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Using interactive multimedia (IMM) to help year four and five students identified as experiencing reading difficulties: A formative approach

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**USING INTERACTIVE MULTIMEDIA (IMM) TO HELP YEAR
FOUR AND FIVE STUDENTS IDENTIFIED AS EXPERIENCING
READING DIFFICULTIES: A FORMATIVE APPROACH**

By

Grace Oakley

A Thesis Submitted in Fulfilment of the Requirements for the Award of

Doctor of Philosophy

**Faculty of Education
Edith Cowan University**

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USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

ABSTRACT

This study involved four formative experiments, each of which investigated ways in which IMM (Interactive Multimedia) could be used to help children who experienced reading difficulties. In each of the four contexts, classroom teachers identified a number of students with reading difficulties, selected pedagogical goals for them and worked with the researcher to plan IMM-based activities that targeted the selected goals. The implementations were evaluated formatively and modifications were made accordingly, with the intention of 'fine-tuning' them to facilitate achievement of the pedagogical goals.

Facilitative and inhibitive factors were identified during and after each formative experiment, as were unplanned outcomes. Finally, attempts were made to ascertain the preferability of the interventions, in terms of efficiency, effectiveness and appeal, as well as with reference to factors that facilitated and inhibited them.

Two of the formative experiments took place at a private girls' school. Both of the participating classroom teachers, a Year 4 teacher and a Year 5 teacher, selected oral reading fluency as a pedagogical goal. A strategy that was termed 'Interactive Multimedia Assisted Repeated Readings' (IMMARR) using electronic storybooks was implemented, in addition to the creation of electronic talking books with the multimedia authoring program, *Illuminatus Opus* (2001), as a context for enhancing oral reading fluency. Many facilitative and inhibitive factors were identified during the implementations, although both teachers judged that the interventions had been effective and appealing. Post-intervention assessments also showed some gains in oral reading fluency, as well as unplanned outcomes, especially for the Year 5 group.

A third formative experiment took place at government primary school, which was a Technology Focus School (a school that had been allocated extra government funding for ICT equipment and professional development). The five participating students from this school had multiple difficulties, as is often the case for students with reading difficulties. The teacher decided upon comprehension as a pedagogical

goal, although many sub-goals, such as vocabulary knowledge and word identification, were assumed. Because she had very little knowledge of software, this teacher decided to allow the participating students to choose their own. This led to the students 'flitting' through a range of approximately 15 CD-ROMs. Many inhibitive and some facilitative factors were identified, as were several unplanned outcomes. Results showed that, even though the teacher had minimal experience with computers and was required to learn alongside the students in this study, the gains made by the students seemed impressive in both cognitive and affective terms. In terms of preferability, the teacher decided that the intervention was superior to traditional methods in terms of effectiveness and appeal.

In the fourth formative experiment, again in a government Technology Focus School, the teacher nominated comprehension as the pedagogical goal for a group of four Year 4/5 students. She selected a small range of software that contained short texts of various genres, in which words and sentences were narrated and highlighted by the computer on request. Vocabulary and comprehension activities were also available after each text. Several facilitative and inhibitive factors were identified and the participating students all made gains towards the selected pedagogical goals, as well as gains in other areas.

From the data that were gathered and analysed during the four formative experiments, it was possible to make some statements about the use of IMM-based activities in helping children who experience reading difficulties, although the focus of this thesis is on the facilitative and inhibitive factors encountered by the educators and students and not on the students' achievements *per se*.

Although using IMM can be in many ways a complex and frustrating enterprise for teachers, it appears to be possible to achieve some increases in reading achievement for these children relatively quickly. Even teachers with little experience in IMM or assisting readers with special needs were able to achieve results in ways that motivated the struggling readers.

Some of the issues that arose during the study were far more fundamental than anticipated. That is, issues concerning the identification and conceptualisation of students' difficulties, the linking of theory with practice and the assessment of learning proved to be almost as problematic as issues relating to educational

technology and, more specifically, IMM, for helping students who experience reading difficulties.

DECLARATION

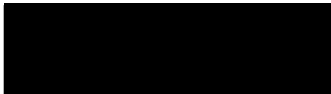
I certify that this thesis does not, to the best of my knowledge and belief:

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Signed:



DATED:

23.8.04

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CHAPTER ONE

INTRODUCTION

Background to the study

Computers are increasingly common in Australian primary schools (Meredyth, Australian Key Centre for Cultural and Media Policy, & Australia. Dept. of Education Training and Youth Affairs, 1999), and the availability of Interactive Multimedia (IMM)¹ has greatly increased in recent years, both in the form of CD-ROMs and World Wide Web (WWW) pages. Educational systems are spending relatively large amounts of money on this new technology and urging teachers to make use of it (Snyder, 1999).

The research literature indicates that the use of IMM can be beneficial to reading (e.g. Adam & Wild, 1997; Dillon & Gabbard, 1998; Doty, Popplewell, & Byers, 2001; Ford, Poe, & Cox, 1995; Glasgow, 1996-7; Meyer & Rose, 1998; Miller, Blackstock, & Miller, 1994; Ricci & Beal, 2002; Wepner, Valmont, & Thurlow, 2000). A major advantage is that it has the potential to cater for individual needs by presenting a range of activities in a variety of media formats and by providing appropriate feedback. If IMM is able to cater for individual needs, it follows that it should be beneficial to students with reading difficulties, and there is some research evidence to show that this is indeed the case (e.g. Anderson-Inman & Homey, 1998; Lewis, 2000b; McKenna, Reinking, Labbo, & Kieffer, 1999).

However, much of the research literature is inconclusive, contradictory, anecdotal and lacking in theoretical justification for the use of IMM (Ayersman, 1995; Blok, Oosdam, Otter, & Overmaat, 2002; National Institute of Child Health and Human Development, 2000; National Reading Panel, 2000), and it appears that many educators have found it difficult to apply existing research findings in order to assist

¹ IMM links together various computer presented elements such as sound, video, text and graphics in a non-linear fashion (Cognition and Technology Group at Vanderbilt Learning Technology Centre, 1993). Interactivity is a key aspect of IMM, and involves the user taking action, such as clicking, dragging, or keying in data. The computer responds in various ways, such as by displaying text, graphics or videos or by playing sounds (Aldrich, Rogers, & Scaife, 1998)

students with reading difficulties. Furthermore, the value of many research findings is questionable because technology and its uses are ever changing, as are definitions of 'literacy' (Calkins & Snyder, 2000; Leu, 2002). By the time researchers have established the efficacy of a particular technology or utilisation of technology, it may be obsolete (Leu, 2000). For this reason, 'research might be better spent exploring issues of how to support teachers' efforts to unlock the potentials of new technologies' (Leu, 2000, p. 762).

It is a matter of great public concern that many students reach school leaving age without acquiring the literacy skills required to lead a full and productive life (Snyder, 1999). This problem is compounded by the fact that there are rising demands for literacy (Snow, Burns, & Griffin, 1998). Furthermore, although some interventions have been shown to be successful for some students, and large amounts of resources have been put into particular interventions, it seems to be the case that some students do not benefit greatly from the intervention programs currently available (Spiegel, 1995). In Australia, fewer resources are directed towards students in the middle and upper primary years who have learning difficulties, and programs and strategies seem to be less effective than in the early years of school (Rohl, House, Loudon, Milton, & Rivalland, 2000). If IMM can play a part in improving this situation it seems that it could, where appropriate, be integrated into the curriculum for students with reading difficulties.

Statement of the Problem

Although some research evidence suggests that IMM can be beneficial to students with reading difficulties, there is little practical advice available to help educators to plan, implement and evaluate IMM-based activities for these students. Also, existing research evidence often has limited relevance in that it does not address the complexity and dynamism of the classroom context, and it is difficult to determine its usefulness in specific situations. Furthermore, because of rapid changes in literacies and technologies and their uses, research findings can quickly become obsolete.

Thus, teachers often find it difficult to acquire the expertise and confidence needed to use this potentially valuable new technology in order to assist students with

reading difficulties. Indeed, at present, the ways in which students and teachers use IMM in the learning/teaching of literacy has been described as unproductive (Collins, Hammond, & Wellington, 1997; Easdown, 1995). According to Lankshear and Snyder (1997, p. 23) teachers have difficulty integrating new technologies into the curriculum in meaningful and effective ways; they tend to tackle this issue 'on the run', make it up as they go along, and grab ideas where they can find them.

Whilst it seems that at present there can be no prescriptive 'best ways' to use IMM to help students with reading difficulties, it seems that current practices could be improved. Many educators would benefit from additional information regarding the issues they may need to consider in planning, implementing and evaluating IMM-based activities for students with reading difficulties. Educators appear to need information to help them decide for themselves 'what works' in specific situations and be informed about the inhibitive and facilitative factors they may encounter.

In response to this gap in knowledge, the intention of the present study was to investigate what happened when educators adopted a formative approach to planning, implementing and evaluating IMM-based activities for individual students with reading difficulties. It was also sought to generate some guidelines for other teachers who wish to adopt a similar approach.

Purpose of the Study

The purpose of the study was to examine the ways that four teachers used and could use IMM to assist students with reading difficulties, and to support them in developing ways to improve their practice in this area. The study investigated what happened when these teachers adopted a formative approach to planning, implementing and evaluating IMM-based activities for individual students with reading difficulties. This is similar to reflective teaching in that it involves reflecting on the learning situation, identifying the problem, trying out one or more solutions, and engaging in further inquiry (Henderson, 1992, p. 49). The 'formative' approach was intended to be more systematic and theory-informed than the 'trial and error' approach currently adopted by many teachers, and was geared towards specific pedagogical goals or outcomes.

The study required the teachers to plan, implement and evaluate IMM-based activities for students with reading difficulties, with support from the researcher, and to modify their practice in response to on-going formative evaluation. Thus, teachers were not merely 'making it up as they went along', but were endeavouring to engage in diagnostic, reflective, formative activity with the aim of finding out what worked in particular situations and with reference to predetermined learning outcomes or pedagogical goals. The study attempted to generate theory about the practices educators engaged in when formatively planning, implementing and evaluating IMM-based activities for individual students with reading difficulties, and what factors seemed to influence these practices.

It was expected that the researcher's role would change as the study progressed, from being a full participant observer to being a facilitator/resource person. Schön's work (1987) on reflective practice has shown that teachers' professional growth can be facilitated when a teacher works with a 'knowledgeable' person who can assist with problems that concern the teacher as they arise. It was expected that working closely with teachers would provide opportunities for the researcher to explore the questions they asked, their concerns, and the inhibitive and facilitative factors that seemed to influence their practice as they became more experienced in using IMM to help students with reading difficulties. As will become evident throughout this thesis, some of these expectations did not come to full fruition.

