostly highlighted the importance of learning to spell in the first few years of formal schooling (see, for example, Puranik & Al Otaiba, 2012), the results of this study highlight that spelling does maintain its relevance beyond the first few years of school. Clearly, learning to spell remains important in the middle and upper primary school years.

While this study has built on literature advocating that proficiency in spelling can influence compositional writing, it needs to be noted that the relationships reported in this study do not provide causal evidence. Rather, the relationships found in the study imply that learning to spell remains an important part of becoming a competent writer, for male and female students in Year 3 and Year 5, and this is regardless of their age. The findings also suggest that if spelling is an arduous task, it is possible that the cognitive demands become greater and the precision of a compositional text may then be compromised.

8.2 Concurrent growth in phonological, orthographic and morphological spelling representations.

To address the second research aim, the CoST was used to examine median performance levels on the components of spelling for students
in Years 3 to 6. Concurrent increases in the performance levels across the phonological, orthographic and morphological subscale scores from Years 3 to 6 were found, albeit to varying degrees. These results contribute to the emerging body of evidence for TWFT (Richards, Aylward, Field, et al., 2006). Specifically, the findings support the assumption that learning to spell “depends on developing awareness of phonological, orthographic, and morphological word forms … and coordinating them” (Richards, Berninger, & Fayol, 2009, p. 332).

The findings also align with the view that “orthographic awareness may not be dependent on first establishing competent phonological spelling skills” (R. Larkin et al., 2013, p. 409). Although the results show that some aspects of morphological spelling appear particularly difficult to master (such as homophones, assimilated prefixes and derivational suffixes), they also indicate that accurate phonological and orthographic spelling representations are not prerequisites for learning aspects of morphological spelling. Importantly, while this finding is consistent with non-linear models of spelling development (see, for example, Berninger, Abbott, Nagy, et al., 2010; Devonshire et al., 2013; Kwong & Varnhagen, 2005; Varnhagen et al., 1997), it negates assumptions associated with stage and phase theories of spelling development (see, for example, Bear & Templeton, 1998; Ehri, 1985; Gentry, 2000). Indeed, as Read and Treiman (2013) justifiably assert, “theories that attempt to identify discrete stages during the development of spelling … are
problematic” (p. 209). In particular, the concurrent pattern of growth in phonology, orthography and morphology that was observed in this study strengthens the evidence provided by Bahr et al. (2012), who analysed students’ narrative and persuasive compositions to demonstrate that growth in spelling between the ages of six and 14 years is nonlinear and that “it takes a long time to develop a robust orthographic lexicon that coordinates phonology, orthography, and morphology and supports word-specific, conventional spelling” (p. 1587).

Another important finding emerging from the CoST data is the substantial increase in performance levels observed between Year 5 and Year 6 in the morphological and phonological subscales. There are three plausible explanations for this: a) changes in memory functioning; b) changes to instructional priorities; and c) accumulation of lexical exposure and oral vocabulary. What follows is an elaboration of each.

First, in light of Gathercole’s (2007) research on working memory, it could be that growth in cognitive functioning plays a crucial role in students’ readiness to process complex words when spelling. The notable increase in performance levels between Year 5 and Year 6 could reflect a developmental change in students’ readiness to accurately encode morphologically complex words, but also to accurately blend phonologically regular medial parts of polysyllabic words.
While the task of spelling is known to place demands on working memory (Berninger, Abbott, Swanson, et al., 2010), Gathercole (2007) also explains that working memory continues to improve throughout childhood, with a particular increase in functioning observed between 10 and 12 years of age. Interestingly, this age is similar to the Year 6 students who participated in the present study. The findings of the present study align with Gathercole’s (2007) assertion that “as the efficiency of processing increases with age, more of this resource is available to support storage, leading to improvements in task scores” (p. 235). It is particularly intriguing that an increasing level of accuracy in medial blending of polysyllabic words was observed at each year level, but particularly between Year 5 and Year 6. This is consistent with research demonstrating that medial phoneme blending requires greater skill than the phonological encoding of initial and final word parts (Cassady & Smith, 2004; Cassady et al., 2008). It also parallels the work of R. Larkin et al. (2013) who argue that one’s capacity to store greater amounts of phonological information increases capacity for efficient and accurate phonological encoding. Their research also showed that being able to “spell a wide range of words accurately, particularly complex and longer words” helps “foster better phonological memory capacity and result(s) in higher nonword repetition scores” (R. Larkin et al., 2013, p. 408). Consistent with their view, the findings of the present study suggest that increased accuracy of complex and polysyllabic words could be the result of
changes that occur in working memory as children progress through school. The results also resonate with the work of Garcia et al. (2010). These researchers suggest that changes may occur in the ways in which students store and analyse the three interrelated linguistic word forms. It seems that students’ phonological, orthographic and morphological knowledge may gradually improve as they advance through schooling, consequently paving the way for increasingly efficient and accurate linguistic cross-mapping.

