Literacy and social disadvantage: An evaluation of research-based literacy interventions for low-progress readers in a school with high levels of socioeconomic disadvantage

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Requirements and Format of a Thesis by Publication at Macquarie University

This statement provides an overview of the requirements and format of a thesis by publication, in relation to University and Departmental requisites.

A thesis by publication must form a distinct contribution to knowledge either by the discovery of new facts or by the exercise of independent critical power. The thesis as a whole should be focused on a single project or set of related questions and should present an integrated body of work, reflecting a coherent program of research.

The basic structure of a thesis by publication is as follows:

- An introduction providing a coherent overview of the background of the thesis, the research questions and the structure and organisation of the remaining chapters. The distinct contribution should be clearly identified.
- A number of chapters each written in the format of self-contained journal articles. These chapters should be published, in press or submitted. Where articles are published, they do not need to be reformatted for inclusion in the thesis. Each chapter should be prefaced by a brief introduction outlining how the chapter fits into the program of research and, in the case of jointly authored chapters, the student's contribution should be clearly specified.
- The final chapter should provide an integrative conclusion, drawing together all the work described in the other parts of the thesis and relating this back to the issues raised in the Introduction.

The length for a thesis completed at the Macquarie University Special Education Centre should generally be 50,000-75,000 words for a Doctorate and 25,000-40,000 words for a Master of Philosophy.

Abstract

This thesis has three main components. First, a literature review investigating the links between socioeconomic disadvantage and literacy, published in two parts. Part I looks at the early (prior to school) years and finds that the relationship between socioeconomic status and literacy is largely due to proximal factors associated with social disadvantage, including the quality of the early home learning environment and parenting practices. Part II focuses on the school years, finding that literacy gaps associated with socioeconomic status are mediated by other factors at both the individual level and, more powerfully, at the school level. This includes quality of literacy instruction. Second, results of experimental studies of school-based reading intervention trials are reported in four papers. Two papers report the results of randomised control trials of two small group interventions — one for young struggling readers (MiniLit) and one for older low-progress readers (MultiLit). Both found especially strong effects on measures of phonological recoding. Follow up studies of participants in these trials are also reported in two papers, which compare the responses to the intervention in the two phases. A fifth paper provides a case study of the implementation of the trials in the context of the participating school. A discussion chapter synthesises the findings of the literature reviews and the experimental studies, and draws conclusions for research and practice. Finally, a paper is included that argues that the literacy gap associated with socioeconomic status can be ameliorated with good instruction and intervention, and that these are still lacking in many schools due to inadequate teacher preparation and misguided policy.

Statement of Candidate

I certify that the work in this thesis 'Literacy and social disadvantage: An evaluation of research-based literacy interventions for low-progress readers in a school with high levels of socioeconomic disadvantage' has not been previously submitted for a degree nor has it been submitted as part of requirements for a degree to any university or institution other than Macquarie University.

I also certify that I have written the thesis and it is an original piece of research. This dissertation contains jointly-authored papers written with my doctoral supervisors, Professor Kevin Wheldall and Dr Robyn Beaman-Wheldall. In the literature reviews and policy paper, I took the lead in writing, with contributions and revisions to subsequent drafts made by my supervisors. In the research papers, my co-authors provided advice in research methodology and implementation, and assisted with statistical analysis.

In addition, I certify that all information sources and literature used are indicated in the chapters that make up this thesis.

The research presented in this thesis was approved by the Macquarie University Human Research Ethics Committee (HREC) and the NSW State Education Research Approval Process (SERAP). The relevant reference numbers are listed below.

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Amendment to protocol (extension of project for three school terms, revised information and consent forms) approved on April 8, 2011.

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Jennifer Buckingham (41986733)

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CHAPTER 1 – Introduction

Publication status: NOT FOR PUBLICATION

Chapter 1 – Introduction

All English-speaking countries, including Australia, have a large number of children with literacy levels considered to be minimal or below minimal. In the most recent Progress in Reading Literacy Study (PIRLS), Australia had one of the highest proportions (24%) among English-speaking countries of Year 4 students with literacy proficiency at or below the low international benchmark, a proportion exceeded only by New Zealand (Thomson et al., 2012).

Low literacy is not evenly distributed across the population. National and international assessments, along with hundreds of research studies, have consistently shown that children from low socioeconomic backgrounds are over-represented among students with the lowest levels of literacy (Australian Curriculum, Assessment and Reporting Authority, 2012; D'Angiulli, Siegel, & Hertzman, 2004; Thomson et al., 2012; Sirin, 2005). A positive relationship between literacy and socioeconomic status is evident from preschool to senior secondary school.

The statistical relationship between literacy and socioeconomic status is persistent but not deterministic. Children from socioeconomically disadvantaged backgrounds, that is, with low household income, low parent education levels and low parent occupational status, are more likely to have lower levels of literacy but are not destined to this outcome. This suggests, and research supports, the theory that socioeconomic status is a proxy for other, associated factors that more directly impact on literacy development, such as the home learning environment, health, and school attendance (Milne & Plourde, 2006; Rothstein, 2010).

Acknowledging the influence of socioeconomic status on literacy development does not absolve educators from their responsibility to ensure that all children who can learn to read, do learn to read, and at the highest possible levels of attainment. Rather, through identifying the factors involved and targeting those that are most amenable to intervention, the goal of reducing the influence of socioeconomic status on literacy is more likely to be achieved.

The quality of initial and remedial literacy instruction are among the most salient factors in literacy acquisition during the years of formal education (NICHHD, 2000; DEST, 2005). Effective evidence-based initial reading instruction is important for successful early reading acquisition for all students, but is especially important for children at risk of reading difficulties, including children from low socioeconomic backgrounds (Lyon, Shaywitz, Shaywitz, & Chhabra, 2005; Taylor et al., 2010). Some children will struggle to learn to read even with high quality initial reading instruction, however (Torgesen, 2000). For these children, effective remedial reading intervention is crucial if they are to make sufficient progress (Slavin, Lake, Davis, & Madden, 2011).

If reading difficulties are identified and remediated in the early years of school, their effects can be minimised more readily (Rose, 2006). Most formal reading intervention programs are targeted at children in the first few years of school. Yet some children will require reading intervention in the later years of school, whether because they did not receive early intervention, or their reading difficulties became apparent later, or because they have more serious difficulties that require consistent support (Slavin, Cheung, Groff, & Lake, 2008; Tunmer, 2008). Few formal intervention programs are aimed at upper primary and secondary students (Louden et al., 2000; van Kraayenoord, 2010). In some schools this may be due to cost constraints. There is, therefore, a need to develop intervention programs that are both effective and cost-effective.

A Response-to-Intervention (RtI) model of assessment and instruction helps schools to more efficiently identify and intervene with struggling readers (Gersten, 2009). In a three-tier RtI model, students who are not making good progress in class (Tier 1) are initially given support in a small group intervention program (Tier 2). Students who continue to struggle are provided with specialist, one-to-one instruction (Tier 3). This approach allows more children with slow reading progress to receive instructional support, reserving the highest intensity of intervention for students with the most serious reading difficulties (Wheldall, 2011). Effective, evidence-based Tier 2 intervention programs would offer schools a means to help more struggling and low-progress readers in all years. This is particularly important for schools with high proportions of socioeconomically disadvantaged students, which have larger numbers of students at risk of reading difficulties.

The aims of this thesis are to investigate the research literature on the nature of the relationship between literacy and socioeconomic status, and to experimentally evaluate the potential for small group reading interventions to accelerate the reading skills of struggling and low-progress readers in a school with high proportions of socioeconomically disadvantaged students. In addition, the thesis discusses the implications of these findings for the successful implementation of school-based reading interventions and education policy more broadly.

With these objectives, the research questions investigated were:

1. Which factors mediate the relationship between socioeconomic status and literacy among children in the years prior to, and after, the commencement of formal schooling identified in the research literature?
2. Does an evidence-based small group intervention for young struggling readers ('MiniLit') accelerate their reading skills, and which ones?
3. Does an evidence-based small group intervention for older low-progress readers ('MultiLit') accelerate their reading skills, and which ones?
4. What are the factors that influence the effectiveness of school-based reading intervention programs?

5. Why do so many students struggle with reading after three or more years of formal schooling when the scientific research literature on effective instruction and intervention is robust?

The structure of the thesis

This thesis is presented as a series of journal articles. Five of the articles have been published in peer-reviewed journals, another articles is in press, and one more article has been submitted. These articles, written as stand-alone documents, comprise the major chapters of the thesis. Each is prefaced by a title page stating the publication status of the article and a short 'linking' piece explaining the function of the article in addressing the specific research questions and the overall objectives of the thesis. There is also a chapter (not intended for publication) written as a case study, describing the context and implementation of the experimental studies, and a concluding chapter. As each of the journal articles is self-contained, there may be some repetition of information. References are at the end of each chapter and may contain duplications for the same reason.

For the most part, this thesis is formatted according to the guidelines in the American Psychological Association's Publication Manual (6^{th} edition, 2009). The exceptions are Chapter 2, for which publication required the Chicago Manual of Style (16^{th} edition) (University of Chicago, 2010), and Chapter 10, for which publication required endnotes in the journal's customised style.

This dissertation has three main components. First, a literature review investigating the links between socioeconomic disadvantage and literacy, published in two parts. Part I looks at the early (prior to school) years and finds that although poverty has a small independent association with literacy, particularly when it is persistent, the relationship between socioeconomic status and literacy is largely due to proximal factors associated with social disadvantage. These factors include the quality of the early home learning environment and parenting practices that encourage literacy and language. Part II focuses on the school years, finding that literacy gaps associated with socioeconomic status are again mediated by proximal factors at both the individual level and, more powerfully, at the school level. This includes quality of literacy instruction.

The second component of the dissertation reports the results of experimental studies of school-based reading intervention trials, in four separate papers. Two papers report on a randomised control trial of a small group (Tier 2) intervention for young struggling readers ('MiniLit'). The first MiniLit paper reports the findings of the initial implementation of the intervention with the full sample of participants. The second MiniLit paper reports the findings of a cross-over trial of two implementations of the intervention with a smaller sample. Two papers report on a randomised control trial of a small group intervention for older low-progress readers ('MultiLit'). As with the MiniLit study, the first MultiLit paper reports the findings of the initial implementation of the intervention with the full sample of participants. The second MultiLit paper reports the findings of a cross-over trial of two implementations of the intervention with a smaller sample. A fifth paper describes the school environment in which the trials took place and the insights they provided about school-based research and intervention.

Third, a paper is included that discusses the implications for policy and practice. It finds that despite what is known about the importance of effective reading instruction and intervention, and its crucial role in closing the literacy gap associated with social disadvantage, it is still lacking in many schools, and traces the reasons why this is the case.

Each of the chapters/articles in this dissertation provides a response to one or more of the research questions. It is hoped that, individually and in sum, they offer useful information for researchers, educators and policy-makers. It is further hoped that the findings of the experimental evaluations will influence decisions about effective literacy practices in schools, particularly for children with reading difficulties, and in some way contribute to mitigating the translation of social disadvantage into educational disadvantage.

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CHAPTER 2 – Literature Review I

Why poor children are more likely to become poor readers: The early years

Publication status: PUBLISHED

Buckingham, J., Beaman, R., & Wheldall, K. (2013). 'Why poor children are more likely to become poor readers: The early years'. *Educational Review*, online first, doi: 10.1080/00131911.2013.795129

Preface to Chapter 2: 'Why poor children are more likely to become poor readers: The early years'.

Although the statistical relationship between socioeconomic status and literacy is well-established, it is not without controversy. Research studies generally find that the influence of an individual's socioeconomic status on educational outcomes, including literacy, diminishes when other factors are taken into account (Marks, 2006; Philips & Lonigan, 2009; Zadeh, Farnia, & Ungerleider, 2010). Some people have argued that this demonstrates that low socioeconomic status should not be seen as a disadvantage to educational achievement and is therefore not a justifiable priority for educators and policy-makers (Donnelly, 2013).

Another interpretation is that the existence of mediating variables in the relationship between socioeconomic status and literacy explains the mechanism by which socioeconomic status affects literacy, rather than dismissing its influence (Lubienski & Crane, 2010). By identifying the factors associated with low socioeconomic status that are more directly influential on children's literacy development, it should be possible to more effectively target the causes of low literacy. This was the objective of the literature review conducted for this thesis.

The original intention was to write a single literature review canvassing the research on the effect of socioeconomic status on literacy development. In the course of scanning, reading and synthesising the thousands of articles yielded by a search of education and psychology databases, two things became apparent. First, different factors were implicated in the relationship between socioeconomic status and literacy development at different stages of children's lives. There was a delineation in the literature between early (prior to school) literacy development, and school-age literacy development. Second, the published literature was too large to adequately cover both stages of development in one paper. The review revealed that the literacy gap associated with socioeconomic status is evident before children begin school, and is a strong factor in their subsequent reading achievement. It was decided that the literature on early literacy development was too extensive and too important to briefly summarise in one article and required a separate paper. This paper became the first published literature review.

Several aspects of the review make it an original and, hopefully, useful contribution to the published literature. As noted, it provides a discrete treatment of early literacy development, allowing the differential impacts of the various aspects of socioeconomic disadvantage in different stages of development to be shown more clearly. The review covers a range of factors, but the articles included are limited to large-scale surveys and quantitative studies of English-speaking children.

One of the most important aspects of the early literacy review is the finding of a number of studies that specific literacy skills were associated with different features of the home learning environment. In these studies, phonological and code-related skills were related to parents actively teaching their children about letters, sounds, and print (eg. Hindman & Morrison, 2012). Vocabulary and oral language were more closely related to 'passive' language and literacy activities like shared reading and talking (eg. Bracken & Fischel, 2008).

These findings are then discussed in the framework of the 'simple view' of reading and Wheldall's model of reading deficit (Gough & Tunmer, 1986; Pogorzelski & Wheldall, 2005). Children from socioeconomically disadvantaged families are more likely to begin school with deficits in both of the key emergent literacy skills — phonological awareness and oral language — that are the foundations of reading (Henning, McIntosh, Arnott, & Dodd, 2010; Farkas & Beron, 2004). Improving the experiences of children at home is ideal, but difficult to achieve. It is therefore crucial that these children have the opportunity for language enrichment at preschool and receive high quality initial instruction at school that explicitly addresses both components of literacy if they are to learn to read successfully.

Statement of candidate's contribution: This paper is co-authored with my doctoral supervisors. I took the lead in writing, with contributions and revisions to subsequent drafts made by my supervisors.

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Why poor children are more likely to become poor readers: the early years

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Gaps in literacy ability between children from different socio-economic backgrounds are evident before formal schooling begins. Low income makes a minor contribution. Socio-economic status exerts its influence on early literacy primarily through its association with other factors. Children from disadvantaged families are less likely to have experiences that encourage the development of fundamental skills for reading acquisition, specifically phonological awareness, vocabulary and oral language. These skills underlie the cognitive processes in the "simple view" of reading – word identification and language comprehension. Low quality early home literacy environments suppress children's genetic potential, increasing the risk a child will struggle to learn to read. In addition, children from low socio-economic status backgrounds are more likely to have infant health outcomes associated with cognitive impairments, such as preterm birth and low birth weight, and are less likely to attend preschool. The risk factors associated with the failure to develop early literacy skills are cumulative and interactive. This literature review describes a predictive pathway between social disadvantage and poor early literacy.

Keywords: socio-economic status; early literacy; home learning environment; phonological awareness; preschool

The relationship between socio-economic disadvantage and poor reading ability is one of the most enduring problems in education. Socio-economic disadvantage is a relative concept referring to low socio-economic status, which is usually defined by income, occupation, education, or any combination of these.

Studies consistently show that socio-economic status is positively related to literacy, from emergent literacy up to the commencement of formal schooling (Molfese, Modglin, and Molfese 2003; Smart et al. 2008), through primary/elementary school (Feinstein and Bynner 2004; Hecht et al. 2000; Kieffer 2010; Lubienski and Crane 2010) and into high school (Organisation for Economic Cooperation and Development 2010). Literacy gaps associated with socio-economic status are evident when children start their school education. In the 2009 Australian Early Development Index survey, which assesses children at the beginning of their first year of school, 13.9% of children in the lowest socio-economic quintile were assessed as being developmentally vulnerable in the language and cognitive skills domain, compared with only 4.7% of children in the highest socio-economic quintile (Centre for Community Child Health and Telethon Institute for Child Health Research 2009).

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A child's socio-economic status is represented by that of their parents. Usually, socio-economic status is a composite variable or index of relative socio-economic advantage/disadvantage with three components – household income, parent occupation, and parent education, each of which has been found to correlate significantly with literacy. In some studies, however, just one or two of these components have been used as a measure of socio-economic status (Sirin 2005).

Low socio-economic status families are typically low income families. The measurement and definition of poverty is contentious. In first world countries, there is debate about whether poverty is relative or absolute, and whether its effects have as much to do with social exclusion as material deprivation. This paper looks at the risk of poor literacy associated with socio-economic disadvantage, which is by nature a relative concept. Although poverty has in some studies been found to have a small, significant independent relationship with cognitive development and literacy (Blanden and Gregg 2004), particularly if it is persistent (McLoyd 1998; Dickerson and Popli 2012), it is rarely the most significant factor.

Of the three measures that comprise the tripartite index of socio-economic status, most research indicates that parent education has the strongest correlation (Cheadle 2008; Downer and Pianta 2006; Marks, Cresswell, and Ainley 2006; Marks 2008; The Sutton Trust 2010). The studies do not establish direct, causal relationships between aspects of socio-economic status – household income, parent education, parent occupation – and reading ability, which are distal factors. It is becoming clear that socio-economic status is a construct that acts as a proxy for other variables which are more likely to directly affect children's cognitive and aca-demic development, such as the quality of the home learning environment (HLE)(Senechal and LeFevre 2002; Taylor, Clayton, and Rowley 2004; Mol and Bus 2011), children's physical health and wellbeing (Malacova et al. 2009; Rothstein 2010), and motivations and attitudes to reading (Cunningham 2008; Petscher 2010). Family income and material resources explain a relatively small unique proportion of the variance (Blanden and Gregg 2004; Fergusson, Horwood, and Boden 2008; Marks et al. 2006). Even so, these relationships are associative or predictive, not necessarily causal (Snow, Burns, and Griffin 1998). The multi-layered complexity of the relationship between socio-economic status and literacy helps to explain why it has been so persistent over time and so resistant to efforts to reduce its impact.

This literature review outlines the research evidence on the main factors that interact with, or mediate, the relationship socio-economic disadvantage has with literacy ability and achievement in the years prior to and the first few years of school. An initial literature search of online databases (A+ Education, Cambridge Journals Online, Education Research Complete, ERIC and PsycLit) using various combina-tions of the search terms "socio-economic", "disadvantage", "poverty", "literacy", and "reading" yielded several thousand citations, even after limiting the search to articles published from 2000. A general Internet Google search was also conducted. Titles and abstracts of all citations were scanned for relevance. Quantitative studies, meta-analyses and literature reviews of English-speaking subjects were selected. In the next stage of the literature search, the selected articles were read and classified according to their major findings, and their reference lists used to source any major or influential studies published prior to 2000. Where there were perceived to be gaps in the literature (for example, health), specific searches of the same online databases were conducted. Several factors were represented most strongly in the lit-erature, both in terms of the extent and the strength of the research evidence, and these became the focus of the review. It also became clear that the literature could be separated into two studies – the years prior to school (the focus of this paper) and the school years (a subsequent paper, under review). The major factors emanat-ing from the literature search and review were gene–environment interactions, the early HLE and its effect on key early literacy skills (phonological awareness and oral language competence, especially vocabulary), and preschool attendance and quality. As there is a very strong socio-economic gradient to child health, it was expected that the research literature would show health as a mediating factor for early literacy development. Although our search did not find good evidence of this link to literacy specifically, child health is included in this review in order to address what is a widely-held assumption.

This literature review contributes to the existing extensive literature on early literacy by including recent studies of the factors influencing literacy development and describing and analysing the findings in the context of socio-economic status. It then explains how the research supports reading development theory, namely the simple view of reading.

Genetic and environmental interactions in reading ability

Although it is consistent, the statistical association between individual socio-economic status and literacy is not simple. There is growing evidence of a non-linear relationship between socio-economic status and reading, whereby disadvantaged environments impact more heavily on some children than others. Children who are genetically predisposed to language and literacy problems are more vulnerable to the effects of a disadvantaged home life, especially in early childhood. In addition, there are a number of factors which mediate the impact of socio-economic status on literacy development and reading achievement.

There is substantial evidence that reading disorders and individual differences within the normal range of reading ability among children are moderately to strongly genetic or "heritable" (Astrom et al. 2011; Byrne et al. 2008; Gayan and Olson 2001, 2003; Hayiou-Thomas et al. 2010; McGrath et al. 2007; Olson 2006; Soden-Hensler, Taylor, and Schatschneider 2012; Taylor and Schatschneider 2010). Estimates of heritability derived from twin studies range from 30% to 60%, depending on the literacy measure. Print awareness and letter naming are typically found to have a smaller genetic component than phonological awareness and decoding (Soden-Hensler, Taylor, and Schatschneider 2012). The remainder of the variance in reading ability is associated with a range of factors in the child's home and school environment (Berliner 2005; Guo and Stearns 2002; Rowe, Jacobson, and Van den Oord 1999; Samuelsson et al. 2008; Taylor et al 2010).

There is also growing evidence that the influence of genetic and environmental factors on reading ability is not simply additive or cumulative, and is not present in the same proportions for all children. Rather, research indicates that genetic factors represent the potential of an individual; the extent to which this potential is actualised depends on the environmental circumstances. In one paradigm of interactions between genes and environment, generally referred to as the "bioecological" model of development (Bronfenbrenner and Ceci 1994), a child's genetic potential for developing competence is amplified in advantaged environments and suppressed in disadvantaged environments (Turkheimer et al. 2003). Another model of gene–environment interactions, known as the "diathesis-stress" model, predicts that genetic influence will instead be stronger in disadvantaged environments (Pennington et al. 2009; Rutter, Moffitt, and Caspi 2006).

The majority of studies of gene–environment interactions in reading ability support the bioecological model (McGrath et al. 2007). Many of these are twin studies which allow comparisons between children with and without shared genetic markers – identical twins, fraternal twins, siblings, and unrelated children living in the same home – but similar shared environmental influences (e.g. Olson 2006; Friend, DeFries, and Olson 2008; Taylor and Schatschneider 2010). These studies have consistently found that environment accounts for larger proportions of variance in reading ability in disadvantaged than advantaged families, and that genetic influences account for larger proportions of variance in reading ability in advantaged families than in disadvantaged families. This gene–environment interaction has been found in early literacy for:

- speech, language and pre-literacy skills in five to seven year olds with speech-language disorders, where four environmental factors studied (including early home literacy environment and parental characteristics) showed interactions supporting the bioecological model, compared with one factor (incidence of otitis media) which supported the diathesis-stress model (McGrath et al. 2007).
- phonological awareness and word reading in five to seven year olds, where no gene-environment interactions were observed for pre-literacy skills in kindergarten children but significant differences in genetic influence were found in early literacy skills of Year 1 children. Heritability of reading skills was significantly higher among children from middle and high income families, while environmental influence on reading skills was higher for children from low income families (Taylor and Schatschneider 2010).

When children reach school age, their home is not the only environmental factor influencing reading development. In a study of twin children from Australia, the United States, Norway and Sweden, Samuelsson et al. (2008) found an interactive relationship between heritability and intensity of early reading instruction at school that supports the bioecological model. Genetic influences on reading ability were stronger where children had received more intensive reading instruction, and environmental influences were stronger when reading instruction had not commenced or was less intensive. Similarly, Taylor et al. (2010, 514) found that the genetic influence on reading ability in first and second graders was a function of the quality of teaching: "When teacher quality is very low, genetic variance is constricted, whereas, when teacher quality is very high, genetic variance blooms".

The implications of this evidence are striking. Although a moderate proportion of a child's reading skill is genetically pre-determined, environmental factors have a strong impact on children's reading development, especially for children whose home lives are characterised by socio-economic disadvantage. These children are less likely to achieve to their genetic potential, as environmental factors impede their development, while their more advantaged peers tend to be limited only by their innate ability.

Wheldall (Pogorzelski and Wheldall 2005; Wheldall 2009) has proposed a two-factor model for reading disability. He suggests that the likelihood a child will have a reading deficit is dependent on the quality of the language learning environment (or "QLLE", which includes both socio-economic background and access to effective reading instruction) and their phonological ability, which has a genetic component. These two factors interact so that a child who is disadvantaged in both QLLE and phonological ability will have a high probability of a severe reading deficit, while children who are disadvantaged in only one of these factors will have a lower level of risk and/or severity of reading problems.

Phonological awareness, oral language ability and vocabulary knowledge: the importance of the early (prior to school age) HLE

The foundations of literacy – phonological awareness, oral language and vocabulary – begin to develop in the early years of life, before children begin formal reading instruction at school (Carroll et al. 2011; Durham et al. 2007; Snow, Burns, and Griffin, 1998). The experiences and environment of children during the early years of their life have a measurable effect on their literacy skills before they reach the classroom. During these early years, a child's home and parents are the main agents of influence. The general finding that family socio-economic status has a moderate association with these emergent literacy skills confirms that factors other than socio-economic characteristics are at play. Numerous studies have found that the impact of socio-economic status on emergent and early literacy skills is partly mediated by the quality of the early HLE (Park 2008; Zadeh, Farnia, and Ungerleider 2010; Washbrook and Waldfogel 2011).

Broadly defined, early HLE is a measure of the availability of literacy resources in the home, cultural enrichment, and reading-related parenting practices during the years zero to five. The way in which the early HLE impacts on the acquisition and development of literacy skills exemplifies the complexity of the relationship between socio-economic status and reading. The research points to a multi-layered interaction between distal factors (income, parent education), proximal factors (quality of the early HLE) and the particular literacy skills being measured. Lower socio-economic status households tend to have lower quality HLEs and this in turn has a significant effect on literacy development (Cheadle 2008; Park 2008; Son and Morrison 2010; Whitehurst and Lonigan 1998). For example, the Longitudinal Study of Australian Children found that the frequency with which parents read to their children varied with parental education level. Sixty two per cent of children with a parent with tertiary education were read to every day, compared with 28% of children whose parents had not completed school (Australian Institute of Family Studies 2011).

The relationship between socio-economic status and early HLE is not perfect, however; wide variations have been found in early HLE quality between households with similar socio-economic characteristics (Bracken and Fischel 2008; Chazan-Cohen et al. 2009; Milne and Plourde 2006). Low income and medium-high income families each demonstrate a range of literacy-related practices, including those that would be considered high quality (Australian Institute of Family Studies 2011; Phillips and Lonigan 2009; Son and Morrison 2010; Rodriguez and Tamis-LeMonda 2011); that is, providing a home environment conducive to literacy development is not just to do with "who parents are" but also "what parents do" (Taylor, Clayton, and Rowley 2004).

Complicating the relationship between socio-economic status, early HLE and literacy are research findings that a high quality HLE is not as simple as just reading to children, which may explain some of the equivocal findings on early HLE and literacy where aspects of the HLE are not well-defined. A review by Snow, Burns, and Griffin (1998) concluded that the strength of the overall association between early HLE and literacy achievement is "modest". Several later studies also provided significant but not strong correlations between HLE and literacy (Foster et al. 2005; Molfese, Modglin, and Molfese 2003; Park 2008). It is important to note, though, that these studies used broad or composite measures of HLE and literacy.

In contrast, Whitehurst and Lonigan (1998) looked at specific aspects of early HLE and specific literacy skills, finding evidence that some components of the HLE are related more strongly to the acquisition of certain literacy skills than others. Subsequent research building upon the work of Whitehurst and Lonigan has concentrated on the specificity of links between early HLE and literacy, focussing on different aspects of the HLE (Kirby and Hogan 2008; Yeung, Linver, and Brooks-Gunn 2002; Son and Morrison 2010; Zadeh, Farnia, and Ungerleider 2010), different types of literacy skills (Downer and Pianta 2006; Rodriguez and Tamis-LeMonda 2011; Whitehurst and Lonigan 1998), or the connections between the two (Burgess, Hecht, and Lonigan 2002; Hume, Lonigan, and McQueen, 2012; Philips and Lonigan 2009; Senechal et al. 1998; Senechal and LeFevre 2002).

Whitehurst and Lonigan (1998) proposed an "inside-out" and "outside-in" typology of literacy skills. The "inside-out" skills domain includes phonological awareness and letter knowledge, while the "outside-in" skills domain includes vocabulary and conceptual knowledge of print. They also proposed that these two literacy skill domains are acquired differentially through different aspects of the HLE. Storch and Whitehurst (2001) refined this thesis further in their literature review, finding that shared reading activities and exposure to books in the early years enhanced oral language and vocabulary (outside-in) skills but not word-letter knowledge or phonological (inside-out) skills. Children's word-letter knowledge at age four was associated with their parents having taught them explicitly about print and the alphabet.

HLE is commonly conceptualised in the research literature as having two main components, described as informal and formal (Senechal and LeFevre 2002) or passive and active (Burgess, Hecht, and Lonigan 2002; Grieshaber et al. 2012). Informal/passive HLE usually includes children's access to literacy materials such as books and educational toys, literacy-related activities such as library and museum visits, and shared book reading with parents. Cheadle (2008) describes these passive or informal activities as "concerted cultivation". Formal/active HLE usually includes parents' direct teaching of letters, sounds and print concepts to their children.

As a general rule, studies which distinguish between the different domains of early literacy skills and their relationship to components of early HLE support Senechal and LeFevre's (2002, 445) contention that "the various pathways that lead to fluent reading have their roots in different aspects of children's early experiences". Higher levels of informal/passive early HLE significantly predict higher emergent literacy skills in vocabulary, oral language ability and receptive language, but not phonological awareness or word-letter knowledge (Baroody and Diamond 2012; Bracken and Fischel 2008; Kirby and Hogan 2008; Senechal and LeFevre 2002; Senechal et al. 1998). Children's phonological awareness and word-letter knowledge are instead predicted by higher levels of active/formal early HLE (Burgess, Hecht, and Lonigan 2002; Evans, Shaw, and Bell 2000; Hindman and Morrison 2012; Kirby and Hogan 2008; Son and Morrison 2010; Zadeh, Farnia, and Ungerleider 2010).

Many studies of early HLE and emergent literacy skills are longitudinal studies which assess children's reading ability again when they reach school age. They indicate that children's emergent literacy skills significantly predict reading test scores in later years (Claessens, Duncan, and Engel 2009; Downer and Pianta 2006; Evans, Shaw, and Bell 2000; La Paro and Pianta 2000; Rodriguez and Tamis-LeMonda 2011; Senechal and LeFevre 2002) reinforcing the importance of home environments conducive to early literacy development on reading achievement.

Phonological awareness

The term phonological awareness refers to the understanding that spoken language is made up of a stream of distinguishable sounds. Phonological awareness encompasses a broad set of skills including the ability to identify words, rhymes, syllables and sounds in speech. The smallest unit of sound in speech is called a phoneme, and the specific skill of identifying and manipulating phonemes in words is called phonemic awareness (Stanovich 1986). Phonological awareness development is closely intertwined with the development of other oral language competencies in the preschool years as a result of verbal interactions with parents and other adults (Snow, Burns, and Griffin 1998). Some researchers argue, however, that the specific sub-set of skills that comprise phonemic awareness often do not develop spontaneously and incidentally in the course of language acquisition, and children must be taught these skills explicitly if they are to successfully make the transition to phonological decoding of words in print (Carroll et al. 2011; Ehri et al. 2001; Snow, Burns, and Griffin 1998).

A large body of research shows that phonological awareness is a powerful predictor of reading ability (Duff and Clarke 2011; Hayiou-Thomas et al. 2010; Melby-Lervag, Halaas Lyster, and Hulme 2012; National Institute of Child Health and Human Development 2000; Oakhill and Cain 2012; Rose 2006; Stanovich 1986). Castles and Coltheart (2004, 79) point out that the evidence is correlational not causal but acknowledge that the relationship between "performance on phonological awareness tasks and reading ability is undisputed". Poor phonological awareness is characteristic of most poor readers, sometimes compounded by other language deficits such as low vocabulary (Lonigan 2006). Despite this strong connection, phonological training provided to children in the preschool years has had mixed results. Trials of phonological training programmes with young children have tended to result in significant positive effects on phonological awareness skills in the short term, but have not always translated into superior reading ability one or two years later (Hagans-Murillo 2001; Nancollis, Lawrie, and Dodd 2005; O'Connor et al. 2009; Whitehurst et al. 1999). Phonological awareness programmes which did yield medium-term benefits for reading were those which included instruction in phonemic awareness and alphabetic knowledge, indicating that making the connection to single sounds and print are crucial (Byrne and Fielding-Barnsley 1995; Ryder, Tunmer, and Greaney 2008; Duff and Clarke 2011). This seems to support the theory that knowledge of letters in print is a third factor in the relationship between phonological awareness and reading (Castles and Coltheart 2004). Further to this, phonological awareness, like vocabulary, seems to have a reciprocal relationship with reading ability – each reinforces and improves the other (Duff and

Clarke 2011; Snow, Burns, and Griffin 1998; Stanovich 1986). Stanovich (1986) contends however that phonological awareness is developmentally limited; that it is only salient in early individual differences in reading ability, while vocabulary has a continuous reciprocal relationship with reading.

Given the strong relationship between phonological and especially phonemic awareness and reading (Ehri et al. 2001; Hatcher, Hulme, and Snowling 2004), socio-economic differences in these skills may explain the literacy gap. Few studies of phonological or phonemic awareness have directly investigated their association with socio-economic status, but those which include socio-economic status as a factor find that phonological awareness is lower among children from low socio-economic backgrounds, (Henning et al. 2010; McDowell, Lonigan, and Goldstein 2007), and that phonological awareness significantly mediates the association between socio-economic status and reading attainment in preschool and the early years of school (Bowey 1995; Hecht et al. 2000; Noble, Farah, and McCandliss 2006). Again, though, the relationship seems to be neither simple nor direct. Gayan and Olson 2001, 2003 and Taylor and Schatschneider (2010) found relatively small home environmental effects on phonological awareness, with a moderate to strong genetic component, while Noble, Farah, and McCandliss (2006) also found gene–environment interactions. Together, these findings suggest that a child's phonological awareness is largely genetically influenced but that the extent to which these skills develop is determined by the environment in which they live. Socio-economic disadvantage (independently, and via its associated factors) contributes significantly but not as strongly as genetic variation to individual differences in phonological awareness, which then impacts on reading ability.

Vocabulary and oral language

Vocabulary and oral language competence are also among the key pre-literacy skills that have been identified in research as being significantly predictive of early and later reading success (Carroll et al. 2011; Hayiou-Thomas et al. 2010; Lee 2011; NICHD 2000). Receptive vocabulary, expressive vocabulary and broader oral language competencies at school entry (such as semantics, grammar and syntax) have each been shown repeatedly to have direct and indirect relationships with reading ability in the first two to four years of school (Durham et al. 2007; Harrison et al. 2009; Hart and Risley 2003; Hayiou-Thomas et al. 2010; NICHD 2005). There is also some evidence that the expressive vocabulary of children as young as two years old is predictive of their language and reading skills up to Grade 5 (Lee 2011), and that the predictive power of vocabulary growth at age three extends to children at the age of 13 years (Farkas and Beron 2004).

While the relationship between oral language (including vocabulary) and reading is quite clear, particularly the correlation between vocabulary and comprehension (Hart and Risley 2003; Snow, Burns, and Griffin 1998; Rose 2006), there is still uncertainty about the mechanism by which oral language is associated with early reading ability. Some studies find a direct link between oral language com-petence and reading ability (Carroll et al. 2011; NICHD 2005), while others find that oral language is associated with early reading mainly through phonological awareness and code-related skills, and has no independent effect (Storch and Whitehurst 2001, 2002).

Differences in the oral language competence of children from different socio-economic backgrounds have been found consistently in research (Farkas and Beron 2004; Hart and Risley 2003; Locke, Ginsborg, and Peers 2002; NICHD 2005; Washbrook and Waldfogel 2011). These findings point to vocabulary deficit in particular as playing a key role in the transmission of socio-economic disadvantage into educational disadvantage, and show that this process begins at a very early age.

Hart and Risley (2003) observed and recorded the verbal interactions between parents and children. At age three, children in welfare-dependent families used an average of 167 *different* words per hour, compared with 251 words in working-class families and 382 words in professional families. Vocabulary size and growth rate at three years old significantly predicted receptive vocabulary and language development when the children were in Grade 3 at school. Hart and Risley argue that differences in oral language competency associated with socio-economic status are largely explained by the different early language experiences of children in different socio-economic circumstances. Children in welfare-dependent families heard half as many words per hour as children in middle income families, and one third as many words per hour as children in high income families. Extrapolating these figures provides an estimate that over the first four years of their life, children in professional families will have heard 30 million more words than children in welfare-dependent families.

Farkas and Beron (2004) also found that large differences in receptive vocabulary had developed in children in different socio-economic groups by age three, had increased further by age five, and were largely stable through to age 13 years.

Other longitudinal studies have added to the evidence that oral language competence is a mediating factor in the relationship between socio-economic status and literacy. Oral language at school entry almost completely mediated the relationship between mother's education and household income and second and fourth grade reading achievement in one study, even after controlling for IQ (Durham et al. 2007). Another found that although oral language skills have a genetic component, they are more susceptible to environmental influences than phonological skills (Hayiou-Thomas et al. 2010).

Preschool

Interpreting the research literature on the impacts of preschool can be difficult, due to the tendency for studies of long day care for very young children to be bundled with studies of part-time preschool for older children (Buckingham 2007). Two findings, however, are relatively clear. First, the beneficial effect of preschool and early education on literacy and academic outcomes is dependent on the quality of the early educational environment (Anders et al. 2011; Cunningham 2008; Early et al. 2007; Magnuson, Ruhm, and Waldfogel 2007). A review of the literature by Dearing, McCartney, and Taylor (2009) describes benefits of attendance at a high quality preschool extending through to adulthood.

Wylie et al. (2004) have identified the amount of print exposure in early childhood education as a key quality aspect, finding that preschool print exposure was not only a significant predictor of reading comprehension in the later school years, but also the strength of the association increased over time. The amount of variance explained by this aspect of early education increased from 3.4% at age three to 9%

at age 12. A meta-analysis conducted by the National Early Literacy Panel (NELP) found that including literacy activities in a play-based preschool curriculum can encourage development of key skills and knowledge including phonological awareness, alphabet knowledge, print concepts, and vocabulary (NELP 2008). Just as in the home environment, different activities influenced different aspects of literacy development – code-related activities improved phonological, phonemic and alphabetic skills while shared reading contributed to oral language development and vocabulary (Shanahan and Lonigan 2010). Dialogic reading, where teachers encourage children to talk at length about the stories, words and pictures in the book, and non-dialogic reading have benefits (Callaghan and Madelaine 2012). "Teacher talk" has also been implicated in the development of language among preschool children. Exposure to high quality teacher talk in preschool (rich vocabulary, sophisticated sentences, thought-provoking questions and positive tone) has been found to be associated with children's literacy and language skills when they reach school (Dickinson and Porche 2011; Test, Cunningham, and Lee 2010).