The ways in which the teachers helped students with reading difficulties in the traditional² context was also examined, as it was anticipated that this would provide a logical starting point for planning, implementing and evaluating activities in an IMM context.

In order to assist educators to develop new ways of teaching, it seemed essential to understand their current perceptions (Bruneau, 1992). Furthermore, it was hypothesised that looking at existing instructional methods would help educators determine the 'preferability' of new methods, or the extent to which new methods were preferable to known methods for attaining desired pedagogical goals (Reigeluth

² 'Traditional' seems to be becoming the conventional word to describe teaching-learning contexts that are not ICT-based (Leu, 2002), although the word 'conventional' is also common (e.g. Uesworth, 2001). In this thesis, the term 'traditional' will be used.

& Frick, 1999). There was no deliberate attempt to transplant existing perspectives and instructional methods into the IMM context, as it was thought that some of these would turn out to be inappropriate, if not counter-productive, as IMM may in some ways be capable of transforming pedagogy, not merely slavishly reproducing existing instructional methods (Leu, 2000). However, as will be explained in later chapters, existing instructional strategies did indeed turn out to be the basis for many of the interventions.

Participating schools were chosen on the basis of their commitment to the use of technology to facilitate learning. It was hypothesised that this would minimise some of the general obstacles often associated with using ICT (Information and Communications Technology) and IMM to facilitate teaching/learning, such as inadequate hardware, software and professional development. It was anticipated that this would make it easier for educators to focus on issues specific to the teaching/learning of literacy with reference to students with reading difficulties.

The Significance of the Study

A major intention of the study was to assist teachers to develop practices and professional knowledge to help them discover what works in particular situations. This was carried out by the researcher assisting teachers to develop a formative approach to planning, implementing and evaluating IMM-based activities for students who experienced reading difficulties. The study explored the difficulties teachers encountered when doing this. The aims of the study were to:

- identify and build on successes and facilitative factors that teachers experienced when using IMM to help students who experienced reading difficulties;
- identify problems (inhibitive factors) that teachers experienced when using IMM to help students with reading difficulties, and discover solutions to these problems;
- help teachers develop criteria for evaluating IMM-based activities and their efficacy and 'preferability' in fulfilling specific pedagogical goals;

- be carried out within the context of the classroom (much previous research has been carried out in laboratory contexts);
- use commercially available software and freely available Web pages (much previous research is based on software designed especially for the research project, which is not generally available);
- focus on middle and upper primary school students, who may not have benefited greatly from other approaches to reading.

The outcomes of this research include some general insights and perspectives that educators may wish to consider when planning, implementing and evaluating IMM-based activities for students with reading difficulties. The study also involved the investigation of issues the participating educators considered when using a diagnostic and formative approach to using IMM-based activities for students with reading difficulties; the results may help inform professional development for teachers, in that a range of obstacles encountered and possible ways of overcoming them was explored.

Organization of the Thesis

The following two chapters are devoted to reviewing the literature. Chapter Two focuses on literacy and literacy teaching, with special emphasis on reading difficulties, and Chapter Three involves the educational benefits of IMM and professional development, particularly in the area of using ICT in the classroom. Chapter Three also reviews literature on the formative experiment methodology. Chapter Four describes the methodology of this study.

Chapters Five, Six, Seven and Eight describe and discuss the formative experiments that took place in four different classrooms. As these were essentially exploratory and as much of the data collection was qualitative, these chapters are written in a descriptive style (in the first person) and illustrated by pictures and excerpts from participants' journals and from interviews.

Chapter Nine is devoted to discussion of the results and their implications, and Chapter Ten outlines conclusions and recommendations.

At the back of this thesis there is a glossary to which the reader will be referred throughout the text. This is intended to assist readers who do not have a strong background in the ICT area and consists mainly of technical terms.

An appendix can also be found at the end of the thesis. This accommodates documents and forms that are too long and cumbersome to be incorporated into the main body of the thesis. In addition, the appendix includes details of the pilot study in the form of an article that was published in *The Australian Journal of Learning Disabilities* (Oakley, 2002a).

Finally, a CD-ROM is included to enable readers to access this thesis electronically, if desired. Samples of the electronic storybooks and PowerPoint presentations created by the students are included on the CD-ROM.

Research Questions

- 1. How did the participating teachers typically help students who experienced reading difficulties, and what role did Interactive Multimedia (IMM) play in this?**

- 2. How could the participating teachers use a 'formative approach' to plan, implement, evaluate and modify IMM-based activities and programs to help students who experience reading difficulties achieve particular pedagogical goals?**

Sub-questions to guide the main question:

- a) What inhibitive and facilitative factors might educators encounter when planning, implementing and evaluating IMM-based innovations to help students with reading difficulties attain specified pedagogical goals³?
- b) How can educators establish 'preferability' of IMM based activities over 'traditional' activities?
- c) What 'unplanned outcomes' might result from using IMM based activities to assist students who experience reading difficulties?

³ 'Planned outcomes' are considered as part of this question.

CHAPTER TWO

REVIEW OF THE LITERATURE I

Literacy Learning and Reading Difficulties

What is Literacy?

Literacy is becoming increasingly difficult to define, and what constitutes literacy in the context of electronic texts is highly debatable (Bolter, 1998). There have been calls for a redefinition of literacy or 'literacies' (Flood & Lapp, 1998) to take into account electronic text and hypertext. According to Leu (2000), literacy is becoming increasingly 'deictic': its meaning is redefined constantly by new technologies and the ways in which these new technologies are used for communicating information. The Commonwealth government has defined literacy in the Australian context as:

[T]he ability to read and use written information, to write appropriately, in a wide range of contexts, for many different purposes, and to communicate with a variety of audiences. Literacy is integrally related to learning in all areas of the curriculum, and enables all individuals to develop knowledge and understanding. Reading and writing, when integrated with speaking, listening, viewing and critical thinking, constitute valued aspects of literacy in modern life (DEETYA, 1998, p. 7)

It must be noted that the relative importance of each component may vary from one situation to another. In the context of IMM, the components of literacy are often closely interwoven, with indistinct boundaries.

According to Kucer (2001, p. 4), becoming literate means:

[L]earning to effectively, efficiently, and simultaneously control the linguistic, cognitive, sociocultural, and developmental dimensions of written language in a transactive fashion.

In this definition, a literacy event is complex and occurs within a social context. Furthermore, people are always in the process of 'becoming' literate, or

adapting to new literacy demands. In a climate where the nature of literacy is changing rapidly, this conceptualisation of literacy (see Figure 2.1.) is useful, although it does not specifically mention the visual or oral facets of literacy.

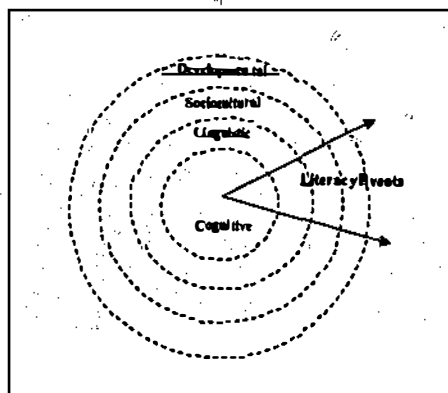


Figure 2.1. Dimensions of literacy (Kucer, 2001, p. 5).

According to Kucer's conceptualisation, at the centre of each literacy act or event is the cognitive dimension, which entails a variety of cognitive and mental processes and strategies. Surrounding the cognitive dimension is the linguistic, which involves various language systems. As well as being individual cognitive and linguistic meaning making acts, literacy acts are also social. Thus, the meanings constructed by individual readers will always be influenced by their social contexts and social identities. Lastly, literacy is developmental, and continues to evolve in order to meet the challenges of changing literacy contexts. Each literacy event depends upon the extent to which the reader has control over the various literacy dimensions. Thus, in any particular literacy context, a reader may have difficulties because of the particular combination of cognitive, linguistic, sociocultural, and developmental factors. Kucer's conception of literacy is in accordance with Snyder's (1997) view that new theories of electronic literacy must take into account the linguistic, the psychological and the sociocultural, although Snyder does not emphasise the developmental dimension.

Literacy events involve making meaning (or encoding meaning) from a multiplicity of different text forms. Because of an increase in the use of ICT and electronic texts, the range of text forms is expanding, and the above definitions of literacy may need to be extended to accommodate this. Kellner explains:

Literacy ... involves the abilities to engage effectively in socially constructed forms of communication and representation ... Multiple literacies involve reading across varied and hybrid semiotic fields and being able to critically and hermeneutically process print, graphics, moving images, and sounds. (Kellner, 2002, p. 163)

A broadened conceptualisation of literacy is accommodated by the notion of 'multiliteracies' that was first introduced in the mid-nineties by the New London Group. This group was concerned that existing definitions of literacy did not incorporate the literacies associated with the diverse cultural backgrounds that result from increased globalisation and communication amongst diverse cultural groups, or with literacies associated with the increased use of ICT, such as visual, multimedia, audio and gestural literacies. They thus coined the term 'multiliteracies' in order to encompass diverse and dynamic literacies (The New London Group, 2000). Lemke (1998) has pointed out that multimedia literacy is a special case in that meaning making in such environments may be multiplicative rather than additive, that is the sum may equal more than its parts. Different elements of multimedia text separately and in concert build three different 'dimensions' of meaning (Unsworth, 2001, p. 10), namely: the 'ideational', relating to participants, actions and circumstances in text; the 'interpersonal', concerning power relations between participants within text and between readers and the text, as well as affective factors; and the 'textual', dimension, pertaining to multimedia elements (e.g. print, images, audio) and the way in which each of these is used to convey information/messages.