Secondly, the marked increase in performance levels between Year 5 and Year 6 could be the result of changes to instructional priorities during these upper primary school years. It is possible that morphological instruction may be more directly taught in Year 5 and Year 6, as this aspect of spelling knowledge is a more prominent feature in the upper primary school years of the Australian Curriculum: English (ACARA, 2014a). In addition, morphology seems to be a component of spelling instruction that is predominantly exclusive to the upper primary school years, as endorsed by many commercially available spelling programs (see, for example, Bear et al., 2012; Westwood, 2005). This is not surprising, as many popular commercial spelling programs are broadly informed by linear theories of spelling development (Adoniou, 2014), and present as convenient and accessible resources for teachers to follow. Consequently, it is unlikely that aspects of morphological spelling are explicitly or adequately taught in the lower and middle primary school years. Finally, this reasoning is also consistent with research showing that
significant improvements in performance can be made if morphological awareness is explicitly taught (Carlisle et al., 2010) and if spelling (more broadly) is explicitly taught (Graham & Santangelo, 2014).

The third plausible explanation for the observed increases in performance levels, particularly in the upper primary years, may be related to students’ cumulative experience with increasingly complex and polysyllabic words and subsequent increase in oral vocabulary. Lexical exposure could occur through interdisciplinary learning and this may enhance students’ growing knowledge of polysyllabic and morphologically complex vocabulary. As students advance through the primary school years, they are inevitably engaging with increasingly complex literature. The spike in scores between Year 5 and Year 6 may also be attributed to potentially pronounced expectations for students to prepare for secondary education by engaging them across various modes and with more complex or technical vocabulary, through disciplines such as Science, Geography, History, Mathematics, or Languages other than English such as French or Italian. The notion that vocabulary knowledge plays an important role in autonomous spelling supports Beck, McKeown and Omanson’s (Phythian-Sence & Wagner, 2007) proposition of vocabulary acquisition in reading. Further, Richards, Berninger, and Fayol (2009) are justified in explaining that an “autonomous orthographic lexicon” can become established when “durable, multifaceted … representations can be directly and … automatically
accessed (Richards, Berninger, & Fayol, 2009, p. 328). With an increase in vocabulary knowledge, a reliance on effortful, strategic encoding diminishes.

Another important finding emerging from the CoST median performance levels is the presence of substantial differences in performance across all three subscales for students in the lower percentiles compared with students in the higher percentiles. This finding suggests that a single mainstream class may constitute enormous variability in performance among the students. Within a given typical class setting, substantial variation in student performance will undoubtedly pose challenges for a teacher. Yet, teachers are expected to ensure individual students’ needs are met and that students are achieving the curriculum indicators of achievement prescribed for each year level.

This finding also highlights the need for early intervention for low-achieving spellers. A comparison of the percentiles within each of the three CoST subscales is indicative of a particularly concerning trend in the trajectory for very low-achieving (10th percentile) students. Critically low performance levels were found among those students, even as they approached the final months of primary schooling. For example, Year 6 students performing in the 10th percentile of the phonological subscale failed to reach the equivalent level of those Year 3 students in the 50th percentile. As stated earlier, explicit instruction in spelling is known to have a significantly positive effect on performances in spelling, and an increased amount
of instruction is also effective (Graham & Santangelo, 2014). Therefore, provisions for targeted intervention in spelling are needed well before low-progress students commence Year 3 schooling.

With regard to the phonological subscale, minimal increase in scores across the four schooling years in the 90th percentile was also evident, and ceiling was not reached. Specifically, it seems that there is scope for improvement in the phonological processing of polysyllabic words beyond the primary school years, even for high-achieving spellers. These results reveal the need for explicit instruction in specific aspects of spelling beyond the primary school years. On the other hand, particular aspects of spelling may require considerably less or no instructional attention for some students. For example, the study revealed that ceiling was reached in the orthographic subscale score for Year 5 students in the 90th percentile. This result suggests that orthographic knowledge is a constrained skill, and that engaging in learning tasks designed to target orthographic features in words may not necessarily be effective in improving spelling performance for some students. When students obtain heightened sensitivity to the legal orthographic patterns inherent in Standard English spelling, no further orthographic knowledge can be gained. This does not necessarily mean that spelling mastery has been reached. Rather, the results suggest that phonological and morphological spelling representations may require further development. For instance, the results relating to the morphological subscale showed that only one of the six
morphological sub-skills reached ceiling. Specifically, the inflected suffix sub-skill was found to be the easiest for students to grasp, and this finding is consistent with other research demonstrating that inflected suffixes are acquired before derivational suffixes (see, for example, Deacon et al., 2014). Importantly, the apparent difficulty across most of the morphological sub-skills suggests that substantial morphological learning is still needed beyond Year 6, even for students performing in the 90th percentile. It also suggests that explicit morphological instruction may need to begin considerably earlier in schooling.

A MANOVA was also conducted to test the significance of group differences related to year level and gender on the three CoST subscales. The results indicate that there was a significant overall increase in scores from Year 3 to Year 6; however, differences between males and females were not found. Specifically, 7.6% of the variance in the dependent variables was accounted for by year level, while the effects for gender and the interaction of year level and gender were non-significant. These findings indicate that growth in phonological, orthographic and morphological knowledge does not differ on the basis of gender. Importantly, they imply that the nature of instruction in spelling should not be determined on the basis of gender. Rather, instruction should be informed by individual performances in phonological, orthographic and morphological representations of spelling.
Additional curriculum demands and increased expectations for independent learning in the secondary school years could result in spelling instruction becoming less of a priority, and this may be irrespective of students’ knowledge of Standard English spelling. Indeed, the expectations set out by ACARA for Australian students completing Year 6 schooling are very high. Specifically, it is expected that students should be completing Year 6 schooling knowing “how to use banks of known words, word origins, base words, suffixes and prefixes, morphemes, spelling patterns and generalisations to learn and spell new words, for example technical words and words adopted from other languages” (ACARA, 2014a: Year 6 Content Descriptor, ACELA1526). In the absence of appropriate intervention, it is possible that persisting difficulties with spelling may then lead to learning difficulties across other disciplines. With this in mind, it is concerning that low-achieving spellers are highly disadvantaged before they even begin secondary education, at least in Australia.