Second, a high quality preschool education from the age of three is beneficial for all children, but is especially important for socio-economically disadvantaged children (Elliot 2006; Sylva et al. 2004). Sammons et al. (2004) found that the positive effects of preschool attendance among children from high socio-economic backgrounds dissipated over time. Among children from low socio-economic backgrounds, however, an achievement gap between children who had and had not attended preschool persisted. Tucker-Drob (2012) also found a differential impact of preschool on children of low, medium and high socio-economic status families, with the greatest benefits accruing to the most disadvantaged children. Dearing et al.'s (2009) study indicated that preschool attendance mediated the relationship between low income and later underachievement at school. Preschool attendance has also been associated with lower rates of referral for special education, after controlling for family background (Anders et al. 2011). Temple, Reynolds, and Arteaga (2010) found that the relationship between preschool attendance and reduced risk of having special educational needs in literacy was stronger for students from low socio-economic backgrounds.

Demographic statistics show that the children from low socio-economic backgrounds, who potentially have the most to gain from high quality early education are the least likely to attend preschool (Australian Institute of Health and Welfare 2011; United States Census Bureau 2010; Sylva et al. 2004), with the implication that improved policy in this area could have a substantial impact on literacy gaps. Preschool early literacy curriculum and pedagogy is also an area of potential beneficial reform with more attention paid to both the code-related and oral language aspects of literacy (Callaghan and Madelaine 2012; Massetti 2009; Young 2009).

Physical health

Numerous studies have found a socio-economic gradient to child health, with child health scores declining with (decreasing) socio-economic status (Bradley and Corwyn 2002; Braveman and Barclay 2009; Braveman et al. 2010; Chen 2004; Cushon et al. 2011; Waldfogel and Washbrook 2010; Zwi and Henry 2005). Australian survey data confirm this link for young children. Children in the lowest socio-economic quartile were twice as likely to be rated as developmentally vulnerable in the physical health and wellbeing domain of the Australian Early

Developmental Index, which assesses children at the beginning of school (Centre for Community Child Health 2009). Children of low socio-economic mothers have greater exposure to a number of risk factors for impaired physical and neurological development, such as maternal smoking in pregnancy (Australian Institute of Health and Welfare 2011; Julvez et al. 2007), and pre-term birth and/or low birth weight (Australian Institute of Family Studies 2011; Australian Institute of Health and Welfare 2011; Berliner 2005) which have been linked to higher rates of intellectual impairment (Ross, Lipper, and Auld 1991), diagnosis of learning disabilities or special educational needs (Litt et al. 2005; Anders et al. 2011), and lower scores on tests of cognition (Julvez et al. 2007) and measures of literacy (Holm and Crosbie 2010).

While the available data strongly indicate that socio-economically disadvantaged children are at greater risk of poor health, evidence of the impact of poor health on literacy development is weak. A large-scale study in the United Kingdom found that child health had a very low predictive power for preschool age cognitive outcomes (Waldfogel and Washbrook 2010). The evidence for a causal or even correlational pathway between socio-economic disadvantage, poorer health, and lower literacy of school age children is even weaker. This does not mean the relationship does not exist, just that it has not been well-established empirically.

Early literacy development and the "simple view" of reading

Despite the complexity of the relationship between early literacy development and socio-economic status and its associated factors, the research findings are congruent with both the "simple view" of reading (Gough and Tunmer 1986) and Wheldall's model of reading deficit (Pogorzelski and Wheldall 2005; Wheldall 2009). The simple view of reading proposes that, at its most basic level, reading has two cognitive requirements – the ability to identify words in print and knowledge of what the words mean. The first of these skills is dependent on a child's ability to decode unfamiliar words, which is strongly associated with phonological awareness. Phonological awareness has a significant genetic component. The second of these skills – language comprehension – relies on the child's vocabulary and semantic-syntactic knowledge, which are associated with oral language competence. Oral language development is highly influenced by the early HLE (Hayiou-Thomas et al. 2010). This fits with the Wheldall model, which predicts reading disability using the two factors most strongly associated with the components of the simple view of reading ability – phonological awareness (which predicts word recognition) and the quality of the HLE (which predicts vocabulary and oral language ability, allowing comprehension to occur).

Viewing the accumulated research on early literacy and socio-economic disadvantage through the framework of these models provides a discernible pattern to the contributing factors. Early reading proficiency requires the development of phonological awareness and the acquisition of oral language competency, including a wide vocabulary. Both of these competencies are influenced by a combination of genetic and environmental factors. One of the key environmental factors associated with the development of literacy skills is socio-economic status. Children in low socio-economic status families are at a higher risk of cognitive deficits associated with low birth-weight and pre-term birth, but the influence of socio-economic status is largely asserted through the quality of the early HLE. A good quality early HLE allows a child's natural cognitive abilities to be fully realised, whereas a poor quality HLE will place even the most innately capable child at risk of underachieving. The highest quality early HLE entails formal and informal literacy components, both of which contribute to the pre-literacy and emergent literacy skills necessary for successful early reading. "Formal" early home literacy activities, such as teaching about letter-sounds and print, rhyming and word games, seem to be related to phonological and decoding skills. "Informal" literacy activities, such as shared reading, detailed and frequent conversation with parents, and library and museum visits, seem to be related to vocabulary and oral language. Children growing up in low socio-economic status families are much less likely to have these crucial early literacy-cultivating experiences and are also less likely to attend high quality preschools, creating the literacy gaps evident when children begin school.

Conclusion

In light of the number of factors that impact on children's literacy development, the robust and persistent literacy gap associated with socio-economic status is understandable. According to Snow, Burns, and Griffin (1998, 125), it is "virtually impossible" to tease out all of the factors and their individual effects. On a hopeful note, however, the available evidence also shows that these factors are rarely deterministic. Children born into low income families need not be further disadvantaged in their literacy development if their parents invest time into the print and language activities that encourage the skills and knowledge children require to become adept readers. Using Taylor et al.'s (2004) expression, who parents are is less important than what parents do. Although it is reasonable to expect that poorer health among socio-economically disadvantaged children would also be a mediating factor in early literacy development there is little good evidence of this, and is an important area for further research.

Policy also has a role. While improving the HLE is inarguably the main element of sustained, generational change in early literacy development, the family home has limited promise as a site of intervention in the short term. Early education research suggests that high quality, research-based pre-literacy programmes in preschools which include phonological awareness and shared reading can be an effective means of improving literacy outcomes in school, particularly for children from socio-economically disadvantaged backgrounds (Callaghan and Madelaine 2012; Prior, Bavin, and Ong 2011). Preschool pre-literacy programmes cannot be expected completely to compensate for variation in the HLEs of children, but they offer the strongest possibility for reducing literacy gaps associated with socio-economic status, with the shortest delay.

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CHAPTER 3 – Literature review II

Why poor children are more likely to become poor readers: The school years

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Preface to Chapter 3: 'Why poor children are more likely to become poor readers: The school years'

The first literature review, which looks at early literacy, finds that home environments and parenting practices in low socioeconomic status families are less likely to have characteristics conducive to literacy and language development. In the years before school, children from low socioeconomic status families are less likely to be read to, to be taught the alphabet and letter-sounds, and to be exposed to a rich vocabulary. These aspects of the early home environment significantly predict the key emergent literacy skills of phonological awareness and oral language that are strongly implicated in reading acquisition, with the result that children from low socioeconomic status families begin school with lower average levels of early literacy ability (Farkas & Beron, 2004; Hay & Fielding-Barnsley, 2009).

The second literature review finds that early literacy ability is a significant predictor of reading achievement in school for all children, but socioeconomic status compounds this problem—children from socioeconomically disadvantaged backgrounds are even more likely to remain poor readers if they begin school with low language and literacy skills (Feinstein & Bynner, 2004; Lubienski & Crane, 2010). Socioeconomic status therefore plays a role in both creating the conditions that lead children to begin school with low literacy and in perpetuating the problem. Again, there are a number of factors associated with low socioeconomic status among school-age children that mediate its influence at both the individual and school-level (Fergusson, Horwood, & Boden, 2008; Palardy, 2008).

Like the first, early literacy review, the second review covers a range of mediating factors, but the articles included are limited to large-scale surveys and quantitative studies of English-speaking children. Due to the greater availability of Australian research on school-age literacy, the second review focuses on Australian studies, where possible.

Furthermore, unlike other literature reviews which examine the research on educational achievement or attainment generally, the review conducted for this thesis is exclusively on reading, language and literacy.

Both reviews find that although low literacy associated with low socioeconomic status is partly due to factors beyond the realm of educational intercession, and requires long-term generational change in family functioning, there is still considerable scope for schools to improve literacy and language achievement of socioeconomically disadvantaged children. High quality reading instruction and intervention in schools have significant effects on reading development and, arguably, offer the most promising approaches to reducing the literacy gap in the shortest time-frame (D'Angiulli, Siegel, & Hertzman, 2004; NICHHD, 2000).

Statement of candidate's contribution: This paper is co-authored with my doctoral supervisors. I took the lead in writing, with contributions and revisions to subsequent drafts made by my supervisors.

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Why poor children are more likely to become poor readers: The school years

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Abstract

Socioeconomic status at the individual- and school-level are positively related to literacy achievement in all English-speaking countries. The components of socioeconomic status – income, parent education and parent occupation – are each statistically significant predictors of school literacy achievement but they are primarily a proxy for more directly salient factors. This literature review outlines the factors that are most strongly implicated in literacy achievement. At the individual-level, they are early literacy ability, gene–environment interactions, home learning environment, time spent reading, sleep, school attendance and school mobility. At the school-level, they are school practices and teacher quality, including quality of initial reading instruction. These factors are interactive; not only are socioeconomically disadvantaged children more likely to experience these conditions, they are also more adversely affected by them than their more advantaged peers. This review concludes that understanding the nature of the relationship between socioeconomic status and literacy is the key to mitigating it.

Keywords

Literacy, socioeconomic status, family environment, schools, teacher effectiveness, reading teaching

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Introduction

The statistical relationship between social disadvantage and poor literacy has been well-documented in Australia and around the world (Australian Curriculum, Assessment and Reporting Authority, 2012; Organisation for Economic Cooperation and Development, 2010). A large number of Australian children struggle to learn to read at even a functional level. In the 2012 National Assessment Program for Literacy and Numeracy (NAPLAN), 6.4% of Year 3 students failed to achieve the minimum reading standards expected for their year of education. A further 9.4% achieved only the minimum standard. Children with low parent education levels and low parent occupational status were more likely to be among the group at the minimum benchmark or below. The 2012 NAPLAN report reveals that 33.4% of Year 3 children whose parents had not completed secondary school fell into this category, as did 31.6% of children whose parents had not been in paid work in the previous year (Australian Curriculum, Assessment and Reporting Authority, 2012). An international survey of Year 4 students, Progress in Reading Literacy 2011 (PIRLS) found that 24% of Australian students were below the intermediate international benchmark for literacy, which is deemed the minimum level of competency. PIRLS uses the (self-reported) number of books in the family home as a proxy for socioeconomic status (SES). Forty per cent of students who had 'few' (25 or fewer) books at home performed below the intermediate benchmark, compared with 16% of students who had 'many' (more than 200) books at home (Thomson et al., 2012).

NAPLAN and PIRLS data are 'book-ended' by survey data providing evidence of language and literacy gaps at school entry and at 15 years of age. In the 2009 Australian Early Development Index (AEDI) survey, which assesses children at the beginning of their first year of school, 13.9% of children in the lowest socioeconomic quintile were assessed as being 'developmentally vulnerable' in the language and cognitive skills domain, compared with only 4.7% of children in the highest socioeconomic quintile (Centre for Community Child Health and Telethon Institute for Child Health Research, 2009). The Program for International Student Assessment (PISA) assesses literacy skills of 15 year olds. In all countries there was a positive relationship between SES and literacy performance, to varying degrees. The strength of this relationship in Australia declined between PISA 2000 and PISA 2009 to become lower than the international average (Thomson & De Bortoli, 2010). Despite the relative decline, a substantial socioeconomic literacy gap was still evident in PISA 2009. Twenty-five per cent of children in the lowest socioeconomic quartile scored in the lowest 'Level 1' literacy band or below, compared with 5% of children in the highest socioeconomic quartile (Thomson & De Bortoli, 2010).

SES is usually a composite variable or index of relative socioeconomic advantage/disadvantage, with household income, parent occupation and parent education as its three components, each of which has been found to correlate significantly with literacy. In some studies, just one or two of these components is used as a measure of SES (Sirin, 2005). Overall, PISA studies find a medium positive correlation (approximately 0.3) between parent occupation and reading literacy scores, putting it within the range of correlations that are typically found for SES and school performance in empirical studies since the 1960s (Coleman et al., 1966; Jencks et al., 1972; Marks, 2009; OECD, 2010).

For many years it was assumed that the educational disadvantage associated with low SES was produced by the circumstances of the individual student, or the aggregate circumstances of individual students in the case of school-level relationships. Recent research on the impact of socioeconomic variables on education shows more complex interactions, however (Aikens & Barbarin, 2008; Holmes-Smith, 2006; Nicoletti & Rabe, 2010). Evidence is accumulating that a student's achievement is predicted not just by their own SES but additionally, and more powerfully, by the average SES of their school (Holmes-Smith, 2006; Thomson & De Bortoli, 2010). Furthermore, it is becoming clear that SES is primarily a distal factor – a latent construct that acts as proxy for other variables that are more likely to directly affect literacy and academic development at both the individual- and school-level (Fergusson, Horwood, & Boden, 2008).

There are literally hundreds of studies investigating SES and literacy. Even the best of these, including longitudinal studies, do not demonstrate direct, causal relationships with reading ability. Nonetheless, there are sufficient high-quality studies to produce a compelling picture of the predictive pathways between various factors and literacy development. This literature review outlines the research evidence on the main factors that interact with, or mediate, the influence that social disadvantage at the individual- and school-level exerts on school-age literacy achievement. The articles included in this review were retrieved using a broad search of online databases. Several thousand articles were scanned for relevance and quality, with an emphasis on primary and quantitative research among those selected. For the most part, the review is limited to studies published since 2000, with a few exceptions for major studies which remain an important source of evidence or insight, and only studies conducted with English-speaking subjects have been included. Not every factor linking SES and literacy is discussed; only those for which the literature search revealed good evidence of a significant relationship. Australian data and research are presented wherever possible.

This literature review, which looks specifically at school-age children, is a companion paper to an article focusing on the relationship between SES and early literacy development (Buckingham, Beaman, & Wheldall, 2013). It contributes to the existing literature on SES and literacy by including the most recent published evidence, emphasising the findings that adverse effects of the risk factors for poor literacy are not just cumulative but amplified among socioeconomically disadvantaged students, and drawing conclusions for policy.

Individual factors

Low SES families are generally low income families. Although low income has been found to have a small, significant independent relationship with cognitive development and literacy (Blanden & Gregg, 2004), particularly if it is persistent (Dickerson & Popli, 2012; McLoyd, 1998), it is rarely found to be the most significant factor. Family income and material resources explain a relatively small unique proportion of the variance (Blanden & Gregg, 2004; Fergusson et al., 2008; Marks, Cresswell, & Ainley, 2006). Most research indicates that of the three measures that comprise the tripartite socioeconomic index, parent education has the strongest influence (Cheadle, 2008; Downer & Pianta, 2006; Marks, 2008; Marks et al., 2006; Sutton Trust 2010). Even so, these factors explain only part of the relationship between a student's socioeconomic background and their literacy achievement at school (Dearden, Sibieta, & Sylva, 2011). Mediating factors include early literacy ability, the quality of the home learning environment, health and sleep, and school attendance and mobility. Research evidence describing these relationships is outlined below.

Early literacy ability

Gaps in children's literacy abilities are evident when children begin school, with children from low socioeconomic backgrounds tending to demonstrate lower proficiency in the two main aspects of emergent literacy — phonological awareness (Henning, McIntosh, Arnott, & Dodd, 2010; McDowell, Lonigan, & Goldstein, 2007) and vocabulary/oral language competency (Farkas & Beron, 2004; Hart & Risley, 2003; Hay & Fielding-Barnsley, 2009; Locke, Ginsborg, & Peers, 2002; National Institute of Child Health and Human Development (NICHHD), 2005; Washbrook & Waldfogel, 2011). A research review by the authors (Buckingham et al., 2013) describes the risk factors associated with impaired early literacy development among socioeconomically disadvantaged children, including the early (prior to school) home learning environment and preschool attendance and quality.

Early literacy ability is a strong predictor of a child's literacy performance throughout their school life (Claessens, Duncan, & Engel, 2009; Hecht, Burgess, Torgesen, Wagner, & Rashotte, 2000; Juel, 1988). Lubienski and Crane (2010) found that kindergarten reading score accounted for 25% of the variance in reading gains from Kindergarten to Year 5 in a longitudinal survey of children in the US, while in a separate analysis of the same survey data, Claessens et al. (2009) also found a correlation of 0.5 between kindergarten and Year 5 reading scores. Feinstein and Bynner's (2004) analysis of British survey data found a 0.5 correlation between cognitive test scores (primarily language and reading) at ages five and 10 years. In a study by Currie and Thomas (1999), reading test scores at age seven significantly predicted reading test scores at age 16 years, explaining around 33% of the variance.

In addition, SES was a significant mediating factor in each of these studies, particularly for the persistence of low reading scores. For example, in Feinstein and Bynner's (2004) analysis, 67% of low SES children who were in the lowest test score quartile at age five remained in the lowest quartile at age 10, compared with 34% of high SES children. These results show that reading ability is not set at age five – there is substantial mobility in the primary school years – but that low SES students are more likely to remain poor readers if they begin school as poor readers.

Gene–environment interactions

Reading disorders and individual differences within the normal range of reading ability among children are moderately to strongly 'heritable' or genetic (Astrom, Wadsworth, Olson, Willcutt, & DeFries, 2011; Byrne et al., 2008; Christopher et al., 2013; Gayan & Olson, 2001, 2003; Hayiou-Thomas, Harlaar, Dale, & Plomin, 2010; McGrath et al., 2007; Soden-Hensler, Taylor, & Schatschneider, 2012). Twin studies have provided estimates of heritability ranging from 30% to 60%, depending on the literacy measure. The remainder of the variance in reading ability is associated with a range of factors in the child's home and school environment (Berliner, 2005; Guo & Stearns, 2002; Rowe, Jacobson, & van den Oord, 1999; Samuelsson et al., 2008; Taylor, Roehrig, Soden Hensler, Connor, & Schatschneider, 2010).

There is increasing evidence that the influence of genetic and environmental factors on reading ability is not simply additive, and is not present in the same proportions for all children. Rather, genetic factors appear to determine the potential of an individual; the extent to which this potential is realised is dependent on the environmental circumstances. The majority of studies of gene–environment interactions in reading ability support the 'bioecological model' (McGrath et al., 2007). In this model of development (Bronfenbrenner & Ceci, 1994), a child's genetic potential for developing competence is amplified in advantaged environments and suppressed in disadvantaged environments (Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003). Studies demonstrating the bioecological model among adolescent children include measures of verbal IQ (Rowe et al., 1999), receptive vocabulary (Guo & Stearns, 2002), word recognition and phonological decoding (Gayan & Olson, 2003), and word recognition, spelling and reading comprehension in low progress readers (Friend, DeFries, & Olson, 2008). In each of these studies, there was high heritability and low environmental influence of skills among students from advantaged homes, and low heritability and stronger environmental influence among students from disadvantaged homes.

In other words, children whose home lives are characterised by social disadvantage are less likely to achieve to their genetic potential, as environmental factors impede their development, while their more advantaged peers tend to be limited only by their innate ability.

Home learning environment

For school-age children, most of their formal learning takes place in the classroom but there is still potential for the home environment to be influential. If the way children spend their after-school time is a factor in their reading development, and if children's after-school experiences and activities differ with SES, these factors would be expected to interact in their effect on reading performance.

The research literature on the impact of children's home learning environment once they reach school age is dominated by studies on the amount of reading at home. This literature is described below. Another set of studies, however, looks at a broader set of home characteristics and parenting practices that impact on children's reading achievement. These studies examine factors such as parents' academic aspirations and expectations for their children, their encouragement of intellectuality and reading, and students' inclination for independent study and good work habits.

A research synthesis by Hattie (2009) includes only two meta-analyses of studies on the home learning environment of school-age children. One of these studies, by Iverson and Walberg (1982), summarised the evidence as finding that sociopsychological or 'process' characteristics of the home have a stronger association with academic ability and achievement than socioeconomic or 'status' characteristics. This suggests that values and parenting practices are stronger factors than income or parent education levels. Hattie's synthesis estimates the effect size of home environment on academic achievement (not restricted to reading ability) to be in the medium–high range compared to other factors but is not specific about which aspects of the home environment are most influential.

Where aspects of parenting practices have been investigated more closely, research has generally supported Parcel and Dufur's (2001) conclusion that beyond a certain level of basic expenditure, home environments that positively impact on education are characterised by 'parental orientation to providing the types of interpersonal resources that favour child development' (p. 883). Home environment factors which have been shown to be strong predictors of reading achievement are parents' educational aspiration and expectations, and encouragement of intellectuality and reading (Fan & Chen, 2001; Fergusson et al., 2008; Greaney & Hegarty, 1987; Wilder, 2013). It seems that these characteristics, rather than help with homework or direct supervision of literacy activities, may positively impact reading ability among school-age children by developing their motivation to read (Guthrie, Wigfield, Metsala, & Cox, 1999; Mucherah & Yoder, 2008; Petscher, 2010), their self-concept as readers (Katzir, Lesaux, & Kim, 2009), and their capacity for self-regulated learning (Xu, Kushner Benson, Mudrey-Camino, & Steiner, 2010), all of which have been shown to mediate the relationship between home learning environment and reading performance.

In one of the few studies with Australian data, Evans, Kelly, Sikora, and Treiman (2010) describe the quality of the home learning environment as its 'scholarly culture'. Using data from literacy assessments in 27 countries, they found that the number of books in the home (their proxy measure of scholarly culture) was significantly positively related to the literacy scores of 15 year old students, net of socioeconomic factors. Among Australian students in the sample, the number of books in the home was the second strongest unique predictor of literacy scores after IQ. Furthermore, there was an interactive effect – having books in the home had a greater impact on children whose parents had the lowest levels of education than on children with university-educated parents.

The Longitudinal Study of Australian Children has found that both parental expectations and the number of books in the home have a significant relationship with SES. Ninety-three per cent of children in the highest SES quartile had more than 30 books at home, compared with 65% of children in the lowest SES quartile. Less than 10% of mothers with tertiary education expected that their children would go no further in their education than completing school, compared with 36% of mothers who had not completed school themselves (Australian Institute of Family Studies, 2011). Chowdry, Crawford, and Goodman (2011) found that parents' and students' educational expectations were strong predictors of student achievement and each explained around 16% of the test-score gap between the lowest and highest socioeconomic groups of 16 year olds in England.

Time spent reading

The majority of studies examining the association between the amount of time children spend reading outside of school and various measures of reading ability find medium but statistically significant positive relationships (Anderson, Wilson, & Fielding 1988; Cheng, Kinger, & Zheng, 2009; Cunningham & Stanovich, 1997, 1998; Greaney & Hegarty, 1987; Mol & Bus, 2011; Watkins & Edwards, 1992). In contrast, Taylor, Frye, and Maruyama (1990) found that only time spent reading in school positively affected reading scores, and Lawrence (2009) found that the time children spent reading books during their summer holidays was predictive of improved vocabulary but not comprehension.

In several studies, the contribution of time spent reading to variance in children's reading scores was considerably (but not completely) reduced after taking children's prior reading ability into account (Cunningham & Stanovich, 1998; Taylor et al.,1990; Watkins & Edwards, 1992). Even after controlling for prior achievement, however, the association between reading time and reading achievement remains practically important for all ability levels. In Taylor et al.'s (1990) study, just 10 min per day of reading outside of school was related to a one-quarter standard deviation improvement in reading skill for below average and average readers, and a half standard deviation improvement for above average readers, over the course of the school year.

A meta-analysis by Mol and Bus (2011) incorporated 99 studies of the relationship between print exposure and reading ability, which tend to report stronger relationships than studies using self-reports of time spent reading. Print exposure is considered by some researchers to be more reliable than self-reports of time spent reading. Print exposure is most often measured by a Title Recognition Test, with the premise that respondents who can identify more real book titles will be those who read more books. Mol and Bus (2011) found that correlations between print exposure and reading ability became higher with age. Print exposure explained 12% of language skills in preschool and kindergarten, 13% in primary school, 19% in middle school and 30% in high school. At all ages the correlations were significant. If the amount of reading students do, including reading at home, is related to their reading achievement, might some of the literacy disadvantage associated with socioeconomic disadvantage be attributable to differences in reading at home? Few published studies investigate this possibility directly. Those which measure SES use it as a control factor rather than as an independent variable. One study which did examine socioeconomic groups, by McKool (2007), found no significant differences in the amount of voluntary after-school reading by students in low and middle/high income families, and echoes other studies in finding that reading time is instead more directly related to a 'positive educational home environment and to the value placed on reading in the home' (p. 119).

Statistics from the PISA provide contrasting evidence of significant differences among students. SES was significantly positively related to the PISA Enjoyment of Reading (EoR) Index. Thirty-three per cent of Australian students in the lowest SES quartile reported that they did not read for enjoyment, compared with 17% of the highest SES quartile. Twenty per cent of students in the lowest SES quartile reported reading for up to 1 h a day, with 21% reading more than 1 h a day. In comparison, 29% of students in the highest SES quartile reported reading up to 1 h a day; 31% read more than 1 h a day (Thomson & De Bortoli, 2010).

Differences in time spent reading for enjoyment appear to predict literacy performance. There was a significant correlation between the PISA 2009 EoR Index and literacy performance. Students with the highest EoR Index had a higher mean literacy performance, equivalent to four more years of schooling, than students with the lowest EoR Index (Thomson & De Bortoli, 2010).

Furthermore, according to the PISA data, both quantity and quality of reading are associated with reading performance, and both are related to SES. The strongest association between text type and reading performance was for fiction books (a medium correlation) and non-fiction books (a small correlation). Magazines, newspapers and comics had very small positive or even negative correlations with reading performance in PISA (Thomson & De Bortoli, 2010). Lawrence (2009) similarly found that reading books outside of school time – fiction and non-fiction – was the strongest predictor of vocabulary growth, while reading magazines and comics was associated with a decline in vocabulary.

Time spent reading and 'Matthew effects'

Studies showing an interaction between reading ability and time spent reading are congruent with the substantial body of evidence supporting a reciprocal relationship (Cunningham & Stanovich, 1998), or as Mol and Bus (2011) put it, a 'spiral of causality' (p. 267). The accumulation of skills and knowledge in some students and the deficit in others creates a widening reading gap that becomes increasingly difficult to close as children get older (Cunningham & Stanovich, 1997; Mol & Bus, 2011; Stanovich, 1986). Often described as the 'Matthew effect', inspired by a verse in St Matthew's gospel which is translated as 'the rich get richer, the poor get poorer', this theory posits that children who do not quickly acquire the fundamental skills of reading tend to read less than their peers with higher reading skills. This initiates a 'feedback loop' of low reading experience and slow reading acquisition, the result of which is lower vocabulary and lower comprehension (Stanovich, 1986). In this theory, reading begets reading (Cunningham & Stanovich, 1997).

The Matthew effect theory is acknowledged as offering a highly plausible explanation of reading development (Cain & Oakhill, 2011; Kempe, Eriksson-Gustavsson, & Samuelsson, 2011; Mol & Bus, 2011; Sideridis, 2011). SES is pertinent to the Matthew effects theory insofar as it influences the development of emergent literacy skills (Buckingham et al., 2013) and is associated with the quality of home learning environment. There is limited evidence that some subpopulations of students exhibit Matthew effects more reliably, including low ability readers from low income families (Morgan, Farkas, & Hibel, 2008) and children with learning difficulties, who are disproportionately from low income families (Morgan, Farkas, & Wu, 2011).

Physical health and sleep

A socioeconomic gradient to child health has been found in numerous studies; child health scores decline with SES (Bradley & Corwyn, 2002; Braveman & Barclay, 2009; Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010; Chen, 2004; Cushon, Vu, Janzen, & Nazeem, 2011; Fletcher & Wolfe, 2013; Waldfogel & Washbrook, 2010; Zwi & Henry 2005). Australian survey data confirm this link for young children. In the AEDI, which assesses children at the beginning of school, children in the lowest socioeconomic quartile were twice as likely to be rated as developmentally vulnerable in the physical health and wellbeing domain (Centre for Community Child Health & Telethon Institute for Child Heath Research, 2009).

Although there is an extensive literature documenting the relationships between low SES mothers, adverse infant health conditions (AIFS, 2011; AIHW, 2011; Berliner, 2005), and cognitive outcomes (Anders et al., 2011; Julvez et al., 2007; Litt, Taylor, Klein, & Hack, 2005), there is limited evidence of socioeconomic differentials in the prevalence of specific illnesses or physical impairments in school-age children. A Western Australian study found that children who had always lived in low income families were twice as likely to have developed persistent asthma by the age of 14 as children who had never been in a low income family (Kozyrskyj, Kendall, Jacoby, Sly, & Zubrick, 2010) and a national report indicates that children in low socioeconomic households are twice as likely be hospitalised for asthma (AIHW, 2011). These studies do not indicate whether the overall prevalence of asthma is related to SES, but they do show that the extent and severity, and therefore the burden of the disease, is greater for socioeconomically disadvantaged students.

It is reasonable to expect that poor health might affect literacy through its impact on school attendance. There is evidence to support the relationship between poor health and school attendance in the specific case of dental health – children with poor oral health scores were more likely to miss school (Berg & Coniglio, 2006; Jackson, Vann, Kotch, Pahel, & Lee, 2011). Children from low socioeconomic backgrounds, on average, suffer from poorer oral health (AIHW, 2011). Numerous studies have found that students with asthma have higher rates of absenteeism (Basch, 2011; Collins et al., 2008; Milton, Whitehead, Holland, & Hamilton, 2004; Moonie, Sterling, Figgs, & Castro, 2006; Taras & Potts-Datema, 2005) but have found only a weak or non-existent relationship between asthma and school performance generally, or literacy in particular (Krensitsky-Korn, 2011; Milton et al., 2004; Moonie, Sterling, Figgs, & Castro, 2008; Taras & Potts-Datema, 2005). There are no studies exploring a possible interaction between asthma, SES and academic achievement.

Otitis media (middle ear infection) is a childhood illness which is common across the population. There is mixed evidence whether otitis media is more prevalent among children of low SES overall (Berliner, 2005; Kong & Coates, 2009; Williams & Jacobs, 2009) but there are stronger findings suggesting that it is likely to have earlier onset, be more frequent and less treated, resulting in a greater probability of hearing loss among extremely disadvantaged children, especially Aboriginal children in remote communities (Williams & Jacobs, 2009). Children who experience even temporary partial hearing loss due to otitis media while they are developing their oral language abilities can experience speech perception and language delays (Winskel, 2006), which may be especially important for non-English-speaking Aboriginal children learning a different phonological system (Williams & Jacobs, 2009). Hearing loss due to otitis media would be expected to affect literacy development at school, especially if the hearing loss is permanent, but this has not been established empirically (Roberts, Rosenfeld, & Zeisel, 2004), nor are there data showing whether hearing impairment is more prevalent among socially disadvantaged children.

In short, while the available data indicate that socially disadvantaged children are at greater risk of poor health, evidence of an educational impact is weak. This does not mean the relationship is non-existent, just that it has not been established empirically.

An emerging area of research suggests that less sleep might be a factor in the lower school performance of children from low SES families. There is some evidence that lower SES children get less sleep than higher SES children (El-Sheikh, Kelly, Buckhalt, & Hinnant, 2010), and a series of studies have found that sleep duration and quality is positively associated with cognitive functioning (Buckhalt, El-Sheikh, & Keller, 2007), intellectual ability (Buckhalt, El-Sheikh, Keller, & Kelly, 2009), verbal comprehension (Bub, Buckhalt, & El-Sheikh, 2011), and letter–word recognition and passage comprehension (Eide & Showalter, 2012) in school-age children. Once again, there also appears to be an interaction between SES and sleep-related variations in performance. Poor quality sleep seems to have a more detrimental effect on low SES children and children whose parents have low education levels (Buckhalt et al., 2007; Buckhalt et al., 2009; El-Sheikh et al., 2010).

Behaviour

The link between behavioural problems and poor reading achievement is well-established. Reviews of the literature by Morgan, Farkas, Tufis, and Sperling (2008) and Limbrick, Wheldall, and Madelaine (2011) report evidence of relationships between behaviour and reading in both directions separately (behaviour problems predict low reading ability and vice versa) as well as a bidirectional relationship. Smart, Prior, Sanson, and Oberklaid (2001) found that behaviour problems contributed to the persistence of reading difficulties over a six-year period, for boys only. McIntosh, Sadler, and Brown (2012)'s longitudinal study found that low phonological awareness at the beginning of kindergarten predicted chronic behaviour problems in Year 5, but that this was mediated by progress in literacy skills over the kindergarten year, indicating that effective initial instruction can mitigate behaviour issues.

The importance of SES in this relationship is not clear. The AEDI shows that the proportion of children assessed as developmentally vulnerable on the 'emotional maturity' domain (which includes sociability, anxiety, aggression, hyperactivity and inattention) increased as SES decreased (Centre for Community Child Health and Telethon Institute for Child Health Research, 2009). Morgan et al. (2008) found that while children from low income families were significantly more likely to have reading problems in third grade, they did not have a higher prevalence of behavioural problems than middle income children. In contrast, Hay and Fielding-Barnsley (2009) found that low SES children had lower average early reading and language skills and that there was a significant positive relationship between these skills and students' in-class on-task behaviour. This indicates correlation but not the direction of the interrelationships.

School attendance and mobility

Common sense dictates that, on average, children are more likely to learn to read if they attend school. This is borne out by research showing a significant positive relationship between school attendance and literacy achievement from Kindergarten and Year 1 (Attendance Works, 2011; Balfanz & Byrnes, 2012; Chang & Romero, 2008) through primary school (Chang & Romero, 2008; Roby, 2004) and into the final years of high school (Dunn, Kadane, & Garrow, 2003). Rothman (2001) suggests that chronic absenteeism is both a cause and effect of low academic achievement. Children who are struggling at school seek to avoid it, and this exacerbates the problem. Although there has been a strong and justified focus on school attendance to close the literacy gap for indigenous Australians (Australian Government, 2012), there is mixed and limited evidence of the impact of attendance for this group of children. Zubrick et al. (2006) found a significant relationship between attendance and academic performance (not literacy specifically) for indigenous Australian children but not for non-indigenous children. Cowey, Harper, Dunn, and Wolgemuth (2009) found inconsistent evidence of a relationship between school attendance and reading scores. They suggest that attendance is only one part of the solution, and that quality of instruction and effective use of class time are mediating factors. In another study, in which students were participants in a reading intervention, attendance was strongly positively related to gains in phonological processing and early literacy skills (Ehrich et al., 2010)

Several studies show the importance of good school attendance in the year of initial reading instruction, finding that chronic absenteeism in Kindergarten is associated with lower reading test scores in Year 3 (Attendance Works, 2011; Balfanz & Byrnes, 2012; Chang & Romero, 2008). Again, there is evidence of an interaction, with absenteeism being particularly detrimental to children from socially disadvantaged families (Balfanz & Byrnes, 2012; Chang & Romero, 2008).

Children from low income and low SES families have much lower average attendance rates and a higher prevalence of chronic absenteeism (usually defined as missing >10% of the school year), placing them at a higher risk for reading failure. In Australia, Rothman (1999, 2001) reports that low SES children had significantly higher school absence rates than middle and high SES children across all school years, with student SES predicting approximately 30% of variance in absence rates. An additional 8% was predicted by the school average SES, indicating a peer effect. A New Zealand survey found that 'justified' (explained, acceptable absences) were similar in all schools, irrespective of average SES. However, schools in the two lowest SES deciles had rates of 'unjustified' absences around three times higher than schools in the two highest SES deciles. Rates of frequent truancy were almost five times higher in low decile schools (New Zealand Ministry of Education, 2011). In the United States, Romero and Lee (2008) found that 21% of low income Kindergarten children were chronic absentees, compared with 8% of higher income children. Similar absentee ratios were found for children with low maternal education and unemployed mothers, and each of these risk factors had a cumulative impact on absenteeism.

School mobility – the number of times a student changes schools – is also correlated with reading and general school achievement. Higher school mobility rates are significantly associated with lower reading achievement in Kindergarten (Burkam, Lee, & Dwyer, 2009) and throughout primary school (Mehana & Reynolds, 2004; Thompson, Meyers, & Oshima, 2011), as well as high school English grades (Dunn, Kadane, & Garrow, 2003; Reynolds, Chen, & Herbers, 2009). These studies each found medium correlations between SES and school mobility. Mehana and Reynolds (2004) and Burkam et al. (2009) again found interactive effects – the relationship between mobility and reading was stronger for children of low SES families.

School factors

The correlation between SES and literacy is well-established in studies conducted since the 1960s and 1970s (e.g. Coleman et al., 1966; Currie & Thomas, 1999; Jencks et al., 1972), but recent research on the impact of socioeconomic variables on education shows complex multi-layered relationships. Improvements in the quality of data and in statistical techniques have allowed the separate associations between student achievement and SES at the student- and school-levels to be investigated. Over the past decade or so, a number of studies have shown that socioeconomic variables are stronger at the school-level than the student-level, that is, the mean SES of a school has a larger impact on a student's achievement than their own SES (Holmes-Smith, 2006; OECD, 2010; Rothman, 2002). Similar to individual SES, school-level SES seems to affect literacy mostly indirectly, operating through its association with school practices rather than resource levels alone (Sirin, 2005).

School-level SES

A number of large-scale studies have found that school-level SES has an effect on literacy achievement in addition to the effect of student-level SES. The largest international study, PISA, found that in most OECD countries, the literacy performance of 15-year-old students was more strongly related to the SES of their school than their own SES. This was true for all English-speaking countries (OECD, 2010).

Studies analysing data from the Longitudinal Surveys of Australian Youth confirm the significant impact of school-level SES, finding furthermore that the independent influence of individual SES decreased between 1975 and 1998, while the influence of school-level SES increased (Rothman, 2002; Rothman & McMillan, 2003). Other studies indicate that the relationship between school-level SES and student literacy becomes stronger as students progress through school (Holmes-Smith, 2006; New South Wales Department of Education & Training, 2011). Research in the UK and USA has also provided evidence of a significant school SES effect on literacy scores and reading growth that is equivalent to, or exceeds, the effect of student SES (Cassen & Kingdom, 2004; Palardy, 2008; Rumberger & Palardy, 2005; Sirin, 2005). Sirin's (2005) meta-analysis describes the effect size of student-level SES as medium and the effect size of school-level SES as large.

Like individual SES, school-level SES can, to some extent, be viewed as a proxy for other more directly salient factors – the conditions and experiences that influence achievement (Barton & Coley, 2009). According to Palardy (2008), schools with higher proportions of students from socioeconomically disadvantaged backgrounds have an 'educational milieu' that presents a 'consistent barrier to learning' (p. 31). That is, rather than school-level SES being simply a concentration of individual disadvantage, schools serving disadvantaged students are characterised by conditions less conducive to educational success. Cassen and Kingdom (2004) put it this way: students with lower SES are more often found in lower quality schools.

The research literature often considers the factors associated with school quality as forming three categories: material resources, structural characteristics and school practices. Material resources include funding to schools, the school's physical environment and educational resources such as technology. Structural characteristics include class sizes and academic streaming. School practices include teachers' expectations of students' ability and achievement levels, rigour of the curriculum, disciplinary climate and homework requirements.

Rumberger and Palardy (2005) found that the material and structural features of schools did not significantly contribute to school-level socioeconomic effects on academic achievement, including reading. Four school practice variables in combination predicted all of the variance in test scores between schools with different levels of mean SES: teacher expectations; curriculum rigour, how safe students felt at school and the amount of homework completed by students. Similarly, Marks (2009) concludes that the academic context of the school is most important, rather than SES. Resource levels may contribute indirectly to achievement in systems with a high degree of school choice, if low SES students become concentrated in low-resource schools (Perry & McConney, 2010).