Tyner (1998) argues that the conception of multiple literacies has led to the 'splintering' of the conception of literacy and that the different 'literacies' (e.g. visual literacy, critical literacy, multimedia literacy) need to be somehow reunited. She suggests that it is necessary to study the areas where:

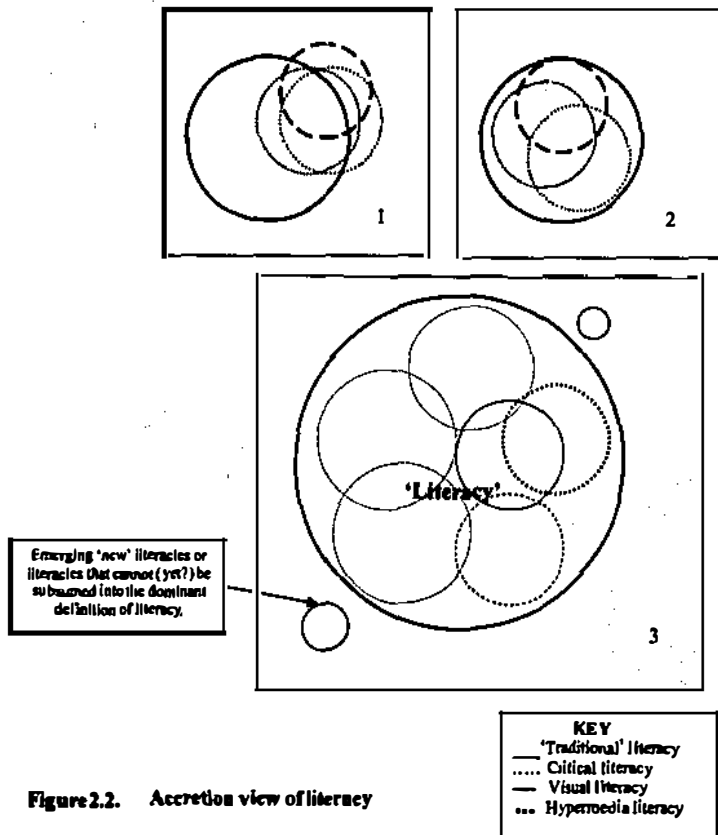
[T]he rationale, skill sets, and purposes of various literacies converge and overlap for clues to the common features, competencies and pedagogies of literacy at this point in time. Only then can a new vision of literacy in its myriad forms begin to take shape. (Tyner, 1998, p. 60)

Tyner suggests that the term 'multiliteracies' can be better conceptualised as elements drawn together under the broad umbrella of literacy, and hypothesises that multiple literacies will eventually merge into a coherent conception of literacy. With this in mind, it seems that an 'accretion' view of literacy might be useful (see Figure 2.2). 'New' literacies collide with (and may conflict with), and then intersect with, core or 'traditional' literacy until they are eventually subsumed, thus expanding the boundaries of literacy itself. It remains to be seen the extent to which 'old' literacies will disappear from the definition of 'literacy'.

This accretion view accommodates the most succinct and appropriate definition for the purposes of this study:

Literacy is the flexible and sustainable mastery of a repertoire of practices with the texts of traditional and new communications technologies via spoken language, print, and multimedia. (Literacy Review for Queensland State Schools, 2000, p. 9)

This definition assumes that (1) literate people have control over the modification and adjustment of their literacy performance in order to meet different contextual demands (flexibility), (2) they maintain and develop their literacy over time (sustainable), (3) they achieve in literacy at a high level (mastery) and (4) they have and know how to use a range of options for performing complex literacy practices (repertoire). Thus, it is compatible with all of the definitions described above. It also implies that there should be a distinction between the definition of 'literacy' (as a shared idea of what types of practices should fall under the broad umbrella of literacy) and 'being literate' (an individual's personal 'literacy', which will be composed of a mix of literacy practices). This is a useful distinction, as it is impossible for any one person to be literate in the whole range of possible literacy practices.



Following Gee's (1992) distinction between Discourse (a range of socioculturally meaningful practices) and discourse (language in use), it might be useful to refer to 'Literacy' and 'literacy', 'Literacy' being the general definition, which includes numerous possible literacy practices, and 'literacy' being an individual's *as is* or *as needed* literacy, or a particular literacy. Both Literacy and literacy can be seen as being in a state of constant flux, as demonstrated by the accretion model shown in Figure 2.2.

What is Reading?

Reading, as an important component of literacy, is also difficult to define, mainly because of its changing relationship to the other aspects of literacy, which is largely a consequence of new technologies. Reading can be defined as:

[A] process of translating signs and symbols into meanings and incorporating the new information into cognitive and affective structures. (Robeck & Wallace, 1990, p. 27)

Thus, whereas literacy refers to both receptive and expressive practices, namely reading, writing, speaking, listening and viewing, in this definition reading is focused on receptive aspects of literacy. This definition is capable of describing reading in an IMM context as it refers to a range of 'signs and symbols', and not only to printed text.

The Australian Language Policy (DEET, 1991) states that flexibility and dynamism are important aspects of reading, as are critical thinking and social and practical contexts. This relates well to Luke and Freebody's (1997) sociocultural model of reading that is accepted by several Australian state departments of education in their curriculum documents and by the Australian Literacy Educators Association (ALEA) and the AATE (Australian Association of Teachers of English) in their web-based literacy teaching resource, My Read <http://www.myread.org/what.htm>. (Commonwealth of Australia, 2002). This model proposes that there are four inter-related and necessary sets of practices involved in reading. These are explained in Figure 2.3.

Codebreaking	'Cracking the code' of grapho-phonetic relationships, discovering prior conventions
Participating in making meaning of text	Comprehension, meaning making, using prior knowledge
'Using' text	Understanding the functions and purposes of different texts, discovering what 'counts' as reading through social interaction
'Analysing' text critically	Being critically literate

Figure 2.3. The four practices of the reader (Luke & Freebody, 1997)

These four practices must all be carried out in concert to read text effectively; they must not be seen as separable or hierarchical. In view of the model's wide acceptance in Australian curriculum documents, many teachers' views of literacy have been influenced by this model, which in turn has influenced their practice.

Although there is a degree of overlap between reading in IMM contexts and reading in traditional contexts (Kamil & Lane, 1998; Tyner, 1998), such as word identification (code-breaking) and most comprehension strategies (participating in text), several new skills and resources will undoubtedly be needed in order to read IMM texts (Dee-Lucas, 1996; Kamil & Lane, 1998). For example, the non-linearity or multi-linearity of some IMM texts may require new strategies for meaning making (Bolter, 1998). That is, different integrative skills may be needed. Students also need to learn how to make meaning from the non-written elements of IMM, such as graphics, video and sound (Collins et al., 1997), and how this relates to the meaning made from the print. In addition, as Lemke (1998) has suggested, there may be a multiplicative effect at play in multimedia contexts, where the sum amounts to far more than the individual media parts.

Who Has Reading Difficulties?

There is no consensus on the definitions of 'reading disabilities' or of 'reading difficulties' (Chan & Dally, 2000; Williams, 1998), as these terms encompass many types of difficulties, which seem to have several different and complex origins. The definition of 'reading difficulties' adopted here will include all students who have difficulties in reading, for whatever reason(s). This concurs with Snow et al.'s (1998, p. 91) view, which states that reading skill should be distributed in a statistically normal way along a continuous dimension. 'From this perspective, reading difficulties form the lower tail of a bell-shaped distribution that shades gradually into normal and superior ranges of reading abilities.'

It is appropriate to use this conceptualisation of reading difficulties as it is in accordance with the way reading difficulties are defined in Australia, where students who are experiencing difficulties in learning to read are not usually labelled as having reading 'disabilities', as is often the case internationally (Louden et al., 2000). Whilst in some other countries such as the USA it is advantageous to have students identified

as learning disabled because this qualifies them for additional funding, identification is not tied to funding in the Australian context (Elkins, 2002).

Snow et al. (1998, p. 42) state that reading difficulties 'impede ... the use of the products and principles of the writing system to get at the meaning of written text.' Thus, a reduced ability to make meaning is a key characteristic of reading difficulties. Although this definition implies that difficulties in using the writing system to understand text are the basis of reading difficulties, it must be remembered that difficulties in understanding and using other symbol systems may also play a part in reading difficulties in the context of LMM.

Reading difficulties have been attributed to such factors (and combinations of factors) as visual and auditory perception and analysis and language factors (Rosner, 1993), sociocultural factors, general cognitive and memory factors, metacognitive and motivational factors, and behavioural adjustment factors (see Chan & Dally, 2000; Snow et al., 1998). Students with reading difficulties may also have other problems, such as poor fine motor control (Sands & Buchholz, 1997). Kucer's (2001) conceptualisation of literacy, which states that each literacy event engages cognitive, linguistic, sociocultural and developmental factors, allows for all of the above explanations of reading difficulties.

Many researchers have claimed that there are two broad categories of reading difficulties, and some even claim that there are three. Stanovich (1999) explains that many theorists and practitioners conceive of two broad types of reading difficulties, namely 'garden-variety' and 'specific' reading difficulties. According to this view, garden-variety poor readers are deemed to be slow learners in general, have learning difficulties in areas other than literacy and often score at low levels on intelligence tests. Students of at least average intelligence who do not necessarily have difficulties in other learning areas are said to experience specific reading difficulties and demonstrate a 'discrepancy' between levels of intelligence and reading. This group is also sometimes referred to 'dyslexic' or 'reading disabled', although the terms are not used consistently, either in the literature or in practice.

According to Stanovich, this inconsistency has led to confusion and unnecessary replication of effort in terms of planning for students with difficulties, as he claims that reading intervention should meet the requirements of both types of poor

reader. Indeed, this inconsistency of definition also makes it difficult to compare research findings (Rivalland, 2000), as there is no certainty that like groups of children are being compared.

Stanovich (1999) and others (Siegel, 1989, 2003; Snow et al., 1998) have argued that the distinction between 'garden variety' and specific reading difficulties is not helpful because evidence exists to suggest that reading difficulties are domain-specific and have little to do with intelligence *per se*. Stanovich also argues that the practice of students with specific reading difficulties in the USA being given additional/qualitatively different types of help from the garden variety poor readers (through additional funding to schools) may be ethically questionable in that it further benefits an already privileged group of people. In the USA it has been shown that a disproportionate number of students from upper socio-economic groups are diagnosed as dyslexic, or suffering from specific reading difficulties/reading disabilities, so it is not ethically appropriate to concentrate scarce resources on an already privileged group (Stanovich, 1999). A further reason that the distinction between the two types of reading difficulties may be of limited worth is because it appears that there is no persuasive evidence to suggest that they require different types of remediation or assistance (Elkins, 2002; Stanovich, 1999), even in a computer-assisted context (Jiménez et al., 2003). That is, both so-called types appear to respond to the same kinds of intervention.

Perhaps one of the most compelling arguments against the discrepancy approach to the identification of reading difficulties is the fact that, according to this definition, a child with a standard score of 110 in reading could be labelled as 'learning disabled', if her IQ is 130 or more. It seems absurd to label a student whose performance is above average as 'learning disabled' (Spiegel, 2003).

Although there are various theories regarding the causes or antecedents of reading difficulties, some of which are outlined above, the literature increasingly indicates that most students with reading difficulties seem to suffer from problems in the language domain. This may, in fact, account for as much as 70% of the variance between good and poor readers (Chan & Dally, 2000). The types of language difficulties associated with reading difficulties include difficulty with phonological processing, word recognition, metalinguistic competence and text processing, as well as spelling and writing (Chan & Dally, 2000). However, according to Kucer's (2001)

conception of literacy, the language/linguistic dimension of literacy cannot meaningfully be completely separated from the socio-cultural, the developmental and the cognitive. It follows, then, that students' reading difficulties need to be viewed in terms of complex interactive developmental, sociocultural, linguistic and cognitive factors.