8.3 Relationships between the NAPLAN spelling results (for low- and high-achieving spellers) and the CoST results.

To address the final research question for Phase One, the low-achieving spellers and high-achieving spellers were identified as those who performed in the bottom third and top third, respectively, in the spelling measure of the NAPLAN Language Conventions Test. Positive correlations between the NAPLAN spelling results and the three CoST subscales were found. For low-achieving spellers across
all year levels, the strongest correlation was between NAPLAN spelling and the orthographic subscale; however, an equally strong relationship was observed with the morphological subscale in the Year 6 low-achieving group. This finding builds on the work of Conrad et al. (2013), who demonstrated that orthographic knowledge, at age seven to nine years, contributes to spelling “over and above the contributions of phonological skills” (p. 1223). It also supports research by Rothe et al. (2014) who provided evidence that orthographic knowledge predicts spelling in German-speaking Kindergarten students. It needs to be noted, however, that German is a more phonetic language than English. While the two studies described by Conrad et al. (2013) and Rothe et al. (2014) did not include a morphological measure, the present study did, and the results showed that for the high-achieving spellers, the strongest relationship was between the NAPLAN spelling measure and the morphological subscale, with the exception of Year 5, in which the relationship with the phonological subscale was marginally stronger than the morphological subscale.

Gender differences were also examined, and by testing the significance of the CoST subscale correlations between males and females, using the low- and high-achieving spelling groups, no significant findings were revealed. The results suggest that students who performed poorly in the NAPLAN spelling retained their status as poor spellers up to 18 months later, as measured by the CoST. Similarly, high-achieving spellers (as measured by NAPLAN
spelling) remained as high-achieving spellers (as measured by the CoST) during the same time period. The results also suggest, particularly for high-achieving spellers, that NAPLAN spelling involves other competencies not measured by the CoST. It also needs to be kept in mind that the spelling component of the NAPLAN Language Conventions Test is based on a proofreading and editing task, whereas the CoST uses a dictation procedure.

### 8.4 Spelling strategies used by low-achieving spellers compared with high-achieving spellers in Phase Two

In the final research phase, qualitative content analysis was employed to identify the spelling strategies used by sixteen participating students. In total, 16 distinct spelling strategies emerged in the data, with each strategy being classed into one of five overarching categories. These are summarised in Table 8.1.
Table 8.1

Summary of Spelling Strategies (Classed by Category)

<table>
<thead>
<tr>
<th>Categories</th>
<th>Strategies</th>
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</thead>
<tbody>
<tr>
<td>Phonological processing (P)</td>
<td>1. Phoneme segmentation</td>
</tr>
<tr>
<td></td>
<td>2. Syllabification</td>
</tr>
<tr>
<td></td>
<td>3. Phonological hybrid</td>
</tr>
<tr>
<td>Orthographic processing (O)</td>
<td>4. Visualising an orthographic unit</td>
</tr>
<tr>
<td></td>
<td>5. Automatic lexical retrieval</td>
</tr>
<tr>
<td></td>
<td>6. Mnemonic (orthographic-based)</td>
</tr>
<tr>
<td></td>
<td>7. Lexical analogical processing</td>
</tr>
<tr>
<td>Morphological processing (M)</td>
<td>8. Conscious application of affix-based rules</td>
</tr>
<tr>
<td></td>
<td>9. Conscious application of etymological features</td>
</tr>
<tr>
<td></td>
<td>10. Using semantic context</td>
</tr>
<tr>
<td>Linguistic cross-mapping</td>
<td>11. Combination of P and O</td>
</tr>
<tr>
<td></td>
<td>12. Combination of O and M</td>
</tr>
<tr>
<td></td>
<td>13. Combination of P and M</td>
</tr>
<tr>
<td></td>
<td>14. Combination of P, O and M</td>
</tr>
<tr>
<td>Behavioural</td>
<td>15. Consulting an expert or resource</td>
</tr>
<tr>
<td></td>
<td>16. Risk avoidance</td>
</tr>
</tbody>
</table>

It is important to acknowledge that the strategies elicited in this study do not imply that no other strategies could in fact exist. Rather, the strategies elicited are limited to those that were revealed in the data available in this study. Consistent with this note of caution, Clay (2013) observes that “as readers become proficient, more of the processing is hidden from view” (p. 57). Indeed, this may apply to spellers as they become proficient. In addition, the findings from the present study have revealed that students who have been explicitly taught to talk about the processes and skills involved in spelling are
more likely to have the metalanguage needed to explain how they encode particular words. If students do not have the metalanguage needed to articulate the strategies they employ, their strategising may not be overt. The absence of an overt strategy should not be inferred as the complete absence of a strategy. Rather, some strategies may be internalised, just as Clay (2013) has observed in students’ reading behaviours. Alternatively, some students may not have been able to clearly articulate some strategies because they did not have the necessary metalanguage to do so. In these cases, inferences of strategy use could be made through systematic linguistic error analysis of students’ written words.