Palardy (2008) found that school practices varied significantly with school-level SES, but also identified significant differences in teacher qualifications and experience. In Palardy's study, there was an interactive effect – school practices were found to have a greater impact in schools with lower mean SES, suggesting that disadvantaged students are more vulnerable to the effect of low-quality schools. In contrast, however, Perry and McConney (2010) found that school-level SES in Australia was positively associated with reading scores to a similar extent for students from all socioeconomic backgrounds.

Teacher quality

Multi-level analyses of student performance have found significant differences between classes within schools, leading some researchers to argue that classroom/teacher effects are stronger than any school-level effects (Hill & Rowe, 1996; Rowe, 2002). One interpretation is that lower average results in schools with lower average SES might be attributed to lower average quality of teaching.

It is important to make a distinction between *teacher* quality and *teaching* quality. Although these terms are often used interchangeably, and education policy debates have been framed around the notion of *teacher* quality, it is difficult to identify a 'high-quality teacher' using measurable characteristics. There is some evidence that student outcomes are positively associated with teachers' years of experience (peaking at around five years) and verbal and intellectual aptitude (Leigh & Mead, 2005; National Council on Teacher Quality, 2004; Rivkin, Hanushek, & Kain, 2005). Yet, somewhat counter-intuitively, research has found that teachers' formal educational qualifications were not strongly related to student performance (Hattie, 2009; Hess, Rotherham, & Walsh, 2005), including reading test scores (Chingos & Peterson, 2011). This does not mean that teacher education and training is unnecessary or unimportant; a more likely explanation is that the effectiveness of teacher training is variable (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009; Buckingham, 2005). Likewise, although teacher employment statistics indicate that schools with the most educational challenges (schools in disadvantaged and/or rural and remote communities) on average have less experienced and less qualified (Auguste, Kihn, & Miller, 2010; Freedman, Lipson, & Hargreaves, 2008; Productivity Commission, 2012), the evidence that this results in lower quality classroom instruction in such schools is limited.

Quality of *teaching* – lesson content and pedagogy used by teachers – is a stronger predictor of student achievement than teacher characteristics (though they are plausibly connected). Hattie's (2009) research synthesis found effects in the high range for 'quality teaching' as rated by students, and for specific aspects of teaching practice including direct instruction, teacher–student relationships, reciprocal teaching and feedback. There is little evidence of variation in quality of teaching practice associated with SES, but in one Australian study, Griffiths, Amosa, Ladwig, and Gore (2007) conducted classroom observations to investigate teaching practice in schools with large numbers of students from disadvantaged backgrounds. They found that the quality of pedagogy was low and stated that 'the link between SES and pedagogy at the class level is disturbing' (p. 9).

Initial reading instruction

Effective reading instruction in the early years of schooling is critical. An extensive body of research shows that quality, comprehensive literacy programmes develop children's skills in five essential areas: phonemic awareness, phonics, fluency, vocabulary and comprehension (Department of Education, Science & Training, 2005; NICHHD, 2000; Rose, 2006). Although these five 'big ideas' of reading are now widely accepted, the quality of initial reading instruction in schools has still been variable (Coltheart & Prior, 2007; Duke & Block, 2012; Lesaux, 2012; Office for Standards in Education, 2011; Patel, 2010).

Phonemic awareness and phonics instruction are essential components of effective initial reading programmes. Phonemic awareness is the ability to identify and manipulate the discrete sounds in words and is a necessary skill in the early and successful acquisition of decoding ability. Phonics instruction teaches children the relationships between the sounds in speech and letters (and groups of letters) in print, providing them with the ability to decode or 'sound out' words using their knowledge of letter–sound correspondences (Snow, Burns, & Griffin, 1998). Numerous research studies, reviews and meta-analyses have shown that the most effective way to teach phonics is with a 'systematic' approach (e.g. Chall, 1983; de Lemos, 2005; Ehri, Nunes, Stahl, & Willows, 2001; Louden et al., 2005).

There is also evidence that effective reading instruction is especially important for children at-risk of reading failure (Lesaux, 2012; Samuelsson et al., 2008; Taylor et al., 2010). Phonics instruction has been shown to be beneficial to all students, but with stronger effects for students from low socioeconomic backgrounds (NICHHD, 2000) and children who begin school with low levels of phonological awareness and pre-literacy skills, who are disproportionately from low socioeconomic backgrounds (Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Savage, Carless, & Erten, 2009; Sonnenschein, Stapleton, & Benson, 2010; Xue & Meisels, 2004). Phonic skills should not be taught in isolation, however, as socioeconomically disadvantaged children are also more likely to have low oral language ability and vocabulary knowledge. The provision of a literacy programme that is equally strong in reading practice and developing vocabulary and comprehension is essential (Adams, 1990; Beverly, Giles, & Buck, 2009; Hamston & Scull, 2007; Rupley, Blair, & Nichols, 2009; Teale, Paciga, & Hoffman, 2007).

The potential for high-quality reading instruction to attenuate the relationship between literacy and socioeconomic disadvantage is evident in several studies (Chatterji, 2006; Magnuson, Ruhm, & Waldfogel, 2007). In one longitudinal study of children from Kindergarten to Grade 5, initial literacy gaps associated with SES progressively dissipated and were no longer evident in Grade 3 when children were provided with a 'rich' initial and on-going literacy programme, which included explicit instruction in phonemic awareness and phonics (D'Angiulli, Siegel, & Hertzman, 2004; D'Angiulli, Siegel, & Maggi, 2004). In another longitudinal study – the 'Clackmannshire study' – there were no literacy gaps between socioeconomic groups among children who had been given synthetic phonics instruction as part of a balanced literacy program, until Grade 5 for comprehension and Grade 7 for reading and spelling (Johnston & Watson, 2005). If effective literacy methods are more beneficial for struggling readers, particularly those from socioeconomically disadvantaged backgrounds, the corollary is that they are more adversely impacted by the absence of high-quality literacy instruction. Consistent findings that teachers are not adequately prepared to teach reading in schools (Binks-Cantrell, Washburn, Joshi, & Hougen, 2012; Fielding-Barnsley, 2010; Rowe, 2006; Walsh, Glaser, & Dunne Wilcox, 2006) points to literacy instruction as a mediating factor in the relationship between low SES and poor literacy.

Conclusion

A persistently large number of children struggle to learn to read even at a basic level, and these children are disproportionately from socially disadvantaged families. Not only is a student's reading achievement predicted by their own socioeconomic background, but it is also, and even more strongly, associated with the average SES of the school they attend. At both the individual- and school-level, beyond a minimum, financial resources make a relatively small contribution. At both the individual- and the school-level, the relationship between SES and literacy is significantly mediated by its association with other more proximal factors.

According to Snow, Burns, and Griffin (1998), it is 'virtually impossible' to tease out all of the environmental factors associated with different socioeconomic groups, and correlational studies can only point to statistical associations rather than prove causality (p. 125). However, the extent and quality of research in this area is gradually building up evidence of the predictive pathways, showing how these factors accumulate and interact to multiply the impact of disadvantage on some children, leading to greater risk of reading problems.

At the individual-level, the impact of SES on school-age reading achievement seems to be largely exerted through its relationship with early literacy. Children's literacy proficiency at the beginning of formal schooling is a powerful predictor of reading achievement throughout their schooling. Children from low SES backgrounds typically start school with lower literacy skills and are more likely to remain poor readers as they progress through school. A number of mediating variables are implicated in this pattern of poor reading development: less time spent reading, less sleep, higher rates of absenteeism and mobility, and less parental encouragement of academic pursuits. Not only are these mediating factors more likely to be experienced by children from low socioeconomic backgrounds, research indicates there is often an interactive effect – socially disadvantaged children suffer more adverse effects from these risk factors than other children.

At the school-level, the relationship between the SES of the school population and the performance of individual students is more closely associated with school practices and academic culture than school resources and structures. Given the importance of quality of teaching, differences in teaching quality is potentially involved. But although low socioeconomic schools tend to have less experienced, less qualified teachers, there is little evidence of how this translates into differences in quality of teaching between schools with different levels of social disadvantage.

There is more evidence to indicate that reading instruction in the first years of school plays a major role in literacy achievement in general, and literacy gaps in particular. The impact of effective instruction including, but not limited to, systematic and explicit phonics instruction is greater for children with low initial levels of literacy and children from low socioeconomic backgrounds. Phonics programs work best when embedded in a rich literacy programme that provides ample time for practice (so that code-related skills can be generalised) and plenty of exposure to real books to develop vocabulary and comprehension, and to foster enjoyment of good literature. If the most effective instruction has not been routinely provided to children when they begin formal schooling, and there is good reason to believe that it has not, this is a potent area for reform.

Of course, low SES does not destine a child to poor literacy achievement, but to argue that it is not important is to misconstrue the research. That the relationship between SES and literacy is attributable, at least in part, to other variables does not negate its impact, it merely explains the process by which SES influences educational performance. Identifying the multiple, cumulative and interactive effects of factors associated with socioeconomic disadvantage, and understanding the processes by which they work to increase the risk of poor literacy, is the key to reducing its impact.

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CHAPTER 4 – Research Paper I

A randomised control trial of a Tier-2 small group intervention ('MiniLit') for young struggling readers

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Preface to Chapter 4: 'A randomised control trial of a Tier-2 small-group intervention ('MiniLit') for young struggling readers'

The literature review in Chapter 2 of this thesis confirmed the relationship between low socioeconomic status (SES) and low literacy. Students with reading difficulties in the early years of schools are more often from low SES households where they are less likely to have experienced home learning environments conducive to the development of language and reading proficiency. It follows, then, that schools with higher proportions of low SES students generally have larger proportions of struggling readers, and this is borne out by statistics (Holmes-Smith, 2006; Perry & McConney, 2010).

Although improving classroom initial reading instruction would arguably avoid much early reading failure, a proportion of children would still need extra instructional support. Some of these students will have 'mild' reading difficulties, while others will have more serious reading disabilities that require specialised remedial instruction (Fuchs & Fuchs, 2006; Friend, deFries & Olson, 2008).

The Response to Intervention (RtI) model of teaching and assessment has been developed for the purposes of accurately identifying students who need instructional intervention and determining the required intensity of provision. In a three-tier RtI model, Tier 1 is whole class instruction, Tier 2 is the first level of intervention for struggling readers, usually provided to small groups of students, and Tier 3 is individual instruction for students who do not respond to Tier 2 intervention (Wheldall, 2009).

In schools with high proportions of struggling readers, a reliance on one-to-one intervention (such as Reading Recovery) inevitably limits the number of children who can be provided with support in the form of a formal reading intervention program. The availability of an effective small group program would offer schools a means to intervene early with more students, reserving one-to-one intervention for children who need it most (Wheldall, 2009).

MiniLit (Meeting Initial Needs in Literacy) was developed with this objective. It was designed for students in the first few years of formal schooling who are not making good progress in reading but do not have a diagnosed intellectual disability (Reynolds, Wheldall & Madelaine, 2007b). It can be implemented as a Tier 2 intervention in a three-tier RtI framework.

MiniLit has been the subject of a number of trials and pilots (Reynolds, Wheldall & Madelaine, 2007a, 2007b, 2010). As a result of this research and development process, it was revised and refined to be delivered as a school-based program in mainstream schools. The study presented in Chapter 3 evaluates the efficacy of the small group MiniLit program in its first implementation over three terms in a low SES school, using school staff as instructors.

Treatment fidelity was measured at three to four week intervals throughout the trial by two experienced consultants from the MultiLit Research Unit (see p. 82). Treatment fidelity was deemed to be satisfactory when it reached a minimum of 80%, a criterion adopted following Borelli et al (2005) who define high treatment fidelity as 80% or greater adherence. It took 10 weeks for treatment fidelity to reach this level (approximately one school term), halfway through the time initially allocated for the trial. This was a key contributor to the decision to extend the trial for a third term.

Although the MiniLit program is conceptualised as a Tier 2 program this was not the context in which it was implemented, partly by 'accident' and partly by 'design'. The 'accident', or rather the aspect over which the study had no control, is that the school in which the trial took place was introducing a program of initial reading instruction (Tier 1) with few of the hallmarks of evidence-based practice. It was therefore not complimentary to the MiniLit program. The 'design' aspect that prevented a strict RtI implementation was a feature of the experimental methodology. The use of a randomised control trial, while necessary to objectively demonstrate MiniLit's effectiveness, required that all participants remain in the program for the duration of the trial. In a true RtI model, strong responders would have been moved back into class and non-responders would have been moved into Tier 3 instruction. These aspects of the study potentially affected the results, which were promising nonetheless.

The sample size for the study ended up being quite small for reasons that could not have been anticipated by the researcher, and which could not be reversed once the trial started. Ideally, sample size would have been larger. Real-world research in schools is particularly vulnerable to attrition of participants.

Small group size can be problematic because very large differences in post-test means are required to achieve statistical significance and because any differences in pre-test means between the groups can affect the results (although in this study, pre-test means were not statistically significantly different). The statistical method of analysis selected for use in the study—analysis of covariance (ANCOVA)—is appropriate in this scenario.

According to Pallant (2011),

> ANCOVA can be used when you have a two-group pre-test/post-test design (e.g. comparing the impact of two different interventions, taking before and after measures for each group). The scores on the pre-test are treated as a covariate to 'control' for pre-existing differences between the groups. This makes ANCOVA very useful in situations when you have quite small sample sizes, and only small or medium effect sizes (p.298).

Statement of candidate's contribution: This paper is co-authored with my doctoral supervisors. I took the lead in writing. My co-authors provided advice in research methodology and implementation, and assisted with statistical analysis.

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A randomised control trial of a Tier-2 small-group intervention ('MiniLit') for young struggling readers[1]

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The response-to-intervention model is predicated upon increasingly intensive tiers of instruction. The aim of the present study was to examine the efficacy of a Tier-2 small-group literacy intervention ('MiniLit') designed for young readers who are still struggling after experiencing whole-class initial instruction. A total of 22 students in Kindergarten and Year 2 at a New South Wales public school were randomly allocated to form two comparable groups. The experimental group received the Tier-2 small-group literacy intervention for one hour per day for four days per week for three school terms (27 weeks of instruction) while the control group continued to receive regular whole-class literacy instruction during this time. All students were assessed on four measures of reading and related skills before the intervention commenced, again after two terms of instruction and once more after three terms of instruction. Large and statistically significant mean differences between the two groups were evident at post-test on two of the four tests employed measuring phonological recoding and single word reading. Large effect sizes provided evidence for the efficacy of the small-group intervention for young struggling readers.

Introduction

Literacy is the foundation skill of education. Literacy ability is related to school completion, participation in higher education and in the labour market (Marks, 2006; Marks, McMillan, & Ainley, 2004) and income (Shomos, 2010). Unfortunately, a large number of children struggle to learn to read at even a functional level. In the 2011 National Assessment Program for Literacy and Numeracy (NAPLAN), 6.3% of Year 3 students failed to achieve the national minimum reading standards expected for their year of education. Children with low parent education levels and low parent occupational status were four to five times more likely than average to be among the group with the lowest levels of reading ability (Australian Curriculum, Assessment and Reporting Authority, 2011).

The NAPLAN statistics are in accord with evidence from other large-scale surveys showing a relationship between literacy achievement and socioeconomic status, both at the individual and at the school level (Marks, 2009; Rothman, 2002; Rothman & McMillan, 2003; Thomson, de Bortoli, Nicholas, Hillman, & Buckley, 2010). Although there is a moderate and persistent relationship between literacy and

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socioeconomic status, the available evidence suggests that socioeconomic status is not in itself a causal factor in the relationship. It is rather a 'risk' variable that acts as a proxy for other factors that impact on literacy, including the quality of the home literacy environment (Aikens & Barbarin, 2008; Dodd & Carr, 2003), quality and quantity of verbal interactions with adults (Hart & Risley, 2003) and cognitive stimulation in the early years (Eamon, 2005). Other studies point to interactions between genes and home environment. According to Friend, De Fries and Olson (2008), the majority of studies of gene-environment effects on children across the normal range of ability support the theory that impoverished environments prevent genetic ability from being fully expressed, finding that genetic influences on reading disability were greater for socially advantaged children, while environmental influences were greater for socially disadvantaged children. High concentrations of disadvantage in a school have been shown to be associated with poor literacy performance through lower quality teaching (Hill & Rowe, 1996), higher absenteeism (Ready, 2010), peers' reading ability (Aikens & Barbarin, 2008) and the average academic achievement level of the school (Marks, 2009).

Although research points to a number of potential mediating factors, Carnine, Silbert, Kame'enui, Tarver and Jungjohann (2006) argue that the most effective and immediate way to improve current reading ability is through exemplary instruction. Explicit and systematic instruction in the fundamentals of reading is particularly important for children from disadvantaged backgrounds, who are less likely to have been exposed to these concepts in their family and home environments. Such instruction is also effective for all children (Department of Education, Science and Training, 2005; National Institute of Child Health and Human Development, 2000; Rose, 2006).

Even with effective initial instruction, however, some children will still struggle to learn to read. Only a small minority have inherited or intrinsic disabilities (Friend et al., 2008). Torgesen, Wagner and Rashotte (2000) estimate that as few as 3–5% of the population have a severe reading disability and do not respond readily to instruction. A much larger proportion of poor literacy performance can be attributed to a combination of a home environment not conducive to language and literacy development and ineffective literacy teaching practice at school. That is, they have an instructional deficit, rather than a reading disability (Fuchs & Fuchs, 2006).

There is strong evidence that children with reading difficulties respond more readily to intervention in the early years of school before problems become entrenched and the gap widens (reviewed in Rose, 2006). In order to do this, accurate identification of children who need supplementary instruction is paramount, ideally using an objective measure such as a curriculum-based assessment to complement teacher judgement (Madelaine & Wheldall, 2010).

In a response to intervention (RtI) model for teaching reading, instruction is tailored to meet the different levels of remediation required by different children, as determined by regular monitoring. It is, by design, a model that focuses principally on quality and quantity of instruction rather than looking for child-centred causes of reading difficulties (Gersten et al., 2009). The RtI model has multiple levels or 'tiers' of instruction, which increase in intensity and duration. In a three-tier RtI model, Tier 1 is whole-class instruction, Tier 2 is small-group instruction for struggling readers identified using a standardised assessment measure (Reynolds & Wheldall, 2007) and Tier 3 is intensive individual instruction for the small number of children who do not respond to the Tier-2 intervention (Slavin, Lake, Davis, & Madden, 2011).

Three-tier RtI models are becoming more widespread in the USA (Gersten et al., 2009) but they are not common in Australia. Most schools offer remedial reading programs using learning support teachers and teacher assistants but generally do not follow the assessment and identification regime of a properly-implemented RtI model. Formal remedial reading programs are more likely to be one-to-one tutor programs (Tier 3 in an RtI model), with small-group instruction being either informal or missed out altogether (van Kraayenoord, 2010; Louden et al., 2000).

Although research indicates that one-to-one tutor sessions may be more effective than small-group instruction for children with the greatest reading difficulties, there is a strong evidence base for providing small-group interventions for children with milder problems, especially in the early years of school (Gersten et al., 2009; Wanzek & Vaughn, 2007). Slavin et al. (2011) reviewed studies of well-established small-group reading interventions with a strong emphasis on phonics, finding effect sizes ranging from 0.19 to 0.82 for programs targeting children in Years 1 to 2. Small-group instruction has the added benefit of being more cost-effective and allows schools to offer supplementary instruction to larger numbers of children. There is evidence that RtI models could reduce the need for Tier-3 intervention (Burns, Appleton, & Stehouwer, 2005).

The most well-known and widely implemented remedial reading program in Australia and elsewhere is Reading Recovery (Clay, 1993). As a one-to-one program involving a specialist reading teacher, Reading Recovery may conceptually be regarded as a Tier-3 intervention in the context of RtI. In practice, it has typically been used as a Tier-2 intervention in the sense that it is the first formal remedial instruction offered to struggling readers – a very cost-ineffective approach. In Victoria, 87,000 students have participated in Reading Recovery since 1984 (Victorian Department of Education and Early Childhood Development, 2011) while in New South Wales, 98,669 students in NSW public schools participated in Reading Recovery between 1996 and 2011 (New South Wales Department of Education and Community Services, 2012). The popularity and longevity of Reading Recovery in schools would suggest that there is a strong evidence base for its effectiveness. However, research reviews published in the last five years have questioned the efficacy of Reading Recovery, finding that many of the studies used to support its continued implementation have methodological shortcomings. They argue that the empirical evidence for the long-term effects of the program is equivocal and that where positive effects have been found, they have not been strong or consistent (Reynolds & Wheldall, 2007; Slavin et al., 2011).

Since 2000, three major reports on reading in Australia (Department of Education, Science and Training, 2005), the UK (Rose, 2006) and the USA (National Institute of Child Health and Human Development, 2000) have come to the conclusion that development of reading skills is more likely to occur with phonics-based reading programs, in which children are taught explicitly about letter-sound correspondences, blending and segmenting, phonemic awareness and generative strategies. This applies to both initial instruction and remedial instruction. Reading Recovery includes this content only in an incidental, non-systematic way (New South Wales Department of Education and Community Services, 2012; Reading Recovery Council of North America, 2007). This may partly explain the relatively low effect sizes when independent reading tests are used (Reynolds & Wheldall, 2007).

Other interventions used for struggling readers in the early years of school have not typically been subject to trials under experimental conditions. Reynolds, Wheldall and Madelaine (2011) reviewed reading interventions for Year-1 students and found that very few interventions were comprehensive literacy programs that included instruction in phonemic awareness and phonics. Few programs had methodologically sound empirical evidence for their efficacy.

Tier-2 reading programs evaluated by the What Works Clearinghouse (WWC) at the US Institute of Education Sciences, which reported at least some statistically significant positive results in phonemic awareness and phonics among young students, included: SpellRead (WWC, 2007), Early Intervention in Reading (WWC, 2008a), Lindamood Phoneme Sequencing (WWC, 2008b, 2010), Success For All (WWC, 2009) and Peer-Assisted Learning Strategies (PALS) (WWC, 2012). With the exception of Success For All and PALS, the WWC describes the extent of the evidence on these interventions as 'small', meaning that there are few high-quality studies investigating their effects. The extent of evidence on PALS and Success For All was rated as medium to large. Only Success For All and SpellRead were classified by the WWC as having positive effects on alphabetic knowledge. The program effects of the other interventions listed above were rated as potentially positive for alphabetic knowledge. A recent research synthesis by Slavin et al. (2011) reported several additional studies on Success For All but none meeting the WWC's standards.

A Tier-2 intervention with published research that was not evaluated by the WWC is Early Literacy Support (ELS) (Hatcher et al., 2006). In a randomized control trial, students who had participated in a 10-week ELS program made significantly more progress on measures of letter knowledge, single word reading and phoneme awareness than the control group, on average (Hatcher, 2006).

The dearth of comprehensive small-group reading interventions with a strong evidence base seems to apply especially in Australia. According to van Kraayenoord (2010), "there are very few literacy interventions that have been well-researched and found to be effective" in use in Australia (p. 374). Major reports on literacy interventions in Australia over the last decade have identified only a few formal reading interventions for young struggling readers, the dominant program being Reading Recovery (Louden et al., 2000; Wyatt-Smith, Elkins, Colbert, Gunn, & Muspratt, 2007). Others include: Support-A-Reader (van Kraayenoord, 2010); and THRASS (Teaching Handwriting, Reading and Spelling Skills) (Louden et al., 2000; THRASS, 2007). None of these programs meet the criteria for a balanced Tier-2 program for young readers that has also been shown to be effective in experimental trials (Brooks, 2007; Symons & Greaves, 2006; WWC, 2007a; Wyatt-Smith et al., 2007).

The MiniLit (Meeting Initial Needs In Literacy) program was developed to meet the need for a Tier-2 program for young students that comprises all of the elements of effective early literacy instruction as determined by large-scale reviews of research (Reynolds et al., 2007c). In line with the recommendations of the Australian (Department of Education, Science, and Training, 2005), US (National Institute of Child Health and Human Development, 2000) and UK reports (Rose, 2006) on the teaching of reading, it is highly planned, systematic and sequential (Reynolds et al., 2010b). MiniLit fills a gap in literacy provision by extending supplementary instruction to a larger group of children at lower cost than one-to-one interventions and, as part of a high quality RtI model, may reduce the need for Tier-3 interventions (Reynolds et al., 2007a). Unlike Reading Recovery, it is inclusive of the very lowest performing students, only moving them on to more intensive (Tier-3) instruction if they fail to make progress (Reynolds & Wheldall, 2007).

The content of the MiniLit program differs from the reading interventions listed above in several important ways. It has a strong emphasis on phonemic awareness and phonics, teaching grapheme and phoneme correspondences explicitly and sequentially. This part of the program, which becomes gradually more difficult as each section of content is mastered, comprises at least half of each of the 24 one-hour lessons in Level 1 of the program (Reynolds et al., 2010a). Following the compelling evidence presented in research reviews, it is a balanced program of literacy instruction. As such, it includes sight words (replacing Phonemic Awareness in Level 2 of the program) and text reading, initially using decodable books to encourage reading fluency, and develops vocabulary and comprehension in group storybook reading (MultiLit, 2011). More detail about the MiniLit program is provided in the Methods section.

Several pilot studies of the MiniLit program have guided its development and provided promising preliminary evidence of an early version of the intervention (Reynolds et al., 2007a, 2007b, 2007c). Three initial pilot studies involved Year-1 and Year-2 students in MiniLit sessions of 1 hour each day, 4 days a week, over 15 weeks. In each of the studies, participating students made statistically significant gains on all standardised reading measures, with large effect sizes. As these studies did not have control groups, treatment causality cannot be claimed, but the large effect sizes indicate that the results are unlikely to be due to maturation alone (Reynolds et al., 2007a).

A fourth trial, using a shortened version of the program used in the first three trials, had an experimental design, including a randomized control group. MiniLit lessons were for 45 minutes, 5 days a week, for 10 weeks. Lesson time was reduced by making the storybook reading session weekly instead of daily. The MiniLit program was delivered in the school itself by school staff who had been trained to teach the program, unlike the previous trials, where MiniLit had been taught off-site with dedicated MiniLit tutors. As MiniLit is intended to be implemented in schools, this is an important feature.

Effects of the MiniLit intervention on growth in test scores were observable but not as large as in the initial 15-week trials. Comparisons of the experimental and control groups' test-score growth showed large effect sizes favouring the experimental treatment but there were no statistically significant differences between the experimental and the control group in either phase of the study, possibly attributable to the small sample size. Another possible explanation is that not all students in the study were below the 25th percentile on all measures at pre-test, so could not strictly be described as the 'struggling readers' for whom MiniLit is designed. Also, the effectiveness of the program in terms of statistical significance may have been diminished by the shortened duration of the lessons and the intervention (Reynolds et al., 2010a).

MiniLit has also been implemented at the Schoolwise Tutorial Centre at Ashfield in NSW since 2005, with Year-1 and Year-2 students referred by their schools. Instruction was in groups of four, on average, for 1 hour a day, 5 days a week, for 15 weeks. There was no control group. Testing took place over the six years from 2005–2010. Groups of students made substantial and statistically significant gains on all of the measures of reading and related skills ($p < 0.0005$) after 15 weeks, with large effect sizes ranging from 0.96–1.41 (mean 1.08) (Wheldall, Beaman, Madelaine, & Kohnen, unpublished data).

A further experimental trial of MiniLit, which builds on the findings of the previous studies, is the subject of this article. It differs from previous trials in a number of ways:

- It is an experimental study, with random allocation to treatment and control groups.
- Students were screened for participation rather than selection being based on teacher nomination alone.
- It included a larger sample size than the previous experimental trial – 22 students in total completed the trial.
- All students except one in each of the experimental and control groups were below the 25th percentile for their age on the Martin and Pratt Non-Word Reading Test (Martin & Pratt, 2001) at pre-test. This is the only measure used in this trial that provides a percentile ranking.
- Participating students were from Kindergarten to Year 2.
- The participating school had a high concentration of socially disadvantaged students.
- The trial was for 27 weeks (three school terms).
- The MiniLit program was implemented in the school setting, by school staff with no experience with MiniLit other than the training provided before the trial commenced.
- The MiniLit program implemented was a revised version, developed to incorporate the findings of previous trials.

The study aims to gather further experimental evidence of the efficacy of MiniLit in a school setting. The participating school was chosen so as to provide some evidence of the potential of MiniLit to improve literacy in schools with a high level of social disadvantage as a cost-effective Tier-2 intervention. The study will also investigate the effect of MiniLit over two and three terms.

Methods

Participants

A total of 22 students in Kindergarten and Year 2 at a NSW public school were participants in the study. The participating school is located in a regional town and has a very low socioeconomic profile. It is classified as a Priority Action School by the NSW Department of Education and Training, placing it among the 101 public schools with the lowest socioeconomic profile in NSW (New South Wales Department of Education and Training, 2010). In 2010, when the study began, the school's Index of Community Socio-Educational Advantage (ICSEA) (Barnes, n.d.), calculated for the federal government's My School website, was 897 (the national average ICSEA value is 1000 with a standard deviation of 100) and 75% of students at the school have an ICSEA score below the national average.

Students were selected for participation in the study through a process of screening and ranking. Kindergarten, Year-1 and Year-2 classroom teachers were asked to identify the lowest 50% of their class in terms of reading ability. Students with a diagnosed (and documented) intellectual disability or severe language impairment were excluded since their needs would have been addressed by alternative provision.

Students identified by the teachers were screened by trained research assistants using two lists from the Wheldall Assessment of Reading Lists (WARL) (Reynolds et al., 2009) and then ranked according to their mean scores. The 16 students with the lowest average WARL scores were selected from Kindergarten and the eight students with the lowest average WARL scores were selected from each of Years 1 and 2, bringing the total number selected to 32 students.

Standardised tests administered to determine baseline measures (described in the section 'Measures') indicated that six of the Year-1 students had reading levels close to average for their age. It was decided to exclude them from the study as they did not meet the definition of low-progress readers. The remaining Year-1 student in the MiniLit program was withdrawn at parent request. A student from Kindergarten also left the school in week-9 of the study. This attrition of 10 students (five experimental and five control) from the original testing group reduced the total number of participants for the study from 32 to 22 students.

The experimental group and the control group each had 11 students, comprising 7 students from Kindergarten and 4 students from Year 2. The Kindergarten students were 10 boys and 4 girls, with a mean age of 67 months (5 years, 7 months) at the beginning of the intervention. The Year-2 students were 4 boys and 4 girls, with a mean age of 91 months (7 years, 7 months) at the beginning of the intervention. None of the children were from homes where languages other than English are spoken. All of the participants were in the bottom quartile for the Martin and Pratt Nonword Reading Test except for one Year-2 child in each group, who were both at the 34th percentile. None of the other measures provided percentile ranks.

Procedure

All participants in both experimental and control groups were given a battery of reading tests at three points in the study – before the reading intervention started ('pre-test'), after two terms of the intervention ('post-test 1') and at the end of the intervention ('post-test 2'). The test battery included the Burt Word Reading Test (Gilmore, Croft, & Reid, 1981), the South Australian Spelling Test (Westwood, 2005), the Martin and Pratt Non-Word Reading Test (Martin & Pratt, 2001) and the WARL (Reynolds et al., 2009*)* (using different lists to the screening WARL). The pre-intervention test battery also included the MiniLit Placement Test (MultiLit, 2011). The tests were administered by trained research assistants. All tests were independently scored and double-scored.

Prior to the administration of the pre-intervention test battery, information and consent forms were sent home to the parents/carers of participating students. Passive consent for the students' participation in the study was required by the university research ethics committee.

Following the pre-intervention test battery, matched pairs of students were identified using their MiniLit Placement Test scores (described in the Measures section, below) and one student from each pair was randomly allocated into either the experimental or control group. The experimental group undertook the MiniLit program, while the control group remained in class for their usual classroom literacy instruction.

The MiniLit program was delivered over three school terms (27 weeks) by instructors trained by MultiLit trainers. (Multilit is the entity responsible for developing the intervention.) It was initially intended to be delivered over two school terms (19 weeks) but part way through the second term, before post-testing commenced, it was decided to extend the intervention for a third term. Formal observations of the lessons by MultiLit consultants had indicated that the MiniLit instructors, who had had no previous experience with the program, did not begin delivering the program to the optimal level until at least half-way through the first term (see the Treatment integrity section, below). Two of the instructors were registered primary school teachers and one had no teaching qualifications.

At the end of the intervention, the data collected in the three testing phases were analysed to compare the growth in scores of the experimental and control groups on the various tests.

The intervention – MiniLit

The MiniLit early literacy intervention program was developed for small-group instruction for struggling readers in the first few years of school (Reynolds et al., 2007a, 2007b, 2010; MultiLit, 2011). Each one-hour MiniLit lesson had the following components: Sounds and Words Activities, Text Reading and Story Book Reading.

The Sounds and Words Activities component of the program (30–40 minutes), encompassing phonemic awareness and phonics, is highly structured and carefully scripted and sequenced. It follows a 'synthetic phonics' approach, where students learn and master letter-sound correspondences, and then progress to blending and segmenting these sounds in words, both orally and in print. Sight words are initially introduced through text reading as 'tricky words' and are later taught explicitly as short lists of common words.

Text reading occurs in two stages, first as part of the intensive scripted Sounds and Words Activities and second through the Text Reading component (5–10 minutes). In the Sounds and Words Activities, students read sentences or simple short stories constructed to reinforce and practice the phonic word attack skills and/or sight words learned in the lesson. In Text Reading, students take turns to read aloud from a controlled vocabulary book at an appropriate instructional level with feedback and guidance from their teacher using the revised Pause, Prompt, Praise tutoring method, as employed in Reinforced Reading (MultiLit, 2007, 2011).

Story Book Reading (10–15 minutes) is the last part of the lesson, developing listening comprehension skill and vocabulary, while also modeling fluent, expressive reading. It is an enjoyable exercise in which the teacher reads a children's storybook of their choice to the group and engages them by commenting and asking questions (MultiLit, 2011).

MiniLit prescribes both content and pedagogy. Effective direct instruction teaching (such as model-lead-test procedures) (Carnine et al., 2010) is intrinsic to the program, as is the use of the revised Pause Prompt Praise technique employed in Reinforced Reading (MultiLit, 2007, 2011). Positive Teaching behavior-management strategies are also a key feature (Merrett & Wheldall, 1990; MultiLit, 2011) to maximise academic engaged time. The last five minutes of the hour was spent giving positive feedback through a rewards system of stamps and sticker prizes.

Students in the experimental group received MiniLit instruction for 1 hour a day, 4 days a week over 27 weeks. Students were withdrawn from class during classroom literacy time. Students were in three groups of three to four students, organised by instructional level. Initially, group membership was flexible as skill acquisition varied but after around 10 weeks of instruction the groups became stable. The average attendance rate for MiniLit lessons was 96% (with a range of 91–100%).

Measures

Burt Word Reading Test (Gilmore et al., 1981)

This test measures single word recognition using a list of 110 words that increase in difficulty. The maximum reading age achievable on the Burt is about 13 years. The Burt has high test-retest reliability (>0.95), high internal consistency (>0.96) and high criterion validity (correlations of 0.90–0.98 between the Burt Word Reading Test and the Schonell Graded Word Reading Test (Schonell, 1995, as cited in Gilmore et al., 1981) and the Oral Word Reading Test (Fieldhouse, 1952, as cited in Gilmore et al., 1981).

South Australian Spelling Test (Westwood, 2005)

This test provides a spelling age for children in the age range 6 years to over 15 years. It can be administered individually or in groups. The test manual reports good internal reliability, with a test-retest reliability coefficient of 0.96 for most year groups. Alternative forms reliability ranges from .89 to .94, depending on age level (Westwood, 2005).

Martin and Pratt Nonword Reading Test, Form A (Martin & Pratt, 2001)

This test measures phonological recoding ability in students aged from 6 to 16 years, using pseudowords of increasing difficulty (Martin & Pratt, 2001). The test has a high test-retest reliability coefficient of 0.96, high alternative-forms reliability coefficients of 0.92–0.96 and a high internal consistency reliability coefficient of 0.96 (Martin & Pratt, 2001). Good criterion-related validity is indicated through positive correlations between the Martin and Pratt and the WRMT-R Word Attack (Woodcock, 1987, as cited in Martin & Pratt, 2001) (0.89), Coltheart and Leahy Nonword reading lists (Coltheart & Leahy, 1996, as cited in Martin & Pratt, 2001) (0.93) and the Neale Analysis of Reading Ability (Neale, 1988, as cited in Martin & Pratt, 2001) (0.78–0.88). Non-word tests are an important measure of early reading progress as they avoid the possibility of students reading words from memory (Hempenstall, 2009).

Wheldall Assessment of Reading Lists (WARL) (Reynolds et al., 2009)

The WARL is a curriculum-based measure of word identification fluency for young students. The test consists of parallel lists of 100 high-frequency words from children's texts and storybooks. The student is presented with the list on a page and instructed to read the words aloud quickly and carefully. They are asked to stop after one minute. The score is the number of words read correctly per minute, averaged over three parallel lists. The WARL has been found to be highly reliable, with reliability coefficients for parallel forms between 0.85 and 0.94 (Reynolds et al., 2009). The validity of the measure has been demonstrated through high correlations between the WARL and the Burt Word Reading Test ($r = 0.79$) and the TOWRE Sight Words Test (Torgesen et al., 1999) ($r = 0.95$) (Reynolds et al., 2009).

MiniLit Placement Test (MultiLit, 2011)

The MiniLit Placement Test assesses students' phonic word attack knowledge and abilities, namely letter-sound correspondences and reading of words containing specific letter-sound correspondences. The test includes only real words, but many are not frequently used and therefore are very unlikely to be recognised as sight words by young students.

Analysis

In order to compare gains made by the two groups, analyses of covariance were employed in the analysis of scores for each variable at post-test 1 and post-test 2, with pre-test scores as the covariate in each analysis. The alpha level was set at 1% ($p < 0.01$) to allow for family-wise comparisons in lieu of the use of a Bonferroni correction (Howell, 2008)

Treatment integrity

A Treatment Integrity checklist was devised to evaluate the instructors' delivery of the program. Two experienced consultants from the MultiLit Research Unit observed MiniLit lessons eight times over the course of the intervention, at three-to-four-week intervals. A Treatment Integrity checklist was completed for each instructor observed. The checklists contained up to 25 criteria, including all aspects of lesson implementation and positive-teaching strategies. Lesson implementation included, for example, 'Models correct sounding out strategy' and 'Monitors students' verbal responses, ensuring students respond on signal'. Positive teaching points included, for example, 'Uses explicit praise' and 'Praises quickly and consistently'. The consultants observed the MiniLit lessons silently and completed the checklists with a 'yes', 'sometimes' or 'no' response. The percentage of 'yes' responses for the lesson observed is the measure of treatment integrity or fidelity. Separate written feedback on performance was provided to the instructors, along with verbal feedback and discussion following the observed lesson.