Indeed, it has been suggested by Klenk and Kibby (2000) that focussing on supposed causes of reading difficulties is of no value and is a practice that stems from the fact that historically, the 'learning disabilities' field was dominated by those psychologists who favoured a 'medical' diagnostic model, based on deductive thinking. Nevertheless, Klenk and Kibby (2000) argue that in reading diagnosis, statements about causations are rare, that thinking in reading diagnosis is essentially inductive as opposed to deductive and that reading diagnosis looks at strengths as well as 'problems'.

It is noted that teachers often have difficulty judging the ability of readers in their classrooms (Madelaine & Wheldall, 2003), often being less accurate with reference to low ability students than they are for higher ability students. In Madelaine and Wheldall's study, 10% of low ability students, as identified by a standardised test, the Wheldall Assessment of Reading Passages (Wheldall, 1996), were not identified as such by their classroom teachers, and 18% of teachers identified students who were not very different from the lowest of the readers judged to be average, as low-progress. More than a quarter of teachers could not identify low-progress from average readers in their classes.

As has been demonstrated in this section, the definition and identification of reading difficulties is not a straightforward and uncontested domain. Accordingly, it will be seen in the following section that helping students who experience such difficulties is a complex endeavour.

Helping Students Who Experience Reading Difficulties

Because there is no consensus on what reading difficulties are and why they arise, there are numerous different intervention programs available. In Australia, a range of methods is currently used to help students with literacy learning difficulties. Here, as in the US and the UK, there is at present an emphasis on the prevention of difficulties.

Louden (2000) identified a sample of schools as successful in providing for students with learning difficulties. Literacy was explicitly taught to students in the early years through teacher-developed programs as well as programs such as *First Steps* (Education Department of Western Australia, 1997a). This is a program developed in Australia that assists teachers to assess the developmental levels of students in a wide range of literacy competencies, and suggests strategies that teachers can use to help students achieve the next level of competence in a given area.

There is also some emphasis on early intervention in Australia, whereby students in the early years who are experiencing reading difficulties receive special support, such as phonological awareness training, which helps students identify units of sounds such as phonemes in spoken language. *Reading Recovery* (Clay, 1993), which involves one-to-one tuition on a daily basis for up to 20 weeks (Chan & Dally, 2000), is also used in many schools.

In Australia, support for students in the middle and upper primary years is often inadequate, with specialised support not always available for students in this age range who experience reading difficulties (Louden et al., 2000) as much of the available funding is directed towards students in the early years. Furthermore, support that is available to older students often fragments reading into compartmentalised 'skills', which may detract from the notion that reading should be meaningful, purposeful and enjoyable (DEETYA, 1998). Fragmenting reading into compartmentalised skills may exacerbate the poor attitudes towards reading that students who experience literacy difficulties typically have.

In addition to the issues discussed above, the conceptualisation and response to readers with difficulties who may be termed 'struggling readers' may need to change in the era of electronic literacy (McKenna et al., 1999). This is because people who are deemed to be struggling in traditional contexts may no longer struggle in electronic contexts because of the support such contexts can provide. Further, there is some debate about whether teachers should use technology to circumvent and/or remediate a student's difficulties. At present it seems that the emphasis is on remediation (Klenk & Kibby, 2000; Latham, 1997). Circumvention of reading difficulties often involves the use of assistive technology such as text-to-speech, which can enable students to access content area texts, for example, when otherwise they would find this difficult if not impossible. As the name suggests, remediation of

reading difficulties using ICT involves the use of software to help students learn or practise literacy skills and behaviours. An example of this would be the use of spelling software such as *Superspell – A Day at the Beach* (2001) to help students improve their spelling and word identification skills.

According to Manzo and Manzo (1993), there are several general 'principles of remediation' that teachers need to observe if they are to successfully assist students who experience literacy difficulties. According to this list of principles, it is crucial to:

- Adopt a diagnostic teaching paradigm. That is, teachers should regularly collect information about students' learning processes, what difficulties they seem to have, and then reflect upon what provisions might be made in order to overcome these.
- Gain students' attention and their commitment to learn. In order to do this, it is necessary for teachers to gain knowledge about the students' interests and personalities.
- Ensure that students remain engaged⁴ during instruction, as time spent engaged in learning tasks is one of the best predictors of achievement in reading.
- Quicken the pace and amount of material covered as this increases the rate of student learning. A related principle involves the provision of frequent, spaced practice, also known as 'distributed' practice. According to this notion, students derive more benefit from many shorter learning sessions than they do from less frequent sessions of longer duration.
- Build self-efficacy, as this can build self-concept. In other words, evidence of progress that is discernable by the student can often lead to feelings of success and self-worth. Such feelings can be motivational and lead to further success.

For the purposes of the present study, the classroom teachers carried out identification of students with reading difficulties. The students identified were deemed by their teachers to be reading significantly below expected levels, as measured by the teachers' usual classroom assessment techniques, which included

⁴ 'Engaged reading' can be defined as 'the joint functioning of motivation, conceptual knowledge, strategies and social interactions during literacy activities.' (Baker, Dreber, & Guthrie, 2000, p. 2).

methods such as observation, running records, and teacher made tests. This approach was deemed to be appropriate as it was congruent with the ways in which Australian students are generally identified as having learning difficulties, and has been used by other Australian researchers (Louden, 2000). It was particularly appropriate in this context as the study was concerned with how teachers may use DMM to help individual students in their class to improve literacy skills. In Australia, it is classroom teachers who most often decide which students are having difficulties in a specific area, and it is classroom teachers who have the responsibility, either alone or with the help of others, of helping these students.

In the present study, participating teachers also identified 'pedagogical goals'. They identified oral reading fluency and/or reading comprehension as areas of need for the students with reading difficulties. It is thus appropriate to review the literature relating to these aspects of reading.

Reading Fluency

Whilst there is no real consensus on the definition of reading fluency (Kuhn & Stahl, 2000), it seems that a common view may be emerging in the literature, if not in classrooms. That is, reading fluency involves rate, accuracy, expression, smoothness and comprehension.

Traditionally, reading fluency has been seen simply as the ability to read aloud smoothly with expression, and it is often seen as being synonymous with automatic word identification, the emphasis being on rate and accuracy (Hasbrouck, Innot, & Rogers, 1999).

In more recent years it has been asserted that reading fluency is closely related to comprehension, although the direction of causality is unclear (Clark, 1995; Harris & Hodges, 1995; Samuels, 2002). According to Laberge and Samuels (1974), automaticity of word recognition is a prerequisite for comprehension, as readers do not have unlimited cognitive resources to devote to the reading task. Without automaticity of word recognition, an excessive proportion of available cognitive resources are used up in lower level processing, leaving inadequate cognitive resources for the higher level cognitive processes necessary for comprehension. Here, automaticity is seen as necessary but not sufficient for comprehension to occur. On

the other hand, it is known that comprehension (derived through semantic and syntactic, as well as grapho-phonics cues) can also facilitate word recognition and thus fluency (National Reading Panel, 2000).

Definitions are complicated by that fact that that they sometimes focus on oral reading, whilst others may also be concerned with silent reading that is smooth, effortless and successful in making meaning.

The various definitions discussed in this section are not necessarily mutually exclusive, but can be seen as components of a more complex and interactive definition of reading fluency. An attempt to synthesise these definitions is represented in Figure 2.4.

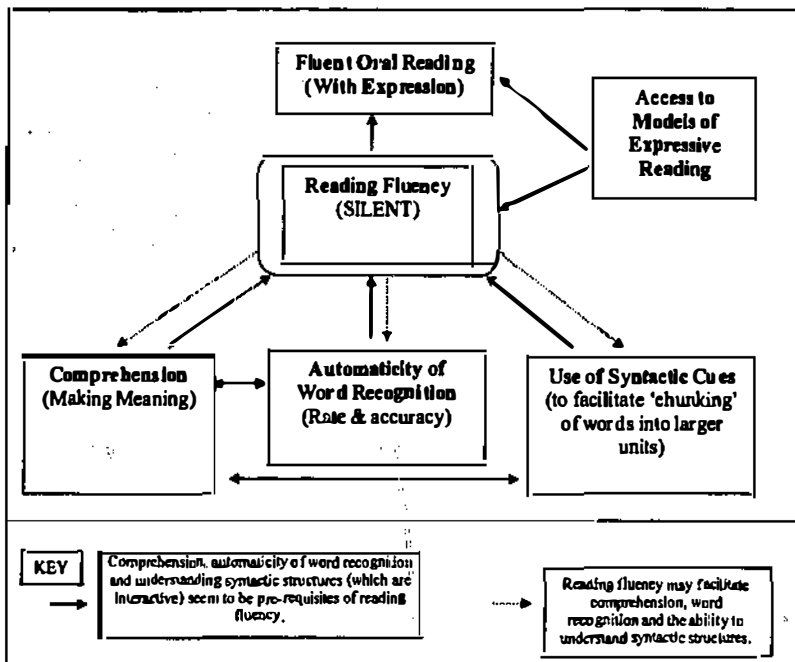


Figure 2.4. Schematic representation of reading fluency and its relationship with comprehension

For the purposes of the present study, it was initially decided that fluency should be focussed on rate and accuracy and, to a lesser extent, prosody, or the 'ability to read orally with speed, accuracy and proper expression' (Samuels, 2002, p. 167). This relatively narrow definition of fluency was selected because it was the one used by researchers who have recommended the use of LMM in the form of electronic storybooks to improve reading fluency (for example, Ford et al., 1995). It is also the definition underlying many of the traditional techniques for improving reading fluency, such as repeated readings (Samuels, 1979)⁵ and paired reading (Topping, 1987). Also, the USA's National Reading Panel (2000, p. 3-1), when it reported on fluency, seemed to agree with this restricted definition:

Fluent readers can read well with speed, accuracy, and proper expression. Fluency depends upon well developed word recognition skills, but such skills do not inevitably lead to fluency.

According to this definition, automaticity of word recognition, the use of syntactic cues such as punctuation and a degree of comprehension are necessary for silent reading fluency, although the weightings of these elements will vary according to the child and the context. A degree of reading fluency (whether oral or silent) may in turn facilitate comprehension, automaticity of word recognition and the ability to use syntactic cues. In order for oral reading fluency to occur (and possibly also to facilitate silent fluent reading) access to models of expressive reading is also necessary

The representation shown in Figure 2.4. includes the elements of reading fluency, as outlined by Samuels (2002). According to this view, reading fluency is facilitated by automaticity of word recognition, a degree of comprehension, and the effective use of syntactic cues. It is also improved by access to models of fluent reading. The representation shows that fluency and its elements have a reciprocal relationship, and that each of the elements of fluency, such as word identification and comprehension, can be improved by fluent reading. In this representation, an assumption is made that fluency in silent reading is necessary in order for fluency in oral reading to occur.