Holmes and Malone’s (2004) study provides evidence of a spelling strategy that was not observed in this study, namely “over-pronunciation”; however, their study was based on adult spellers only. An extensive search found no scholarly literature available to demonstrate the existence of spelling strategies used by middle and upper primary students above and beyond those found in the present study. Although the notion of risk avoidance in spelling has been discussed in the literature (see, for example, Graham & Santangelo, 2014; Kohnen et al., 2009), it seems that the present study is the first to provide concrete evidence of this behavioural strategy, at least among some middle and upper primary school students. Similarly, although it has been assumed that proficient spellers tend to display greater autonomy and efficiency in utilising experts and/or resources (such as teachers and/or dictionaries) when spelling unfamiliar words
(see, for example, Westwood, 2005), this study is the first to present
evidence of such a behavioural strategy, albeit from student self-
report data.

Another major finding is the subtle, yet unique differences
observed among individual students’ strategies. However,
overarching patterns of similarity among the low-achieving spellers
were evident and these differed to the patterns of similarity observed
among the high-achieving spellers. These patterns are summarised in
Table 8.2.

Table 8.2
Comparative Summary of Low- and High-achieving Spellers’
Strategy Use

<table>
<thead>
<tr>
<th>Low-achieving spellers</th>
<th>High-achieving spellers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavily rely on phonological processing.</td>
<td>Utilise a comprehensive repertoire of strategies, rather</td>
</tr>
<tr>
<td></td>
<td>than rely on a single strategy.</td>
</tr>
<tr>
<td>Display poor orthographic sensitivity. Processing is also</td>
<td>Display heightened orthographic sensitivity and efficient</td>
</tr>
<tr>
<td>unreliable and inefficient.</td>
<td>processing.</td>
</tr>
<tr>
<td>Automatically retrieve very few words with accuracy.</td>
<td>Automatically retrieve a large bank of words with accuracy.</td>
</tr>
<tr>
<td>Display implicit and unreliable morphological processing.</td>
<td>Consciously apply morphological processing.</td>
</tr>
<tr>
<td></td>
<td>Cross-map among word forms.</td>
</tr>
<tr>
<td></td>
<td>Adapt strategy choice flexibly.</td>
</tr>
</tbody>
</table>

Importantly, high-achieving spellers are able to draw on a
broader range of spelling strategies than low-achieving spellers.
Moreover, the high-achieving spellers can adapt and manipulate the strategy of choice on the basis of word complexity. In contrast, low-achieving spellers tend to overcompensate and use inefficient and inappropriate phonological and orthographic processing. This finding was not only evidenced in the qualitative data presented by the participants in Phase Two, but it was reflected in the nature of the linguistic errors (as measured by the CoST) observed in Phase One (see section 6.2).

In a number of ways, the findings of Phase Two build on the research of Rittle-Johnson and Siegler (1999) and Sharp et al. (2008), who identified and described the spelling strategies used by students in the early years of formal schooling. Firstly, the present study examined the spelling strategies used and articulated by students across the middle and upper primary school years, as opposed to students in Year 1 and Year 2, resulting in the identification of several additional strategies that have not been previously reported in the literature. Specifically, Rittle-Johnson and Siegler (1999) found that students in Year 1 use between one and five strategies, while students in Year 2 use up to six strategies. The findings of the present study build on this knowledge by providing evidence that a student in Year 3 may use as many as eight spelling strategies, while a student in Year 6 may use as many as nine. In addition, Sharp et al. (2008) identified nine strategies among the 31 Year 1 students in their study, which is substantially less than the 16 strategies that were identified among the older students in this study.
Secondly, Sharp et al. (2008) provide evidence of adaptive strategy choice, and this is akin to the high-achieving spellers’ adaptive strategy choice observed in the present study. Although Lennox and Siegler (1994) have speculated that good spellers and poor spellers may use different strategies, insufficient evidence has been reported in the literature, particularly relating to students in the middle and upper primary school years. Indeed, the studies reported by Rittle-Johnson and Siegler (1999) and Sharp et al. (2008) do not provide any evidence of the spelling strategies used by the low-achieving spellers compared with high-achieving spellers.

Although Kwong and Varnhagen (2005) state that “beginning spellers bring a wealth of knowledge of the English spelling system to bear on their earliest writing” (p. 154), the findings of the present study suggest that this may partly depend on the quality of instruction that students receive, as pointed out by Herrington and Macken-Horarik (2015). If students are only taught to ‘sound out’ words and/or to ‘retrieve words’ that they have committed to long term memory, they may be less likely to consciously draw on other linguistic processes when encoding less familiar words. This, by no means, implies that emerging spellers do not have the capacity to utilise a multitude of spelling strategies. It does, however, emphasise that explicit instruction in linguistic processing and cross-mapping is critical to spelling development. In addition, the findings of this study revealed the importance of repeated and regular exposure to words through contextualised reading and writing experiences; a
characteristic of the high-achieving spellers’ profiles (see Appendix L). This is a reasonable proposition which aligns with Kwong and Varnhagen (2005), who assert that “with repeated experiences … children become both more accurate and more efficient in selecting and applying spelling strategies” (p. 154).