As may be seen from Figure 1, program implementation by the instructors did not reach the minimum criterion of 80% fidelity until week-10, after which point the

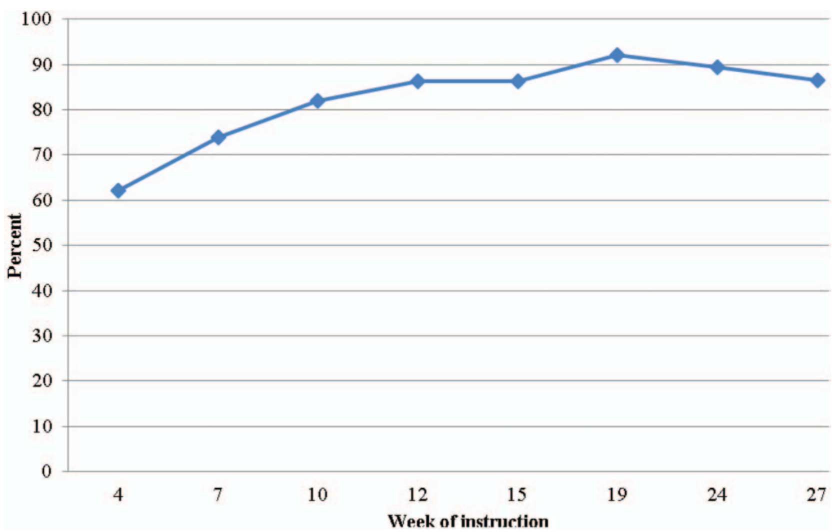

Figure 1. Mean percentage treatment integrity over the three terms of intervention.

minimum 80% fidelity criterion was maintained (and exceeded). In view of the relatively low treatment fidelity during the first term it was decided to extend the program for a third term, as discussed earlier.

Results

Means and standard deviations for all measures (raw scores) for both experimental and control groups at pre-test, post-test 1 and post-test 2 are shown in Table 1.

As may be seen from Table 1, the control group means were slightly higher than those for the experimental group at pre-test for all measures but none of these differences was statistically significant. (The subsequent analyses of covariance take these small differences into account.)

Analyses of covariance (ANCOVA) were conducted on the scores for each measure separately at post-test 1 and post-test 2 (with pre-test scores as the covariate). Partial eta squared was calculated for each measure at post-test 1 and post-test 2 to determine the size of the treatment effect. Results of these analyses are reported in Table 1.

Results after two terms (post-test 1)

Statistically significant, positive treatment effects were found for two measures after two terms – the Martin and Pratt Nonword Reading Test and the Burt Reading Test at the stated alpha level ($p < 0.01$). The effect sizes of the differences between the experimental and control group means on the Martin and Pratt (partial eta squared = .487) and on the Burt (partial eta squared = .329) were both very large (an effect size is considered to be large when partial eta squared is equal to or greater than .138).

The other two measures did not show statistically significant differences between the means of the two groups after two terms, but had small to medium effect sizes. The South Australian Spelling Test had a medium effect size (.101) and the WARL had a small effect size (eta squared = .054).

Results after three terms (post-test 2)

Even stronger positive treatment effects were found for the Martin and Pratt and the Burt measures after three terms. The differences between the experimental and control groups on the Martin and Pratt and the Burt were again statistically significant at the specified alpha level ($p < 0.01$) with increased very large effect sizes (Martin & Pratt .587; Burt .359). The two measures that had not shown statistically significant differences between groups after two terms also exhibited stronger effects after three terms but the mean differences were not statistically significant at the stated alpha level ($p < 0.01$). On the South Australian Spelling test, the effect size increased from medium to large (eta squared = .204) and on the WARL the small effect size increased slightly (eta squared = .09).

Growth in mean scores of the experimental and control groups over two and three terms

Figures 2 to 5 show the growth in group mean scores on the four measures, using adjusted means accounting for the initial small differences between groups.

Table 1. Means and standard deviations (raw scores) of experimental and control groups at pre-test, post-test 1 (after two terms) and post-test 2 (after three terms), results of analyses of covariance and effect sizes (partial eta squared).

Measure	Group	Pre-test Mean (*SD*)	Post-test 1 Mean (*SD*)	*F*	*p*	*ES**	Post-test 2 Mean (SD)	*F*	*p*	*ES*
Martin & Pratt	E	3.36 (4.11)	12.09 (5.89)	18.03	.0005	.487	15.55 (5.64)	27.00	.0005	.587
Nonword Test	C	4.09 (4.72)	5.27 (4.13)				5.75 (4.74)			
Burt Word	E	8.45 (10.92)	18.91 (9.61)	9.307	.007	.329	24.36 (9.36)	10.66	.004	.359
Reading Test	C	10.73 (9.95)	15.27 (10.06)				17.45 (10.17)			
South Australian	E	5.64 (6.96)	12.00 (4.17)	2.13	.161	.101	15.55 (4.78)	4.87	.040	.204
Spelling Test	C	6.73 (6.12)	10.36 (6.31)				11.64 (6.41)			
WARL (words correct	E	10.27 (11.12)	21.36 (13.07)	1.08	.312	.054	30.55 (15.55)	1.89	.185	.090
per minute)	C	12.45 (12.52)	20.55 (17.48)				26.00 (21.09)			

Note: *ES = partial eta squared, large effect size is evident when partial eta squared is $\geq .138$.

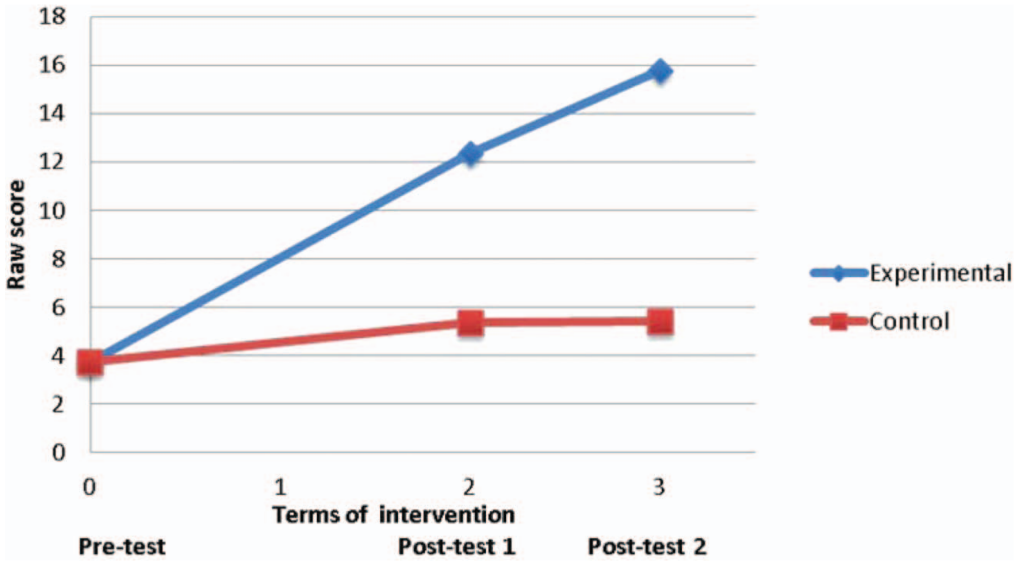

Figure 2. Adjusted Martin and Pratt Nonword Reading Test raw score means for the experimental and control groups at the three testing points.

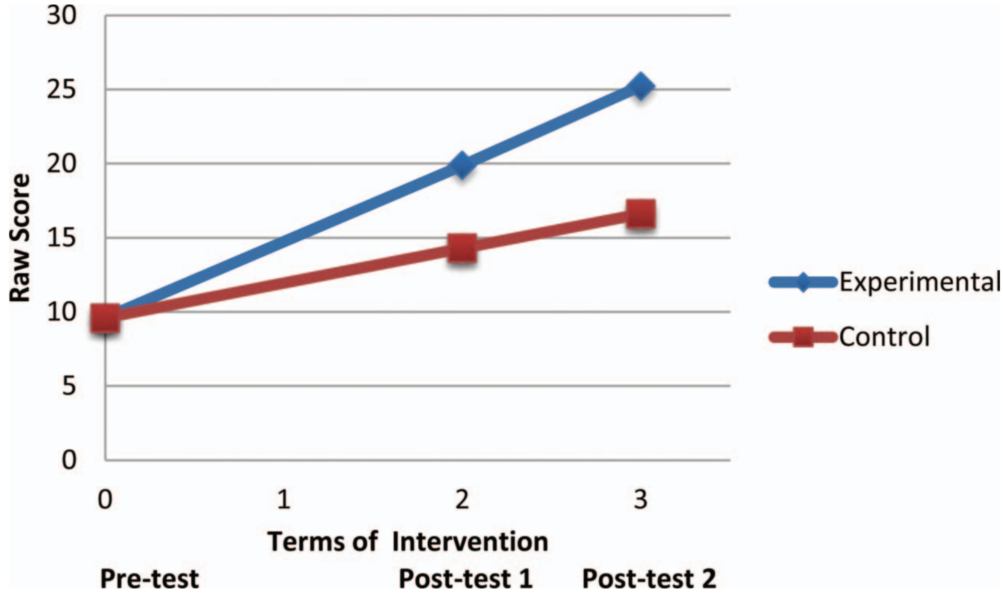

Figure 3. Adjusted Burt Word Reading Test raw score means for the experimental and control groups at the three testing points.

Figures 2 and 3 show the large and increasing gains made by the experimental group on the Martin and Pratt and the Burt compared with the control group. Figures 4 and 5 show the smaller (non-significant) gains on the South Australian Spelling Test and the WARL after two terms, and the steeper gradient of the experimental group on these measures after three terms.

Percentile rank and standard scores (Martin & Pratt)

The Martin and Pratt test is the only measure used in this study that provides both percentile ranks and standard scores. All 22 experimental and control participants

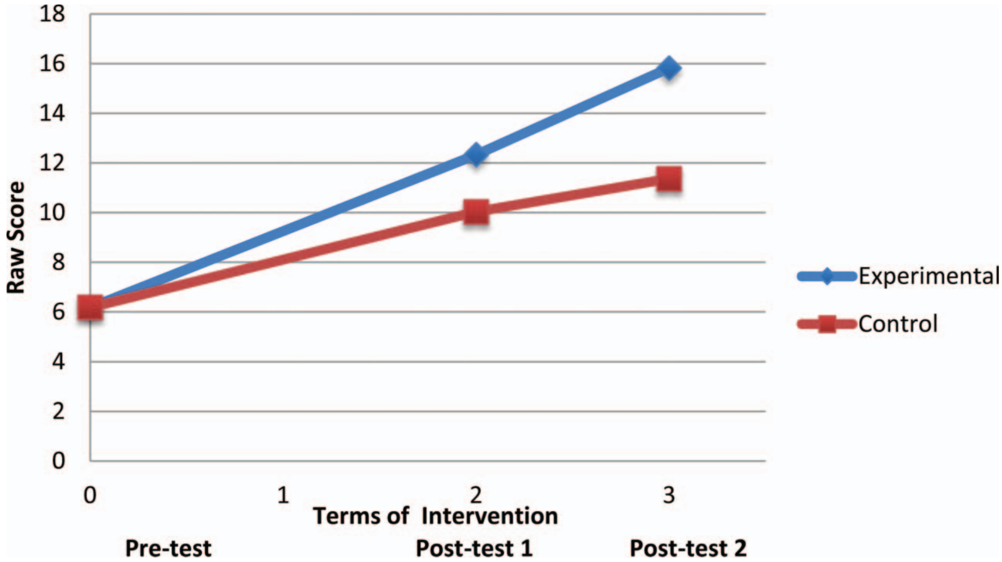

Figure 4. Adjusted South Australian Spelling Test raw score means for the experimental and control groups at the three testing points.

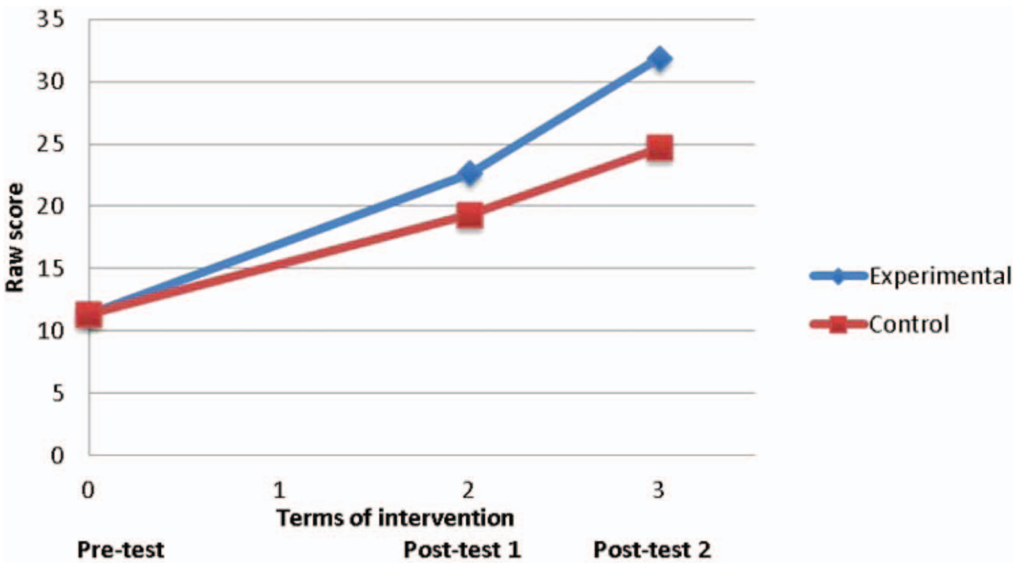

Figure 5. Adjusted WARL raw score means for the experimental and control groups at the three testing points.

were in the bottom quartile at pre-test on the Martin and Pratt, except for one Year-2 child in each group, both of whom were at the 34th percentile, as stated earlier. After three terms, only three control group participants were above the bottom quartile (but none were above the 40th percentile – range <1–39%). In the experimental group after three terms, eight participants were now above the bottom quartile and seven participants were at the 50th percentile or higher (range 16–86%). In other words, eight of the 11 *control* students were still in the bottom quartile at post-test 2, but only three of the 11 *experimental* students remained in the bottom quartile at post-test 2. The mean standard score at post-test 2 for the control group was 82.09 (9.27) and for the experimental group was 101.00 (12.09). The experimental group mean on this measure after three terms was consequently now in the average range.

Discussion

Over the last decade or so, it has become widely accepted that a three-tiered RtI model is the most effective approach to addressing reading difficulties in young children (Gersten et al., 2009). In an RtI model, students who are not making good progress in learning to read after receiving high quality whole-class (Tier-1) instruction are offered supplementary instruction in a small-group (Tier-2) intervention. Only the small number of students who are still demonstrating difficulties move into more intensive one-to-one (Tier-3) instruction.

Few small-group interventions have been developed and rigorously tested for children struggling with learning to read in the early years of schooling. The most commonly used interventions are one-to-one tutoring programs that typically do not have a strong experimental evidence base, particularly in the improvement of phonemic awareness and word decoding skills (Reynolds & Wheldall, 2007; Reynolds et al., 2011; Slavin et al., 2011).

The MiniLit program is a comprehensive Tier-2 reading intervention designed for young students who are struggling to learn to read after one year of initial reading instruction. Previous studies of MiniLit had produced positive results (Reynolds et al., 2007a, 2007b, 2007c, 2010a), indicating that it had the potential to be a successful Tier-2 intervention. In this study, a revised version of MiniLit was implemented in a school setting and the growth in student test scores was evaluated after two and three terms of instruction. The study was a randomised control trial, allowing program effects to be determined.

After two terms of MiniLit instruction, the experimental group had made greater mean gains on all four measures. Comparative mean gains on two of the measures (phonological recoding and reading single words) were statistically significant with very large effect sizes. Comparative gains on the other two measures (spelling and oral reading fluency) were not statistically significant but yielded small to medium effect sizes. After three terms of instruction, the same pattern of results was observed, but with increased effect sizes for all measures.

The measures with the strongest results were the Martin and Pratt Nonword Reading Test and the Burt Word Reading Test, both of which require students to read aloud individual words or non-words. The Martin and Pratt test explicitly assesses phonological recoding in its purest form, as it consists of pseudo-words that the child will never have encountered before and thus cannot read from memory, while the Burt test has a mixture of phonically regular real words and phonically irregular real words. After two terms (18 weeks) of instruction, students in the MiniLit program had made highly significantly greater gains in both kinds of word reading than the control group. These comparative gains were extended with a further nine weeks of instruction.

For the South Australian Spelling Test and the WARL there were observable differences favouring the experimental group after two and three terms, reflected in small and medium effect sizes, but the mean differences in gains were not statistically different. In spelling, there was a medium effect size and in the WARL there was a small effect size, after both two and three terms of instruction. In the case of spelling, a larger sample size might have resulted in a statistically significant difference in mean gains.

These findings are consistent with the earlier non-experimental MiniLit studies, which provided positive results after 15 weeks of instruction of the same frequency and duration (one hour a day, four days a week) as in the present study. The findings also support the explanation that the weaker findings in the fourth (experimental) MiniLit study (with the exception of the WARL) might be attributed to the substantial reduction in intensity and duration of the program in that trial implementation (45 minutes a day, 4 days a week for 10 weeks, compared to 60 minutes a day, 4 days a week for 27 weeks). In the fourth trial, as in the present study, small sample sizes might have contributed to the fact that the moderate effect sizes observed were not reflected in statistically significant differences in mean gains between experimental and control groups. Furthermore, revisions to MiniLit after the fourth trial might have improved the program's effectiveness.

It was shown to be less successful in improving spelling and word list reading fluency, as measured by the South Australian Spelling Test and the WARL. Although spelling was not taught explicitly in the program, there was a medium effect size. The weakest results for this study were for performance on the WARL, which tests word list reading fluency (speed and accuracy). Unlike the fourth MiniLit trial, which showed a large effect size for the difference in gains between experimental and control groups on the WARL after 15 weeks of instruction, there was only a small effect size observable in the present study even after three terms (27 weeks) of instruction.

Although MiniLit is predicated on the premise that effective reading instruction is effective irrespective of students' socioeconomic background, the WARL results possibly reflect a difference between this study and the fourth MiniLit study – the demographics of the participating schools. Students in the fourth MiniLit trial were drawn from a school located in a Sydney suburb with a high socioeconomic profile. The present study draws its participants from a school with a very low socioeconomic profile in a regional town. Since fluency is dependent on oral reading practice (Kuhn & Stahl, 2003; Martens et al., 2007; National Institute of Child Health & Human Development, 2000), it may be more influenced by differences in the home literacy environment than other measures. Although it is sometimes posited that students in socioeconomically disadvantaged families are less likely to read regularly at home (for example, Noble, Farah, & McCandliss, 2006), and therefore have fewer opportunities to practice and generalise their acquired reading skills, a literature search revealed no recent (in the last two decades) statistical evidence to support or refute this claim. There is a substantial published literature on differences in home literacy activities, such as shared book reading, among pre-school age children from varying socioeconomic backgrounds in Australia (see Edwards, Baxter, Smart, Sanson, & Hayes, 2008) and in other countries (see Bracken & Fishel, 2011). The home literacy activities of children of primary school age have been relatively neglected, however. This is an important avenue for future research.

A further possibly salient difference between this study and the fourth MiniLit study is the higher baseline reading abilities of the participants in the latter study. A higher starting point might have allowed the students in the fourth trial to consolidate their pre-existing word attack skills and hence reach fluency more quickly.

In terms of implementation, perhaps the most important difference between this study and the first three trials was the relative inexperience of the instructors with the MiniLit program specifically and, furthermore, with the pedagogy and instructional approach more generally. In the first three trials, instructors were familiar with the program and had some experience with its delivery. Moreover, these instructors were very experienced in delivering similar programs designed for older students. In this study, the instructors had two days of training before the trial began, with on-site instructional support from MultiLit consultants in the first week of the trial and intermittently thereafter. Two instructors were qualified teachers and one had no education qualifications or training.

The effect of this inexperience on the quality of instruction can be seen clearly in the Treatment Integrity data. Fidelity in program delivery to at least 80% accuracy was not observed until week 10, after around one term of instruction. A second trial implementation with the same instructors might achieve similar results in a shorter space of time.

The publication of these results brings the evidence on MiniLit in line with the extent of research on other Tier-2 interventions for children in the first two to three years of school, most of which have also been subjected to one or two randomised control trials (with the exception of Success for All). The treatment effects on phonic word decoding skills for MiniLit exceed the effect sizes reported for those interventions. Medium average effect sizes (Hedges' *g*) reported by WWC (2007a, 2007b, 2008b, 2012) were found for Lindamood Phoneme Sequencing (0.45), Peer Assisted Learning Strategies (0.35), SpellRead (0.47) and Success For All (0.33). Large effect sizes were reported for Early Intervention in Reading (1.10) for one study (WWC, 2008a). Hatcher et al. (2006) report medium to large effect sizes (in Cohen's *d*) for Early Literacy Support (0.46–0.94).

There are several limitations to the study. First, the trial involved a relatively small number of participants in just one school, which constrains generalisation of the findings. Also, the participants were relatively homogeneous with respect to language background. None were from homes where English is the second language. Second, the measures of reading ability were limited in their scope and some students scored below the lowest level for which norms are provided (for calculating reading age, for example). A small test battery was deliberately chosen to reduce the risk of stress for the young participants, but there is inevitably a trade off in terms of the depth and scope of the assessment of their reading abilities.

Overall, the study achieved its research objectives. It demonstrated the effectiveness of MiniLit in a school setting, particularly for improving phonic word attack skills and reading single words, and with positive but less pronounced results in spelling and oral reading fluency. On the one measure for which percentile ranks are available – the Martin and Pratt Nonword Reading Test – it provides evidence that the reading gap might be closed in the majority of cases using an effective Tier-2 intervention. All but 3 of 11 experimental students (73%) moved from the bottom quartile to above the 50th percentile, with the highest ranking at the 86th percentile. This success rate is consistent with Torgesen's (2000) estimation that around 3–5% of all students (20% of 'struggling' students) will not respond to Tier-2 instruction and will require a more intensive Tier-3 intervention. Finally, the study found strong treatment effects after two terms of instruction and these effects were strengthened after a further term.

As a result of the trial, the MiniLit program has been further refined to more easily be implemented within one hour. More broadly, this study adds to the growing, and as yet incomplete, research literature on effective Tier-2 interventions for young struggling readers.

Note

1. Disclosure: Professor Kevin Wheldall and Dr Robyn Beaman are both directors of MultiLit Pty Ltd, the publisher of the MultiLit/MiniLit program.

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CHAPTER 5 – Research Paper II

Evaluation of a two-phase implementation of a Tier 2 (small group) reading intervention for young struggling readers

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Preface to Chapter 5: 'Evaluation of a Two-Phase Implementation of a Tier 2 (Small Group) Reading Intervention for Young Struggling Readers'

The initial trial of the small group MiniLit program found greater improvements for the experimental group than the control group on all measures of reading skill development. Two measures—phonological recoding and single word reading—were statistically significant after two and three terms. Two other measures—spelling and word reading fluency—were non-significant, but observably different, particularly after a third term.

As noted in Chapter 4, it was originally intended for the intervention to be two terms but, prior to post-testing at the end of the second term, it was decided to extend the intervention and the study for a third term. This decision was made for a number of reasons: slow but promising improvements in weekly monitoring tests; low treatment fidelity for the first 10 weeks of the study; and a greater than anticipated loss of instruction time due to pre- and post-testing, student absences and school activities. The much improved results at the end of a third term of intervention justified this decision.

A commitment had been made to students participating in the original control group that they would also be offered the MiniLit program if it was determined to be effective. It was not envisaged at the beginning of the first trial that the second implementation would be also be evaluated, yet it seemed prudent to collect post-test data at the end of the second implementation since the school was not just willing to allow it, but highly interested in the results. As a number of the same students would be involved, it was decided to evaluate the second implementation as a 'cross-over' study, rather than a separate trial.

As noted in Chapter 4, the sample was intended to include students from Kindergarten, Year 1 and Year 2, and students from each of these years were screened for participation and selected into the study. There were, however, no Year 1 students in the study sample, due to a combination of high pre-test scores in this cohort (and the consequent decision to exclude these students) and the transfer of one student into Reading Recovery (at parent request).

Furthermore, in the second implementation, the Year 2 students from the initial trial were in the second half of Year 3, and no longer the appropriate target group for MiniLit. The only remaining students from the original trial who could be included in a cross-over study were the original Kindergarten sample (in Year 1 for the second implementation). This reduced the sample size considerably, but it was considered large enough to provide interesting data.

The paper which comprises Chapter 5 reports the findings of the cross-over study involving the fourteen students who remained in the school and participated in the study over six terms (three terms in the control group and three terms in the experimental group, or vice versa). The article compares the effectiveness of the MiniLit intervention in the two phases of the study and interprets the findings in the context of other changes occurring within the school over the period of time in which the study took place.

Statement of candidate's contribution: This paper is co-authored with my doctoral supervisors. I took the lead in writing. My co-authors provided advice in research methodology and implementation, and assisted with statistical analysis.

Abstract

In a Response to Intervention (RtI) model, reading is taught in increasingly intensive tiers of instruction. The aim of the study was to examine the efficacy of a Tier Two (small group) literacy intervention for young struggling readers. This article focuses on the second phase of a randomised control trial involving fourteen students in Kindergarten as participants. In Phase 1of the randomised control trial, the experimental group (E1) received the intervention for one hour, four days per week, for three school terms. The control group received regular classroom instruction. Large and statistically significant mean differences between groups were evident after three terms on two of four measures—the Martin and Pratt Non-word Reading Test and the Burt Word Reading Test, which measure phonological recoding and single word reading, respectively. Very large effect sizes were found. In Phase 2, the original control group (E2) received the intervention in the same way. Testing at the end of Phase 2 confirmed the intervention's large effect on phonological recoding, but the results for the three other tests showed no acceleration in the Phase 2 experimental group (E2). This study evaluates the efficacy of the trialled intervention, adds to the research literature on Tier 2 interventions for young struggling readers, and yields practical implications for schools who offer literacy interventions without a strong RtI framework.

Evaluation of a Two-Phase Implementation of a Tier 2 (Small Group) Reading Intervention for Young Struggling Readers

Literacy is the bedrock of education and is the prime focus of the early years of schooling. In New South Wales (NSW) public schools, for example, the first two hours of each day are devoted to literacy. Even so, a substantial number of children cannot read at even a functional level after four years at school. In the 2012 National Assessment Program for Literacy and Numeracy (NAPLAN), 6.4% of Year 3 students did not achieve the national minimum reading standards expected for their year of education. A further 10.4% achieved only the minimum standard (Australian Curriculum, Assessment and Reporting Authority, 2012). NAPLAN data contribute to a large body of literature showing a moderate and persistent relationship between literacy and socioeconomic status (Marks, 2009; Rothman, 2002; Rothman & McMillan, 2003; Thomson et al., 2010). In 2012, 33.4% of Year 3 children whose parents had not completed secondary school achieved at or below the minimum standard in the NAPLAN reading tests, as did 31.6% of children whose parents had not been in paid work in the previous year (Australian Curriculum, Assessment and Reporting Authority, 2012).

A wide range of reading performance exists within each socioeconomic group, showing that the relationship is not deterministic. Although the research on socioeconomic status and literacy achievement shows the significant impact of a number of out-of-school factors, including the early home literacy environment (Aikens & Barbarin, 2008; Dodd & Carr, 2003; Eamon, 2005; Hart & Risley, 2003), according to Fuchs and Fuchs (2006), the majority of reading difficulties arise from an instructional deficit and are therefore amenable to school-based strategies. Likewise, Carnine, Silbert, Kame'enui, Tarver, and Jungjohann (2006) argued that, irrespective of the reasons for children's reading difficulties, the most effective and immediate way to improve the current reading ability of school age children is through exemplary teaching, namely explicit and systematic instruction in the fundamentals of reading — phonemic awareness, phonics, fluency, vocabulary and comprehension. Explicit and systematic instruction in these concepts and skills is effective for all children but is particularly important for children from disadvantaged backgrounds who are less likely to have been exposed to these concepts in their family and home environments (Department of Education, Science, and Training, 2005; National Institute of Child Health & Human Development [NICHHD], 2000; Rose, 2006).

Some children will still struggle to learn to read even with effective initial instruction and will require extra instructional support at various levels of intensity and duration. Response to Intervention (RtI) is a model for instruction and assessment that focuses principally on quality and quantity of instruction rather than the causes of reading difficulties. The RtI model has multiple levels or 'tiers' of instruction, which increase in intensity and duration (Gersten et al., 2009). In a RtI model with three tiers, Tier One is whole class instruction and Tier Two is small group, supplementary, intensive, research-based instruction for students who are identified as 'struggling readers'— those who do meet reading standards in the classroom setting, sometimes defined as the bottom 25% of their age cohort (Wheldall, 2009). Tier Three is intensive individual instruction for the small number of children who do not respond to Tier Two intervention and require specialised support. The RtI model uses rigorous assessment tools to identify struggling readers, to monitor their progress, and to determine which level of intervention they require (Fuchs & Fuchs, 2006; Gersten et al., 2009).

For children with the greatest reading difficulties, research indicates that one-to-one tutoring sessions are the most effective. For children with milder problems, however, a strong evidence-base supports small group interventions, especially in the early years of school (Gersten et al., 2009; Slavin, Lake, Davis, & Madden, 2011; Wanzek & Vaughn, 2007). Small group instruction is also more cost-effective.

Ideally, intervention for children with reading difficulties should begin to be instituted no later than after one year of formal schooling (Gersten & Dimino, 2006; Torgesen, 2000) before problems become entrenched and the achievement gap widens (reviewed in Rose, 2006). Three major reports on reading in Australia (Department of Education, Science, and Training, 2005), the UK (Rose, 2006), and USA (NICHHD, 2000), conclude that reading skills are most likely to develop with phonics-based reading programs, in which children are taught explicitly about letter-sound correspondences, phonemic awareness and generative strategies in both initial instruction and remedial instruction settings. In a review of reading interventions for Year 1 students, Reynolds, Wheldall, and Madelaine (2011) found that very few early interventions were comprehensive literacy programs that included instruction in phonemic awareness and phonics, and few programs had methodologically sound empirical evidence for their efficacy. The most widely used early reading intervention in Australia — Reading Recovery — does not include this content in a systematic way (New South Wales Department of Education and Community Services [NSW DECS], 2012; Reading Recovery Council of North America, 2007).

What Works Clearinghouse (WWC) at the US Institute of Education Sciences has evaluated a number of Tier 2 reading programs. At least some statistically significant positive results in phonemic awareness and phonics were found among young students in these programs, but with varying degrees of supporting evidence. These programs included:

1. Lindamood Phoneme Sequencing, which focuses entirely on explicit instruction in phonemic awareness and phonics (WWC, 2008b, 2010).

2. Peer-Assisted Learning Strategies (PALS), in which highly skilled students coach and mentor their peers with limited reading skills within the classroom (WWC, 2012).
3. Success For All, which comprises both a whole school, complete literacy curriculum and small group supplementary instruction for struggling readers (WWC, 2009).
4. Early Intervention in Reading, which comprises both whole class and supplementary small group instruction (WWC, 2008a).
5. SpellRead, which is delivered in 60-90 minute lessons over 5-9 months, with explicit instruction in phonemic awareness and phonics (WWC, 2007).

Another Tier 2 program (not evaluated by WWC) with published research is called Early Literacy Support (ELS) in which students alternate daily between small group and individual instruction (Hatcher et al., 2006). A randomised control trial demonstrated that students who had participated in a 10 week ELS program had significantly higher growth in letter knowledge, single word reading and phoneme awareness than the control group. Medium to large effect sizes were reported (Hatcher et al.).

Response to Intervention models with three tiers of instruction are not common in Australia; students in formal remedial reading programs are likely to be in the form of one-to-one tutor programs (possibly a Tier 3 intervention in an RtI model), with small group instruction (Tier 2) being either informal or absent (van Kraayenoord, 2010; Louden et al., 2000). Only a few formal reading interventions for young struggling readers are identified in major reports on literacy interventions in Australia, the dominant program being Reading Recovery (van Kraayenoord; Louden et al.; Wyatt-Smith, Elkins, Colbert, Gunn, & Muspratt, 2007). None meet the criteria of a Tier 2 program within an RtI model for children in the first few years of school, but the most well-known of these are:

1. THRASS (Teaching Handwriting, Reading and Spelling Skills), a phonics teaching method that is used in some schools as a whole-class program and in others for remedial instruction for smaller groups (Louden et al., 2000). It is designed to be one part of a balanced literacy program (THRASS, 2007). There is limited evidence that it is effective as an intervention for young students in improving word attack skills (Brooks, 2007; Symons & Greaves, 2006).
2. L3 (Language, Learning and Literacy), a program introduced to NSW public schools in 2010. Students work in small groups on tasks differentiated for ability level while teachers move around to each group giving 10 minute targeted lessons. It is designed to work as an in-class intervention that precedes, and aims to reduce, progress into Reading Recovery (NSW DECS, 2011c). No research has been published on trial implementations and no evaluations are publicly available.

The MiniLit (Meeting Initial Needs In Literacy) program is designed as a Tier 2 program for young students (in the first three years of school) who are performing below their peers in reading acquisition. It comprises all of the elements of effective early literacy instruction as determined by large-scale reviews of research (Reynolds, Wheldall, & Madelaine, 2007; Reynolds et al., 2011). Unlike other interventions, such as Reading Recovery, it is not focused on a single year of schooling (Year 1) and is inclusive of the very lowest performing students, moving them on to more intensive (Tier 3) instruction only if they do not make progress (Reynolds & Wheldall, 2007). More detail about the MiniLit program is provided the Method section.

Several pilot studies have guided the development and investigated the effectiveness of the MiniLit program. Three initial pilot studies of an early version of the intervention involved Year 1 and Year 2 students in MiniLit sessions of one hour each day, four days a week, over 15 weeks. The lessons took place during school time in a tutorial centre external to the students' schools. Participating students were tested on the same test battery prior to and after completing a 15 week MiniLit program. In each of the studies, participating students made statistically significant gains on all measures. Treatment causality cannot be claimed as these studies did not have control groups, but there were large effect sizes (Reynolds, et al., 2007).

A fourth trial had an experimental design, with sixteen Year One students randomly assigned into treatment and control groups. In the first phase, one group of eight students (Group 1) participated in a shortened version of the MiniLit program used in the previous trials while the other eight students (Group 2) were the control group. In the second phase, Group 1 became the control group and Group 2 participated in MiniLit. Delivery of the program was in a school, by school by staff who were trained to teach the program (Reynolds, Wheldall, & Madelaine, 2010). At the end of the 10 week MiniLit intervention no statistically significant differences between the experimental and the control group in either phase of the study were noted. Large effect sizes were evident, however. The large effect sizes suggest that a larger sample size with more statistical power would have achieved significance. Another possible contributing factor to the weaker results in this trial is that not all students in the study scored below the 25th percentile on all pre-test measures , so could not strictly be described as the 'struggling readers' for whom MiniLit is designed (Reynolds et al., 2010). Finally, the intervention was only given for one term.

MiniLit has also been implemented at the Schoolwise Tutorial Centre at Ashfield in New South Wales since 2005. During the six years between 2005 and 2010, ninety students were tested before and after participation in a 15 week MiniLit program. There was no control group. After 15 weeks, students had made substantial and statistically significant gains on all of the measures of reading and related skills, with large effect sizes. Their average reading fluency was shown to have increased by 66% (Wheldall, Beaman, Madelaine, & Kohnen, unpublished report).

More recently, a further randomised control trial using a revised version of MiniLit was implemented with 22 students from Kindergarten and Year 2 in a NSW public school. Students in the experimental group received MiniLit instruction for one hour a day, four days a week for three terms (27 weeks). At the end of the intervention, the experimental group had significantly higher scores than the control group on measures of phonological recoding and word reading, with very large effect sizes. No significant differences were noted between the groups in spelling (but a large effect size) and no discernible effect on students' single word reading fluency scores were evident (Buckingham, Wheldall, and Beaman, 2012).

This paper focuses on a subset of 14 students from the randomised control trial reported in Buckingham at el. (2012). In this study, the Kindergarten students formed a two-phase, cross-over study extended over six terms. The study aims to gather further experimental evidence of the efficacy of MiniLit in a school setting, and particularly the potential of MiniLit, as a cost-effective, Tier Two intervention, to improve literacy in schools with a high level of social disadvantage.

Method

Participants

Participants were a subset of students involved in a larger sample (n=22) three-term randomised control trial reported in Buckingham et al. (2012). Fourteen students in Kindergarten participated in the six-term trial. The Year 2 students were excluded from the six term, cross-over study because they moved into Year 3 after the first three terms of intervention, and thus outside the target group for MiniLit (K-2).

The site of the study was a regional NSW public school with a low socioeconomic profile. When the study began in 2010, the school had an Index of Community Socio-Educational Advantage (ICSEA) (Barnes, n.d.), calculated for the federal government's

My School website, of 897. (The national average ICSEA value is 1000 with a standard deviation of 100.)

Selection of students for participation in the study was completed through a process of screening and ranking. The lowest 50% of students in each class in terms of reading ability was identified by Kindergarten classroom teachers. Students with a diagnosed (and documented) intellectual disability or severe language impairment were excluded since their needs would have been addressed by alternative provision.

Identified students were screened by trained research assistants using two lists from the WARL (Reynolds, Wheldall, & Madelaine, 2009) and then ranked according to their mean scores. The lowest ranked 16 students from Kindergarten were selected for the study. Information and consent forms were sent home to the parents/carers of selected students. Passive consent for the students' participation in the study was required by the university research ethics committee and the State Education Research Approval Process (SERAP) office of the New South Wales Department of Education and Community Services (NSW DECS).

Matched pairs were created using scores on the MiniLit Placement Test (described in Appendix 1) and students were randomly allocated into two groups: the experimental (treatment) group and the control group. One student from Kindergarten left the school in the ninth week of the study reducing the total number of participants for the study from 16 to 14 students (the data for the matched student were also excluded from the study).

The participants included 10 boys and four girls, with a mean age of 67 months (5 years: 7 months) at the beginning of the intervention. The primary language for all participants was English. Standardised tests were administered to determine baseline measures (described in in Appendix 1).

After two terms, all but one student who began the intervention in Kindergarten moved into Year 1. One student repeated Kindergarten. All 14 students remained in the study for six terms.

Procedure

The study was implemented as a two-phase, cross-over design. Each phase was three school terms (approximately 27 weeks of instruction). The group who received the intervention in Phase 1 of the study—Experimental Group 1 (E1)—became the comparison group in Phase 2. In Phase 2 of the study, the control group from Phase 1 received the intervention and became Experimental Group 2 (E2). Phase 1 was implemented as a randomised control trial but in Phase 2, the group not receiving the intervention was not under control conditions and will be referred to as the 'comparison' group.

The MiniLit program was delivered to students in the experimental groups in each phase for one hour each day, four days a week, over three school terms (27 weeks). Students were withdrawn from class during classroom literacy time. Instructors were trained by MultiLit trainers. (MultiLit is the entity responsible for developing the intervention.) Two of the instructors were registered primary school teachers and one had no teaching qualifications. Students in the comparison group remained in class and received usual classroom literacy instruction for the duration of the study. In Phase 1, control conditions were specified for the comparison group, but in Phase 2, students in the comparison group may have received another formal reading intervention for part of the time. The reading activities of the comparison group were not within the remit of the study. Following the intervention, the data collected in the three testing phases were analysed to compare the experimental and control/comparison groups' score growth on the test battery. Lesson observations for treatment integrity took place at three week intervals by highly experienced special educators familiar with MulitLit practices and procedures.

All experimental and control/comparison group participants undertook a battery of reading tests before the reading intervention started, at the end of three-terms and again at the end of six terms. The tests were administered by trained research assistants and all tests were independently scored and double-scored. The test battery included the Burt Word Reading Test (Gilmore, Croft, & Reid, 1981), the South Australian Spelling Test (Westwood, 2005), the Martin and Pratt Non-Word Reading Test (Martin & Pratt, 2001), and the WARL (Reynolds et al., 2009*)* (using different lists to the screening WARL). The pre-intervention test battery also included the MiniLit Placement Test (MultiLit, 2011). Details of the tests are in Appendix 1.