⁵Samuels (2002, p. 168) has now extended this definition to include both recognition-decoding processes and the comprehension process

Some Conventional/Traditional Techniques for Teaching Reading Fluency

Some of the established techniques used to teach reading fluency will now be discussed, as well as some possible roles for IMM. The techniques described below are to some extent based on diverging views of fluency and the consequent diverging views on how it can be improved.

Modelling of fluent reading

Students need to know what fluent reading sounds like in order to be able to read fluently (Clark, 1995). Many students unfortunately may not have regular access to models of fluent oral reading and, indeed, may often hear dysfluent models, for example when listening to peers read in such activities as round-robin (when groups of children take turns to read sections aloud from a book whilst the others read along silently) and paired reading (when pairs of children take turns to read sections of a book whilst the other reads along silently). CD-ROM electronic storybooks may provide models of texts being read fluently. Both genders and a range of age groups can be used as narrators – not only the (often female) teacher. For boys with reading difficulties, the availability of male role models may be particularly important (Rhodes & Dudley-Marling, 1996). Furthermore, students can access electronic storybook models often and independently, without requiring the time of a teacher or other proficient reader. However, it must be acknowledged that what counts as oral reading fluency may vary, as people from diverse linguistic and cultural groups may have different patterns of intonation, as well as different ways of using pitch, volume and pace.

The provision of models of fluent reading is unlikely to improve reading fluency for students with difficulties unless several other conditions are met. In order to read with increased rate, accuracy and prosody, students may need the opportunity to discuss the features of fluent reading, and have their attention drawn to volume, pitch, phrasing, rate and emphasis (Rasinski & Padak, 1996). A degree of proficiency in word identification and comprehension seems to be also necessary (Samuels, 2002).

Teaching self-monitoring

It has been claimed that students need to be able to monitor their own oral reading in order to achieve fluency – in the sense that they can read aloud with appropriate expression (Clark, 1995). To do this, they must become aware that they need to store ‘model voices’ in their heads, and be able to compare these with their own performance. Explicit teaching and feedback are often required in order for students to achieve this type of metacognitive awareness. Once they have such awareness, they should be able to listen to models in a more reflective way and to consciously think about how they might change their own oral reading performances (Clark, 1995). The use of tape recorders during practice and performances can help students compare their own performances to their internalised model performances. As yet, most electronic storybooks do not provide recording and playback facilities. Exceptions to this include Scholastic’s *Wiggleworts* (n.d.). However, tape recorders could be used in conjunction with electronic storybooks in order to overcome this limitation.

Repeated readings

One of the major means of teaching reading fluency has been ‘repeated reading’, which is also known as ‘repeated readings’. Repeated reading can be defined as follows:

Repeated reading is a technique that has students read and reread a text many times to improve reading fluency on indicators such as word recognition, accuracy, reading speed, and oral reading expression. (Samuels, 2002, p. 175)

The texts read are usually short sections of approximately 50 to 200 words. Hasbrook et al. (1999) have suggested that this can be extended to 350 words for students in upper primary grades. The passage chosen for repeated readings should be interesting to the child and ‘easy’ (Rasinski & Padak, 1996), which would usually equate to an accuracy rate of 95% (Strickland, Ganske, & Monroe, 2002).

Reading rate or speed is an initial focus of repeated readings and can be graphed after each performance to facilitate monitoring of performance and as a motivational aid. Once students have reached a satisfactory rate, emphasis is changed from reading quickly to sounding ‘good, entertaining, and communicating meaning

and feeling' (Clark, 1995, p. 258). What counts as a satisfactory rate of reading is open to debate, and much depends on the age of the child and the requirements of the text (some parts may need to be read quickly, and some slowly, for appropriate expression to occur). Wixson and Lipson (1997, p. 30), write:

How fast is fast enough, and how slow is too slow, are questions still open for debate...Norms for reading rate vary widely

Other ways of encouraging students to repeatedly read texts to enhance fluency include choral reading and readers' theatre (Tyler & Clark, 2000), which involves small groups of students reading sections of texts that have been rehearsed to an audience.

The repeated readings strategy has been extensively researched and found to improve fluency in a wide range of students, and has also resulted in improved comprehension (Hasbrouck et al., 1999). The USA's National Reading Panel (NRP) (2000) synthesised research on the efficacy of this technique and found that of the 14 studies that addressed the immediate effects of repeated reading (or variations of Repeated reading), all reported 'demonstrable improvements from a first passage reading to a final passage reading with whatever measures were used' (NRP, p. 3-15).

Even though all of the repeated readings interventions considered by the NRP led to improvements, some conditions were more effective than others. Repeated reading with phrasing support appeared to be no better than repeated reading alone in a study of 45 good and poor-reading 5th graders (Taylor & Adelman, 1999), whereas repeated reading with feedback or guidance (Pany & McCoy, 1988) was more efficacious than repeated reading alone with 3rd graders.

In addition, the studies considered by the NRP found clear improvements after repeated readings across the whole range of student ability, although in some studies greater gains were noted for readers with lower ability levels. The NRP acknowledges that, indeed, this 'could be an artefact of the design because these readers' initial performances would be relatively more deficient and would therefore be most amenable to improvement.' (NRP, 2000, p. 3-15).

It has been shown that the facilitative effects of repeated readings can be transferred to new, previously unread passages (Dowhower, 1987; Samuels, 1979). However, in the case of students with learning difficulties, such transfer appears to

dependent upon the number of words the texts have in common (Rashotte & Torgeson, 1985). The NRP, however, did not make any claims for repeated readings regarding transfer to other texts because the studies it considered did not address this.

One of the disadvantages of the use of repeated readings in a so-called traditional context is the breakdown of speed and comprehension that occurs when a child is unable to decode a particular word, or is unable to do so quickly. As LaBerge and Samuels (1974) have pointed out, if word identification does not occur automatically, there may be less cognitive capacity left over to engage in the higher order processes necessary for comprehension. It seems that electronic storybooks may be used to reduce this problem in that students can select unknown words and immediately obtain a pronunciation, thereby maintaining the speed and accuracy that is necessary for fluency.

The research concerning the efficacy of this technique for students with learning difficulties has been somewhat mixed, although some research in this area, such as that conducted by Sindelar, Monda and O'Shea (1990), has found that the effects of repeated readings are comparable for both readers with and without difficulties.

Assisted/ Paired Reading

A variation of repeated readings is 'assisted', 'unison', or 'paired reading' (Topping, 1987). This is also known as the Neurological Impress Method (NIM) (Heckelman, 1969). Here, the child reads in unison with, or echoes, a proficient reader. Like repeated readings, this technique has been found to be an effective technique for improving fluency not only in a practised text, but also in novel, unpractised material (Young, Bowers, & MacKinnon, 1996). In this technique, the proficient reader 'fades out' and lets the student take over when she or he is able. There is also research to show that reading along with a tape recording of a fluent reader can be beneficial to students (Shany & Beimiller, 1995).

It has been suggested by Ford, Poe and Fox (1995) that the computer may play the role of the proficient reader. In a study in which a computer-based version of assisted/repeated readings was used to teach reading fluency, students repeatedly read texts in 15 to 30 minute sessions from *Discis* electronic storybooks. Students initially read along with the computer narration and then read independently, clicking on

unknown words when necessary in order to obtain pronunciations. The researchers were unable to show any benefits of using the computer-based version over the traditional one, other than savings in teacher time. This study can be criticised because the participants only had three or four sessions each on the computer, perhaps not enough for them to become proficient and comfortable in the use of the technology. Indeed, the researchers acknowledge that the students had difficulty using the mouse and, perhaps as a consequence of this, seldom clicked on unknown words. This problem could possibly have been overcome with more practice.

Despite these limitations, it could be argued that the saving of precious teacher time is sufficient justification for using electronic storybooks to implement assisted/paired reading, especially in the case of students with reading difficulties, who particularly need additional practice (Chan & Dally, 2000). Hasselbring et al. (1997) have pointed out that the use of computers can also minimise the embarrassment that students with learning difficulties can feel when they have to repeatedly ask for assistance; it is not so stressful to seek support from a computer.

Oral Recitation Lesson

Another variation of repeated readings is the Oral Recitation Lesson (ORL) (Hoffman & Crone, 1985). This consists of two main components. In the first, the teacher reads aloud a selection of text, which is followed by an analysis and discussion of the selection and the joint construction of a graphic story map that students then use to write a story summary. The teacher again models the segments of the text and students practise the segments either individually or chorally. Next, the teacher discusses elements of good expressive reading, such as rate, pitch, and intonation, with the students. It appears that the computer could easily take over from the teacher in the provision of models/oral readings of the text.

The second component of the ORL involves the students working for ten minutes a day to practise their text segments using a 'barely audible voice'. This component could easily be modified to allow the student to read along with the computer before reading the text independently. The ORL seems superior to repeated readings or assisted/paired reading as it addresses word recognition techniques and comprehension, as well as speed, accuracy, and prosodic features. Clearly, electronic storybooks could not be used to implement the ORL without significant teacher input,

but they could be used to provide fluent models and as a context for independent practice.

The major components in traditional strategies for teaching reading fluency, then, are the provision of models of fluent reading, the availability of support from a proficient reader, repeated readings, and also explicit discussion about the elements of fluency and strategies that students may use to achieve it.

Reading Comprehension

Difficulties in reading comprehension

One of the major problems faced by students with reading difficulties is difficulty in comprehending. Comprehension can be defined as 'the ability to use previously acquired information to construct meaning for a given text' (Lipson & Wixson, 1997, p. 23).

Research into reading comprehension has a long history (Duke & Pearson, 2002), so the literature in this area is extensive. This literature review focuses primarily on reading comprehension difficulties, as reading difficulties are the focus of the study.

Pressley (2000; 2002) has cogently argued that skilled word decoding is necessary but not sufficient for skilled comprehension, and the fact that word identification is the prime focus in many literacy interventions limits their efficacy. Indeed, it has been found that students with learning difficulties have more difficulty comprehending what they read than do students without difficulties, even when the level of decoding ability is held constant (Englert & Thomas, 1987). It seems clear, then, that excessive emphasis on word identification may be misplaced.

Comprehension is interlinked not only with word identification but also with rate of reading as well as the ability to 'chunk' texts into meaningful units (Irwin, 1991). It has been suggested that repeated readings, described above, is one way of providing the practice necessary for students to understand the syntactic cues that mark phrase boundaries (Schreiber, 1980). Another method of marking phrase boundaries is to provide students with texts in which the phrases have been pre-

marked or 'cued', for example by the teacher drawing slash marks on the text (Rasinski, 1990).