The findings of this study are consistent with Perfetti and Hart’s (2002) view that poor readers and spellers can experience difficulty integrating orthographic and semantic knowledge in an efficient manner and tend to rely merely on phonological knowledge. Although Perfetti and Hart’s (2002) LQH aligns closely with TWFT, their theorising is predominantly grounded on research on learning to read. As such, TWFT was used in the present study as an innovative theoretical framework from which to begin the process of analysing and categorising strategies that emerged from the quantitative and qualitative data. Crucially, evidence of linguistic cross-mapping, as a new category of strategies, has surfaced as a result of this study. The findings also reveal that linguistic cross-mapping characterises the high-achieving spellers and not the low-achieving spellers.

8.5 Conclusion

This chapter has discussed the results of the Major Study in light of the literature. The concluding chapter will begin with a summary of the research context and key findings; however, its focus is on the implications of the findings for curriculum, pedagogy, and pre-service and in-service teacher education in the domain of spelling.
Limitations will also be acknowledged and recommendations for future research will be offered.
9 CONCLUSION

9.1 Summary of the context

This study has established the importance of learning to spell in the middle and upper primary school years and has addressed the complexities of becoming a proficient speller. Specifically, the context for the study was focussed on students in Years 3 to 6 enrolled in mainstream schools in the Australian Capital Territory. A review of the literature identified a need to develop a valid and reliable spelling assessment tool underpinned by TWFT, examine the separate and joint influences of spelling, grammar and punctuation on written composition, and understand the complex processes involved in learning to spell beyond the initial years of formal schooling in Australia. Consequently, a new spelling measure was developed and tested in a Pilot Study, while a mixed-methods design was adopted in a Major Study to yield new understandings of spelling acquisition in an Australian middle and upper primary school context. In sum, quantitative and qualitative data were gathered from almost 1,400 students across 17 mainstream Australian schools, making this study the largest and most comprehensive examination of spelling acquisition conducted within an Australian context.

What follows is a reiteration of the key findings of the present study. The chapter then addresses the implications of the study for pedagogy, curriculum, and pre-service and teacher education courses.
Finally, the limitations of the research are acknowledged and recommendations for future research are presented.

9.2 Summary of the key findings

The development and testing of the CoST that occurred during the Pilot Study has extended current research methods in the area of spelling assessment. Specifically, the CoST builds on TWFT, and particularly on the research of Bahr and colleagues (2012). The CoST is founded on the premise that breakdowns in phonological, orthographic and/or morphological “processes can lead to spelling errors” (Bahr, 2015, p. 195), and that refinement of all three processes has the potential to lead to concurrent rather than sequential processing. Importantly, the CoST is the first spelling assessment tool which adopts an analysis of phonological, orthographic and morphological errors in dictated words. Moreover, this tool is the first of its kind to include a measure of phonological medial blending in polysyllabic words. In addition, features such as inflectional and derivational suffixes, homophones and Latin and Greek roots are included as individual constructs within the morphological subscale. Taken together, these features enable a comprehensive analysis of linguistic error patterns without labelling competency into a particular spelling ‘stage’ (Bear et al., 2012) or spelling ‘phase’ (Ehri, 1985). The development and testing of the CoST in the Pilot Study resulted in a reliable and valid spelling assessment tool, and this then provided an important foundation for the Major Study.
Becoming a competent speller has been identified in the Major Study as a critical part of learning to write, yet the results have also demonstrated that spelling is a complex and gradual process of building efficient connections among phonology, orthography and morphology. While proficiency in spelling, grammar and punctuation jointly influence compositional writing in the middle and upper primary school years, spelling competency has been shown to be the most critical factor of the three language conventions, and this is regardless of students’ age. As highlighted by Kohnen et al. (2009) and Richards, Berninger, and Fayol (2009), if difficulty with spelling persists, it can impede the writing process because greater cognitive attention may be devoted to correctly spelling individual words, rather than focussing on other aspects of writing such as lexical sophistication and structural cohesion. If word formation processes are inefficient and unreliable, lexical sophistication and overall richness of a written text may be undermined. Indeed, qualitative data obtained during the study suggest that low-achieving spellers are reluctant writers and are inclined to compromise on word choice by relying on words that they know they can spell, rather than selecting words that can most effectively express the message they intend to convey.

Understanding the linguistic errors students make when spelling is fundamental to effective pedagogy; however, the present study challenges the long standing assumption that students’ application of spelling proceeds in sequential ‘stages’ or ‘phases’.
Specifically, an examination of the phonological, orthographic and morphological subscale scores of the CoST revealed concurrent and significant increases from Years 3 to 6 in all three subscale scores. Notably, the study provided evidence that students in the middle and upper primary school years continue to build efficient, autonomous and accurate phonological processing, particularly between Year 5 and Year 6; however, students simultaneously continue to refine orthographic and morphological processing. In addition, although more males than females in the study were identified as low-achieving spellers in all subscales of the CoST, the effects for gender and the interaction of year level and gender were statistically non-significant. In addition, gender did not appear to contribute to the relationships found between NAPLAN spelling (a proofreading and editing task) and the three subscale scores of the CoST, for low-achieving spellers and high-achieving spellers. This suggests that gender differences should not influence students’ likelihood to succeed in spelling.