The Intervention — MiniLit

The *MiniLit early literacy intervention program* is a small group instruction program for struggling readers in the first few years of school. It includes instruction in all of the elements of effective reading instruction identified in research—phonemic awareness, phonics, fluency, vocabulary and comprehension—taught in a direct, explicit and sequential manner (Reynolds et al., 2007, 2010; MultiLit, 2011).

Students were taught in three groups of 3 to 4 students, grouped by instructional level. There was initially some movement between groups as skill acquisition varied but the groups became stable after around 10 weeks of instruction. The average attendance rate for MiniLit lessons was 96% (with a range of 91% to 100%).

Each one hour MiniLit lesson had the following components: Sounds and Words Activities (30-40 minutes), Text Reading (5-10 minutes) and Story Book Reading (10-15 minutes). The Sounds and Words Activities component includes highly structured, carefully scripted and sequenced instruction of phonemic awareness and phonics. Students first learn and master letter-sound correspondences, quickly progressing to blending and segmenting these sounds in words, both orally and in print. Sight words are initially taught through text reading as 'tricky words', and later more explicitly as short lists.

Text Reading is first introduced as part of Sounds and Words activities and later becomes a separate component. In the Sounds and Words Activities, students read sentences or simple short stories that reinforce phonic word attack skills and/or sight words they have been learning. In Text Reading, students read aloud from a controlled vocabulary book at their instructional level. Their instructor uses the revised Pause, Prompt, Praise tutoring method, as used in Reinforced Reading (Ellis, Wheldall, & Beaman, 2007; MultiLit, 2011).

Story Book Reading (10-15 minutes) is the final part of the lesson. This activity is less structured; the teacher reads a children's storybook to the group, engaging them by commenting on the story and asking questions. The teacher models fluent, expressive reading and the students develop listening comprehension and vocabulary skills (MultiLit, 2011).

Direct instruction teaching (such as model-lead-test procedures) (Carnine, Silbert, Kame'enui, & Tarver, 2010) are instrinsic to the MiniLit program. Positive teaching behaviour management strategies (Merrett & Wheldall, 1990; MultiLit, 2011) are used to maximise time-on-task.

Analysis

In order to compare gains made by the experimental and control/comparison groups after each phase of the intervention, analyses of covariance were employed for each measure at post-test 1 (after three terms) and post-test 2 (after six terms), with pre-test scores as the covariate in each analysis. Raw scores were used in the analyses because many of the participants were younger than 6 years old, the minimum age for which standard scores are available for the measures employed. The alpha level was set at 1% ($p<0.01$) to allow for family wise comparisons in lieu of the use of a Bonferroni correction (Howell, 2008). Treatment effects were also calculated for each measure in each phase of the study, using partial eta squared as the measure of effect size, as calculated by the SPSS statistical analysis package (IBM Corp, 2012).

Results

In this six term study, only Phase 1 (the first three terms) was a controlled trial, where students not receiving the intervention remained in their usual classrooms and did not participate in any other formal remedial reading programs. In Phase 2, students were no longer in controlled trial conditions. Students not receiving the intervention in Phase 2 (the original experimental group in Phase One) may have participated in other remedial reading programs and are therefore more accurately described as a 'comparison' group than a 'control' group. The Phase 1 experimental group/Phase 2 comparison group will be called 'E1', and the Phase 1 control group/Phase 2 experimental group will be called 'E2'.

Means and standard deviations for all measures (raw scores) for the Phase 1 experimental group (E1) and the Phase 2 experimental group (E2) at pre-test, end of Phase 1 (post-test 1, after three terms), and end of Phase 2 (post-test 2, after six terms) are shown in Table 1.

As may be seen in Table 1, the E1 group means were slightly lower than those for the E2 group at pre-test for all measures but none of these differences was statistically significant. (These small differences are taken into account in the analyses of covariance.) Analyses of covariance (ANCOVA) were conducted on the raw scores for each of these measures separately at post-test 1 and post-test 2 (with pre-test scores as the covariate). Treatment effect size using partial eta squared was calculated for each measure at post-test 1 and post-test 2. Table 1 presents the results of these analyses.

Table 1.

Means and standard deviations (raw scores) of Phase 1 experimental (E1) and Phase 2 experimental (E2) groups at pre-test, post-test 1 (after 3 terms) and post-test 2 (after 6 terms), results of analyses of covariance and effect sizes (partial eta squared)

Measure	Group (n=14)	Pre-test Mean (SD)	Post-1 Mean (SD)	F	p	ES*	Post-2 Mean (SD)	F	p	ES*
Martin & Pratt Nonword Test	E1	1.00 (1.16)	14.14 (5.58)	18.13	.001	.622	14.00 (7.19)	.397	.541	.035
	E2	1.14 (1.35)	4.00 (3.92)				12.29 (6.80)			
Burt Word Reading Test	E1	2.29 (1.11)	20.57 (5.91)	12.21	.005	.526	29.86 (8.82)	6.67	.025	.377
	E2	4.00 (3.96)	12.71 (9.53)				23.00 (11.96)			
South Australian Spelling Test	E1	1.29 (1.60)	14.29 (4.31)	4.13	.067	.273	20.00 (5.39)	1.38	.265	.111
	E2	2.86 (3.58)	9.43 (7.04)				16.57 (9.33)			
WARL (words correct per minute, wcpm)	E1	3.43 (1.40)	21.86 (7.60)	3.55	.086	.244	38.57 (10.37)	2.93	.115	.210
	E2	4.71 (3.86)	16.43 (14.16)				32.00 (18.93)			

*ES = partial eta squared, large effect size is evident when partial eta squared is ≥.138

Results at the end of Phase 1 – group means and treatment effects

Statistically significant, positive treatment effects at the stated alpha level ($p<0.01$) were found for two measures—the Martin and Pratt Nonword Reading Test and the Burt Reading Test. The treatment effect sizes for these measures were very large (Martin & Pratt partial eta squared = .622; Burt = .526). (Effect sizes calculated using partial eta squared that are larger than 0.138 are considered to be large) (Howell 2008).

No significant differences were found between the group means for the other two measures, but treatment effect sizes were substantial. Effect sizes were large for both the South Australian Spelling test (partial eta squared = .273) and large for the WARL (partial eta squared = .244). These findings confirm the findings of the larger randomised control trial (Buckingham et al., 2012).

Results at the end of Phase 2 – group means and treatment effects

No significant differences between group means were found at the stated alpha level ($p<0.01$) for any measure at the end of Phase 2, that is, after both groups had each had three terms of the intervention. Mean scores and treatment effects are shown in Table 1.

Figures 1 to 4 show important differences in progress between the two study phases on each of the measures. (Note that these graphs show corrected mean scores generated by the covariance analyses, ie. allowing for small initial differences between groups at pre-test.) Figure 1 shows that test scores on the Martin and Pratt increased strongly for the experimental group in both phases, while there was virtually no growth in scores for the control/comparison groups, with the end result being similar mean scores for E1 and E2 at the end of Phase 2 and an overall treatment effect that is very small (partial eta squared = .035). In other words, the second treatment group (E2) who were formerly the control group had almost caught up with the original experimental group (E1), following intervention.

Figures 2, 3 and 4 show different patterns of score growth to Figure 1. At the end of Phase 1 of the study, the experimental group (E1) had made larger gains than the control group in the Burt (Figure 2), the South Australian Spelling Test (Figure 3) and the WARL (Figure 4), as shown by the divergent post-test 1 means, although the differences for the WARL and South Australian Spelling were not statistically significant. At the end of Phase 2, there had been little divergence or narrowing of the scores, as can be seen in the almost parallel slopes between the post-test 1 and post-test 2 means on these three measures. This indicates that the E1 students continued to grow on these measures after they had finished MiniLit.

The effect sizes (reported in Table 1) calculated at the end of Phase 2 for each measure were smaller than at the end of Phase 1, indicating that some of the gap evident at the end of Phase 1, when only one group had had the intervention, was reduced when the second group received the intervention, as we would expect. The effect size for the Martin and Pratt test at the end of Phase 2 was negligible (partial eta squared = 0.35), in accordance with the non-significant difference between the means of the two groups at post-test 2. In other words, at the end of Phase 2, the Phase 2 experimental group (E2) had almost completely closed the gap with the Phase 1 experimental group (E1), because E1 had shown no growth in Martin and Pratt scores in the period after they completed the intervention. For the Burt Word Reading Test and the South Australian Spelling Test, the effect size was reduced at the end of Phase 2, but not substantially (Burt partial eta squared = 0.377; Spelling = 0.111) indicating that although the E2 students had made progress it was not sufficient to 'catch up' to E1, because the E1 continued to grow after they completed the intervention. For the WARL, there was little change in the effect size at the end of Phase 2 (partial eta squared = 0.210). Therefore, with the exception of phonological recoding (as measured by the Martin and Pratt), the earlier Phase 1 intervention had a stronger effect.

Figure 1. Martin and Pratt Nonword Reading Test mean scores at pre-test, post-test 1 and post-test 2.

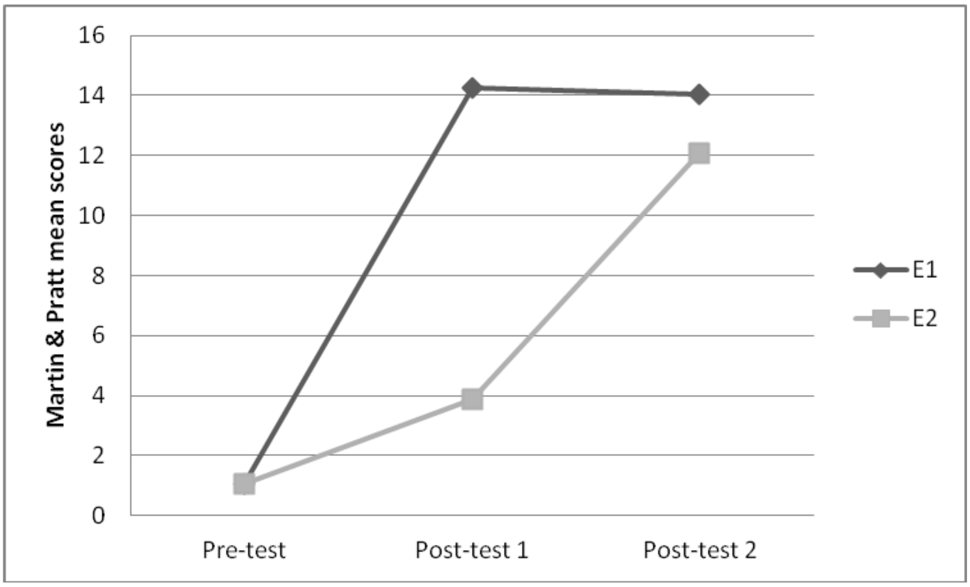


Figure 2. Burt Word Reading Test mean scores at pre-test, post-test 1 and post-test 2.

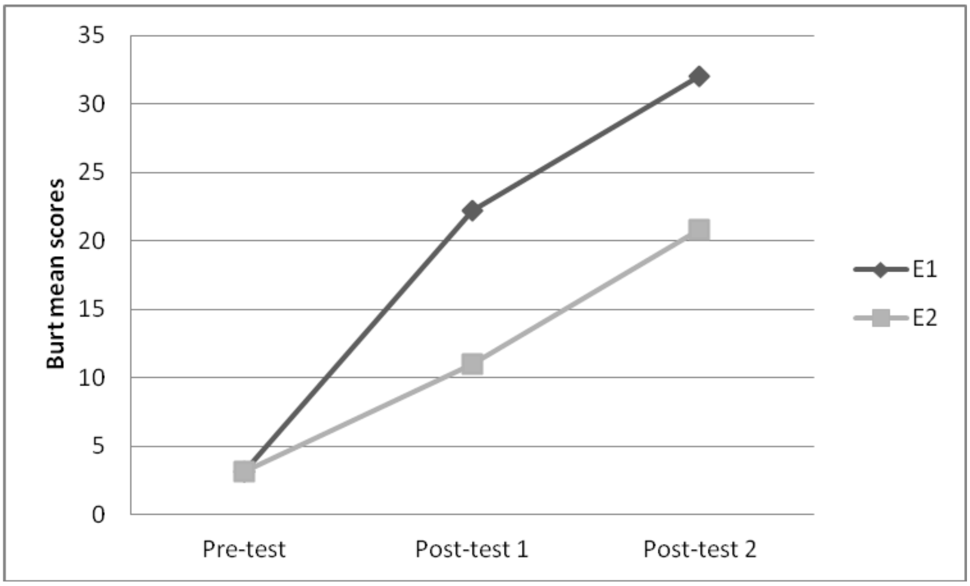


Figure 3. South Australian Spelling Test mean scores at pre-test, post-test 1 and post-test 2.

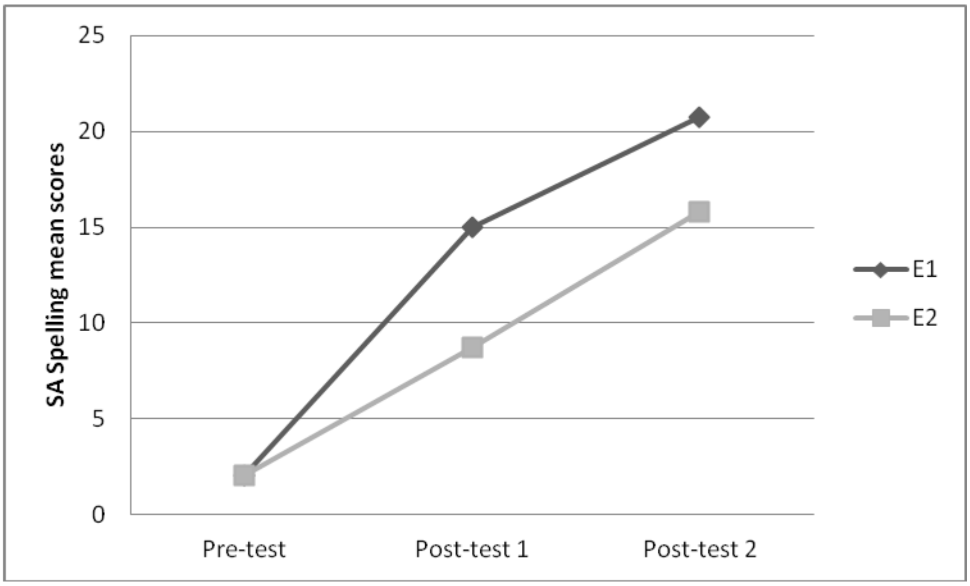
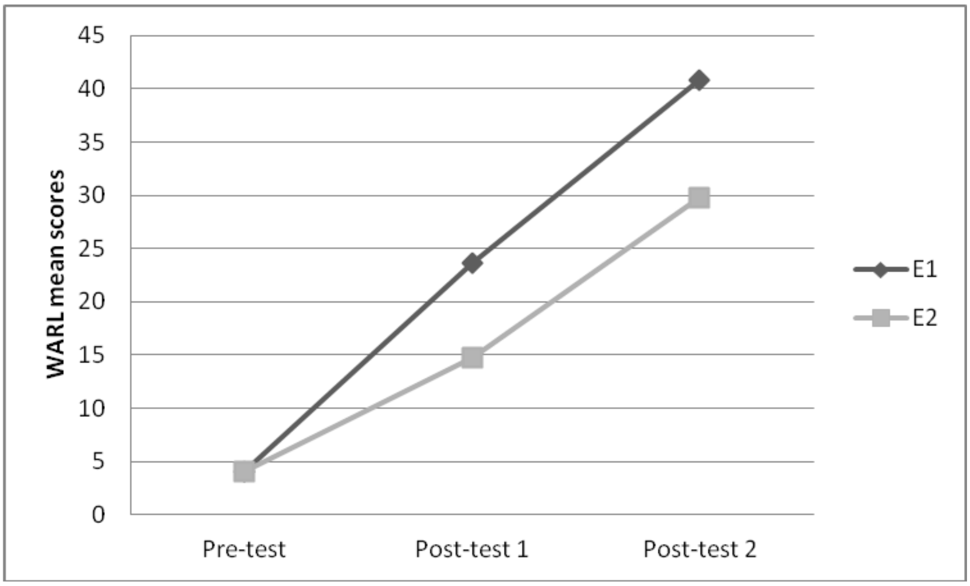


Figure 4. Wheldall Assessment of Reading Lists (WARL) mean scores at pre-test, post-test 1 and post-test 2



Discussion

The efficacy of a small group (Tier 2) intervention was evaluated in a two-phase, cross-over study, implemented over six terms, involving 14 Kindergarten students randomly allocated in two groups from matched pairs. The seven students in the Phase 1 control group became the experimental group in Phase 2 of the study. At the end of the six-term study, both groups of students had completed three terms of intervention.

Phase 1 was the first three-terms; the experimental group for this phase will be called E1. Phase 2 was the last three terms of the study; the experimental group for this phase (the original, Phase 1 control group) will be called E2.

At the end of Phase 1, the E1 group mean was significantly higher on the Martin and Pratt Nonword Reading Test and the Burt Reading Test, and the effect sizes were very large, confirming the powerful effect of the intervention on phonological recoding and word reading. No significant differences were found between groups for the other two measures, but large effect sizes for both the South Australian Spelling Test and the WARL were found.

These effect sizes are in keeping with the observable differences in the growth in raw scores of the two groups in Phase 1, under experimental conditions (see Table 1). At the end of Phase 1, the E1 group could spell twice as many more words correctly as the control group (13 versus 6.5) on the South Australian Spelling Test, and the mean WARL scores indicate that the E1 group's fluency grew by 50% more than the control group (18.4 words correct per minute versus 11.7). These results are informative, and suggest that statistical non-significance for these measures might be attributable to the lack of power in the small sample size (Bell, 2011; Slavin & Smith, 2009).

At the end of Phase 2, when both groups had had three terms of intervention, there were no significant differences between groups on any measure (see graphs 1 to 4 and Table 1). For the Martin and Pratt, the convergence of the two groups was preceded by strong growth of both E1 and E2 while receiving the intervention, and virtually zero growth of these groups in their control/comparison periods. For the other measures, however, both groups grew during their experimental and control/comparison phases, but at different rates. E1 had higher mean scores than E2 for the Burt, South Australian Spelling Test and WARL at the beginning of Phase 2 and E1 continued to make progress on these measures while it was the comparison group. With a lower starting point at the beginning of Phase 2 on these measures, E2 made progress while it received the intervention but did not accelerate enough to catch up to the still-growing E1 group. Treatment effect sizes at the end of Phase 2 confirm this. After both groups had received the intervention, no difference was apparent on the Martin and Pratt—the original control group (E2) had completely closed the gap. For the other measures, however, a treatment effect was still evident, showing that the E1 group was still achieving superior results, even three terms after they completed the intervention.

The small sample size and implementation on a single school site limit generalisation, but the results have several implications specifically regarding literacy practices within the participating school and more generally for the ability of the program to be successful in a regular school setting.

The Martin and Pratt results imply that students were not receiving good phonics instruction in the classroom, as no growth in phonological recoding occurred for either group during their control/comparison period. Classroom literacy instruction for the Phase 1 control group was delivered through a program called L3. This was a new Kindergarten program developed by the NSW DECS, and which was being implemented by the school for the first time at the same time as the intervention. Little information about L3 is publicly available so the program can only be described in rudimentary terms. No scope and sequence is available for the content of each lesson; the information for parents states only that 'L3 focuses on providing rich literacy experiences' and that children will 'listen to the reading of stories, poems and songs' (NSW DECS, 2011b, 2011c). There is no mention of phonemic awareness, phonics or any other instruction related to alphabetic knowledge, such as letter-sounds, and if such instruction occurs there is no publicly available information about the form such instruction takes. Data collection is in the form of continuous text reading levels, writing vocabulary, and a listening test (NSW DECS, 2011a). Phase 2 of the study took place when students were in Year 1. Classroom literacy teaching for the comparison group during this phase was not through a formal program.

The stronger and enduring results for the E1 group on the Burt, the South Australian Spelling Test and WARL might be interpreted as evidence for early intervention. Even though E2 were only in Year 1 when they received the intervention, they did not make as much progress over the course of the intervention as the E1 group, which began the intervention in Term 3 of Kindergarten and continued to make progress on all measures except phonological recoding once they returned to the classroom. That the E2 did not catch up to the E1 group in three of the four measures perhaps demonstrates the difficulty closing reading gaps as children get older, but more research is necessary to support this.

In terms of general implementation, the study offers some useful lessons. First, a good Tier 2 program can be an effective way to provide supplementary reading instruction, but its impact is diminished if high quality core instruction is not evident in the general education classroom. Given the students' low levels of letter-sound knowledge at pre-test and their failure to make any progress in phonological recoding while not in the intervention, it is reasonable to assume that the intervention was, in some cases, providing initial instruction rather than supplementing and reinforcing what was being taught in class. It therefore is to be expected that it would take some time for these students to develop secondary skills such as spelling and fluency.

The objective of this trial was to evaluate the efficacy of the small group 'MiniLit' program and assess its potential as a Tier 2 intervention in a three-tier RtI model. Although the use of a randomised control trial was necessary to obtain the most scientifically valid evidence, in this case it required a relatively simple two group comparison. This meant that the other important component of RtI – monitoring and data-based decision-making about instruction could not be included.

Consequently, the results may have been affected by the constraints of the trial methodology, as students could not be moved out of the program. Under standard three-tier RtI conditions, students who are clearly not making progress with Tier 2 instruction would be diverted to Tier 3 intervention. Furthermore, students who made rapid progress would ideally return to regular class instruction when they reached an agreed criterion (say, the 40^{th} percentile in the Martin and Pratt test), allowing them to more quickly generalise to the higher order skills being developed in the classroom. In sum, Tier 2 programs work best when part of a dynamic RtI model, involving careful and timely data-based decisions for each child.

This study supports the efficacy of the small group program implemented in the trial, particularly in developing the necessary and fundamental skills required to decode words. It has also provided important cautionary information about the limitations of Tier 2 interventions in a regular school setting, when not embedded in an exemplary RtI model. Further study of the intervention when implemented alongside strong and consistent Tier 1 and Tier 3 instruction would be instructive.

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Appendix 1

From Buckingham, Wheldall, & Beaman (2012)

Measures

Burt Word Reading Test (Gilmore et al., 1981). This test measures single word recognition using a list of 110 words that increase in difficulty. The maximum reading age achievable on the Burt is about 13 years. The Burt has high test-retest reliability (>0.95), high internal consistency (> 0.96) and high criterion validity (correlations of 0.90–0.98 between the Burt Word Reading Test and the Schonell Graded Word Reading Test (Schonell, 1955) and the Oral Word Reading Test (Fieldhouse, 1952) (as cited in Gilmore et al., 1981)

South Australian Spelling Test (Westwood, 2005). This test provides a spelling age for children in the age range 6 years to over 15 years. It can be administered individually or in groups. The test manual reports good internal reliability with a test-retest reliability coefficient of 0.96 for most year groups. Alternative forms reliability ranges from .89 to .94 depending on age level (as cited in Westwood).

Martin and Pratt Nonword Reading Test, Form A (Martin & Pratt, 2001). This test measures phonological recoding ability in students aged from 6 to 16 years, using pseudowords of increasing difficulty (Martin & Pratt. The test has a high test-retest reliability coefficient of 0.96, high alternative-forms reliability coefficients of 0.92-0.96 and a high internal consistency reliability coefficient of 0.96 (Martin & Pratt). Good criterion-related validity is indicated through positive correlations between the Martin and Pratt and the WRMT-R Word Attack (Woodcock, 1987) (0.89), Coltheart and Leahy Nonword reading lists (Coltheart & Leahy, 1996) (0.93) and the Neale Analysis of Reading Ability (Neale, 1988) (0.78-0.88) (as cited in Martin & Pratt). Non-word tests are an important measure of early reading progress as they avoid the possibility of students reading words from memory (Hempenstall, 2009).

Wheldall Assessment of Reading Lists (WARL) (Reynolds et al., 2009*).* The WARL is a curriculum-based measure of word identification fluency for young students. The test consists of parallel lists of 100 high frequency words from children's texts and storybooks. The student is presented with the list on a page and instructed to read the words aloud quickly and carefully. They are asked to stop after one minute. The score is the number of words read correctly per minute, averaged over three parallel lists. The WARL has been found to be highly reliable, with reliability coefficients for parallel forms between 0.85 and 0.94 (Reynolds et al., 2009). The validity of the measure has been demonstrated through high correlations between the WARL and the Burt Word Reading Test ($r = 0.79$) and the TOWRE Sight Words Test (Torgesen, Wagner, & Rashotte, 1999) ($r = 0.95$) (as cited in Reynolds et al., 2009).

MiniLit Placement Test. The MiniLit Placement Test assesses students' phonic word attack knowledge and abilities, namely letter-sound correspondences and reading of words containing specific letter-sound correspondences. The test includes only real words, but many are not frequently used, and therefore are very unlikely to be recognised as sight words by young students (MultiLit, 2011).

CHAPTER 6 – Research Paper III

A randomised control trial of a MultiLit small group intervention for older low-progress readers

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Preface to Chapter 6: 'A randomised control trial of a MultiLit small group intervention for older low-progress readers'.

Although efforts to instil excellent initial reading instruction and effective early intervention in schools will be vital to minimise the prevalence of reading difficulties in future, the fact remains that many students currently struggle to achieve minimal reading standards after three or more years of school (Thomson et al., 2012). Their need for remedial reading instruction should not be neglected. Recent research shows that although it may be more difficult to help older low progress students, it is not impossible (Wanzek et al., 2013).

There are a number of reasons older students might be making poor progress in their reading. They may have had poor quality initial instruction, they may have missed out on early intervention, their reading difficulties may not have become apparent until later ('the fourth grade slump') (Chall and Jacobs, 1983), or they may have a more serious reading disability that requires ongoing and consistent instruction support.

As mentioned in the previous chapters, schools with higher proportions of low SES students usually have larger numbers of students with low reading achievement (Holmes-Smith, 2006; Perry & McConney, 2010). There have typically been few formal intervention programs expressly for older low-progress readers (Year 3 and over) with a strong evidence-base used in Australian schools (Louden et al., 2000). This gap in provision led to the development of the Making Up Lost Time in Literacy (MultiLit) program.

An important feature of MultiLit is that it is a comprehensive intervention with components specifically devised to develop skills in the five essential elements of reading. While MultiLit has a strong emphasis on teaching phonological recoding skills, it is not a phonics program exclusively. It also includes sight words and reinforced reading of real text to develop vocabulary and comprehension. The aim is for students to become accurate and fluent decoders and to then integrate and generalise these skills in continuous text reading (Ellis, Wheldall & Beaman, 2007).

There are a number of versions of MultiLit which have been used and evaluated in various environments outside of mainstream schools, including the special education school and the MultiLit clinic at Macquarie University, and the Schoolwise tutorial centres. There is also a one-to-one program—the MultiLit Reading Tutor program—which is in use in many mainstream schools. All of these programs have a large and still-growing body of supporting evidence (Wheldall, 2009; Wheldall & Beaman, 2000, 2010).

Chapter 6 reports on the first evaluation of a small group MultiLit program designed for use as a school-based program in mainstream schools. Like the small group MiniLit program described in Chapters 4 and 5, it was conceptualised as a Tier 2 intervention in a three-tier Response to Intervention model. Also like the MiniLit studies, it could not be implemented under strict RtI conditions. Unlike the MiniLit studies, however, Tier 1 (whole class instruction) was not contradictory to the MultiLit program, as the school was undergoing substantial reform of its literacy practices, adopting the explicit instruction approach also used in MultiLit across the school. The primary obstacle to standard RtI procedures was the randomised control trial (RCT) methodology, which prevented students from moving out of the program if they were strong responders or non-responders. This aspect of the RCT implementation may have affected the overall results but was essential for rigorous statistical evaluation of the program's efficacy.

The MultiLit study did not have the same level of attrition of participants as the MiniLit study. Only four of 48 students originally selected for participation did not complete the MultiLit trial. Nonetheless, this is not a large sample and therefore it was important to use the most appropriate method of statistical analysis. As previously discussed in Chapter 4 (p.71), analysis of covariance (ANCOVA) is suitable for small groups as it takes into account any differences in pre-treatment means between the groups (Pallant, 2011).

A note may be relevant here about our decision not to use alternative measures at post-test. The decision was made for a number of reasons. First, alternative measures were not available for all tests. Second, even when there is high reliability between the alternative measures of the same test, there are always differences between the means and standard deviations of the tests. This effectively means that the same scale is not being used for raw scores and it is difficult to interpret gains. Third, since the participants were low-progress readers, a time lapse between testing of six months was considered sufficient to avoid practice effects. Furthermore, any such effects would have influenced the results for both the experimental and control groups equally. Finally, no error correction was provided following the tests, so any improvement in scores on post-test could not be attributed to the student remembering the correct response.

Statement of candidate's contribution: This paper is co-authored with my doctoral supervisors. I took the lead in writing. My co-authors provided advice in research methodology and implementation, and assisted with statistical analysis.

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A randomised control trial of a MultiLit small group intervention for older low-progress readers

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A large number of Australian children in the later years of primary school have low literacy skills and require remedial instruction. The aim of this study is to evaluate the efficacy of a comprehensive small group reading intervention for low-progress readers, within a regular school setting. The intervention, called 'Making Up Lost Time in Literacy', is a comprehensive reading program with explicit teaching in phonics as well as sight words and guided book reading. Participants were Year 3 (average age 8 years, 8 months) to Year 6 (average age 11 years, 8 months) students in a New South Wales public school. Forty-four students took part in a two-school-term trial, with matched pairs of students randomly allocated into experimental and control groups. A reduced sample of 30 students participated in a three-school-term trial. The experimental group received the small group instruction for 1 h per day for four days per week, while the control group remained in the usual classes. All students were assessed on measures of reading and related skills before the intervention began, after two terms of instruction and, for the reduced sample, after three terms of instruction. Very large and statistically significant mean differences favouring the experimental group were found for the phonological recoding measure. Four other measures had no statistically significant differences between groups but had treatment effect sizes ranging from small to large. The results suggest that the program was highly effective in teaching phonic word attack skills, but older low-progress readers may require more intensive intervention to advance their general reading ability.

Keywords: literacy; response to intervention; Tier 2; struggling readers; effective instruction

Introduction

According to Cunningham and Stanovich (1997), 'early success at reading acquisition is one of the keys that unlocks a lifetime of reading habits' (p. 943). Unfortunately, many Australian children are denied this early success, with potential adverse effects on their later academic careers (Maani & Kalb, 2007), school completion and labour market prospects (Marks, 2006; Marks, McMillan, & Ainley, 2004), income (Shomos, 2010), health (Australian Bureau of Statistics, 2008), and quality of life (Australian Bureau of Statistics, 2008; Bynner, 2008).

The National Assessment Program for Literacy and Numeracy (NAPLAN) in 2010 found that 6.1% of Year 3 (average age 8 years, 7 months) and 8.6% of Year 5 students (average age 10 years, 6 months) failed to achieve the national minimum reading standards expected for their year of education (Australian Curriculum, Assessment and

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Reporting Authority, 2010). This equates to more than 15,000 Year 3 students and 23,500 Year 5 students in Australia who were below the expected minimum reading standard (Australian Bureau of Statistics, 2011).

This paper briefly discusses some of the factors associated with literacy gaps between socioeconomic groups, and how socioeconomic status and instructional variables interact to create reading deficits. It summarises the research findings on a number of intervention programs aimed at struggling primary school aged readers, and then describes an experimental trial of a new intervention program aimed at these readers – small group Making Up Lost Time in Literacy (MultiLit).

Socioeconomic and genetic influences on reading ability

Rates of failure to achieve minimum literacy standards in NAPLAN increase as parental education and occupational status decrease. Year 3 students whose parents' highest education level was Year 11 or less were six times more likely to have reading levels below the minimum standard than students who had at least one parent with a bachelor degree (13.1% as compared to 2.1%) (Australian Curriculum, Assessment and Reporting Authority, 2010).

The statistical association between literacy and socioeconomic status is well-established in Australian and international surveys (Marks, Cresswell, & Ainley, 2006; Rothman & McMillan, 2003; Thomson & de Bortoli, 2010). Although the strength of the simple statistical relationship is fairly consistent, with correlations typically around 0.30 (Marks, McMillan, & Ainley, 2004), the way in which socioeconomic status influences achievement is neither simple nor direct.

Numerous studies over the last decade have revealed that socioeconomic status has effects on achievement at three levels – individual, school and community (Aikens & Barbarin, 2008; Holmes-Smith, 2006; Nicoletti & Rabe, 2010). Socioeconomic status, itself an index of household income, parent education and parent occupation rather than a single measure, seems to be a proxy for other variables such as school quality, home literacy environment (Aikens & Barbarin, 2008; Dodd & Carr, 2003), oral language capacity (Hart & Risley, 2003), family cultural capital (Marks, Cresswell, & Ainley, 2006) and child health (Malacova et al., 2009; Rothstein, 2010). Nonetheless, socioeconomic status does not predict literacy ability with certainty. Children from advantaged backgrounds also exhibit a range of literacy abilities, albeit skewed to the higher end of the range, demonstrating that environment is not the only influential factor. There is also a genetic component in intelligence (Berliner, 2006; Bronfenbrenner & Ceci, 1994; Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003), and a similar relationship may exist for literacy ability.

The study by Friend, DeFries, and Olson (2008) found that the environment was the main factor in reading deficits among children whose parents had low levels of education, while genetic influences were a stronger influence on reading deficits among children whose parents had high levels of education. These findings have important implications for educational practice and policy. They indicate that most reading deficits are not attributable to hereditary or intrinsic disabilities and are either preventable or treatable. Torgesen, Wagner, and Rashotte (1997) estimate that as little as 3–5% of the population has severe reading disability and do not respond readily to instruction.

Friend et al. (2008) contend that poor teaching and a language-deprived home life are often the main cause of reading deficits. Wheldall and Beaman (2000) agree that social background factors are important, but they argue that the most effective and immediate way to improve current reading ability is through exemplary instruction that addresses the specific cognitive skills and strategies necessary for reading.

Phonological processing

Wheldall (Pogorzelski & Wheldall, 2005; Wheldall, 2009) has proposed a two-factor model for reading disability. He suggests that the likelihood a child will have a reading deficit is dependent on the quality of the language learning environment (or 'QLLE', which includes both the socioeconomic background and the access to effective reading instruction) and their intrinsic phonological ability. These two factors interact so that a child who is disadvantaged in both QLLE and phonological ability will have a high probability of a severe reading deficit, while children who are disadvantaged in only one of these factors will have a lower level of risk and/or severity of reading problems.

A review by Pogorzelski and Wheldall (2005) described an accumulating body of research to support the theory that failure to learn to read is 'primarily a language-based problem; more specifically a phonological processing problem' (p. 2). Phonological processing refers to the ability to identify the components of speech – words, rhymes, sounds and so on. More specifically, phonemic awareness is the ability to break up (or segment) words into their component sounds (called phonemes) orally and also to recognise words by combining (or blending) their component sounds. These skills are important for on-going progress in reading because they underpin a reader's ability to decipher unfamiliar words.

In the past, children with reading deficits have been diagnosed with specific types of disability such as dyslexia and provided with differential instruction and resources (Wheldall, 2009). However, evidence that the nature of reading deficits is similar regardless of causation (Siegel, 1993; Stanovich, 1991) has led some researchers to argue in favour of a 'non-categorical' approach to remediating reading deficits. Pogorzelski and Wheldall (2002; Wheldall & Pogorzelski, 2003) found that students diagnosed with dyslexia made similar gains in reading ability after participation in a phonics-based reading program as students with an uncategorised reading deficit. Reviewing the evidence, Pogorzelski and Wheldall (2005) concluded that 'categorisation into subtypes may not, on a practical level, be warranted or helpful' (p. 19) and suggest the generic term 'low-progress readers', a classification based on demonstrated ability rather than genesis.

Effective instruction and intervention

Early success and failure in reading predicts reading progress. Without effective intervention, gaps in reading ability evident in the first few years of school are compounded over time and become increasingly difficult to remediate (Feinstein, 2007; Reynolds, Wheldall, & Madelaine, 2011; Stanovich, 1986; Torgesen, 2005). Although it is widely accepted that children respond more readily to early intervention before difficulties become entrenched (Rose, 2006), this does not negate the fact that many children require significant reading support at later ages, either because they have missed out on early intervention, it has been ineffective or they require on-going support.

Over the last decade, three major reports on reading in Australia (Department of Education, Science and Training, 2005), the UK (Rose, 2006) and USA (National Institute of Child Health and Development, 2000), have come to the conclusion that development of reading skills is more likely to occur with phonics-based reading programs, in which children learn about letter-sound correspondences, phonemic awareness and generative strategies. This applies to both initial instruction and remedial instruction. Explicit and systematic instruction in these fundamentals of reading is particularly important for children from disadvantaged backgrounds who are less likely to have been exposed to these concepts in their family and home environments. It is, however, effective for all children (Department of Education, Science and Training, 2005; National Institute of Child Health and Development, 2000; Rose, 2006).

Most older low-progress readers need, and respond to, a reading intervention that contains the components of effective early instruction (Abbot & Berninger, 1999; Brooks, 2007; Ellis, Wheldall, & Beaman, 2007). While phonics is an essential component of early and remedial reading instruction, it is not sufficient. The major reviews named above identified five key components of effective reading programs. They are:

(1) *Phonological awareness*. Learning that speech is made up of words, syllables, rhymes and sounds, and to identify, blend and segment the sounds (phonemes) and syllables that make up words in speech.
(2) *The alphabetic principle*. Learning the common sounds associated with the letters of the alphabet and using these sounds to decode words on the page.
(3) *Fluency*. Gaining automaticity in decoding and recognition of sight words so that reading becomes effortless, allowing the student to gain meaning.
(4) *Vocabulary*. Learning the meanings and uses of a wide range of words.
(5) *Comprehension*. Acquiring the ability to understand the full context and meaning of what is being read, and the ability to relate this to their knowledge of the world.

In combination, these components provide students with the two fundamental skills required for literacy – decoding or deciphering the words on the page and understanding what they mean. This is known as the simple view of reading (Gough & Tunmer, 1986; Tan, Wheldall, Madelaine, & Lee, 2007).

The content of reading programs is not the only factor to consider; the method of delivery is also important. Research evidence strongly supports teaching that is direct, explicit and systematic (Carnine, Silbert, Kame'enui, Tarver, & Jungjohann, 2006; Hattie, 2009; Rose, 2006). This type of instruction breaks down skills and content to be learnt into small steps presented in a specific sequence, which students are required to master at each stage. It is also characterised by frequent monitoring and feedback (Carnine et al., 2006).

Intervention programs for older low-progress readers

Formal reading remediation programs in Australian primary schools are aimed mostly at children in the lower grades (Wyatt-Smith, Elkins, Colbert, Gunn, & Muspratt, 2007). The most common reading intervention in Australia is Reading Recovery (Clay, 1993) – a one-to-one intervention that is available only to students in Year 1 (New South Wales Department of Education and Training, 2011; K.D. Woodward, personal communication, July 6, 2011).

Despite the popularity and longevity of Reading Recovery, reviews published in the last five years have found that many of the studies used to support its continued implementation have methodological limitations (Reynolds & Wheldall, 2007; Reynolds, Wheldall, & Madelaine, 2009; Slavin, Lake, Davis, & Madden, 2011).