In addition, difficulties in comprehension are frequently associated with a passive approach to the reading task, insensitivity to text structure and poor metacognitive skills (Williams, 1998), as well as with limited prior/conceptual knowledge, limited vocabulary knowledge (Gersten, Fuchs, Williams, & Baker, 2001), and limited task persistence (McKinney, Osborne, & Schulte, 1993). Students with reading difficulties need to be taught how to overcome all of these difficulties.

Duke and Pearson (2002, p. 205) have summarised the research findings and have listed what 'good' comprehenders do (see Figure 2.5). Poor comprehenders are unable to accomplish many or all of the proficiencies listed by Duke and Pearson efficiently, although it has been found that they can often successfully be taught to do so. However, these students generally require more extensive, structured and explicit instruction than do other students (Gersten et al., 2001).

1. Good readers are active readers.
2. Good readers are goal-directed and constantly monitor their reading and the text to check whether their goals are being met.
3. Good readers skim and scan the text before reading, noting the text structure, headings, and sections that might be relevant to their purpose.
4. Good readers make predictions about what will be in the text.
5. Good readers are selective readers, constantly making decisions about what parts of the text they need to read carefully, what they can read quickly, what to skip, etc.
6. Good readers construct, question and reconstruct meanings from text as they read.
7. Good readers attempt to infer meanings of new words and concepts from texts, and are able to deal with inconsistencies and gaps in comprehension.
8. Good readers use, compare and integrate their prior knowledge when making meaning from texts.
9. Good readers think about the style, beliefs and intentions of the author.
10. Good readers self-monitor their comprehension and 'fix' it when it breaks down by adjusting their reading strategies.
11. Good readers make evaluative judgements about the quality of texts, and respond to texts in different ways, intellectually and emotionally.
12. Good readers read different text types in different ways.
13. When reading narrative texts, good readers pay close attention to details such as the characters and the setting.
14. When reading expository texts, good readers constantly summarise and re-summarise.
15. Good readers take short breaks in their reading to process texts, and reflect on what they have read.
16. 'Comprehension is a consuming, continuous and complex activity, but one that, for good readers, is both *satisfying and productive*' (Duke & Pearson, 2002, p. 206).

Figure 2.5. What good readers/comprehenders do (Duke & Pearson, 2002).

Comprehension instruction for students with reading difficulties

Comprehension instruction can be defined as: '[A]n attempt to teach students how to think while they read' (Grasten et al., 2001, p. 310).

Wilder and Williams (2001) have pointed out that much current reading instruction, which is based on constructivist theories, does not work well for students with reading difficulties. Constructivist theories assume that each reader brings a unique knowledge base to the reading event and integrates that knowledge with the text in order to construct meaning (Cambourne, 2002). However, students with reading difficulties often have a restricted knowledge base (Anderson & Pearson, 1984) and they also tend to use prior knowledge somewhat uncritically. Furthermore, it has been shown that such students lack knowledge of written text structure and have fewer metacognitive strategies than do good readers. In addition, they may have cognitive problems, such as working memory limitations (Swanson & Alexander, 1997).

Furthermore, as mentioned above, too much emphasis on word-identification and lower-level skills has not been useful for teaching students with comprehension difficulties. Lipson and Wixson (1997) recommend a 'balanced' approach to teaching students with reading difficulties, which does not over-rely on either skill-building or constructivist methods. As well as explicit instruction in comprehension, all students require many opportunities to read, write and discuss texts (Duke & Pearson, 2002): they need to spend a great deal of time reading a variety of authentic texts for authentic reasons, in an environment that is rich in vocabulary and concept development and discussion of words and their meanings.

Duke and Pearson (2002) have recommended guided practice, with a gradual release of responsibility ("scaffolding") as a crucial part of nonnal comprehension instruction. This should take place as part of the teaching-learning cycle, after explicit description of a particular reading comprehension strategy and when it should be used, teacher modelling of the strategy, and collaborative use of the strategy in action. Finally, independent use of the strategy should be possible. However, students with reading difficulties often need to be monitored and supported by teachers for longer periods than do normally achieving students.

It appears that peer-mediated 'think alouds', where students verbalise their reading strategies and evaluate their efficacy, are useful to students with reading difficulties (Gersten et al., 2001). Also, peer-mediated reciprocal teaching (Oczkus, 2003; Palincsar & Brown, 1984), which involves small groups of students using four specific strategies to help them make sense of texts, has been found useful for students with comprehension difficulties (Gersten et al., 2001). The four strategies involved are: predicting what might be discussed in the next section of text, asking questions about the meaning of the text, summarising the text, and clarifying any confusing content or vocabulary.

Thus, the strategies used to teach students who experience comprehension difficulties are not necessarily radically different from those used to teach children without difficulties; rather the strategies must involve more explicit explanations, modelling, scaffolding and practice.

Summary of Chapter

In summary, literacy can be defined as making meaning and/or creating meaning from a range of text types, whether written, spoken, pictorial or multiple media. It has been suggested that the term 'Literacy' may be used to refer to the large number of possible literacies, which are a result of the proliferation of text types, purposes and audiences. The term 'literacy' may be used to refer to an individual's *as is* or *as needed* literacy. As pointed out by Kucer (2001), literacy involves developmental, sociocultural, linguistic and cognitive factors, which cannot be meaningfully separated.

Reading is a component of literacy and refers to making meaning from texts, which will be mainly written but may also be contain spoken and visual elements, as well as animation and video. In IMM contexts, such texts may also be interactive. Luke and Freebody (1997) have suggested that reading consists of four sets of practices, namely code-breaking, participating in making meaning of text, using text and analysing text critically. It seems that these sets of practices are still valid in IMM contexts.

In this study, the term 'reading difficulties' is used in the broad sense suggested by Snow et al. (1998), or the lower tail of a bell-shaped distribution. It is

noted that this distribution may differ according to the specific context, but those at the lower tail may still be defined as experiencing difficulties in their particular context.

There are many strategies available that may help some students who experience reading difficulties, a traditionally popular one being direct instruction. There are also a large number of packages and schemes, such as *Reading Recovery* for use with young students having difficulties in learning to read (Clay, 1993). Furthermore, Manzo and Manzo (1993) have suggested several 'principles of remediation', which include the use of a diagnostic paradigm, ensuring student engagement and commitment to learn, quickening the pace and amount of material covered, providing 'distributed' practice of material learnt, and building self-efficacy.

Oral reading fluency, an important area in which students may need assistance, may be improved through a number of strategies, such as repeated readings (Samuels, 2002), modelling of fluent reading (Clark, 1995), assisted/paired reading (Topping, 1987), teaching phrasing (Rasinski, 1994), teaching self-monitoring (Clark, 1995) and the oral recitation lesson (ORL), which involves explicit discussion about fluency as well as repeated readings (Hoffman and Crowe, 1985).

With reference to reading comprehension, some common strategies include peer-mediated reciprocal teaching (Oczkus, 2003; Palincsar & Brown, 1984), guided practice, the teaching of self-monitoring for meaning and how to 'think aloud', vocabulary improvement, teaching about 'three levels' of meaning (literal, inferential, evaluative), and teaching students how to read different text types strategically, as well as how to use their prior knowledge to facilitate meaning (Duke & Pearson, 2002). These strategies are all meaning-making practices and are closely aligned to Freebody and Luke's (1997) 'participating in the meaning of text' practice.

In Chapter Three the literature on Interactive Multimedia (IMM) and how it might be used to help students who experience reading difficulties is reviewed. Also briefly reviewed is some relevant literature on teacher education and professional development that will, in later chapters, provide a background for the levels of teacher knowledge and skills observed in the study.

CHAPTER THREE

REVIEW OF THE LITERATURE II

Interactive Multimedia and Professional Development

In this chapter, the literature concerning the use of IMM to facilitate learning, reading, and reading by students who experience reading difficulties, is reviewed. This examines theories of how IMM might help students learn, as well as research on how teachers and children tend to use IMM in the classroom.

Also in this chapter, some literature concerning teacher education in the use of IMM in the classroom is considered. This is necessary because teacher education appears to be a major factor in how ICT (including IMM) is used in the classroom.

What is Interactive Multimedia (IMM)?

IMM links together various elements such as sound, video, text and graphics in a non-linear fashion (Cognition and Technology Group at Vanderbilt Learning Technology Centre, 1993). Interactivity is a key aspect of IMM, and involves the user taking action, such as clicking, dragging, or keying in data. The computer responds in various ways, such as by displaying text, graphics or videos or by playing sounds (Aldrich et al., 1998). IMM is an aspect of ICT (Information and Communication Technology), although it is becoming increasingly difficult to separate IMM from the broader umbrella of ICT, as software and hardware are becoming progressively more inter-linked and networked.

Interactive Multimedia (IMM) and Learning

The literature suggests that IMM may help facilitate the teaching and learning of literacy on several levels. It is potentially an effective means of catering for the individual needs of students by allowing them to learn at their own pace and by providing appropriate feedback when it is needed (Matthew, 1997). IMM may also help learners develop and/or use several different 'learning styles' (Standish, 1992),

'preferred perceptual modalities' (Matthew, 1996) or 'intelligences' (Burton, 1996; Gardner, 1993, 2000). Other learning styles that have been linked to IMM include 'field dependence' versus 'field independence', surface processors versus deep processors, active versus passive learners, 'visual' versus 'verbal' processors and Kolb's four learning styles (Hede, 2002).

Field dependence or independence determines the extent to which a learner relies on the context in which information is presented, and a field dependent learner will often find it more difficult to transfer learning to novel contexts. Another category of styles, surface processors can be distinguished from deep processors by the fact that they tend to rely more on memorisation and rehearsal as opposed to elaborated structuring and representation of knowledge, which seems to be a more effective style in IMM environments (Hede, 2002).

Some learners are more passive than others, and particular aspects of IMM might suit these two types of learners to differing degrees, although this area has not as yet been adequately researched. Hede has also described 'visual' and 'verbal' learners, and proposed that visual learners are likely to gain more in IMM contexts than are verbal learners.

Kolb (1984) has suggested four learning styles, which can be seen as being positioned on a continuum, with learners ranging from activists who learn best through being involved in concrete experiences, to reflectors who learn best through reflective observation (watching others or reflecting on own experience), to theorists who learn best through abstract conceptualisation (hypothesising about experiences and observations), and finally to pragmatists who learn best through active experimentation (using theories to solve problems and make decisions). Although Kolb conceived of these styles as being on a continuum that learners should move along as they develop, it has been claimed that they may come to prefer one style over another, although others will perform well in several modalities (Dunn, 1990).