Another important finding was that the orthographic subscale of the CoST was generally the main predictor of NAPLAN spelling. This finding supports the view that heightened sensitivity to sub-lexical orthographic regularities plays an important role in learning to proofread and edit spelling errors, but also in learning to spell more broadly (Richards, Berninger, & Fayol, 2009; Rothe et al., 2014). It is not surprising that the orthographic subscale of the CoST appears to be such a strong predictor of NAPLAN spelling, considering that the
latter is essentially a visual-spatial exercise that involves scanning word/s, and identifying and correcting orthographic anomalies. In addition, the stability of spelling performance found in Abbott et al.’s (2010) longitudinal research resembles findings from the present study, which revealed that low-achieving spellers (as measured by NAPLAN spelling) remained as low-achieving spellers (as measured by the CoST) up to 18 months later. This finding highlights the need to systematically utilise assessment outcomes in order to guide instruction, and in particular to provide early and effective intervention in spelling for those students experiencing difficulties with spelling.

An analysis of the qualitative data in Phase Two demonstrated the importance of building students’ metalanguage as a means to facilitate problem solving when learning to spell. The data also revealed that the high-achieving spellers in the study, like effective readers, utilised many strategies. Specifically, high-achieving spellers were able to draw on multiple sources of information to encode complex or less familiar words. They were able to efficiently integrate phonological, orthographic and morphological word forms and manipulate strategies on the basis of lexical quality. In contrast, the low-achieving spellers in the study relied on inefficient phonological processing, and displayed poor orthographic sensitivity and unreliable orthographic processing. Additionally, low-achieving spellers were unable to overtly coordinate more than one process simultaneously when encoding.
9.3 Implications for pedagogy and curriculum

Bahr (2015) justifiably asserts that explicit instruction in spelling “should continue through the upper grades” (p. 201); however, the results of the present study suggest that explicit instruction may need to continue beyond the upper primary school years and into high (secondary) school. Although, the Australian Curriculum for English includes spelling-related content descriptors in the high school years, greater instructional attention may need to be devoted to spelling in the first few years of high school, particularly for low-achieving spellers.

It is promising that ACARA’s Australian Curriculum for English (2014a) acknowledges the need for teachers to address aspects of morphology from as early as Year 1. Indeed, this is stipulated in one of the Year 1 curriculum content descriptors (ACELA1455), which states that students should be able to “recognise and know how to use morphemes in word families for example play in played and playing”. With this in mind, it is critical that correct manipulation of inflected words is explicitly taught through a range of modes, including speaking, reading and writing. The popular use of commercially available phonics programs and/or the adoption of rote word learning as instructional methods do not adequately address morphology. For this reason, these approaches should be treated with greater caution.
While the teaching of inflected suffixes in the early years of formal schooling is a reasonable proposition (Apel et al., 2013), the evidence from this study shows that derivational suffixes are more difficult to master, suggesting that they may need to be taught after inflected suffixes have been taught. Derivational knowledge is an important aspect of morphological instruction as it provides students with fundamental understanding of nominalisation. Indeed, instruction in nominalisation can coincide with instruction in the generalisations associated with derivational suffixes. Specifically, teaching nominalisation involves teaching students how to transform a verb or an adjective to a noun (e.g., compete to competition). In turn, understanding the foundation of nominalisation enables students to develop word consciousness and a more concise and sophisticated writing style. The teaching of etymology could also be addressed through the teaching of morphology, whereby students are assisted in identifying base words and discussing ways in which suffixes function, as described by Deacon et al. (2011) and Hutcheon et al. (2012). This type of instruction could result in greater generalisation to new words.

Students should be provided with frequent opportunities to work with increasingly complex and polysyllabic words. This is particularly crucial for low-achieving spellers as they tend to be more reluctant to read and write than high-achieving spellers. Considering the development of word-specific knowledge is known to develop gradually (Bahr et al., 2012) and that vocabulary acquisition is
unconstrained (Paris, 2005), an instructional approach to spelling which engages students in systematic inquiry of words has potential to substantially support learning in vocabulary and spelling. In turn, this undoubtedly will benefit students’ capacity for expression through writing.

Another important implication of the study is that teachers need to model the process of coordinating (cross-mapping) phonological, orthographic and morphological processes. Spelling instruction should be manifested through systematic linguistic inquiry and in the context of quality literature and authentic writing experiences; however, careful modelling and scaffolding by the teacher is crucial. Teachers need to model spelling as a problem solving process by showing students how to systematically think about words using phonological, orthographic and morphological ‘lenses’.

Table 9.1 presents a series of guiding questions which a teacher could use when modelling linguistic inquiry. Specifically, overt critical reflections of a particularly challenging word may require the teacher to think aloud by asking and responding to the following series of questions:
Table 9.1
Thinking Aloud: Questions for Modelled Inquiry