A disadvantage of one-to-one reading interventions is the cost to schools, instigating interest in the effectiveness of small group interventions (Gersten et al., 2009). Offering tuition in small groups reduces the cost and allows more children to access supplementary instruction. There is some evidence that small group instruction with a strong emphasis on phonics can be effective for struggling readers (Slavin et al., 2011), but there may be some tradeoff between group size and effect size (Vaughn et al., 2003).

There are numerous small group literacy programs aimed at struggling readers in the later years of primary school (Year 3 and above). Few, however, are comprehensive programs containing all of the key components of reading instruction outlined above, and fewer have strong evidence of their efficacy. Studies providing empirically valid evidence are those with a randomised control study design, using standardised reading measures, with an adequate sample size and duration of treatment (Slavin et al., 2011; What Works Clearinghouse [WWC], 2008). Programs that meet all of these criteria (target age, group size, content and experimental evidence basis) are:

- *Corrective Reading* (Engelmann, Hanner, & Johnson, 2002). Corrective Reading: Decoding and Corrective Reading: Comprehension are remedial reading programs for students in Year 4 and above. Together, they address the five key components of reading using a Direct Instruction pedagogy (Marchand-Martella, Martella, & Przychodzin-Havis, n.d.). The programs can be delivered in groups of up to 20 students and each lesson is 45 min long. Reviews of literacy interventions by Slavin et al. (2011) and WWC (2007, 2010a) found that only two studies out of a total of more than 150 studies met evidence criteria. Slavin et al. (2011) calculated an average effect size for Corrective Reading: Decoding of +1.22 in a study by Hempenstall (2008) and +0.16 in a study by Torgesen et al. (2006). The WWC describes the extent of evidence on the Corrective Reading programs as small, with potentially positive effects in alphabetics and fluency, but no discernible effects on comprehension for Year 3 students (WWC, 2007), and no discernible effects on any of the measures used for Year 5 students (WWC, 2010a).
- *Wilson Reading System* (Wilson, 1995). The Wilson Reading System intervention program is delivered in groups of up to 15 students in Year 4 and above. The WWC examined 28 studies of the Wilson Reading System, finding that none met its evidence criteria. Slavin et al. (2011) included one study in their review – Torgesen et al. (2007) – and calculated an overall effect size of +0.17 for general reading ability. However, the Wilson Reading System was modified for this study and it, therefore, does not evaluate the full program (Torgesen et al., 2007).
- *Spell Read* (Rashotte, MacPhee, & Torgesen, 2001). Spell Read is usually taught in groups of up to five students and is aimed at struggling readers in Year 2 and above. Lessons take 60–90 min. A WWC report on this intervention describes its effects as positive for alphabetics, and potentially positive for fluency and comprehension, based on two studies meeting the evidence criteria (WWC, 2007). Slavin et al. (2011) calculated an overall effect size for this program of +0.17 from one study by Torgesen et al. (2007).
- *Reading Mastery* (Engelmann & Bruner, 1995). The 'Signature Edition' of this program is aimed at students from Kindergarten to Year 5 and is delivered in groups of three to six students in 30–45 min lessons, using Direct Instruction pedagogy. Of 175 studies reviewed by the WWC, only two met its evidence standards, reporting potentially positive effects on fluency in Year 4 students and no

discernible effects on comprehension in Year 4 and 5 students. There was no alphabetic measure (WWC, 2010b).

A literature search did not reveal any additional recent studies to those identified in the WWC intervention reports and the review by Slavin et al. (2011). There are, however, several older studies (from the 1970s and 1980s) showing the efficacy of earlier versions of the Reading Mastery (Engelmann & Bruner, 1995) program which are not mentioned in the WWC reports (Engelmann, 2008). Brooks (2007) describes a number of other small group programs used in primary schools in the UK, but a literature search failed to find any published studies that involved randomised control trials of these interventions.

Reports on literacy interventions in Australia (Louden et al., 2000; State Government of Victoria, 2001; Wyatt-Smith et al., 2007) named two additional formal remedial reading programs that could be implemented in small groups:

- *THRASS* (THRASS, n.d.). Teaching Handwriting and Spelling Skills (THRASS) is a phonics teaching method that is used in some schools as a whole-class program and in others for remedial instruction for smaller groups (Louden et al., 2000). It is designed to be one part of a balanced literacy program rather than a comprehensive program of reading instruction (THRASS, n.d.). According to Brooks (2007), there is little evidence of THRASS's efficacy as a 'catch up' intervention for older students. A literature search did not find any published studies involving older low-progress readers in primary schools.
- *QuickSmart* (Graham, Pegg, & Alder, 2007). The QuickSmart literacy program aims to develop automaticity in word decoding, oral fluency, vocabulary and comprehension strategies for students in Year 4 and above. Lessons are delivered to pairs of students, in three half-hour sessions each week (Graham, Pegg et al., 2007). A quasi-experimental study using a comparison group but not a matched, random-allocation control group found that the treatment group of low-progress readers recorded higher average growth in vocabulary and comprehension scores than the comparison group of average readers. A major problem with non-matched comparison groups is that the group with the lower baseline score necessarily has more room to gain than a group with a higher baseline score. Even so, only the comprehension score growth was statistically significant at $p < 0.05$ (National Centre of Science, Information and Communication Technology, and Mathematics Education for Rural and Regional (SiMERR), 2009). Another study involving students in Years 5, 6 and 7 also used comparison groups of average and high achieving students. The only standardised measure was for comprehension, with statistically significantly higher growth in comprehension for the treatment group (Graham, Bellert, Thomas, & Pegg, 2007).

The above review of existing interventions points to the need for a comprehensive research-based remedial reading program for older low-progress readers in primary schools that has been subjected to experimental trials.

MultiLit

MultiLit is a non-categorical remedial reading program for struggling readers developed by researchers at Macquarie University Special Education Centre (Wheldall &

Beaman, 2000) and based on the available scientific research evidence. The program provides intensive, systematic and explicit instruction in three main areas: phonic word attack skills, sight word recognition and one-to-one supported book reading. It also tailors instruction to the specific level of skill of the student through initial and continuous assessment. MultiLit was initially devised as a one-to-one Reading Tutor Program (RTP). An extensive evaluation of data collected from participants in the MultiLit RTP over a number of sites and contexts found that students with low reading ability made statistically significant and educationally important gains over the course of the program (Wheldall & Beaman, 2000).

The developers of MultiLit later designed a hybrid model of small group lessons and one-to-one tutoring for use in the 'Schoolwise' program and other tutorial centre contexts. 'Schoolwise' is run in tutorial centres in the inner-Sydney suburbs of Ashfield and Redfern, and in Darwin, with students attending classes 3 h each day, five days a week. Participants include children from low socioeconomic backgrounds in inner Sydney and indigenous children in Redfern and Darwin. It has also been used with Aboriginal groups in Cape York (Wheldall & Beaman, 2010).

In the Schoolwise project in Ashfield, students with very low levels of literacy attended the tutorial centre for two school terms (around 18–20 weeks). In 2007, in a quasi-experimental 'cross-over' study design, the progress of Year 5 and Year 6 students participating in the MultiLit Schoolwise project in the first half of the school year was compared with a wait list control group attending regular school classes. In the second half of the year, the control group attended Schoolwise while the other group returned to regular school classes. The students attending Schoolwise made significantly greater reading gains than the students in regular classes in both phases of the study, with effect sizes ranging from moderate (0.5) to large (1.42) (Wheldall, 2009).

Schoolwise participants in 2008 made mean gains of 20 months in reading accuracy, 16 months in reading comprehension, 20 months in single-word reading, 22 months in spelling, 20 months in non-word reading and increased their fluency by 46%. This acceleration in reading ability substantially narrowed the literacy gap between the Schoolwise students and the average reading level for their age (Wheldall, 2009).

The current study: group MultiLit

In order to extend access to MultiLit for schools, a new version of the program has been developed. This new small group version of MultiLit was designed to allow the program to be delivered more cost-effectively and to a larger number of students, without the need for individual one-to-one instruction.

The version of MultiLit in this study differed from previous and other existing iterations of MultiLit, and from previous studies, in several important ways. First, it was a small group MultiLit instruction delivered within a regular school setting. Second, the program was delivered in 'pure' MultiLit sessions of 1 h per day whereas, previously, small group MultiLit has been delivered in sessions of up to 3 h per day which has included other literacy activities. Third, unlike the Schoolwise program, there was no individual instruction provided to students. All lesson components were delivered in small groups of between four and six students. Fourth, the program was delivered by school staff with minimal training and limited experience with MultiLit teaching methods. Fifth, the research design is a randomised control trial.

The study aims to gather experimental evidence of the efficacy of a 1 h, 'pure' MultiLit group program for small groups of students in a primary school setting. The participating school was chosen so as to provide some evidence of the potential of MultiLit to improve literacy in schools with a high level of social disadvantage as a cost-effective small group intervention.

Data were collected at three points – pre-test, after two terms of intervention, and after three terms of intervention – and the growth in scores of the control and experimental groups compared using analysis of covariance (ANCOVA). Treatment effect sizes were calculated. Results are presented for six tests of reading ability and their implications are discussed.

Method

Participants

A total of 44 students from Years 3 to 6 at a New South Wales (NSW) government school were participants in the study. The participating school is in a regional town and is classified as a Priority Action School by the then NSW Department of Education and Training (now NSW Department of Education and Communities), placing it among the 101 public schools with the lowest socioeconomic profile in NSW (New South Wales Department of Education and Training, 2010). When the study began in 2010, the Index of Community Socio-Educational Advantage (ICSEA) (Barnes, n.d.), calculated for the school for the federal government's My School website, was 897. (The national average ICSEA value is 1000 with a standard deviation of 100.) Seventy-five percent of students at the school had an ICSEA score below the national average.

Students were selected for participation in the study through a process of screening and ranking. Years 3 to 6 classroom teachers were asked to identify the lowest 50% of their class in terms of reading ability. Students with a diagnosed (and documented) intellectual disability or severe language impairment were excluded since their needs would have been addressed by alternative provision.

Students identified by the teachers were screened by trained research assistants, using two supplementary lists from the Wheldall Assessment of Reading Passages (WARP) (Wheldall & Madelaine, 2006) and then ranked according to their mean scores. The 12 students with the lowest average WARP scores were selected from each of Years 3, 4, 5 and 6 (a total of 48 students).

The experimental group and the control group each initially had 24 students. Two students from the experimental group, one in Year 4 and one in Year 5, left the school during the first term of the intervention. As it was no longer necessary to test their matched pairs from the control group, a total of 44 students participated in the first set of post-intervention tests, which were administered after two terms.

All 12 Year 6 students left the study after two terms, when they moved on to high school. A further Year 4 student, this time from the control group, also left the school after two terms and this student and his matched pair in the experimental group were hence excluded from the analyses. The final sample for analysis was therefore 30 students.

In the full sample, Year 3 students comprised eight boys and four girls, with a mean age of 104 months at the beginning of the intervention. Year 4 students comprised seven boys and three girls, with a mean age of 116 months at the beginning of the intervention. Year 5 students comprised nine boys and one girl with a mean age of 130 months at the beginning of the intervention. Year 6 students comprised 10 boys and

2 girls, with a mean age of 140 months at the beginning of the intervention. All students moved into a higher grade for the third term of the intervention (except the Year 6 students, who graduated and left the school as noted earlier) as it was a new school year. None of the children were from homes where languages other than English are spoken. A flow diagram of recruitment and attrition of students is shown in Figure 1.

All students were in the bottom quartile for the Martin and Pratt Nonword Reading Test (Martin & Pratt, 2001) at the beginning of the intervention, except for one student from the Year 5 experimental group who had a percentile rank of 42 and one from the Year 6 control group who had a percentile rank of 37. (None of the other measures provide percentile ranks.)

Procedure

All participants in both experimental and control groups were given a battery of reading tests before the reading intervention started ('pre-test') and after two terms of the intervention ('post-test 1'). The reduced group of participants was given the test battery again at the end of three terms ('post-test 2'). The test battery included the Burt Word Reading Test (Gilmore, Croft, & Reid, 1981), the South Australian Spelling Test (Westwood, 2005), the Martin and Pratt Nonword Reading Test (Martin & Pratt, 2001), and the assessment version of the WARP (Wheldall & Madelaine,

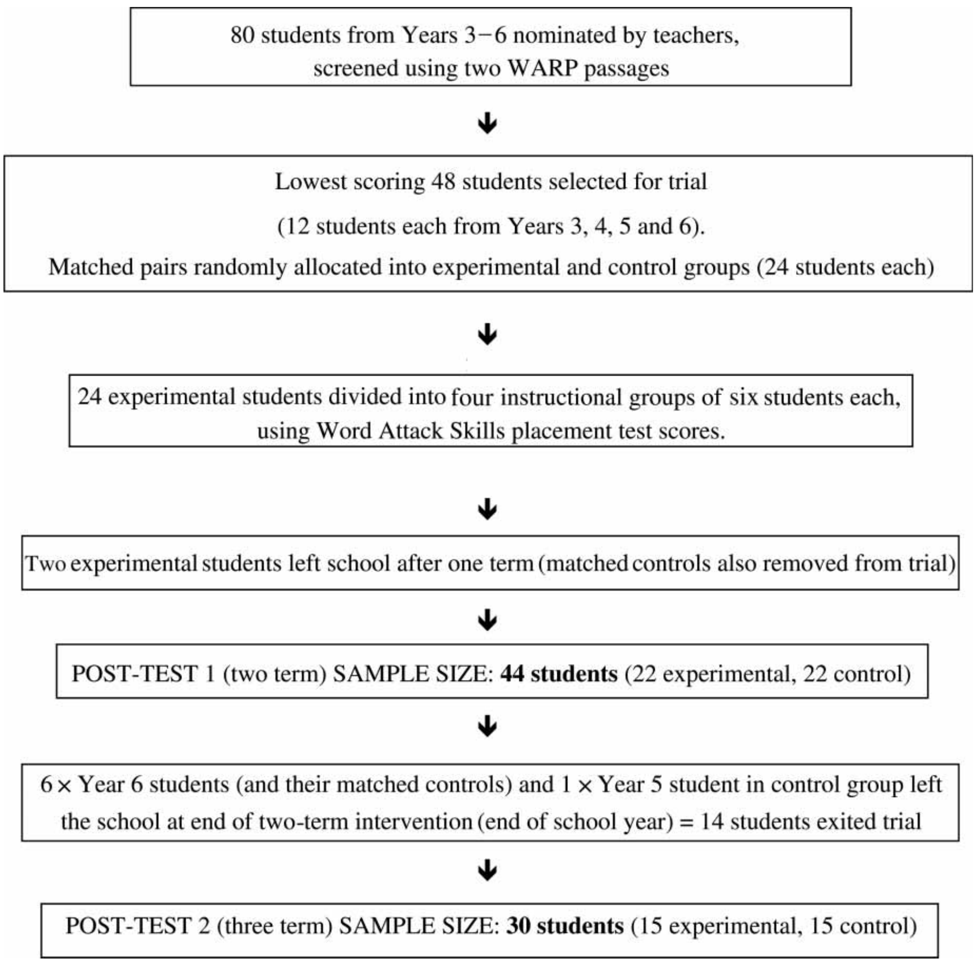

Figure 1. Recruitment, allocation and attrition of participants in trial.

2006) (which uses different passages to the screening WARP). The pre-intervention test battery also included the MultiLit Placement Test (MultiLit, 2007d), and the two post-test batteries included the Neale Analysis of Reading Ability (Neale, 1999). Trained research assistants administered the tests. All tests were independently scored and double-scored.

Throughout the intervention, each student was given a 1 min WARP test each fortnight by the first author to monitor their progress. The set of 10 monitoring WARP (Wheldall & Madelaine, 2006) was different from the supplementary screening WARP and the assessment WARP in the test battery, as noted above.

Information and consent forms were sent home to the parents/carers of participating students before the pre-intervention test battery was administered. Passive consent for the students' participation in the study was required by the university research ethics committee.

Following the pre-intervention test battery, matched pairs of students were identified using their screening WARP scores (described in 'Measures'). One student from each pair was then randomly allocated into either the experimental or control group. The MultiLit program was delivered to the experimental group while the control group remained in class for their usual classroom literacy instruction.

The MultiLit program was delivered over three school terms (27 weeks) by instructors trained by MultiLit trainers (MultiLit is the entity responsible for developing the intervention). It was initially intended to be delivered over two school terms (19 weeks). During the second term, however, before post-testing commenced, it was decided to extend the intervention for a third term. Formal observations of the lessons by MultiLit consultants had indicated that the MultiLit instructors, who had had no previous experience with the program, did not begin delivering the program to a sufficient level of fidelity until around half-way through the first term (see 'Treatment integrity'). Three of the four instructors were registered primary school teachers without any special education qualifications, with classroom teaching experience of 2, 4 and 5 years. The fourth instructor was tertiary educated but had no teaching qualifications or experience.

At the end of the intervention, the data collected in the three testing phases were analysed to compare the growth in scores of the experimental and control groups on the various tests.

The intervention – MultiLit

The MultiLit program implemented in this trial was an adapted version of the MultiLit RTP (MultiLit, 2007a), a one-to-one, intervention for struggling readers in Year 2 and above. The adapted version was developed for small group instruction with the objective of providing an effective and less costly intervention for older low-progress readers within a school setting.

The MultiLit program incorporates the key elements of effective reading instruction identified in large-scale reviews, including the (Australian) National Inquiry into the Teaching of Literacy (Department of Education, Science and Training, 2005). These elements are phonemic awareness, phonics, fluency, vocabulary and comprehension.

MultiLit has three basic components: Word Attack Skills (accuracy and fluency), Sight Words and Reinforced Reading. Each 1 h MultiLit session is divided into four discrete lessons of a set length.

Word Attack Accuracy (15 min). This lesson provides explicit instruction in phonemic awareness and phonic word decoding skills. The level at which students begin instruction is determined by their performance on the MultiLit placement test, which is directly aligned with the teaching program. Students progress through specifically sequenced sub-levels and levels as they master the content. Their rate of progress is dependent on the speed of mastery. The aim of this lesson is to provide students with skills to read familiar and unfamiliar words, using phonetic rules and decoding strategies (MultiLit, 2007d).

Word Attack Fluency (10 min). In this lesson, students work on the same set of materials as in Word Attack Accuracy, but in this case, working on the development of fluency – speed and accuracy. Students work at least one level below their Word Attack Accuracy level, but are usually several levels below. As in Word Attack Accuracy, rate of progress is determined by mastery. Students must achieve a fluency target within each sub-level to progress to the next sub-level. The aim of this lesson is to develop fluency and automaticity in reading decodable text (MultiLit, 2007d).

Sight Words (15 min). In this lesson, students are taught 20 lists of 10 sight words, moving onto a new list each time they demonstrate mastery. The 200 sight words are high frequency words, both phonically regular and irregular, derived from a content analysis of children's storybooks (Stuart, Dixon, Masterson, & Gray, 2003). The aim of this lesson is to develop students' rapid recognition of commonly occurring words, and thereby allow them more immediate access to the text (MultiLit, 2007c).

Reinforced Reading (*PPP*) (20 min). Using a book of an appropriate instructional level, the teacher first introduces any unknown vocabulary or sight words. Comprehension questions about the previous reading are asked if it is a book being continued, or the teacher introduces a new story. Students take turns to read aloud from the book, with feedback and guidance provided by their teacher using the revised Pause, Prompt, Praise (PPP) tutoring method (MultiLit, 2007b; Wheldall & Beaman, 2000), in which students are given several seconds to attempt an unknown word without help, followed by a sequence of prompts, and finally given specific praise for their efforts. Comprehension questions are again asked at the end of the session. The student's instructional level is determined using a 100-word sample of text from a book. An instructional level book is one which students read with 90–95% accuracy. MultiLit has its own system for levelling texts consisting of 10 'M-levels' which have been graded against other levelling systems to allow the selection of appropriate books (Pearce, Wheldall, & Madelaine, 2006).

The above lesson types are the basic components of the MultiLit program. As students move through different parts of the program at different rates, however, components can also be completed at different rates. Two additional MultiLit program components were introduced to the MultiLit lessons as groups completed the basic components.

PPP-C (*Comprehension*). The procedure is similar to regular PPP, but students read aloud from a book that is two levels below their instructional level to allow students to read fluently and focus on the meaning. After a few minutes, or a few paragraphs, students are asked to turn their books face down and the teacher asks a number of 'who, what, when, where, why, how' comprehension questions (MultiLit, 2007b; Wheldall & Beaman, 2000). PPP-C was introduced to the lesson program when students completed the Word Attack (accuracy) component.

Repeated Reading. This activity was designed specifically for this trial to build connected text reading of increasing difficulty through repetition and practice. Students work on one passage for two days. On the first day, the teacher models reading the passage fluently and expressively, then students take turns to read the passage, without being timed. The teacher and other students provide brief explicit feedback and constructive comments on their reading. On the second day, the teacher and students read the passage aloud together. Each student then reads the passage aloud individually while being timed and their errors recorded by the teacher. Their score is words read correct per minute. If there is time, students have two turns. Each passage has a target rate of words correct per minute, increasing as the students progress through the passages. Repeated Reading was introduced into the lesson program when students completed the Word Attack (fluency) component.

All students had the standard form of MultiLit comprising all four basic components throughout the two-term and three-term interventions. Only one group of four students completed Word Attack (fluency) during the third term of intervention and hence moved on to Repeated Reading for the remainder of the term (four weeks).

MultiLit prescribes both content and pedagogy. Effective direct instruction teaching (such as model–lead–test procedures) (Carnine et al., 2006) is intrinsic to the program. Positive teaching behaviour management strategies (Merrett & Wheldall, 1990; Wheldall & Merrett, 1984) are also a key feature, in order to maximise time on task and build student confidence through contingent praise and acknowledgment.

Students in the experimental group received MultiLit instruction for 1 h a day, four days a week over 27 weeks. They were withdrawn from class during classroom literacy time. Students were in four groups of six students for the first two terms, and four groups of four for the third term, organised by the instructional level. Group membership was initially flexible as skill acquisition varied but the groups became more stable throughout the intervention.

The MultiLit program was delivered in 72 days over two terms with students attending an average of 65 lessons. The average attendance rate for MultiLit lessons for the two-term group was 91% (with a range of 70–99%). Over three terms, the program was delivered on 108 days with students attending an average of 96 lessons. For the three-term group, the average attendance rate was 89% (with a range of 73–98%). Student absences included those occasions when MultiLit lessons were missed due to other school activities.

Measures

Burt Word Reading Test (Gilmore et al., 1981). This test measures recognition of single words using a list of 110 words of increasing difficulty. Reading age achievable on the Burt is a maximum of about 13 years. The Burt has high internal consistency (>0.96), high test–retest reliability (>0.95). High criterion validity has been demonstrated with correlations of 0.90–0.98 between the Burt Word Reading Test and the Schonell Graded Word Reading Test (Schonell, 1955, cited in Gilmore et al., 1981) and the Oral Word Reading Test (Fieldhouse, 1952, cited in Gilmore et al., 1981).

South Australian Spelling Test, 2nd ed. (Westwood, 2005). This test can be administered individually or in groups, giving a spelling age for children in the range 6 years to over 15 years of age. Good internal reliability with a test–retest reliability coefficient of 0.96 for most year groups is reported in the manual. Alternative forms reliability range from 0.89 to 0.94 depending on the age level (Westwood, 2005).

Martin and Pratt Nonword Reading Test, Form A (Martin & Pratt, 2001). This test uses pseudowords of increasing difficulty to measure phonological recoding ability in students aged from 6 to 16 years (Martin & Pratt, 2001). The test has high alternative-forms reliability coefficients of 0.92–0.96, a high test–retest reliability coefficient of 0.96 for Form A, and a high internal consistency reliability coefficient of 0.96 (Martin & Pratt, 2001). Positive correlations between the Martin and Pratt test and the Woodcock Reading Mastery Test-Revised Word Attack (Woodcock, 1987, cited in Martin & Pratt, 2001) (0.89), Coltheart and Leahy nonword reading lists (Coltheart & Leahy, 1996, cited in Martin & Pratt, 2001) (0.93) and the Neale Analysis of Reading Ability (Neale, 1988, cited in Martin & Pratt, 2001) (0.78–0.88) indicate good criterion-related validity.

Wheldall Assessment of Reading Passages (*WARP*) (Wheldall & Madelaine, 2006). The WARP is a curriculum-based measure of passage reading fluency for older low-progress readers (Year 3 and above). The test consists of standardised passages in the form of short stories of 200 words in length. The student is presented with the passage on a page and instructed to read the words aloud quickly and carefully. They are asked to stop after 1 min. The score is the number of words read correctly per minute. In the test battery, the score was averaged over three passages. The WARP comprises a set of 3 assessment passages and 10 monitoring passages. In addition, for the purposes of screening in this study, two additional WARP, not included in either the assessment or monitoring passages, were employed. The WARP has been found to have high parallel forms and repeated measures reliability, with coefficients typically exceeding 0.95. The validity of the WARP has been demonstrated with high correlations between WARP scores and the accuracy measure of the Neale Analysis of Reading Ability (0.87) and the Burt Word Reading Test (0.85) (Wheldall & Madelaine, 2006).

Neale Analysis of Reading Ability (Neale, 1999). This test assesses students' reading accuracy and reading comprehension. Six text passages of increasing difficulty are presented to the student and they are asked to read them aloud. Errors are recorded and used to calculate an accuracy score. At the end of each passage, the examiner asks the students a set of comprehension questions. The number of correct responses provides a comprehension score. The Neale Analysis has been shown to have high levels of internal consistency for accuracy and comprehension with correlations ranging from 0.71 to 0.96 (Neale, 1999). Pearson product moment correlations ranging between 0.88 and 0.96 were found between the Neale Analysis for accuracy and comprehension and the Schonell Graded Word Reading Tests, indicating good criterion-related validity (Neale, 1999).

MultiLit Word Attack Skills Placement Test (MultiLit, 2007d). The MultiLit Word Attack Skills Placement Test assesses students' knowledge of letter-sound correspondences and their ability to read phonetically regular words and non-words. The letters and words are presented in a specific sequence of increasing complexity, beginning with single sounds and simple words and progressing to digraphs, blends and words requiring rule-based strategies. This test is used to place students at the appropriate level of the MultiLit Word Attack Skills component of the MultiLit program and, in this trial, to create instructional groups of students beginning at a similar level.

Analysis

To compare gains made by the two groups, ANCOVAs were employed in the analysis of scores for each variable at post-test 1 and post-test 2, with pre-test scores as the covariate in each analysis. The alpha level was set at 1% ($p < 0.01$) to allow for family-wise comparisons in lieu of the use of a Bonferroni correction.

Treatment integrity

A Treatment Integrity checklist was devised to evaluate delivery of the program by the instructors. Two experienced consultants from the MultiLit Research Unit observed MultiLit lessons eight times over the course of the intervention, at three- to four-week intervals. The checklist was completed for each instructor observed. Separate written feedback on performance was provided to the instructors, along with verbal feedback and consultation following the observed lesson. The checklists contained up to 25 criteria, including all aspects of lesson implementation and positive teaching strategies. Lesson implementation included, for example, 'Models correct sounding out strategy' and 'Monitors students' verbal responses, ensuring students respond on signal'. Positive teaching points included, for example, 'Uses explicit praise' and 'Praises quickly and consistently'. The consultants silently observed the MultiLit lessons and completed the checklists with a 'yes', 'sometimes', or 'no' response. The percentage of 'yes' responses for the lesson observed is the measure of treatment integrity or fidelity.

All lesson components are considered to be part of the MultiLit program. Treatment Integrity data were collected for all basic and additional components and aggregated. With the exception of Reinforced Reading (PPP), individual components were not analysed separately. Nor was an attempt made to associate particular program components with treatment effects, as the number of students involved in individual instructional groups was too small to provide meaningful statistical information.

As may be seen from Figure 2, program implementation by the instructors did not reach the minimum criterion of 80% fidelity until week 10 (excluding Reinforced Reading, or 'PPP'), after which point the minimum fidelity criterion was mostly maintained (and exceeded). The low treatment fidelity during the first term led to the decision to extend the program for a third term. Reinforced Reading (PPP) is shown separately because it became apparent that this was an area of particular difficulty.

Results

Results are presented separately for the full sample after two terms of intervention (pre-test and post-test 1) and for the reduced sample after two and three terms (pre-test, post-test 1 and post-test 2).

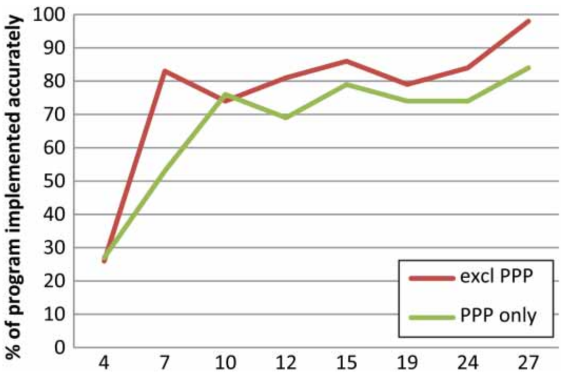

Figure 2. Mean percentage treatment integrity over the three terms of intervention.

Results for the full sample after two terms

Means and standard deviations for all measures (raw scores) for both experimental and control groups of the complete sample at pre-test and post-test 1 are shown in Table 1.

Table 1 shows that the control group means were slightly higher than those for the experimental group at pre-test on all measures but none of these differences was statistically significant. (The subsequent ANCOVAs take these small differences into account.)

ANCOVAs were conducted on the scores for each measure separately at post-test 1. Pre-test scores were the covariate for all measures except for the accuracy and comprehension components of the Neale Analysis of Reading Ability, as this test was not administered in the pre-test battery. Pre-test scores for the Burt (which correlates highly with the Neale) were used as the covariate for the two Neale measures. Partial eta squared was calculated for each measure at post-test 1 to determine the size of the treatment effect. Results of these analyses are reported in Table 1.

Statistically significant, positive treatment effects were found at the stated alpha level ($p < 0.01$) for one measure after two terms – the Martin and Pratt Nonword Reading Test. The effect size of the difference between the experimental and control group means on the Martin and Pratt (partial eta squared = 0.405) was very large. (An effect size is considered to be large when partial eta squared is equal to or greater than 0.138.)

The other five measures did not show statistically significant differences between the means of the two groups after two terms, but effect sizes ranging from large to small were found for four of the five measures. The Burt Word Reading Test had a large effect size (partial eta squared = 0.141), the South Australian Spelling Test and WARP had medium effect sizes (partial eta squared = 0.108 and 0.059, respectively), and the accuracy component of the Neale Analysis had a small effect size

Table 1. Means and standard deviations (raw scores) of experimental and control groups of complete sample ($n = 44$) at pre-test and post-test 1 (after two terms), results of ANCOVAs and effect sizes (partial eta squared).

Measure	Group	Pre-test mean (SD)	Post-test 1 mean (SD)	*F*	*p*	ES
Martin & Pratt Nonword Test	E	11.55 (7.84)	19.59 (7.78)	27.938	0.000	0.405
	C	12.05 (6.44)	13.27 (6.39)			
Burt Word Reading Test	E	32.27 (12.72)	40.09 (14.86)	6.756	0.013	0.141
	C	34.73 (11.08)	38.68 (11.55)			
South Australian Spelling Test	E	21.45 (9.50)	24.64 (7.79)	4.956	0.032	0.108
	C	21.86 (8.22)	23.27 (7.54)			
WARP (words correct per minute, wcpm)	E	47.18 (27.71)	63.59 (32.42)	2.590	0.115	0.059
	C	52.36 (29.09)	65.59 (32.35)			
Neale accuracy	E		26.73 (13.43)	1.436	0.238	0.034
	C		27.05 (11.33)			
Neale comprehension	E		8.95 (3.18)	0.284	0.597	0.007
	C		8.95 (3.85)			

Notes: ES = effect size, where 'small' is >0.01; 'medium' is >0.06; 'large' is >0.138). ANCOVAs of both Neale measures used Burt pre-test scores as the covariate in lieu of Neale pre-test scores.

(partial eta squared = 0.034). The comprehension component of the Neale Analysis was the only measure that did not exhibit at least a small treatment effect.

An alternative method of analysis for comparing experimental and control groups where pre-test and post-test measures are available is to calculate independent means *t*-tests using gain scores of the measures employed (i.e. the differences between pre-test and post-test scores). Using this method, the results of the ANCOVAs were again confirmed with only the Martin and Pratt measure revealing a statistically significant difference between experimental and control groups ($p < 0.001$; other measures $p = 0.014–0.205$). Note that such analyses were not possible with the two Neale Analysis of Reading measures because pre-test data were not collected for these tests. Effect sizes for gain score mean differences were calculated using Cohen's *d*. The values obtained were as follows: Martin and Pratt 1.23 (large); Burt 0.73 (medium); South Australian Spelling 0.57 (medium); WARP 0.39 (small).

Results for the reduced sample after two and three terms

Means and standard deviations for all measures (raw scores) for both experimental and control groups of the reduced sample at pre-test, post-test 1 and post-test 2 are shown in Table 2.

Table 2 shows that the control group means were slightly higher than those for the experimental group on all measures at pre-test but none of these differences was statistically significant. (The subsequent ANCOVAs take these small differences into account.)

ANCOVAs were conducted on the scores for each measure separately at post-test 1 and post-test 2 (with pre-test scores as the covariate, except for the Neale measures, as noted above). Partial eta squared was calculated for each measure at post-test 1 and post-test 2 to determine the size of the treatment effect. Results of these analyses are reported in Table 2.

Statistically significant, positive treatment effects were found for one measure – the Martin and Pratt Nonword Reading Test – after two and three terms. There was a large treatment effect at post-test 1 (partial eta squared = 0.274) increasing to a very large effect at post-test 2 (partial eta squared = 0.520).

The other measures did not show statistically significant differences between the experimental and control groups at post-test 1 or post-test 2, but there were treatment effects of varying sizes. The Burt Word Reading Test had a large effect size at post-test 1 (partial eta squared = 0.149) and a medium effect size at post-test 2 (partial eta squared = 0.057). The South Australian Spelling Test and the WARP had small effect sizes at post-test 1 (spelling partial eta squared = 0.044; WARP partial eta squared = 0.047), slightly decreasing at post-test 2 (spelling partial eta squared = 0.037; WARP partial eta squared = 0.012). The accuracy component of the Neale had a small effect size at post-test 1 (partial eta squared = 0.036) but at post-test 2 this had dissipated to no detectable treatment effect. The comprehension component of the Neale showed the opposite trend – no treatment effect at post-test 1 increasing to a borderline small treatment effect at post-test 2 (partial eta squared = 0.098).

Again, the results of these ANCOVAs were confirmed by independent means *t*-tests of gain scores with statistically significant differences between experimental and control groups evident only for the Martin and Pratt test after both two and three terms of instruction ($p < 0.01$ and $p < 0.001$, respectively). No other differences were statistically significant at the 1% level for either two or three terms of instruction

Table 2. Means and standard deviations (raw scores) of experimental and control groups of reduced sample ($n = 30$) at pre-test, post-test 1 (after two terms) and post-test 2 (after three terms), results of ANCOVAs and effect sizes (partial eta squared).

Measure	Group	Pre-test mean (SD)	Post-test 1 mean (SD)	*F*	*p*	ES	Post-test 2 mean (SD)	*F*	*P*	ES
Martin and Pratt Nonword Test	E	9.53 (8.06)	17.40 (7.64)	10.212	0.004	0.274	19.33 (10.10)	29.26	0.000	0.520
	C	10.27 (4.11)	12.67 (5.53)				11.07 (4.48)			
Burt Word Reading Test	E	27.93 (10.45)	35.67 (13.98)	4.715	0.039	0.149	37.73 (16.06)	1.643	0.211	0.057
	C	30.93 (8.58)	35.00 (9.37)				38.47 (9.90)			
South Australian Spelling Test	E	19.27 (10.00)	22.53 (7.81)	1.236	0.276	0.044	23.80 (9.54)	1.037	0.318	0.037
	C	20.00 (6.55)	22.00 (6.66)				23.07 (6.54)			
WARP (words correct per minute, wcpm)	E	38.27 (23.96)	53.00 (30.82)	1.319	0.261	0.047	61.53 (33.96)	0.323	0.575	0.012
	C	43.40 (26.38)	56.33 (31.04)				66.13 (30.95)			
Neale accuracy	E	na	21.80 (11.24)	1.002	0.326	0.036	27.00 (12.90)	0.240	0.629	0.009
	C	na	23.13 (11.03)				29.20 (9.80)			
Neale comprehension	E	na	7.67 (2.61)	0.43	0.837	0.002	10.60 (5.83)	2.946	0.098	0.098
	C	na	8.60 (3.85)				9.87 (3.38)			

Notes: ES = effect size, where ‘small’ is >0.01; ‘medium’ is >0.06; ‘large’ is >0.138. ANCOVAs of both Neale measures used Burt pre-test scores as the covariate in lieu of Neale pre-test scores.

(p = 0.060–0.890). Effect sizes for gain score mean differences were again calculated using Cohen's *d*. After two terms of instruction, the effect size values were as follows: Martin and Pratt 1.02 (large), Burt 0.68 (medium), South Australian Spelling 0.39 (small) and WARP 0.22 (small). After three terms, the values were: Martin and Pratt 1.42 (large); Burt 0.35 (small); South Australian Spelling 0.39 (small); WARP 0.05 (insubstantial).

Growth in mean scores of the experimental and control groups of the reduced sample over two and three terms

Figures 2–5 show the growth in group mean scores on the four measures, using adjusted means accounting for the initial small differences between groups.

Figure 3 shows the large and increasing gains made by the experimental group on the Martin and Pratt (statistically significant with large to very large treatment effects). Figures 4–6 show the smaller (non-significantly different) gains on the Burt, the South Australian Spelling Test and the WARP after two and three terms.

Percentile rank on Martin and Pratt Nonword Reading Test

The Martin and Pratt test is the only measure employed that provides both percentile ranks and standard scores. As stated in the Method section, all but two students were in the bottom quartile at pre-test on the Martin and Pratt – one from the control group and one from the experimental group, who were at the 37th and 42nd percentiles, respectively. In each group, 15 students were below the 10th percentile.

After two terms, three of the control group students were at the 25th percentile or above, compared with seven of the experimental students. The number of students below the 10th percentile in the control group had increased to 17 students, while in the experimental group only five students were below the 10th percentile.

After three terms, no student from the reduced control group was above the 25th percentile, compared with six students from the reduced experimental group; two of these students from the experimental group were above the 50th percentile. Thirteen students from the control group and six students from the reduced experimental group remained below the 10th percentile.

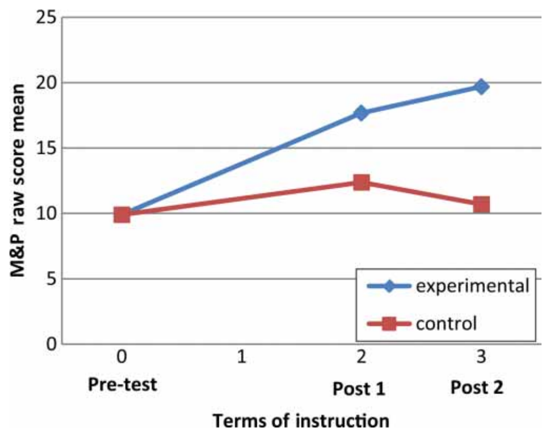

Figure 3. Adjusted Martin and Pratt Nonword Reading Test raw score means for the reduced experimental and control groups at the three testing points.