If a child with reading difficulties appears to have a preferred learning style, IMM may help educators to build on this, although it is acknowledged that there are difficulties diagnosing learning styles and matching appropriate activities to them (Curry, 1990; Jongsma, 1990; Snyder, 1990; Stahl, 1999).

Another potential benefit of IMM is the fact that it can, through multiple media, present 'multiple cues', either simultaneously or serially. Learning may be increased when the number of cues is increased as multiple cues may support and reinforce each other and result in more elaborated mental representations. For example, when pictures and speech are presented simultaneously, learning can be enhanced. This is known as the 'contiguity principle' (Mayer & Anderson, 1992). McKenna et al. (1999) have pointed out that the multi-sensory cues made available through IMM can also help draw attention to contextual information, which students with reading difficulties might otherwise ignore as they often have a tendency to focus on only one or two meaning making strategies. On the other hand, in some circumstances students with reading difficulties may find multiple media distracting (Case & Truscott, 1999). This may be especially so at certain stages of literacy development, such as when the child is trying to master code-breaking. Because of these potential difficulties, educators may be advised to take special care that the text, graphics and audio are appropriate for the particular students and pedagogical goals in question.

It is possible that some learning difficulties may be attributed to the fact that teachers often present information to students in an over-simplified and structured way, which neglects the fact that the nature of understanding is essentially constructive and that most knowledge domains are essentially complex and ill-structured (Spiro, Feltovich, Jacobson, & Coulson, 1991). Because of the way this oversimplified or 'packaged' information is processed and stored by students, it may be difficult for the student to 'reassemble' and adaptively fit the information to new problems or situations, for example realising that the same letter patterns may represent many different sounds, or that meanings may differ according to context. IMM may promote 'cognitive flexibility' or the ability to transfer knowledge to new situations in that it often encourages the re-assembly or customisation of knowledge from memory and not mere retrieval of learned 'chunks'. The means by which IMM may promote cognitive flexibility is that it can allow 'multiple juxtapositions of instructional content' (Spiro et al., 1991, p. 28); the same material can be revisited at different times, in different formats, in different contexts for different purposes, and from different perspectives. According to this theory, IMM may facilitate the construction of personally meaningful knowledge that is inherently purposeful and

amenable to deconstruction and reconstruction. A major implication of this is that IMM may help students learn in such a way that knowledge may be more readily applied to new contexts.

The notion of 'scaffolding' can be applied to the support offered to learners in IMM environments (McKenna, 1998). Scaffolding is a term often associated with the assistance provided by a teacher or tutor (Vygotsky, 1978). IMM may allow students to operate at or near their 'zone of proximal development' (ZPD) by providing modelling, the activation of relevant cognitive operations and the provision of guidance (Salomon, Globerson, & Guterman, 1989). The zone of proximal development can be described as the difference between what a student can do unassisted and what the student can do with the support and assistance of a more knowledgeable other. According to Vygotsky (1978) the most effective teaching-learning operates within the ZPD. This has implications for helping students with reading difficulties, who often need extensive scaffolding.

IMM is also capable of supporting 'anchored instruction', which involves the creation of non-school-based learning for students, or learning that is easier to apply to outside-world contexts. An anchor, such as a video clip, can provide a common experience for students from diverse backgrounds. It may also provide background knowledge with which new knowledge may later be associated, thus facilitating comprehension. This may particularly benefit those students whose reading difficulties stem from variations in the forms and functions of the language used at home vis-à-vis those used at school and from the ways in which teachers cater for them. Anchored learning attempts to relate knowledge to a range of contexts and to minimise inert knowledge, or knowledge that is not transferred to new situations (Kinzer & Leu, 1997).

Cognitive apprenticeship (Brown, Collins, & Duguid, 1989) refers to a pedagogical strategy in which students engage in complex, authentic and situated activities. IMM permits, to some extent, an apprenticeship environment in that it can provide authentic contexts, expert guidance, and opportunities to practise and reflect (Casey, 1996). For students who find it difficult to see the purposes of 'school' literacy, and who are thus not highly motivated, anchored instruction and the cognitive apprenticeship approach may be beneficial, although there presently is little research evidence to support this.

Interactivity is a key aspect of IMM, which may assist learning by giving control to the learner (McKenna, 1998). It can also allow learners to 'learn by doing' (Schank, 1994), thus potentially leading to more meaningful learning. Another aspect of interactivity is that it can allow immediate feedback, which can be beneficial to learning (Miller et al., 1994).

The use of computers and IMM also appears to be motivational to students who experience reading difficulties (Adam & Wild, 1997; Balajthy, Reuber, & Damon, 1999; Hasselbring et al., 1997). Without motivation, it is unlikely that students will gain enough practice to become good readers (Allington, 1977). Motivation is thus crucial to this group of students.

Many of the outlined theories of learning in multimedia contexts are somewhat partial and contradictory. Mayer (2001) has constructed a comprehensive theory of learning in IMM contexts in an attempt to integrate some of the above ideas. According to his cognitive theory of multimedia learning, meaningful learning occurs when students are able to select and organise relevant visual and verbal information and then integrate the newly constructed representations in a meaningful and systematic way. Three assumptions underlie Mayer's theory, which have been foreshadowed above. Firstly, it is assumed that learners benefit from being able to access and process information through two channels, namely the visual and the linguistic. Secondly, it is assumed that the human brain has a limited processing capacity, meaning that in some cases 'cognitive overload' can occur, which can impede learning. Thirdly, it is assumed that learning is enhanced by 'active' as opposed to 'passive' information processing. That is, learners need to apply a conscious set of cognitive activities during learning. This assumption concurs with a constructivist notion of learning, which states that learners actively integrate new knowledge with prior knowledge.

Mayer has isolated five steps that learners need to actively follow in order to learn successfully in multimedia contexts. Firstly, they must select relevant words and, secondly, they must select relevant images. Thirdly, they need to organise the selected words and fourthly, organise the selected images. Fifthly, word-based and image-based representations should be integrated, a process that is facilitated by learners drawing on their prior knowledge. Mayer's theory, instead of merely stating

how IMM might facilitate learning, offers specific guidance to designers and teachers about how best to implement learning in IMM contexts.

On the basis of an examination of existing research on IMM and learning, Mayer has extrapolated seven principles of multimedia design (Mayer, 2001, p. 184). These offer significant direction in the design and evaluation of IMM applications.

1. **The multimedia principle.** Students tend to learn better from words and pictures than from words alone.
2. **The spatial contiguity principle.** Students learn better when corresponding words and pictures are presented close to each other on the screen, rather than far apart.
3. **The temporal contiguity principle.** Students learn better when corresponding words and pictures are presented simultaneously as opposed to serially.
4. **The coherence principle.** Students learn better when extraneous words, images and sounds are excluded rather than included.
5. **The modality principle.** Students learn better from animation and narration rather than from animation and on-screen text.
6. **The redundancy principle.** Students learn better from animation and narration than animation, narration and on-screen text.
7. **Individual differences principle.** Design effects are stronger for low-knowledge⁶ learners than they are for high-knowledge learners and for high-spatial⁷ learners than for low-spatial learners.

Many of these principles, however, may not be applicable in cases where children are still learning to read or are using IMM to support their reading, as the above principles seem to assume that users can already read written text. Furthermore, Mayer's focus is on individual psychological processes and socio-cultural and environmental factors are not considered.

⁶ The low-knowledge high-knowledge dimension refers to the extent and relevance of the learner's prior knowledge.

⁷ The low-spatial high-spatial dimension refers to the student's ability to generate, maintain and manipulate mental images (Mayer, 2002, p. 172)

Hede (2002) also has attempted to integrate the theories about how IMM can influence learning. Like Mayer's theory, Hede's model, which is illustrated diagrammatically in Figure 3.1, appears to present learning as primarily an individual, cognitive process. Although it does not appear to incorporate socio-cultural or environmental factors, Hede claims that the model presents 'learning as a complex psychosocial interaction between the learner and the instructional designer' (Hede, 2002, p. 185).

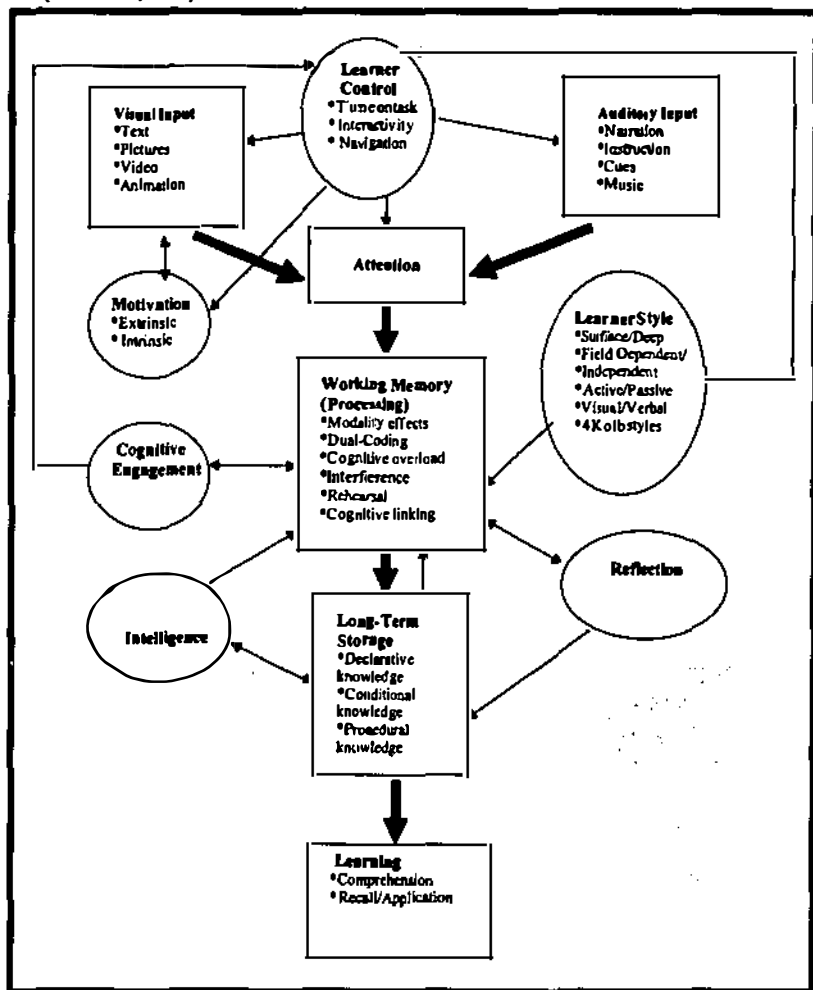
Hede's model consists of four main groups of multi-dimensional elements:

- 'Multimedia input' is composed of three elements, namely visual input, auditory input and learner control;
- 'Cognitive processing' is composed of two elements, namely attention and working memory;
- 'Learner dynamics' is composed of three elements, namely motivation, cognitive engagement and learner style;
- 'Knowledge and learning' is composed of four elements, namely intelligence, reflection, long-term storage and learning.