<table>
<thead>
<tr>
<th>Phonological lens</th>
<th>Guiding questions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- How many phonemes does this word have?</td>
</tr>
<tr>
<td></td>
<td>- How many syllables does this word have?</td>
</tr>
<tr>
<td></td>
<td>- How many phonemes are in each syllable?</td>
</tr>
<tr>
<td></td>
<td>- Can I segment this word or word part using onset and rhyme? How?</td>
</tr>
<tr>
<td></td>
<td>- Does this word contain common blends or digraphs?</td>
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<tr>
<td></td>
<td>- Which part/s of the word can/cannot be phonologically spelled?</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Orthographic lens</th>
<th>Guiding questions</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>- Are there any tricky trigraphs or quadgraphs? Do these patterns remind me of other words?</td>
</tr>
<tr>
<td></td>
<td>- Are there any tricky vowel patterns like diphthongs and schwa vowels? Do these remind me of other words?</td>
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<tr>
<td></td>
<td>- Can I find small words within?</td>
</tr>
<tr>
<td></td>
<td>- Are there any orthographic rules that can be applied?</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Morphological lens</th>
<th>Guiding questions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- How many morphemes does this word have?</td>
</tr>
<tr>
<td></td>
<td>- What are the morphemes?</td>
</tr>
<tr>
<td></td>
<td>- Are the morphemes bound or free?</td>
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<tr>
<td></td>
<td>- What do the morphemes mean?</td>
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<td></td>
<td>- Is the word inflected or derived from a base or root word? What is it?</td>
</tr>
<tr>
<td></td>
<td>- Is there a rule that applies to the prefix or suffix?</td>
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<tr>
<td></td>
<td>- What other words follow the same rule?</td>
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<tr>
<th>What works best?</th>
<th>Guiding questions</th>
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<tbody>
<tr>
<td></td>
<td>When spelling this word, is it better to use:</td>
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<tr>
<td></td>
<td>- Phonological thinking only? Why?</td>
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<td></td>
<td>- Phonological and orthographic thinking? Why?</td>
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<td>- Orthographic and morphological thinking? Why?</td>
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<td></td>
<td>- Phonological and morphological thinking? Why</td>
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<tr>
<td></td>
<td>- Phonological, orthographic and morphological thinking? Why?</td>
</tr>
</tbody>
</table>

*Note. Table 9.1 adapted from Daffern (2015, p. 38)*
With careful teacher modelling and scaffolding, students can build the necessary metalanguage needed to critically think and talk about their spelling and broaden their repertoire of spelling strategies. Importantly, an inquiry approach enables students to become flexible in their strategy choice and increasingly efficient in coordinating multiple linguistic processes. While explicit teaching of cross-mapping is critical, providing students with regular practice may also help students to develop increasing efficiency and autonomy in their spelling.

The study also revealed that the homophone sub-skill was the least developed aspect of spelling knowledge. As it currently stands, the Australian Curriculum for English refers to homophones in Year 4. Therefore, the teaching of homophones may occur most prominently in Year 4. This may partly explain the minimal increase observed in the homophone sub-skill of the CoST (namely, between Year 4 and Year 5 only). The implication of this finding is that homophones need to be systematically taught across all year levels. Homophones should also be explicitly documented and accounted for in the Australian Curriculum for English across all (or at least, most) of the primary school year levels, not just in Year 4.

Provision for intensive remediation in spelling is needed in the middle and upper primary school years if ACARA’s expectations of spelling acquisition are to be met. In line with the findings of Graham and Santangelo’s (2014) meta-analytic review, remediation requires an increased amount of regular and explicit instruction.
Moreover, while instruction does not need to differ on the basis of gender (Limbrick, Wheldall, & Madeleine, 2012), instruction should be informed by students’ current levels of understanding, their personal interest in particular words, and their application of conventional spelling in compositional writing.

Considering the diversity of spelling competency in a given class setting, structuring a differentiated program of instruction that is sustainable and effective can be challenging. Importantly, all students should be provided with regular opportunities to expand their individual vocabularies while engaging in phonological, orthographic and morphological thinking processes when learning to spell. Access to explicit and relevant instruction and feedback is critical. One way this could be achieved is to group students on the basis of common strategy use and/or lexical knowledge. Groups of students then cycle through activities, each time focussing on a specific component of spelling. An example is presented in Figure 9.1:
The findings of this study also have important implications for assessment. Firstly, the combined use of quantitative and qualitative data yields comprehensive insights regarding spelling acquisition. This suggests that multiple forms of assessment should be integrated into an instructional program. These may include linguistic analyses of dictated words (as in the CoST) and spelling errors recorded in students’ written compositions. In addition, conducting open-ended interviews (see, for example, Appendix H), questionnaires and/or surveys with the students are also important. Further, the CoST can be used to map student data against the median scores and percentiles that have been presented in the present study. Finally, TWFT
provides a more robust framework for spelling assessment than the categorisation of students into spelling ‘stages’ or ‘phases’.

9.4 Implications for pre-service and in-service teaching

There is clear evidence that the teacher is an important influential factor in student academic achievement (Hattie, 2009). If teachers are expected to explicitly model the processes that underlie spelling, their own knowledge of the metalanguage and processes associated with spelling is paramount. Teachers also need to understand how to linguistically analyse students’ spelling errors, and then use this feedback to inform the nature of instruction they provide to their students. Training in the use of the CoST could be a valuable starting point for in-service teachers needing such skill development.

As linguistic knowledge on the teacher’s part is critical, pre-service teacher education courses should include appropriate learning experiences, informed by current research in the area of spelling. As noted by Westwood (2013, p. 21), “most primary school teachers in Australia lack any real depth of linguistic and metalinguistic knowledge – because this type of information is rarely included in teacher education courses”. Westwood (2013, p. 21) goes on to say that “teachers’ own lack of confidence in teaching morphological principles (and with teaching spelling in general), often causes them to rely on the use of commercially published spelling programs”. Although Westwood (2013) does not substantiate such assertions with specific research evidence, his claims mirror findings from an
intervention study reported by Herrington and Macken-Horarik (2015) and from qualitative data gathered from the Australian primary school teachers in Adoniou’s (2014) study. Indeed, it was also demonstrated in the present study. Specifically, most of the teachers in the present study were not equipped with a comprehensive understanding of spelling, which may explain their inclination to rely on commercial programs that do not align with current understandings of the complex nature of learning to spell. In light of this revelation, it is clear that ongoing professional development in the area of spelling is also critical if teachers are to confidently implement evidence-based practice.