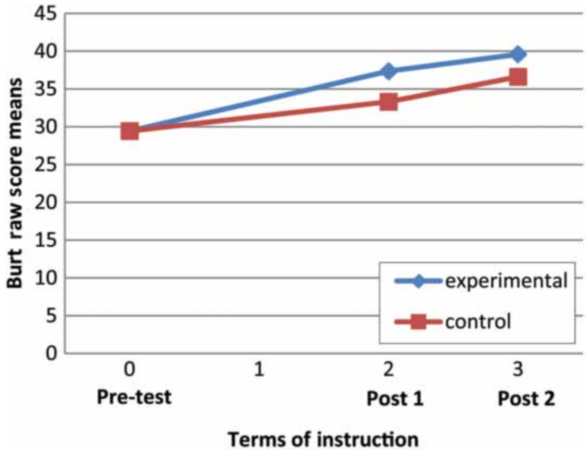

Figure 4. Adjusted Burt Word Reading Test raw score means for the reduced experimental and control groups at the three testing points.

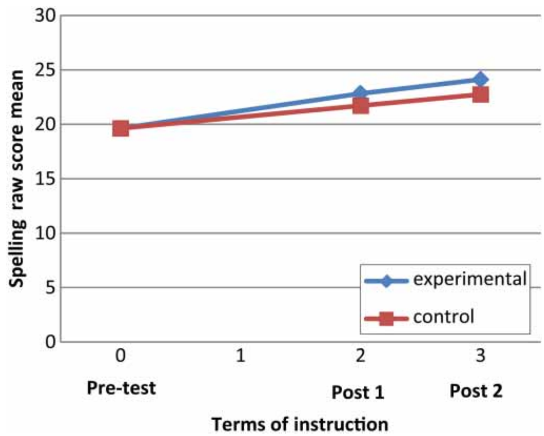

Figure 5. Adjusted South Australian Spelling Test raw score means for the reduced experimental and control groups at the three testing points.

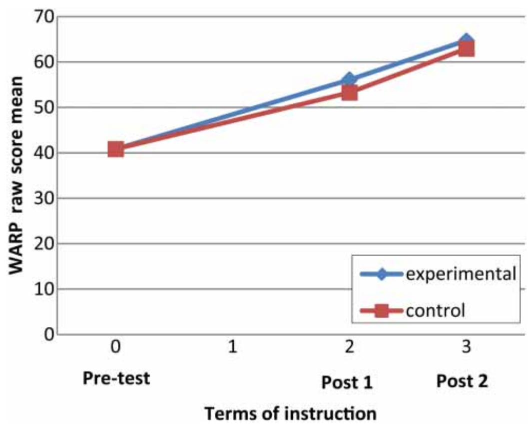

Figure 6. Adjusted WARP raw score means for the reduced experimental and control groups at the three testing points.

Discussion

A recent national literacy testing program has found that a large number of Australian Year 3 and Year 5 students have reading abilities below the minimum standard expected for their year of schooling (Australian Curriculum, Assessment and Reporting Authority, 2010).

These 'older' struggling readers require an effective reading intervention that will allow them to make academic progress along with their peers. The research literature reveals only a few formal, replicable, comprehensive small group reading interventions for older struggling readers, none of which have strong positive evidence for their efficacy. The MultiLit small group reading intervention was developed to meet this need. This study has subjected the MultiLit small group program to a rigorous experimental evaluation.

Several versions of the MultiLit program have been implemented and evaluated over the last 15 years, each tailored to meet the needs of the participating students. The programs have varied in the length of the daily session, the duration of the intervention, group sizes, the setting and the experience of the instructors. The fundamental content and pedagogy of the program have been consistent, however, and the results of program evaluations have typically been strongly positive and statistically significant.

The version of MultiLit implemented in this trial differed from other MultiLit programs and studies in several important ways. First, it was a 1 h daily program, conducted four days a week. Second, all instruction was in small groups, with no individual tuition. Third, it was implemented in a regular school setting, with school staff who had no previous experience with the program. Fourth, it was a 'pure' MultiLit program without any additional materials. Fifth, it was a randomised control trial, which provides the most rigorous experimental evidence.

The results of the study were mixed. Strong, positive, statistically significant results with very large effect sizes were found for only one measure – the Martin and Pratt Nonword Reading Test (Martin & Pratt, 2001) which measures phonological recoding. The average test score of the experimental group was statistically significantly higher ($p < 0.001$) for this measure than the control group after both two and three terms of intervention. The treatment effect sizes were very large. Partial eta squared for the full sample after two terms was 0.405 and for the reduced sample after three terms was 0.520. This indicates that the program was very successful in improving students' phonic word attack skills. After three terms of intervention, the experimental group's Martin and Pratt test scores more than doubled. In comparison, the control group had no growth in their Martin and Pratt test scores over the same period (Figure 3).

On all other measures, there were no statistically significant differences between the experimental and control groups. There were, however, a range of effect sizes, indicating some positive treatment effects that were of insufficient magnitude to achieve statistical significance: a large effect size was found for the Burt Word Reading Test; medium effect sizes were found for the South Australian Spelling Test and the WARP for the full sample after two terms; small effect sizes were found for the South Australian Spelling Test and the WARP for the reduced sample after two and three terms. Neale accuracy and comprehension scores suggested either no discernible treatment effects or small effects. It should be noted that studies with small samples tend to yield larger effect sizes without achieving statistical significance (Bell, 2011; Slavin & Smith, 2009).

In sum, these results provide very promising evidence of the small group MultiLit program's efficacy in only one area – phonic word attack skills – with less pronounced and non-significant effects in single-word reading, spelling and fluency. Interestingly, MultiLit participants did make observable gains in the other variables measured, but they were not significantly greater than the control group gains.

A number of factors may have influenced these results, involving the implementation of the program, the structure of the program itself, and the school context.

First, treatment integrity was not optimal for the first term of the intervention. It was very low initially, and it only reached and maintained a 80% threshold from Week 10. For the two term intervention, this is half of the instructional period. The MultiLit instructors had no experience with the program, or indeed with direct instruction or positive teaching methods, and had only two days of training prior to the commencement of the trial.

Second, the MultiLit program, and direct instruction and positive teaching in general, were also new to the students. Student behaviour was difficult to manage for the first term, but by the third term of intervention, the behaviour was much improved.

Third, all students scored very low on the placement test and, therefore, commenced instruction on a low level in Word Attack Accuracy. The MultiLit placement test places students on the first failed level. For some of the older students, their first failed level represented a gap in their knowledge rather than their instructional level. In the individual MultiLit RTP, this is far less of a problem because the 'gaps' may be quickly addressed and the student moves on. In the group program, however, the students' gaps may well not coincide. A significant amount of time in the first term of the intervention involved instruction in content already known by these students. This created some frustration and may have influenced students' attitude to the program and, therefore, their behaviour. It also meant that a substantial proportion of the program had passed before students reached their true instructional level.

Fourth, the initial group size of six students proved to be too large, particularly when there was regular testing. The program has tightly defined time limits, and testing six students took up a large amount of the lesson, leaving insufficient time for instruction and created potential for students to be off task. In the third term of instruction, after the natural attrition of the Year 6 students (the second term of the intervention was Term 4 of the school year), group size was reduced to four. This turned out to be the optimal group size.

Fifth, the weakest component of the program was Reinforced Reading. This component is essential for students to practise and generalise the word attack skills and sight words they have learned, and to develop fluency, vocabulary and comprehension. The Reinforced Reading session had two deficits. It was the least well delivered session in terms of the consistency of the PPP method used by the instructors (see Figure 2). In addition, the length of the session (20 min) was too short. With four to six students in a group, each student was able to read aloud for up to 5 min at the most. This is almost certainly not enough time to be beneficial, especially if this is the only time the student spends reading aloud in any given day, as was the case here.

Sixth, several students had reading difficulties that could be classified as severe, and therefore were not strictly suitable for small group intervention. Although they made slow progress in the MultiLit program, in an ideal Response to Intervention scenario, these students would have been moved into more intensive, one-to-one instruction. As that option was unavailable, the students remained in the program for the duration of the intervention.

Seventh, in addition to their very low scores on the Martin and Pratt test (Martin & Pratt, 2001), participants in this trial began the intervention with very low fluency levels – much lower than participants in Schoolwise, and well below the 25% quartile for their year of schooling (Madelaine & Wheldall, 2002). Although average fluency scores (words correct per minute) of both the experimental and control groups increased by as much as 80% (for Year 3 students), their post-test fluency scores remained very low in absolute terms. Such low fluency levels underscore the observation that a number of students were in need of Tier 3 intervention.

Finally, the intervention took place as part of a whole-school reform of literacy teaching that embraced explicit instruction, and with a particular focus on spelling. While the Martin and Pratt scores showed a clear divergence between the experimental and control groups, with the control group making no gains, both groups made similar progress on the other measures. If these students had been making progress of the same magnitude prior to the trial, they would likely not be, by definition, low-progress readers.

The data and observational information from this trial have some important implications, both for this particular MultiLit program and for small group reading intervention generally. As noted above, small group MultiLit was highly effective in developing the 'lower order' phonic word attack skills essential for reading. Small group MultiLit was far less effective in transferring these abilities to the more complex skills of spelling and oral reading fluency. This may reflect specific deficits in program implementation, such as quality of instruction, group size, the appropriate placement of students and the absence of one-to-one supported reading, or it may signify a deeper issue of treatment resistance among older students.

Implementation factors cannot be ignored – more positive results might have been achieved with expert instructors, for example – but the far larger gains in reading skills typically achieved by students of a similar age with the MultiLit RTP and the Schoolwise program can also be interpreted as evidence that an hour a day of small group supplementary instruction may not be enough to accelerate the reading progress of older low-progress readers.

Nonetheless, this trial provides positive exploratory evidence that phonic word attack skills can be taught effectively to older low-progress readers in small groups. It also indicates that in order to achieve similar gains in other reading skills, these students may need additional reading intervention that is more intensive, either with longer daily sessions, or with more one-to-one instruction, or a combination of the two. These findings add to the research literature and should inform the on-going development of effective reading intervention programs for older, low-progress readers. They provide a platform for future, larger scale trials that would allow comparisons of sub-groups and produce more robust statistical indicators of the program's efficacy.

Disclosure

Professor Kevin Wheldall and Dr Robyn Beaman are both directors of MultiLit Pty Ltd, the publisher of the MultiLit/MiniLit program.

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CHAPTER 7 – Research Paper IV

Evaluation of a two-phase, cross-over study of a small group ('MultiLit') reading intervention for older low-progress readers

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Preface to Chapter 7: 'Evaluation of a two-phase cross-over study of a small group ('MultiLit') reading intervention for older low-progress readers

The initial randomised control trial (RCT) of the small group MultiLit program reported in Chapter 6 had relatively weak results, except in phonological recoding which was highly statistically significant. Students in the control group made virtually no progress in phonological recoding in the first three term intervention, while the experimental group (MultiLit) students made good gains. There was no difference in the progress of the two groups on other measures.

Despite these results, it was decided in consultation with the school to proceed with a second implementation for a number of reasons. There had been a commitment to the control group students to offer them MultiLit instruction if the program was successful. As with the MiniLit trial, treatment fidelity had not reached an optimal level until the second term of the trial (a factor that had also contributed to the decision to extend the intended two-term trial to a third term). It was expected that instructional quality would be higher in a second implementation, with a positive effect on efficacy. Further, the research team had identified a number of aspects of the program's implementation that could be revised and improved. These changes are described in Chapter 7.

It was decided to evaluate the second implementation as a two-phase cross-over study to allow comparison of the two phases. There was some attrition of students prior to and during the second phase of the study, most notably the departure of the Year 6 students from the original RCT who had moved on to high school. Three other students left the school during the second phase of the six-term study and the data from their matched pair students were therefore also excluded from the final sample. Nevertheless the sample size of 26 was considered sufficient to evaluate the study.

No treatment fidelity measure was used in the second implementation of the MultiLit intervention. At the time, it was not considered necessary, as the second implementation had the same instructors, who had achieved a sustained high level of treatment fidelity for the last 12 weeks of the first trial. In retrospect, however, it would have been prudent to continue to assess treatment fidelity to ensure that program implementation was optimal. Although treatment fidelity is not a common feature of educational research, it is important, and this oversight will inform the design of future studies.

Chapter 7 describes the cross-over study and its results. It shows a much stronger response in the second implementation of the small group MultiLit intervention, achieving positive, significant results in all but one measure. The article discusses the possible influence of the changes made to the program on these improved results.

Statement of candidate's contribution: This paper is co-authored with my doctoral supervisors. I took the lead in writing. My co-authors provided advice in research methodology and implementation, and assisted with statistical analysis.

Abstract

The aim of the study was to examine the efficacy of a small group (Tier 2 in a three-tier Response to Intervention model) literacy intervention for older low-progress readers in Years 3 to 6). The results of two phases of a 'cross-over' experimental study are described. In Phase 1, the experimental group (E1) received the one hour intervention daily for three school terms. The control group received regular classroom instruction. In Phase 2, the original control group received the intervention (E2). At the end of Phase 1, there was a statistically significant difference between groups and a very large treatment effect on one of six measures—the Martin and Pratt Non-word Reading Test of phonological recoding. At the end of Phase 2, the large effect on phonological recoding was confirmed, and there were also statistically significant differences on four other measures—single word reading, fluency, and passage reading accuracy and comprehension.

Evaluation of a Two-Phase Cross-Over Study of a Small Group ('Multilit') Reading Intervention for Older Low-Progress Readers

A large number of children in developed, English-speaking countries struggle to learn to read at even a functional level. The Progress in Reading Literacy Survey (PIRLS) is an international assessment of literacy of Year 4 students. In PIRLS 2011, the proportion of students who achieved at the minimum literacy benchmark or below ranged from 16% in the United States and Canada to 24% in Australia and 25% in New Zealand (Thomson et al., 2012). Another international survey, Program for International Student Assessment (PISA), tests student literacy at age 15 years. In PISA 2009, the proportion of students achieving at the lowest literacy level or below ranged from 10.3% in Canada to 14.3% in Australia and 18.5% in the United Kingdom (Thomson & De Bortoli, 2010).

Students from socioeconomically disadvantaged backgrounds are more likely to have low literacy achievement. The quality of reading instruction and intervention is a strong mediating factor in the literacy gap associated with socioeconomic status (Buckingham, Beaman & Wheldall, 2013; Buckingham, Wheldall & Beaman-Wheldall, in press). Large scale surveys of literacy research in the United States (NICHHD, 2000), Australia (DEST, 2005) and England (Rose, 2006) have concluded that the best scientific evidence supports the finding that effective reading instruction has five 'pillars': phonemic awareness, phonics, fluency, vocabulary and comprehension. Each of these elements is necessary for the successful, early acquisition of reading skills and general literacy development. They are essential components of both effective classroom teaching and reading interventions for struggling readers.

The importance of early intervention for struggling readers cannot be overstated and is well-recognised (Feinstein, 2007; Reynolds, Wheldall, & Madelaine, 2011;

Stanovich, 1986; Torgesen, 2005). Many schools have at least one formal early reading intervention program, such as Reading Recovery, which targets Year 1 students (Clay, 1993; New South Wales Department of Education & Communities, 2013; Reading Recovery Council of North America, 2013; Tanner et al., 2011). Yet the statistics presented above indicate that at Year 4, substantial numbers of students are still in need of literacy support, whether because they missed out on early reading intervention, the intervention was ineffective, their reading difficulties were identified later, or they are a student who requires ongoing literacy support. There is therefore a need for literacy interventions aimed at older (Year 3 and above), low-progress readers. Low-progress readers are students whose literacy skills are well below their classmates', around the lowest 25% of their age cohort (Pogorzelski & Wheldall, 2005).

The MultiLit reading intervention was designed specifically for older, low-progress readers. It exists in a number of formats. The MultiLit Reading Tutor Program is a 30-40 minutes a day, one-to-one format, which is implemented in schools and at the MultiLit Literacy Centre. The MultiLit 'Schoolwise' Program is conducted in tutorial centres which students attend for three hours a day, five days a week. Students work in groups and individually with teachers. Evaluation of these programs has shown them to be highly effective (Wheldall, 2009; Wheldall & Beaman, 2000, 2010).

The growing body of research supporting a Response to Intervention (RtI) approach to teaching and assessment indicates that there is a missing step in reading intervention offered in schools. In an RtI model, students are provided with increasingly intensive 'tiers' or levels of instruction, depending on their reading progress. In a three-tier RtI model, Tier 1 is whole class instruction, Tier 2 is small group instruction, and Tier 3 is individual instruction. Students who are not making good progress in reading in class are provided with supplementary instruction in a small group. Students who are still struggling to make reading progress in the small group are provided with specialist one-to-one instruction (Gersten et al., 2009). A review of reading interventions by Slavin, Lake, Davis, and Madden (2011) found that small group instruction with a strong phonics emphasis can be beneficial to students whose reading difficulties are not extreme. The RtI approach is therefore both effective and cost-effective. Small group interventions allow more students to be given extra reading support, reserving the most intensive (and expensive) one-to-one instruction for the few students with serious reading difficulties.

The MultiLit small group program was developed as a Tier 2 reading intervention for students in Year 3 and above. A randomised control trial of the small group MultiLit program over three terms is described in Buckingham, Beaman, and Wheldall (2012). Classroom teachers identified the lowest 20 readers in each year (a total of 80 students), who were then given screening tests by trained testers. The 12 students with the lowest screening test scores from each year were selected for participation in the trial and randomly assigned into either the experimental or the control group. The control group had their usual classroom literacy instruction, while the experimental group attended MultiLit lessons for one hour a day, four days a week, for three terms. All students in the control and experimental group were given a battery of tests pre-intervention, after two terms of intervention and after three terms of intervention, and the results compared.

At the end of three terms, the initial trial showed strong, statistically significant, positive results in phonological recoding only, with a very large treatment effect size (partial eta squared = 0.520). There were small treatment effects on single word reading (0.057) and spelling (0.037). Treatment fidelity had not reached an optimal level until the 14^{th} week of the intervention and so on this basis, the school and researchers decided a second implementation would be worthwhile. In the second phase of the intervention, the original experimental group returned to their usual classroom literacy lessons and the control group replaced them in the small group MultiLit program, becoming a new experimental group. As there was some attrition of students from the school after the initial trial, 12 of whom were Year 6 students leaving for high school and another five of whom were students who moved away during the trial, the sample for the two-phase crossover study is smaller. This article presents and compares the findings of the first and second implementations of the MultiLit intervention, evaluated as a two-phase, cross-over study over six school terms.

Method

Participants

Participants were 26 students from Years 3 to 6 in a public primary school with a high proportion of socioeconomically disadvantaged students, located in a large New South Wales regional town. Participants in the two-phase, cross-over study are a subset of the participants in the initial (three-term) randomised control trial (each school term is approximately 10 weeks). There were 30 participants in the initial three-term trial — 15 in the first experimental group and 15 in the first control group. Several students left the school during the second three-term phase of the study — one from the first experimental group (E1) and two from the second experimental group (E2). In order to maintain comparability of the two groups, the data from their matched pairs have also been excluded. As a result of these departures and exclusions, a total of 26 students in two randomised, matched groups participated in the six-term, two phase cross-over study.

Procedure

In Phase 1 of the study, students in the first experimental group (E1) were withdrawn from class to participate in the group MultiLit program for one hour a day, four days a week, for three terms (27 weeks) during class literacy time. Students in the control group remained in their usual classrooms (detailed in Buckingham et al., 2012). In Phase 2 of the study, which took place over the next three terms, the first control group became the second experimental group (E2) and participated in the group MultiLit program. The first experimental group returned to their usual classroom literacy lessons and became the 'comparison' group. This has been described as a comparison group (rather than a control group) because in Phase 2 students were no longer in controlled trial conditions. Students not receiving the intervention in Phase 2 (the original experimental group in Phase 1) may have participated in other remedial reading activities and are therefore more accurately described as a 'comparison' group than a 'control' group, in our view.

All participants were given a battery of tests before commencement of the intervention, again at the end of Phase 1 when the first experimental group (E1) had completed the intervention, and a third time at the end of Phase 2, when the second experimental group (E2) had completed the intervention. At the end of the study, both groups had participated in the group MultiLit program for three terms.

Measures

The test battery consisted of six measures — the Burt Word Reading Test (Gilmore, Croft, & Reid, 1981), South Australian Spelling Test (Westwood, 2005), Martin and Pratt Nonword Reading Test (Martin & Pratt, 2001), Wheldall Assessment of Reading Passages (Wheldall & Madelaine, 2006), and Neale Analysis of Reading Ability (Accuracy and Comprehension) (Neale, 1999). Descriptions of these tests are provided in Buckingham et al. (2012).

Intervention

The MultiLit program components are described in Buckingham et al. (2012). They were Word Attack (Accuracy), Word Attack (Fluency), Sight Words, and Reinforced Reading. The content and delivery of each component of the program were basically the same in Phases 1 and 2 of the study. However, some small changes in program implementation took place in Phase 2, including smaller group size and changes to the placement procedure.

Group size: In Phase 1, students in the MultiLit program were in instructional groups of six students for the first two terms, reduced to four students for the third term when the Year 6 students had left the school (Year 6 is the final year of primary school in NSW). In Phase 2, students in the MultiLit program were in instructional groups of four students for all three terms of the intervention.

Placement: In Phase 1, before beginning the MultiLit intervention, students were given the MultiLit Placement Test in order to determine the appropriate starting level of Word Attack (Accuracy) instruction. Students were allocated to instructional groups according to their starting level. The MultiLit Placement Test procedure in Phase 1 was to start instruction for each group at the lowest level required by any one group member, and then to proceed with instruction through each consecutive level. In Phase 1, almost all students were placed at the lowest level to start the program. It became apparent that this was too low for some of the older students in particular — their knowledge of phonics was uneven rather than consistently low.

In Phase 2, the placement procedure was changed to take this into account. Phase 2 MultiLit students were taught only the individual levels of the Word Attack program each group member had failed. Consecutive instruction of each level continued from the level failed by *all* group members. This change in procedure allowed some groups to quickly progress through the most basic Word Attack levels and move to their substantive instructional level. As a consequence, Phase 2 MultiLit students completed the Word Attack components more quickly and moved onto the additional program components developing fluency and comprehension.

Analysis

To compare the progress made by the experimental and their respective control or comparison groups, analyses of covariance were employed for each measure at post-test 1 (after three terms) and post-test 2 (after six terms), with pre-test scores as the covariate in each analysis (with some exceptions detailed below). The alpha level was set at 1% ($p<0.01$) to allow for family wise comparisons in lieu of the use of a Bonferroni correction (Howell, 2008).

Treatment effects were also calculated for each measure in each phase of the study, using partial eta squared as the measure of effect size, as calculated by the SPSS statistical analysis package (IBM Corp, 2012). Confirmatory analyses of gain scores using t-tests of significance were also completed to provide additional information. This also allowed Cohen's 'd' to be calculated, a measure of effect size that may be more familiar to some readers.

Results

In this six term study, only Phase 1 (the first three terms) was a controlled trial, where students not receiving the intervention remained in their usual classrooms and did not participate in any other formal remedial reading programs. The Phase 1 experimental group/Phase 2 comparison group will be called 'E1', and the Phase 1 control group/Phase 2 experimental group will be called 'E2'.

Means and standard deviations for all measures (raw scores) for the Phase 1 experimental group (E1) and Phase 2 experimental group (E2) at pre-test, post-test 1 (after three terms) and post-test 2 (after six terms) are shown in Table 1. Table 1 shows that the E1 group means were slightly lower than those for the E2 group at pre-test on all measures but none of these differences was statistically significant. (The subsequent analyses of covariance take these initial small group differences into account.)

Table 1. Means and standard deviations (raw scores) of Phase 1 experimental (E1) and Phase 2 experimental (E2) groups at pre-test, post-test 1 (after 3 terms) and post-test 2 (after 6 terms), results of analyses of covariance and effect sizes (partial eta squared)

Measure	Group (n=13)	Pre-test Mean** (SD)	Post-1 Mean*** (SD)	F	p	ES*	Post-2 Mean (SD)	F	p	ES*
Martin & Pratt Nonword Test	E1	9.23 (8.47)	18.62 (10.60)	22.46	0.00	0.49	16.23 (10.02)	0.78	0.39	0.03
	E2	10.23 (4.44)	10.92 (4.54)				18.92 (3.93)			
Burt Word Reading Test	E1	27.62 (11.18)	36.31 (16.82)	0.54	0.47	0.02	37.54 (14.65)	19.50	0.00	0.46
	E2	30.92 (9.19)	38.46 (10.36)				45.92 (8.09)			
South Australian Spelling Test	E1	19.08 (10.70)	23.23 (10.18)	0.01	0.94	0.00	25.23 (9.19)	0.53	0.48	0.02
	E2	19.62 (6.98)	23.62 (6.64)				26.85 (6.99)			
WARP (words correct per minute, wcpm)	E1	36.00 (24.90)	58.85 (35.87)	0.34	0.57	0.01	62.15 (36.18)	57.22	0.00	0.72
	E2	43.77 (28.48)	66.62 (33.20)				97.92 (35.85)			
Neale Accuracy	E1		25.85 (13.50)	0.13	0.73	0.01	26.85 (14.14)	12.17	0.00	0.35
	E2		28.54 (10.17)				37.54 (8.08)			
Neale Comprehension	E1		10.46 (6.28)	1.75	0.20	0.07	9.92 (5.45)	11.99	0.00	0.34
	E2		10.08 (3.59)				13.69 (5.09)			

*ES = partial eta squared, large effect size is evident when partial eta squared is ≥.138
** Pre-test means are covariates for Phase 1 (Pre-test / Post-1) ANCOVAR, except Neale measure which uses Burt Pretest mean.
*** Post-1 means are covariates for Phase 2 (Post-1 / Post-2) ANCOVAR, except Martin & Pratt measure which uses Pre-test mean.

Analyses of covariance (ANCOVA) were conducted on the scores for each measure separately at post-test 1 and post-test 2. For the analyses of covariance at post-test 1, pre-test scores were the covariate for all measures except for the Neale Analysis of Reading Ability Accuracy and Comprehension components, as this test was not administered in the pre-test battery. Pre-test scores for the Burt (which correlates highly with the Neale) were used as the covariate for the two Neale measures. For the analyses of covariance at post-test 2, the post-test 1 scores were used as the covariate for all measures (including Neale) except for the Martin and Pratt Nonword Reading Test, as the groups were closest on all measures except for the Martin and Pratt at this point. Partial eta squared was calculated for each measure at post-test 1 and post-test 2 to determine the size of the treatment effect. Results of these analyses are reported in Table 1.

Results at the end of Phase 1 – group means and treatment effects

Statistically significant, positive treatment effects at the stated alpha level ($p<0.01$) were found for one measure — the Martin and Pratt Nonword Reading Test. The treatment effect size for this measure was very large (Martin & Pratt partial eta squared = 0.494). (Effect sizes using partial eta squared that are larger than 0.138 are considered to be large.) No significant differences were found between the group means for the other measures and there were negligible treatment effects. These analyses confirmed for the reduced groups the results reported by Buckingham et al. (2012).

Results at the end of Phase 2 – group means and treatment effects

Significant differences between group means were found at the stated alpha level ($p<0.01$) for four measures at the end of Phase 2, that is, after both groups had each had three terms of the intervention. The E2 group had significantly higher mean scores on the Burt Word Reading Test, Wheldall Assessment of Reading Passages, Neale Analysis of Reading Ability (Accuracy) and Neale Analysis of Reading Ability (Comprehension). Large treatment effects were found for each of these measures. Mean scores and treatment effects are shown in Table 1.

There was no significant difference between E1 and E2 means at post-test 2 in the Martin and Pratt Nonword Reading Test or the South Australian Spelling Test, however the progress of the two groups in these two measures was quite different. For the Martin and Pratt, there were significant differences and a large treatment effect at post-test 1, but at post-test 2, E2 had closed the gap. In the South Australian Spelling Test, however, the groups were not significantly different at any point.

Figures 1 to 6 show these differences in progress between the two study phases on each of the measures. Figure 1 shows that test scores on the Martin and Pratt increased strongly for E1 in Phase 1 and E2 in Phase 2. There was either no growth or negative growth in scores for the control/comparison groups, with the end result being similar mean scores for E1 and E2 at the end of Phase 2 and an overall treatment effect that is very small (partial eta squared = 0.03).

Figures 2 and 4 show different patterns of score growth to Figure 1. At the end of Phase 1 of the study, the Phase 1 experimental group (E1) had made similar progress to the control group in the Burt (Figure 2) and the WARP (Figure 4), as shown by the closeness of the post-test 1 means, and these differences were not statistically significant. At the end of Phase 2, however, there had been a divergence in the Burt and WARP scores, with the Phase 2 experimental group having significantly higher mean scores at post-test 2. The treatment effects at the end of Phase 2 were very large (Burt partial eta squared = 0.459; WARP partial eta squared = 0.713).

Figure 3, which shows the mean scores on the South Australian Spelling test, displays a different pattern of progress again. In this measure, there were no significant differences between the two groups at the end of Phase 1 or Phase 2, and the treatment effect was close to zero.

As the Neale Analysis of Reading Ability was only administered twice — post-test 1 and post-test 2 — only Phase 2 progress is shown in Figure 5 (Neale Accuracy) and

Figure 6 (Neale Comprehension). Like the Burt, and WARP, the Phase 2 experimental group (E2) means were significantly higher than the comparison group on the Neale measures at post-test 2. There were also large treatment effects (Neale Accuracy partial eta squared = 0.346; Neale Comprehension partial eta squared = 0.343).

In summary, at the end of Phase 2, there were significant differences between the two groups in the Burt, WARP, Neale Accuracy and Neale Comprehension measures, due to the greater progress of the E2 group in Phase 2. There were no significant differences between the groups on the Martin and Pratt and the South Australian Spelling tests at the end of Phase 2, but for different reasons. In the Martin and Pratt, both experimental groups made strong progress during their experimental phase, so were at similar points after both groups had the intervention. In the South Australian Spelling Test, there was no difference between the groups at any point.

Figure 1. Martin & Pratt Nonword Reading Test mean scores for Phase 1 experimental (E1) and Phase 2 experimental (E2) groups at pre-test, post-test 1 and post-test 2

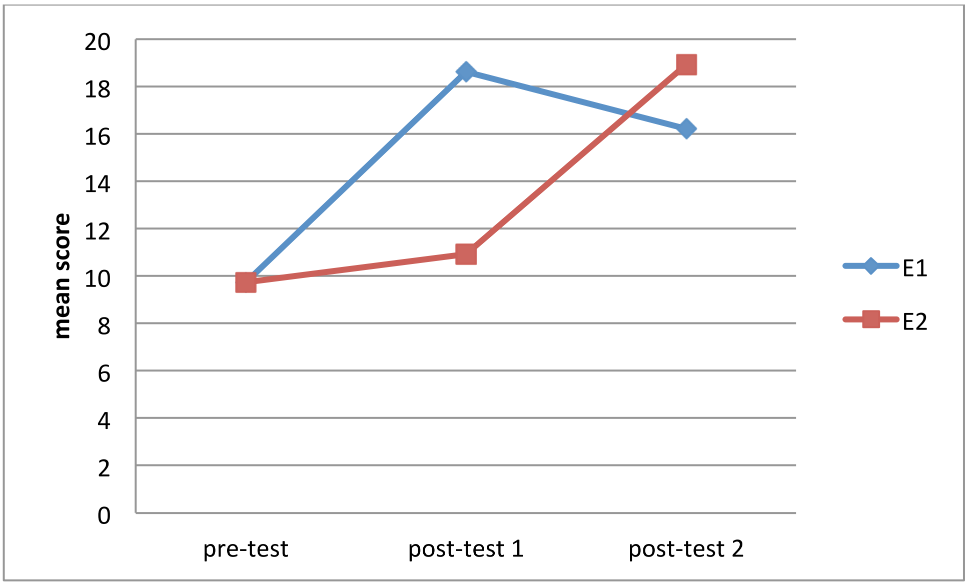

Figure 2. Burt Word Reading Test mean scores for Phase 1 experimental (E1) and Phase 2 experimental (E2) groups at pre-test, post-test 1 and post-test 2

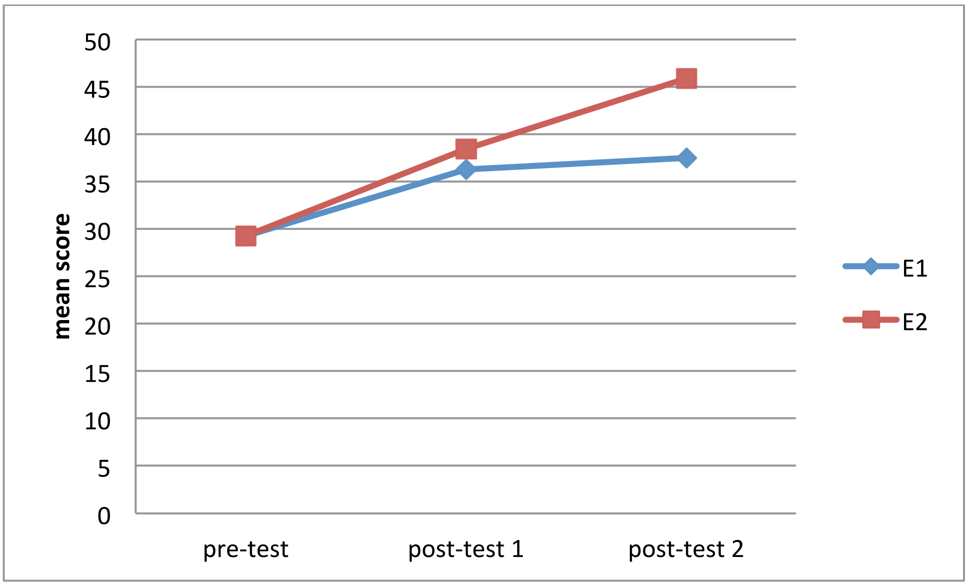

Figure 3. South Australian Spelling Test mean scores for Phase 1 experimental (E1) and Phase 2 experimental (E2) groups at pre-test, post-test 1 and post-test 2

Figure 4. Wheldall Assessment of Reading Passages (WARP) mean scores for Phase 1 experimental (E1) and Phase 2 experimental (E2) groups at pre-test, post-test 1 and post-test 2

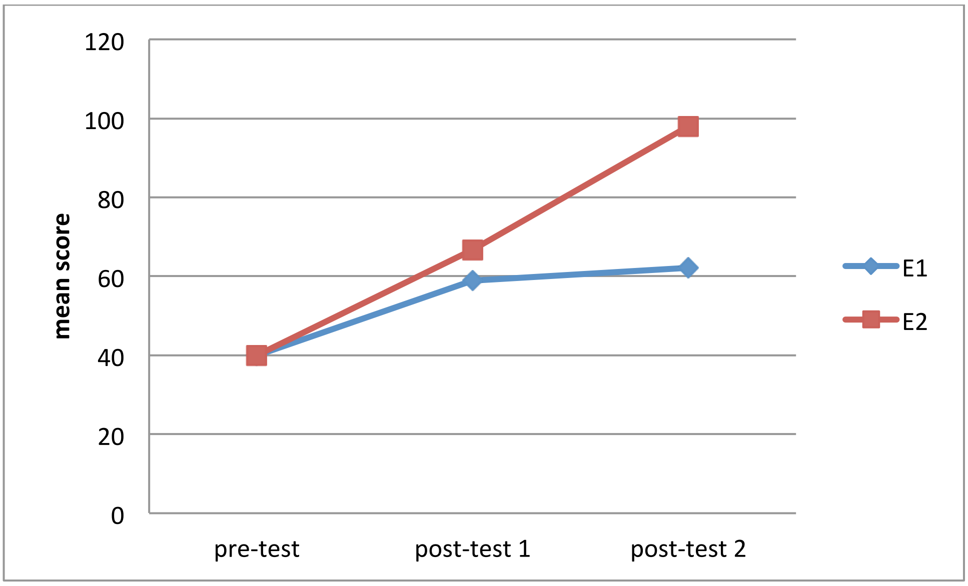

Figure 5. Neale Analysis of Reading Ability (Accuracy) mean scores for Phase 1 experimental (E1) and Phase 2 experimental (E2) groups at pre-test, post-test 1 and post-test 2

Figure 6. Neale Analysis of Reading Ability (Comprehension) mean scores for Phase 1 experimental (E1) and Phase 2 experimental (E2) groups at pre-test, post-test 1 and post-test 2

Growth in mean scores of the two groups over Phases 1 & 2 – mean gain scores and treatment effects

The differences in statistical significance in the means at the end of Phase 1 and Phase 2 (see Table 1), and the data graphed in figures 1 to 6, indicate that the intervention had different effects at each phase.

To quantify and compare the effects of the intervention in Phase 1 and Phase 2 that are apparent in the graphs, gain scores on all measures were calculated for both groups (E1 and E2) in each phase. Gain scores provide additional information to the pre- and post-test means because they evaluate the score growth of a group, not just differences between group means at different points. Treatment effects were then calculated for all measures in both phases using independent means t-tests to compare groups. This allows comparison of each group's progress separately in each phase, instead of the overall progress at the end of Phase 2. The gain scores and associated effect sizes are presented in Table 2. Treatment effects are presented as Cohen's 'd'.

The Phase 1 gain scores were significantly higher for the experimental group (E1) on only one measure — the Martin and Pratt Nonword Reading Test. The effect size was also very large ($d = 2.43$). The Burt Word Reading Test was the only other measure with an appreciable effect size, but it was small ($d = 0.24$).

The Phase 2 gain scores were significantly higher ($p < 0.01$) for the experimental group (E2) for all measures except the South Australian Spelling Test. There were also very large effect sizes for all measures except the South Australian Spelling Test. This gain score analysis of the two phases of the trial suggests that the Phase 2 experimental group (E2) had a stronger response to the intervention than the Phase 1 experimental group (E1).

Table 2. Mean score gains, standard deviations, t-tests of significance (2-tailed) and effect sizes (‘d’) for Phase 1 experimental (E1) and Phase 2 experimental (E2) group in each study phase.

Measure	Group (n=13)	Phase 1 mean gain (SD)	t-test of Phase 1 gains (p)	Phase 1 effect size (‘d’)	Phase 2 mean gain (SD)	t-test of Phase 2 gains (p)	Phase 2 effect size (‘d’)
Martin & Pratt Nonword Test	E1	9.38 (5.37)	0.00	2.43	-2.38 (4.59)	0.00	2.26
	E2	0.69 (3.57)			8.00 (4.49)		
Burt Word Reading Test	E1	8.69 (8.1)	0.66	0.24	1.23 (5.45)	0.00	1.14
	E2	7.54 (4.74)			7.46 (3.67)		
South Australian Spelling Test	E1	4.15 (3.26)	0.90	0.05	2.00 (4.24)	0.52	0.29
	E2	4.00 (3.03)			3.23 (5.40)		
WARP (words correct per minute, wcpm)	E1	22.84 (12.40)	1.00	0.00	3.31 (5.07)	0.00	5.52
	E2	22.85 (8.88)			31.31 (11.92)		
Neale Accuracy	E1				1.00 (4.42)	0.00	1.81
	E2				9.00 (7.90)		
Neale Comprehension	E1				-0.54 (2.22)	0.00	1.87
	E2				3.62 (3.69)		

Discussion

In a two-phase crossover study of a small group literacy intervention for older, low-progress readers (MultiLit), the second experimental group to receive the intervention had a much stronger response than the first experimental group. At the end of the first phase, there was a statistically significant, positive effect of the intervention on only one of six measures — the Martin and Pratt Nonword Reading Test. This test of phonological recoding also showed a very large treatment effect at the end of Phase 1.

At the end of Phase 2, both analyses of covariance and gain score analyses showed a statistically significant, positive effect for the second experimental group on five out of six measures — the Martin and Pratt Nonword Reading Test, Burt Word Reading Test (which measures single word reading), Wheldall Assessment of Reading Passages (WARP, which measures fluency), and two components of the Neale Analysis of Reading Ability (measuring passage reading accuracy and comprehension). There were very large treatment effects for these five measures at the end of Phase 2.

No significant differences between groups or treatment effects were found for the sixth measure, the South Australian Spelling Test, in either phase of the study. The lack of an effect on the spelling measure in either phase of the intervention is not unexpected. Although it is hoped that an increase in phonological recoding ability will eventually transfer to spelling skills, very little time was spent on spelling instruction in the program.

The Phase 1 and Phase 2 results on the reading measures have a number of possible explanations. In Phase 1 of the study, there was a strong emphasis on phonics. All groups started at the lowest level of the Word Attack program. Approximately half of each lesson was spent on phonics and this component of the program was the earliest to achieve treatment fidelity (Week 10). The skills learnt in the Word Attack component on the program most closely relate to those measured in the Martin and Pratt Nonword Reading Test; this is likely to explain the strong results on this measure of phonological recoding.

The results of Phase 2 are similarly strong for phonological recoding, but were also strong and significant for single word reading (Burt), fluency (WARP), passage reading accuracy (Neale) and comprehension (Neale). The more powerful results in Phase 2 might be attributed to a number of factors.

Group size was lower in Phase 2 than in most of Phase 1. For two terms of the three term Phase 1 intervention, the MultiLit students were in groups of six, decreasing to groups of four when the Year 6 students left the school. In Phase 2, MultiLit students were in groups of four for the entire intervention. In the smaller groups, testing time was shorter (allowing increased teaching time), there was a narrower range of ability levels in each group and, perhaps most importantly, the amount of time for each student to do reinforced reading was greater. All of these had a potentially positive impact on the program's efficacy.

Changes to MultiLit program implementation in Phase 2 may also have influenced the results. As noted in the method section, the placement of groups on the Word Attack component of the program was revised in Phase 2 so that all students would reach their substantive instructional level more quickly. This change in the placement procedure allowed students to progress through and complete the Word Attack component earlier in the intervention. Students were then able to expend more time on activities designed to develop the higher order skills of fluency and comprehension. The Phase 2 results provide evidence of the positive effect of this change in instructional focus.

There was also a noticeable difference in the behaviour of the Phase 1 and Phase 2 experimental groups. It is not clear whether this was a cohort effect, a function of the changes in group size and program implementation, or perhaps a third factor — instructional quality. Although treatment fidelity data was not collected in the Phase 2 implementation, it is likely that the MultiLit instructors were more proficient in teaching the program in Phase 2, and this positively influenced both behaviour and learning.

The lack of significant differences between the two groups at the end of Phase 1 in all measures except the Martin & Pratt was not because the experimental group had not made progress over the period of the intervention, rather it was because both groups made similar progress in this period. This suggests that all students had benefitted from another, unmeasured factor. During Phase 1, the school was undergoing substantial reforms to its teaching processes in all classrooms, including adopting explicit teaching methods in literacy (but without an increase in phonics instruction). This may have contributed to the control group's improved performance. Furthermore, during the trial all classrooms had fewer low-progress readers (half of whom were in MultiLit for one hour each day during literacy time), which may have positively affected the instruction received by control students.

This two-phase, crossover study of the small group MultiLit program had some limitations. The final sample size was not large (26 students) and confined to one school, and the measures used do not cover the full-range of literacy skills. Nonetheless, the study has provided evidence of the efficacy of the intervention, showing statistically significant and educationally important increases in both first and second order reading skills, especially in the second implementation. These results contribute to the research evidence on reading interventions for older students.

The study also reinforces the necessity of good experimental trials. The randomised control trial methodology is an important feature of this study. Without a control group for comparison, the Phase 1 results would have appeared to be stronger than they really were. It also demonstrates the benefits of trialling new programs over a realistic period of time. Even though the MultiLit program was based on the best available research and had good evidence of efficacy in other formats and in other settings, the initial results of the small-group school program trialled in this study were strong only in phonological recoding. It was not until the second phase that highly positive results were yielded, indicating that abandoning programs too early can be imprudent. Ethical judgements are required — if the Phase 1 implementation had shown an adverse effect on students' reading skills it would not have been repeated — but it may be too much to expect immediate strong benefits of even the most well-designed program.

Further research on this program to support the results would be ideal, but this study provides evidence that a comprehensive literacy intervention which explicitly develops the five essential skills of reading can markedly improve literacy skills among older low-progress readers.

Disclosure

Emeritus Professor Kevin Wheldall and Dr Robyn Beaman-Wheldall are both directors of MultiLit Pty Ltd, the publisher of the MultiLit/MiniLit program.

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CHAPTER 8 – DISCUSSION

Publication status: NOT FOR PUBLICATION

Chapter 8 — Discussion

The objective of this thesis was to examine the relationship between socioeconomic status and literacy through a review of the literature and to evaluate the efficacy of two comprehensive research-based interventions to help students with reading difficulties. The findings can be summarised as follows:

Low socioeconomic status is a source of disadvantage in literacy but it is not a simple relationship.

There is a moderate relationship between literacy and socioeconomic status (SES) when measured as an index of household income, parent education and parent occupation (Marks, 2006). Two literature reviews showed that SES should more accurately be viewed as a 'proxy' variable for other, more directly salient factors (Lubienski & Crane, 2010). In the prior-to school years, the influence of SES is strongly mediated by infant health and aspects of the early home environment that significantly predict how well-equipped a child is to learn to read when they begin school (Bracken & Fischel, 2008; Hindman & Morrison, 2012). Young children from low SES homes generally have lower phonological awareness and oral language skills, which in turn relate to their development of the two components of the 'simple view' of reading—decoding and comprehension (Farkas & Beron, 2004; Gough & Tunmer, 1986; Henning, McIntosh, Arnott, & Dodd, 2010). When they reach school age, the initial literacy disadvantage of low SES children is compounded by other mediating factors associated with socioeconomic disadvantage, such as poor school attendance and low quality instruction (Fergusson, Horwood, & Boden, 2008; Palardy, 2008). Taken together, these literature reviews suggest that the problem of socioeconomic disadvantage in literacy achievement is real but not insurmountable. Educational policies that target the mediating factors, especially instruction, offer a potentially powerful means to reduce the reading gap.

Trials conducted in a low SES school indicated that the MiniLit and MultiLit small group programs are effective interventions for struggling and low-progress readers.

Schools with larger numbers of low SES students usually have larger numbers of struggling readers in every grade who require effective intervention (Holmes-Smith, 2006; Perry & McConney, 2010). Time-intensive and costly one-to-one programs can only reach a limited number of these students. Futhermore, formal interventions are typically restricted to the early years. The MiniLit and MultiLit small group programs were developed to meet the need for effective intervention programs that can accommodate larger numbers of students of all ages. They were devised to be suitable for use as Tier 2 interventions in a three-tier Response to Intervention (RtI) model in which Tier 1 is whole class instruction, Tier 2 is small group instruction, and Tier 3 is individual instruction. Evaluations of two implementations of each of MiniLit and MultiLit programs using randomised control trials (RCT) methodology indicate that they were effective on a variety of reading measures. With the exception of phonological recoding which was consistently positive, there were differential effects in the two implementations (or ‘phases’), with implications for research and practice.

MiniLit

The strongest and most consistent findings were for phonological recoding. Positive, statistically significant differences and very large effect sizes on phonological recoding test scores were found in both studies and in both implementations of MiniLit. In each implementation, the experimental group made strong gains while the control group made virtually no progress in this measure. There were differential effects in each phase for the other measures, however.

At the end of the RCT and Phase 1 of the cross-over study, positive, significant differences and very large effect sizes were also found for single word reading. In spelling and fluency, the group differences were non-significant but there were mostly large effect sizes. Overall, there was a strong response to the first implementation of small group MiniLit.

At the end of Phase 2 of the cross-over study there were no significant differences between groups on single word reading, spelling or fluency, but effect sizes were still large. The Phase 2 experimental group had made strong gains, but the Phase 1 experimental group had also continued to made good progress after they had completed the intervention. Their progress on these measures was almost parallel, resulting in similar scores at the end of the study. Overall, there was a strong response to the second implementation of small group MiniLit.

The possible reasons for these patterns of response are canvassed in detail in Chapter 5. It is evident that students were not receiving effective phonics instruction in the classroom; the control groups in Phases 1 and 2 made no progress in phonological recoding. The other measures suggest a more complex situation. Both experimental groups had a strong (if not always statistically significant) response to the intervention, however the first experimental group's progress in single word reading, spelling and fluency was sustained after completing the intervention. Consequently, there was little difference between the groups at the end of Phase 2 on these measures, even though the second experimental group had also improved markedly. Among the likely explanations are that earlier intervention for the first experimental group was more effective and this initial 'boost' allowed students to generalise their skills and continue to improve with regular classroom instruction. This has important implications for school-based implementation as formal interventions are usually introduced from Year 1, after a year of schooling. The MiniLit study findings cautiously suggest that it might be better to implement Tier 2 interventions earlier, perhaps after six months of schooling. A further explanation is that the different rates of progress of the control groups during the study might be attributed to differences in classroom literacy instruction. The Phase 1 control group was in kindergarten and participating in the new L3 program, while the Phase 2 control group was receiving usual classroom literacy instruction.

MultiLit

As in the MiniLit study, the strongest and most consistent results were for phonological recoding. Positive, statistically significant differences and very large effect sizes on scores in phonological recoding were found in both studies and in both implementations of MultiLit. In each implementation, the experimental group made strong gains while the control group made virtually no progress in this measure. Again, like the MiniLit studies, there were differential effects in each phase for the other measures, but the results displayed a different pattern—there was a much stronger response to the program in the second implementation.

At the end of the RCT and Phase 1 of the cross-over study, there were no significant differences between groups on single word reading, fluency, spelling, or passage reading accuracy or comprehension. Effect sizes were small or negligible. Overall there was a weak response to the first implementation of small group MultiLit, except in phonological recoding.

At the end of Phase 2 of the cross-over study, there were significant differences between groups, favouring the Phase 2 experimental group, and very large effect sizes for all measures except spelling. Overall, there was a very strong response to the second implementation of MultiLit, except in spelling.

The possible reasons for these divergent responses are discussed in detail in Chapter 7. Key among them is the quality of instruction. MultiLit instructors did not achieve a high level of treatment fidelity until almost half-way through the first implementation. It is likely this affected the program's efficacy. Perhaps partly because of this, there were behavioural difficulties with students in the first implementation which reduced time on task. Also importantly, the group sizes in the first implementation did not allow sufficient time for reinforced reading, which was rectified in the second implementation. This indicates that good phonics instruction is more likely to lead to improved passage/book reading when it is part of an integrated and comprehensive program of instruction.

The research conducted for this thesis yielded more than data, however. It also provided information that allows the two other proposed research questions to be addressed: what are the factors not inherent to program content and design that influence the effectiveness of school-based reading intervention programs? And why do so many students struggle with reading after three or more years of formal schooling when the scientific research literature on effective instruction and intervention is robust?

School-based reading interventions, and experimental studies of their efficacy, are influenced by exogenous factors that affect their outcomes

Research involving human beings is inevitably beleaguered by exogenous influences that confound the results (Willingham, 2012). Highly-controlled laboratory experiments can minimise the influence of unmeasured variables to some extent, but this is far more difficult in studies conducted in 'real-world' environments, even under experimental conditions. The main disadvantage of real-world research is that the pure effects of a treatment or condition cannot be completely isolated; unmeasured variables may influence the responses of participants and either heighten or diminish the effects (Hattie, 2009). Real-world research also has advantages, however. It demonstrates the results that can realistically be expected in an authentic context. It allows for findings that are unanticipated yet potentially important.

Trialling the MiniLit and MultiLit programs in a mainstream school setting was not a straightforward exercise. That the participating school was a public school with high proportions of socioeconomically disadvantaged students made it an ideal context for study but also created particular difficulties for conducting research. Although the principal and school executive were enthusiastic about the MiniLit and MultiLit studies, obtaining approval from the Department of Education and Communities took a prolonged period of time. The centralised nature of public school governance also led to the unfortunate situation where the school was directed to introduce a new kindergarten literacy program in the same year as the studies began. This new kindergarten literacy program took an approach to reading instruction that directly conflicted with both the MiniLit program and the explicit teaching model being instilled throughout the school at the time. The study also had a higher attrition of participants through student mobility (which is related to low socioeconomic status) (Burkham, Lee, & Dwyer, 2009) than would be considered ideal as well as some problems with late arrivals to school and behavioural issues.

While these factors most likely had an adverse effect on the data, they can arguably be seen as assets to the overall research project. They demonstrated the challenges associated with successfully establishing new programs in schools and evaluating their outcomes. These sometimes unexpected challenges emanated from all groups involved:

- the state education bureaucracy in approving the project;
- the resistance of at least one member of teaching staff to accept the program;
- disruption to usual classroom literacy practices as a result of an education department directive;
- the protracted period of time before a sufficient level of treatment fidelity was achieved,
- the need to replace a MiniLit/MultiLit instructor because they struggled to teach the program effectively;
- the instructional, social and behavioural needs of the participating students.

Research and program evaluations must take all relevant factors into account when determining the efficacy of a program. Treatment fidelity is especially important. Unless it is known whether the program is being implemented correctly, it is not possible to draw conclusions about its efficacy. The MultiLit study in particular, which had a much stronger effect in the second implementation, demonstrated the influence of skilled instructors and informed decision-making. Another important implication following from this is the need for school-based programs to be evaluated rigorously over a sufficient period of time to allow careful, data-driven revisions to be made where necessary, and for the effects to be observed.

Another key lesson for educators is that the success of a Tier 2 intervention is partly dependent on the quality of Tier 1 instruction. The powerful results of both MiniLit and MultiLit in phonological recoding indicate that students were not receiving effective instruction in phonics in the classroom. MiniLit students also began the program with extremely low levels of other reading skills. This meant that, in effect, MiniLit was providing initial instruction in small groups, rather than supplementing and supporting high quality Tier 1 instruction. It is therefore understandable that lower-order skills—phonological recoding and single word reading—were the first and quickest to develop, with the second-order skills of fluency and spelling taking longer to improve.

Statistical analyses of the MiniLit and MultiLit studies showed that small group programs were effective as stand-alone remedial interventions, but appraisal of the context in which they were implemented leads to the conclusion that Tier 2 interventions are most likely to be successful if implemented as part of a thorough and well-designed RtI program.

Adoption of effective evidence-based reading instruction in schools is stymied by poor policy development and inadequate teacher education.

The findings reported in this thesis add to and support the extensive literature on effective reading instruction and intervention. They suggest that students with reading difficulties, including those from low socioeconomic status backgrounds, can make good progress when provided with an effective evidence-based reading intervention for a sufficient period of time.

If there is a large amount of robust scientific evidence about how best to teach children to read, why are so many children still achieving low levels of literacy after four or more years of formal education? It is not for lack of investment of financial and human capital by governments (Rorris et al., 2011). If the school that participated in the MiniLit and MultiLit trials is representative of public schools in low socioeconomic status communities, it is not for lack of effort and commitment. Teachers at the participating school were professional, hard-working, and open to advice from the research team. Yet they were largely graduates of teaching degree courses that offer very little education on scientific studies of reading. Furthermore, they are guided by government policies that similarly fail to encourage the use effective evidence-based reading instruction techniques. Indeed, in the period during which the research for this thesis was undertaken, government directives actively discouraged it. The appendix of this thesis describes the political and ideological sources of the persistent research-to-practice gap in reading instruction.

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APPENDIX 1 – Policy Paper

Why Jaydon can’t read: The triumph of ideology over evidence in teaching reading

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WHY JAYDON CAN'T READ: THE TRIUMPH OF IDEOLOGY OVER EVIDENCE IN TEACHING READING

The current entrenched rate of illiteracy among Australian children is unnecessary and avoidable, write **Jennifer Buckingham**, **Kevin Wheldall** and **Robyn Beaman-Wheldall**.

Governments across Australia recognise the importance of literacy. Billions of dollars have been spent on programs aimed at improving the literacy of school children in the last decade alone.[1] These programs have most often focused on low-performing students and those most at risk of having low reading achievement—students from low socioeconomic status (SES) backgrounds and Indigenous students.[2] Yet national and international tests show that average achievement is static, with no reduction in the proportion of Australian students at the lowest performance levels and no increase in the proportion of students at the highest performance levels—if anything, the trend is in the wrong direction.[3] Low SES and Indigenous students are still strongly over-represented among students with the lowest standards of reading at primary and secondary levels.[4]

This lack of improvement, despite significant investment of financial and human resources over many decades, suggests that the problem of poor literacy is intractable. High quality research evidence and case studies of individual schools contradict this conclusion. With exemplary teaching, and effective and timely intervention, more students can achieve higher levels of reading achievement and fewer will fail to learn to read, irrespective of their family background.[5] The problem is that too many children are not receiving exemplary instruction. A persistent 'research-to-practice gap' has prevented the widespread adoption of effective methods for teaching reading, with profoundly negative consequences for children.[6]

All other English-speaking nations have experienced the same problem with translating knowledge into action, but the degree to which it is extant largely depends on the success of government policy. In the United Kingdom, where policy on reading instruction is now highly prescriptive as a result of the Rose review in 2006, there are indications of improved reading levels.[7] There has been lesser improvement in the United States, where the policy was ambitious but difficult to implement.[8] With ambiguous

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policies, Australia and New Zealand languish at the bottom of English-speaking nations in the 2011 Progress in International Reading Literacy Study (PIRLS).[9] This essay investigates why the highly robust scientific evidence on reading instruction has yet to influence classroom teaching in Australia.

What is effective reading instruction?

It is important to distinguish between teaching *reading* and teaching *literacy*. Reading refers to the ability to decode, recognise and draw meaning from the printed word. It is a specific and measurable process. Literacy, in educational parlance, is a broader term that involves 'listening to, reading, viewing, speaking, writing and creating oral, print, visual and digital texts, and using and modifying language for different purposes in a range of contexts.'[10] This essay is about the teaching of reading, particularly initial and remedial reading. Initial reading instruction and remedial reading instruction are highly specialised and well-researched disciplines of study. Although the principles of effective evidence-based reading instruction apply generally, it is vital in the early years of school and for struggling readers.

Strong differences of opinion among educators on what constitutes effective methods of reading instruction have been dubbed 'the reading wars'—with proponents of phonics-based instruction on one side and 'whole language' instruction on the other.

Strong differences of opinion among educators on what constitutes effective methods of reading instruction have been dubbed 'the reading wars'—with proponents of phonics-based instruction on one side and 'whole language' instruction on the other.[11] It is a false dichotomy, however.[12] Phonics, when taught properly, provides beginning readers with the skills and knowledge to decode and read familiar and unfamiliar words, avoiding the need to remember every word in written English by sight.[13] Whole language methods focus on children using their reading skills in context, enjoying the experience of reading and appreciating the meaning of words.

Unfortunately, whole language advocates deny the importance of phonic skills in learning to read, claiming that reading is acquired naturally—like speech. In the whole language approach, if phonics is taught, it is only incidentally and in context.[14] For example, the English Teachers Association of NSW advises that when children come across an unknown word, they should be encouraged to 'predict' or guess it, even though it has long been known that predicting words using context and picture cues has a low probability of accuracy, particularly when the text becomes more complex.[15] Accurate phonic decoding is listed as a strategy of last resort.

Advocates of evidence-based effective reading instruction, however, do not promote phonics as a singular, complete approach to the teaching of reading. Phonics instruction is one essential component of a comprehensive initial reading program—it is necessary but not sufficient on its own.[16] Good reading programs are equally strong in developing higher order skills that lead to understanding and analytical response.[17]

There is a large and robust body of scientific evidence on how children acquire reading skills early and quickly. It shows that effective reading instruction has five main components or 'big ideas': phonemic awareness, phonics, fluency, vocabulary and comprehension. It also shows that the best way to teach these skills is through explicit instruction by clearly explaining, demonstrating and guiding students to develop these skills.[18]

Reading instruction that incorporates the five big ideas and teaches them in an explicit and systematic way is effective for all children. It is, however, particularly effective for children most at-risk of difficulties in learning to read—low SES students, Indigenous students, and boys.[19]

Although phonics is only one part of a comprehensive reading program, it warrants special attention. Many teachers and reading programs purport to teach phonics, but do not reflect the specific set of research literature devoted to the most effective way of teaching phonics.[20] The research literature shows that phonics is most effectively taught by the 'synthetic' approach—a highly structured, sequential and explicit method that teaches beginning and remedial readers how to construct words from the smallest language 'building blocks' of letters and letter combinations, and their corresponding sounds.[21] Implicit or incidental teaching of phonics is not effective evidence-based reading instruction.

Why do so many children still struggle to learn to read?

According to reading researchers, the whole language approach has dominated the teaching of reading in Australian schools over the last 30 years.[22] This contention is supported by pro-whole language statements and articles by high-profile literacy academics in university education faculties and teacher professional organisations.[23] In addition, despite short-term efforts and positive rhetoric, no government in Australia has implemented policies leading to the widespread adoption of effective evidence-based reading instruction. It has sometimes been a case of one step forward, three steps backwards. In 2009, the NSW government published three papers on teaching reading, focusing on the elements of instruction most often misunderstood or entirely missing from initial reading instruction—phonemic awareness and phonics. These documents were praised by reading scientists and created some optimism that change may be afoot.[24] By 2012, after a change of government, these documents were removed from the education department website and can now be obtained only through special request. In 2010, the NSW education department implemented in a number of state schools an initial reading instruction program that claims to be research-based, but does not resemble effective evidence-based reading instruction as understood in the scientific reading research literature.[25]

Unlike the negligible positive impact of system-level programs, marked improvement has been observed in individual schools as result of school-driven initiatives. For example, Bellfield Primary School (closed in 2010), Ballajura Primary School, Goondi State School, and Innisfail East State School have all shown remarkable improvements in their reading levels after adopting proven, explicit teaching methods.[26] The MiniLit and MultiLit remedial reading programs—comprehensive programs that incorporate all five 'big ideas' of reading—provide more evidence of the power of good instruction. Various versions of the programs have been used in tutorial centres, schools and reading clinics for more than a decade. Numerous evaluations in this time show that children accelerate their reading progress, often achieving reading levels average for their age, and sometimes higher.[27]

If we know what works in teaching children to read, what is the problem?

> The most effective teachers (as determined by the reading score growth of their class) used a highly structured approach to introduce phonics content, and then embedded the knowledge in a wider context to encourage generalisation.

Many teachers are not using the most effective methods for teaching reading

Although there has been no comprehensive audit of literacy lessons in schools, surveys and research projects have provided evidence that the quality of teaching of reading is highly variable in Australian schools. A study of initial reading instruction in a national sample of 200 classrooms found wide (statistically significant) differences in reading growth. The most effective teachers (as determined by the reading score growth of their class) used a highly structured approach to introduce phonics content, and then embedded the knowledge in a wider context to encourage generalisation.[28] A study of 33 Catholic primary schools in Victoria found a strong emphasis on explicit phonics teaching and widespread use of commercial phonics programs, but noted a lack of integration of this component into richer literature-based activities and writing.[29]

Methods with weak proof for their effectiveness are still widely used. A survey of special education teachers in a national sample of schools reported a disproportionate use of evidence-based practices but also reported moderate-to-high levels of using interventions with poor research support.[30]

The most widely used early intervention program in primary schools is Reading Recovery. In NSW, it is the only formal remedial reading program fully funded by the state government, even though it does not include all the components of effective evidence-based reading instruction, and despite research findings questioning its efficacy among children with the most serious reading difficulties.[31] Reading intervention relies heavily on one-to-one programs, which are expensive and therefore available to limited numbers of students. In a Response to Intervention (RtI) model of teaching and assessment, struggling readers are first provided with support in small groups, reserving one-to-one tuition for students with the most serious reading difficulties.[32] RtI offers a more cost-effective approach but has rarely been used.[33]

Perhaps the strongest evidence of ineffective teaching is the substantial number of children who have failed to achieve even the most basic level of reading ability after three years of schooling.

Perhaps the strongest evidence of ineffective teaching is the substantial number of children who have failed to achieve even the most basic level of reading ability after three years of schooling. In the 2012 NAPLAN tests, 38,000 Year 3 students (13.8%) were at or below the (very low) minimum standard for reading.[34] This does not include students exempt from testing, such as children with disabilities and new migrants. This is the equivalent of 100 average size primary schools full of cognitively able children who are poor readers despite an estimated 1,200 hours of reading instruction.[35] There are thousands more non-readers in the higher grades.

The evidence on effective teaching methods, and phonics in particular, has not bypassed teachers and schools entirely. Australian researchers have repeatedly found positive attitudes about 'code-based' reading instruction methods among pre-service and in-service teachers in surveys since 2005.[36] A growing awareness in schools of the need for phonics instruction can also be seen in the strong market for commercial phonics programs. Retailers and distributors of commercial phonics programs say thousands of schools across Australia have bought *Jolly Phonics* and other popular programs such as THRASS and the Spalding Method.[37] But according to the product consultants, more sales of phonics programs have not translated into better outcomes for numerous reasons. Product sales do not necessarily mean the products are used well, or even used at all. Training, which focuses on using the product resources, is insufficient, particularly for teachers without a strong grasp of language structure. The research described below indicates that this may be typical.

The 'Peter effect' in language skills—One cannot give what one does not possess

In the Bible, when a beggar asked the apostle Peter for money, he replied that he could not give what he did not have himself. In the context of education, the 'Peter effect' is 'one cannot teach what one does not know.'[38] Low entrance requirements have resulted in pre-service teachers whose personal literacy skills may be inadequate to teach reading effectively.[39]

This view is supported by research surveys showing that teacher educators and senior school staff in a national sample of university education faculties and schools had low levels of confidence in the personal literacy skills of beginning teachers. Half the senior school staff surveyed said beginning teachers were 'fairly well' prepared, and only 4% said beginning teachers were 'well' prepared in personal literacy competence.[40] Similarly, teacher educators in focus groups held for the National Inquiry into Teaching Literacy (NITL) reported that 'many [teacher education] students lacked the literacy skills required to be effective teachers of literacy' and needed explicit teaching themselves about meta-linguistic concepts.[41] The report also noted that not all universities required pre-service teachers to address this problem as a condition of graduation.

Studies conducted in the United Kingdom, the United States and Australia have repeatedly found that a large proportion of pre-service and in-service teachers had insufficient knowledge of meta-linguistics—basic language constructs such as phonological awareness and morphology—to be able to use it in their teaching.[42] For example, a study in Victoria found that only 9% of pre-service teachers and 18% of in-service teachers knew that the word 'box' has four speech sounds. Only 38% of pre-service teachers and 52% of in-service teachers could identify the correct definition of a syllable.[43] A study conducted in Queensland likewise found that pre-service teachers had 'weak' and 'rudimentary' awareness of the language constructs that underpin phonics.[44]

It therefore appears that the ground has shifted somewhat. The importance of phonemic awareness and phonics in teaching reading seems to be widely acknowledged among teachers, but many have neither the personal literacy skills nor the requisite professional and practical knowledge to teach them well.

Teacher education does not prepare teachers to use effective reading instruction

The 2005 NITL report concluded that teachers were not 'adequately equipped with the evidence-based knowledge and practical strategies' to teach essential reading skills.[45] An audit for the inquiry found that in almost all 34 four-year primary education teaching degree courses, less than 10% of time in compulsory subjects was spent on preparation to teach reading. In half the degree courses, it was less than 5% of time. The audit did not scrutinise the content of the courses, leaving open the question of whether even this small amount of time was spent wisely. In a newspaper interview in 2008, inquiry chairman Ken Rowe said nothing had changed in universities since the inquiry because:

> Higher education providers of education and those who provide ongoing professional development of teachers, with a few exceptions, are still puddling around in postmodernist claptrap about how children learn to read.[46]

Several other Australian studies support this assessment. Three-quarters of pre-service teachers in a Queensland university reported that they did not feel well prepared to teach reading and had been given no training in phonics instruction.[47] In a survey of pre-service teachers in Victoria, more than half said their courses advocated whole language approaches to teaching reading, and expressed low confidence in their ability to teach reading to students with learning disabilities and Indigenous students.[48] A national survey of beginning teachers found many were unsatisfied with their practical preparation for teaching reading, the main criticism being 'too much theory, not enough instruction.'[49]

The importance of phonemic awareness and phonics in teaching reading seems to be widely acknowledged among teachers, but many have neither the personal literacy skills nor the requisite professional and practical knowledge to teach them well.

Why are teachers not taught or required to use effective evidence-based reading instruction?

The two major influences on teaching methods in schools are the university teacher education faculties that graduate all teachers in Australian schools—state, Catholic and independent—and government education departments, particularly state governments. Even though much of the debate over reading standards and quality teaching occurs in the public sphere, history shows that the battle of ideas in the media has little sustained effect on the priorities of academia. Some academics are derisive about public debates over education, claiming that such debates are manufactured crises for political gain and bemoan the popular appeal of 'common sense language' instead of 'scholarly, academic writing.'[50]

There appears to be an ideological hegemony among university education faculties and state education departments that actively or passively works against implementing effective evidence-based reading instruction. In many cases, the commitment to whole language is vested or professional—the result of a career built on promoting whole language pedagogies, seemingly disregarding the accumulation of evidence against it. Eminent researcher Margot Prior has likened it to 'religious' devotion.[51] For some, however, whole language philosophy and teaching of reading are enclosed in a broader economic and cultural ideology of social and economic equality.[52]

Another important factor in the research-to-practice gap in reading instruction is that scientific knowledge is not privileged in education research, practice or policy development. Levin identifies four main problems emerging from research on 'knowledge mobilisation' from research to practice:

1. poor links between researchers and users
2. lack of interest and outright resistance to research evidence
3. inadequate research
4. likelihood that policy will be influenced by politics rather than evidence.[53]

> An anti-science sentiment prevails in some Australian education faculties and teacher professional organisations, especially those that promote whole language.

All these ring true for reading instruction in Australia. Classroom teachers do not have time to keep up with new research findings through primary sources such as academic journals. Additionally, they often do not have the scientific expertise to translate these findings and apply them in the classroom, as is true for the large majority of people. Few teacher education courses provide pre-service teachers with the scientific and statistical skills to evaluate and interpret data, to understand research methodology, and to critically appraise studies of different kinds.[54] Research in the United States shows that teachers see scientific research evidence as just another type of information, and often as 'less influential' than information from colleagues and their own experiences.[55] This can be seen as rational in some ways because much research conducted in education faculties is of low quality, dominated by case studies, self-reporting, small samples, and weak methodology. Randomised control trials—the 'gold standard' for scientific research—are relatively rare in education. [56] Of the 137 conference papers available online from the 2012 Australian Association for Research in Education (AARE) conference, only one reported research that used scientific methodology, but even it did not use random allocation.[57] Internationally, reading instruction is a notable exception, with an accumulated body of evidence from the United States, the United Kingdom and Canada consisting of large controlled trials and meta-analyses of replicable and longitudinal studies.[58]

In Australia, as elsewhere, the best educational practice and policy research tends to emanate from departments of psychology and economics.[59] An anti-science sentiment prevails in some Australian education faculties and teacher professional organisations, especially those that promote whole language.[60] The English Teachers Association of NSW bases its position statement on teaching reading on 'psycholinguistic research, evolutionary theory and linguistic phenomena such as homographs and homonyms.'[61] For example, University of Wollongong Professor Brian Cambourne denies the superiority of the scientific method and criticised the NITL for restricting its literature review to scientific studies. He suggested the inquiry should have included qualitative research that answered questions like, 'What's happening and what do these happenings mean?' and 'How does Mrs Smith set up her kindergarten classroom so that children learn to listen closely to what each other says?'[62]

The resistance of university education faculties to embracing effective evidence-based reading instruction might be mitigated if government education departments—employers of 65% of Australia's teachers and creators of curriculum, assessment and policy—were a positive influence on quality teaching methods. That they have not been a positive influence to date is not for lack of investment of financial and human resources, but because of a rather misplaced and misguided effort.

This essay will not chronicle government policies on the teaching of reading, but several recent examples at the federal and state level illustrate the point. One of the key education reforms of the Gillard government was the development of a national curriculum. Although the draft literacy curriculum referred to all elements of effective evidence-based instruction, Learning Difficulties Australia pointed out that it had a number of important weaknesses in its conception of initial instruction, particularly the appropriate sequence of content, and did not provide clear guidelines for skills progression.[63] These weaknesses remain in the published curriculum.[64] Another major policy announcement of the federal government was a 'Reading Blitz,' reportedly at a cost of $1.1 billion—the equivalent of $8,000 for each primary school teacher in Australia.[65] The public information does not indicate that this policy required schools to implement effective evidence-based reading instruction. Specific educational terms such as 'running records' and 'phonemics' are used inappropriately and ambiguously, suggesting a lack of expertise in policy development.[66] Every primary school teacher in Australia could be provided with extensive professional development in initial and remedial reading instruction for a fraction of the cost of the Reading Blitz policy.

In the last several years, there has been a concerted effort by the NSW government to develop strong evidence-based policy on teaching, but with mixed results. It has established a research body —the Centre for Educational Statistics and Evaluation—to gather and synthesise education research to inform policy. A Ministerial Advisory Group on Literacy and Numeracy (MAGLAN) was convened to provide expert guidance, particularly in early literacy. Unfortunately, the MAGLAN report exemplifies the flawed approach to developing policy on reading instruction that has plagued Australia's school system. The advisory group members, although distinguished educators and researchers, were not experts in the specific scientific field of reading instruction. Consequently, the report contained a number of misrepresentations of research on reading, including conflation of precise and non-interchangeable educational terms.[67] This has serious ramifications—if policy is to have the desired effect it must be based on the most accurate information. There is a new website called 'Effective Practices in Literacy and Numeracy,' but it does not provide any guidance to schools on effective evidence-based reading instruction, or any practical advice on how to identify and support students with reading difficulties.[68]

NSW is not atypical; policy development on reading and literacy in all governments is consistently undermined by the vagaries of the political cycle, a reliance on non-expert 'experts,' and misallocation of vital resources into ineffective programs, partly because of persistent failure to evaluate programs properly.[69] This cycle must be broken if the successes seen in individual schools are to be shared across the country.

What can be done?

This essay has not touched on the role of children's home environments in reading development, the importance of which is irrefutable.[70] In terms of policy, however, the immediate benefits will be gained from focusing efforts on providing the highest quality education. Ensuring that all children have the opportunity to receive effective evidence-based reading instruction requires changes at three levels—governments, universities, and schools.

Governments must cease wasting money on ineffective 'add-on' programs that add to the burden of schools. If more money is to be spent on schools, it should be spent on up-skilling classroom and learning support teachers. The Response to Intervention (RtI) model is being under-utilised, but is potentially a more effective and cost-effective approach for schools to identify and offer timely intervention for struggling readers.

Although it is tempting to suggest that all schools should be required to implement government-designated reading instruction programs that meet the criteria of effective evidence-based reading instruction, such a proposition carries the risk of any monolithic policy—one fails, all fail. Some level of professional autonomy must be allowed to schools. One way around this problem is the British government's policy of creating a list of approved reading programs from which schools can choose. Schools wishing to use a different program must provide justification, including support from parents.

Neither the federal government's established bodies for quality control in higher education—the

Australian Institute for Teaching and School Leadership (AITSL) and the Tertiary Education Quality Standards Agency (TEQSA)—nor the various state-based teacher registration authorities have proven themselves capable of ensuring that teacher education courses are producing graduate teachers with the necessary skills to teach reading effectively. Positive steps are being taken at federal and state levels to lift the calibre of pre-service teachers by making it more difficult to enrol in teacher education courses, but this does not guarantee the quality of the training they receive.

Good quantitative research is expensive but ultimately less expensive than ineffective programs. Research funding in Australia should prioritise scientifically valid, replicable and reliable studies.

Arguably, every teacher education course should have, at minimum, a one semester subject on the five 'big ideas' of effective reading instruction, and practical training in how to teach them. Again, the most obvious answer is to enforce stronger requirements on universities through tied funding but, as with schools, increased government intervention can do more harm than good. A consumer, market-driven approach might be preferable. The National Council on Teacher Quality is an independent non-profit organisation that has evaluated almost all of the more than 1,300 teacher education courses in the United States and rated them on various criteria.[71] Prospective teacher education candidates can use this information to decide where to enrol, just as schools can use it in their hiring decisions. Such a project is feasible in Australia, with the government compelling universities to provide the information and data required by any organisation that undertook it.

Research funding bodies must be more discerning about the research they support. Educational research is not of a routinely high standard in Australia and therefore rarely influential. Relatively little funding is available for educational research—about $240 million was spent on education research in 2008–09 (latest published statistics), compared to more than $4 billion on health.[72] The enormous interest in international assessments like the Program for International Student Assessment (PISA), and widespread analysis of the data, shows an appetite and respect for good research in education. Yet such surveys are not a substitute for high quality experimental studies. Good quantitative research is expensive but ultimately less expensive than ineffective programs. Research funding in Australia should prioritise scientifically valid, replicable and reliable studies.

For their part, schools must be less willing to accept as inevitable the large numbers of students who do not learn to read. Without diminishing the importance of the role of parents, it is schools that are charged with the major responsibility for children's academic education. Where schools have taken this responsibility seriously, and taken all possible steps to achieve their goal, success has followed.

Conclusions

The current entrenched rate of illiteracy among Australian children is unnecessary and avoidable. Poorly conceived government policies and university education faculties wedded to out-dated and unproven teaching methods have each contributed to the situation. Billions of dollars have been spent, only to have thousands of children complete school without the most fundamental skill required for a happy, productive life—the ability to read. Realistically, there will always be some children who struggle to learn to read, but with effective instruction and timely intervention, the number of children who need ongoing support can be drastically minimised.

Endnotes

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APPENDIX 2 – Final ethics approval letter

MACQUARIE UNIVERSITY

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16 June 2010

Professor Kevin Wheldall
The MULTILIT Centre
Suite 202
299 Lane Cove Road
Macquarie Park
NSW 2113

Reference: 5201000468D

Dear Professor Wheldall,

FINAL APPROVAL

Title of project: Literacy and social disadvantage: An evaluation of a research-based literacy intervention for low-progress readers in schools with high levels of socioeconomic disadvantage

The above application was reviewed by the Faculty of Human Sciences Ethics Review Sub-Committee. Approval of the above application is granted, **effective 25 May 2010** and you may now proceed with your research. The following personnel are authorized to conduct this research:

Professor Kevin Wheldall – Chief Investigator
Dr Robyn Beaman – Co-investigator
Ms Jennifer Buckingham – Co-investigator

Please note the following standard requirements of approval:

1. The approval of this project is **conditional** upon your continuing compliance with the *National Statement on Ethical Conduct in Human Research (2007).*

2. Approval will be for a period of five (5 years) subject to the provision of annual reports. **Your first progress report is due on 1st May 2011.**

If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report on the project.

Progress Reports and Final Reports are available at the following website:
http://www.research.mq.edu.au/researchers/ethics/human_ethics/forms

3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Sub-Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4. Please notify the Sub-Committee of any amendment to the project.

5. Please notify the Sub-Committee immediately in the event of any adverse effects on participants or of any unforeseen events that might affect continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at: http://www.research.mq.edu.au/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide Macquarie University's Research Grants Officer with a copy of this letter as soon as possible. The Research Grants Officer will not inform external funding agencies that you have final approval for your project and funds will not be released until the Research Grants Officer has received a copy of this final approval letter.

Yours sincerely,

Dr Peter Roger
Chair
Faculty of Human Sciences Ethics Review Sub-Committee
Ethics Review Committee (Human Research)