9.5 Limitations and future directions

While NAPLAN data were used in the Major Study to demonstrate predictive validity of the CoST, additional validity testing of the three subscales of the CoST, using alternative measures of phonology, orthography and morphology, would have been ideal. It needs to be noted, however, that this was not possible because suitable measures of phonological, orthographic and morphological representations of real word spelling do not currently exist. Indeed, the purpose of the Pilot Study was to address this particular measurement gap in relation to spelling. However, future research should seek to develop parallel or alternative tests for the CoST to strengthen its validity and increase its utility. In addition, relationships between the CoST subscale measures and nonword (pseudo word) measures of phonology (see, for example, Wagner et
al., 2013), orthography (see, for example, Conrad et al., 2013) and morphology (see, for example, Nunes et al., 2003), are worth examining in future studies.

The generalisability of the findings in the study is limited to mainstream schools across the ACT. It is worth noting, however, that the average ICSEA for the participating schools in the Major Study was similar to the average national ICSEA. Having declared this, the ACT broadly represents one of the highest performing jurisdictions in Australia in terms of academic achievement in school, as measured by NAPLAN. Further, as all students were able to opt out of the present study, it is possible that some potentially low-achieving spellers may have been less inclined to agree to participate in the first instance. Consequently, the achievement outcomes observed in the present study may be somewhat skewed. For example, the median performance levels in the components of spelling across Years 3 to 6, as measured by the CoST in the first research phase, may not be representative of student performances in other Australian states and/or territories. Therefore, utilising the CoST to measure spelling performance with other student populations may provide critical information needed for future developments in national curriculum and assessment regimes.

Despite the inevitable feasibility constraints in undertaking doctoral research, almost 1,400 students participated in the study, and this facilitated a comprehensive examination of spelling in the middle
and upper primary school years. Nevertheless, the sample size for this study does pose some limitations to the findings. Specifically, in the third research question of the Major Study, hierarchical regression analyses were limited by the truncated scores, particularly in the Year 6 cohort. Further, with a larger sample, the number of variables acceptable in the regression models could also be increased. For instance, in the first research question of the Major Study, a larger sample size would allow the regressions to cover a more comprehensive range of predictive factors, potentially revealing a number of other significant findings. Other factors worth exploring in future research should include measures of reading fluency, comprehension, oral language, handwriting automaticity and memory functioning. Moreover, while data gathered from a small number of students participating in Phase Two enabled a fine-grained examination of students’ spelling processing, limitations to the generalisability of the results must be acknowledged, principally because of the small sample size. In addition, during this final research phase, an examination of the spelling strategies used by the participating students was determined through linguistic error analyses of written words as well as self-reported data from the students and their teachers. It needs to be noted that although some students were unable to properly articulate the strategies used because of their limited metalanguage, a linguistic error analysis technique of students’ written words was an effective way to gain clarity regarding strategy use. Classroom observation data, in conjunction with self-
reports and linguistic error analyses, may have further validated the results.

While this study has found that learning to spell is an important part of becoming a competent writer in the middle and upper primary school years, the utilisation of Year 7 and Year 9 NAPLAN data in future research is recommended in order to determine whether spelling remains influential in the high school years, when compared to grammar and punctuation. Finally, intervention studies are also needed in order to determine the effectiveness of an instructional approach that is informed by the findings of the present study.

9.6 Concluding remarks

By employing quantitative and qualitative research methods, this doctoral research contributes to knowledge in the field of spelling acquisition in several ways. An innovative dictation-based spelling assessment tool, informed by TWFT, has been developed and tested. Crucially, the development of the CoST paves the way for further investigation, not just in the area of spelling, but in other aspects of literacy learning. Additionally, it offers educators with a valid and reliable measure of spelling competency for use in school contexts. This study has also established that learning to spell in the middle and upper primary school years is an important part of learning to write in contemporary times. Moreover, while ‘stage’ and ‘phase’ theories of spelling development have been contested by seminal researchers,
this study is pivotal in the evidence it provides. Specifically, the findings of this study support the view that spelling knowledge does not proceed in developmental stages. If it did, then it would be expected that high-achieving spellers would have completely mastered phonological and orthographic skills before grasping any morphological skills.

Instructional influences and students’ experiences with language and literature appear to be among the influential factors in learning to spell. Importantly, a fine-grained understanding of the linguistic complexities underlying spelling acquisition, as presented in this study, is critical for effective pedagogy. In essence, the insights gained from this research enable educators to provide systematic and explicit instruction in the linguistic processes and skills associated with Standard English spelling.

The importance of spelling in pedagogy, educational policy development and research should not be underestimated. Too often, it has been assumed by educators of English that spelling is a lower-order mechanical skill that can be learned through rote memory and endless testing of words (Herrington & Macken-Horarik, 2015). This research has demonstrated that while proficiency in spelling does significantly influence compositional writing, it is a complex higher-order word formation process that demands systematic and explicit instruction.
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