Hede (2002) acknowledges that his model is more classificatory and descriptive than predictive, but it is nevertheless a useful theoretical framework for IMM and learning, as it draws together a diversity of factors from a range of theories and research results. Whereas Mayer's theory focuses on the design of IMM and how students in general react to certain design elements, Hede's framework facilitates the understanding of some of the many factors that can mediate an individual's learning in IMM contexts. It is noted, however, that only IMM factors and individual factors are considered. Social, contextual and teacher-related factors are not included.

In summary, IMM may facilitate learning by catering to and/or developing different learning styles or intelligences; it may provide multiple cues, either sequentially or simultaneously, which may enhance learning; it may encourage cognitive flexibility; it can provide scaffolding; it can enable active learning; and it is often motivational. This is all highly relevant when assisting children who experience learning difficulties in that such students often respond positively to multi-sensory interventions, often do not transfer knowledge learnt to new contexts, are frequently

under-motivated, and need a high degree of scaffolding and timely feedback (Westwood, 2003).



The Use of IMM to Assist Students Who Experience Reading Difficulties

It appears that IMM has the potential to help students with reading difficulties, although there has been limited research activity in this area. In Canada, Zakaluk

(1996) found great improvements in the reading and writing abilities of students in Grades 2 to 5 after they had used multimedia for presentations and the Internet for communication. McKenna, Cowart and Watkins (1997, cited in McKenna et al. (1999), also found that IMM could help students with reading difficulties. In this study, it was found that 'struggling' readers benefited from repeated readings of electronic storybooks, which provided pronunciations of unknown words. The students gained substantially in terms of sight words learnt.

In the following section, I discuss the potential of IMM in relation to helping students with reading difficulties to code-break, participate in the meaning of text, use text functionally and with purpose, and to critically analyse text (Luke & Freebody, 1999; Oakley, 2002b).

Code-breaking

Students with reading difficulties are often poor 'code breakers'. IMM may help them become better at decoding text (Freebody, 1992) in several ways. IMM can help students develop phonological awareness (Balajthy et al., 1999; Bowman, 1999), which is crucial to reading (Bums, Griffin, & Snow, 1999; Hempenstall, 2003). Students with reading difficulties are often unable to recognise the different sound units in language and to manipulate them. IMM may help students become phonologically aware by presenting activities such as those suggested by Yopp (1992, p. 699): sound matching, sound isolation, blending, sound addition and substitution activities. There are many software packages, such as *Phonics Alive 2!* (1998), that focus on phonological awareness and phonics. Talking Nursery Rhyme books, such as *Mixed-Up Mother Goose* (1995) may demonstrate rhyme and alliteration in a dynamic, engaging manner. The ability of students to recognise rhyme and alliteration predicts reading and spelling achievement in later years (Maclean, Bryant, & Bradley, 1987).

Word awareness, which seems to be necessary for phonological as well as syntactic awareness (Rohl & Milton, 1993) may be developed through IMM activities, such as *Living Books* storybooks, where individual words or groups of words may be highlighted as they are read aloud by the computer. Other print conventions such as directionality may also be revealed in this way (Burton, 1996).

Word identification may be facilitated by IMM in several ways. IMM software, such as storybooks may help students build up their sight word vocabulary by pronouncing problematic words using digitised or synthesised speech (Collins et al., 1997; Miller et al., 1994; Roffey, 1995). IMM may help students build up larger sight vocabularies purely by encouraging them to read more, by virtue of its motivational and stimulating interfaces. Labelled illustrations, which may help increase students' sight word knowledge and improve their vocabularies, are available in many electronic storybooks.

Word identification through graphophonic analysis is an area in which many students with reading difficulties need instruction and practice, and IMM may help facilitate this skill for these children (Raskind & Higgins, 1999). Graphophonics involves being able to identify the sounds of individual letters and clusters of letters and 'sounding out' until the word is recognised. In *Beginning to Read* (n.d.), for example, the child must enter initial and end letters to form new words. The program then provides pronunciations. Spelling software, such as *Phonics Alive! 3 The Speller* (1999) can also improve the child's ability to make graphophonic associations. Students with reading difficulties often find graphophonic analysis difficult (Burns et al., 1999).

Although there are many ways in which IMM may help facilitate code breaking (Wepner et al., 2000), it may also be disadvantageous in several ways. For example, the use of digitised pronunciations may in some cases discourage students from using the syntactic and semantic cues available to help them identify new words (McKenna, 1998), thus encouraging a dependency on supported electronic texts. This is an area that requires further exploration, but is not a focus of the present study.

As discussed in the previous chapter, in order to read effectively, word identification must be carried out with sufficient speed to enable automaticity or fluency so that readers have sufficient cognitive resources left to allow comprehension to take place (LaBerge & Samuels, 1974). IMM software, through the provision of such features as digitised pronunciations and also the modelling of fluent reading, can help students who have reading difficulties to attain fluency (Homey & Anderson-Inman, 1994). Techniques such as repeated reading of the same text, and unison reading, can be used in IMM contexts in similar ways to traditional print contexts.

Miller et al. (1994) investigated the effect of using electronic talking books for repeated readings, using the measure of 'search for meaning'³ miscues, through the logging of the number of times children clicked on the help features of the program (such as pronunciations and definitions). They found that search for meaning miscues diminished in the intervention group of four 8-year-old children, whereas in the comparison group, who undertook repeated readings of traditional printed texts, no such diminution of search for meaning miscues occurred. Limitations of this research include the small number of subjects and the assumption that the relationship between children accessing help features and needing help features is unproblematic. It has been pointed out that this relationship, in fact, is not straightforward (Medwell, 1996)

Following the study by Miller et al. (1994), Ford, Poe and Cox (1995) carried out a study, which involved 9 students, aged from 7 to 10 years old, who needed to improve their fluency. Weekly 15-minute sessions were held for eight weeks and it was concluded that there seemed to be no particular advantages or disadvantages of using computers (repeating readings) to help students attain fluency. However, the freeing up of valuable teacher time and giving students opportunities to engage in independent practice was an important benefit.

In another comparison study, Humble (2000) found that students who silently read along to *Living Books* electronic storybooks performed as well as did students who read aloud to an adult, showing that the use of electronic books could be used as an alternative to adults to support students' reading practice. In addition to this, McKenna et al. (1997, unpublished paper cited in McKenna et al, 1999) found that repeated readings of electronic texts could increase the number of sight words recognised. It has been suggested that the term 'code-breaking' could also be used to refer to understanding the conventions of symbol systems other than the printed word (Limbrick, 2001)

Participating in making meaning of text (comprehension)

IMM may facilitate the participation in making meaning of text, or comprehension, in students with reading difficulties (Boone & Higgins, 1993; Homey & Anderson-Inman, 1999). Aspects of comprehension that IMM may be able to help

³ A 'search for meaning' miscue is based on the fact that competent readers do not tend to correct miscues that do not interfere with comprehension, although they do correct miscues that interfere with comprehension.

develop include syntactic awareness, vocabulary development (Higgins & Cox, 1997), prior content knowledge, and ways of organising information so that it is meaningful, for example through the provision of 'advance organisers' (Chun & Plass, 1996). There are two major potential disadvantages of using IMM to facilitate comprehension. Firstly, the provision of multimedia elements, such as images and sounds, may prevent the reader from mentally generating images, thus tuning readers into 'mere' viewers (Lu, 1993-4).

Secondly, it may also be difficult for readers to integrate and structure information encountered into existing schemata because there is often a lack of in-built sequence in IMM programs. The difficulty readers can have in imposing cohesion upon the information encountered has been termed 'cohesion deficit' (Duchastel, 1991). Laurillard (1998) states that narrative structure is an important means of conveying a message and the lack of this in many IMM environments may adversely affect comprehension.

It has been suggested that students with reading difficulties may find it particularly difficult to navigate around electronic texts and to integrate information (Wissick & Gardner, 2000). They thus need to be explicitly taught strategies for reading in this context. Trushell, Burrell and Maitland (2001) found that, for Year 5 (UK) students, too much 'eye candy'⁹ in interactive storybooks was disruptive to the comprehension of some students. Furthermore, despite the 'book' analogy that is common in electronic storybooks, and prompts students to read in a linear fashion, many students did not read from the beginning to the end in a linear way. Indeed, some students read from the back to the front. Trushell et al. (2001) suggest that a small amount of teacher or parental supervision is necessary to counteract these tendencies.

Underwood (2000) also found that recall levels were low for students who had read electronic talking books and they were often confused about the storyline. However, Doty et al. (2001) found that after reading electronic talking books, students were better able to answer comprehension questions than those in a control group, although their ability to construct oral retells was not significantly different.

⁹ The term 'eye candy' refers to cued animation and effects, which may or may not be relevant to the storyline.

Greenlee-Moore and Smith (1996), also found that children comprehended electronic talking books better than they comprehended traditional texts.

Reading to learn, or studying, is another aspect of reading that may be facilitated by the use of IMM. Higgins, Boone and Lovitt (1996) found that the use of IMM enabled poor readers to retain more information than they retained in traditional reading contexts. Dillon and Gabbard (1998) have stated in their literature review on the use of hypennedia and learning (quantitative research only) that it can be beneficial to comprehension and learning in tasks that involve repeated manipulation of, and searching for, information. However, learners' abilities and preferred learning style moderate this finding.

Using texts functionally and with purpose

Using texts or understanding their functions and purposes can be enhanced by the use of IMM, which can simulate 'real-world' situations through the use of graphics, sound and digital video (Bolter, 1998). The World Wide Web (WWW) provides access to 'real' web pages, be they commercial, educational or private. Links to real people by email are also often provided on web pages, enhancing authenticity and purposefulness. This, in turn, may be motivational, an important facilitative factor; declining levels of motivation to read in the middle and upper primary years are well documented, especially amongst students who have learning difficulties in this area (McKenna, 1998).

Students also need to be exposed to different genres so that they can learn about how different text structures may achieve different purposes (Dettwianka, 1990). IMM environments, with their wealth of information, may easily expose different genres, such as explanations, narratives, instructions, poems and songs. Furthermore, having access to a diversity of texts from a variety of authors may help students realise that there are many literacies (Lemke, 1998), and that texts are written and read for a variety of purposes, in a variety of ways. Through engaging with IMM, students may have various opportunities to make decisions regarding the appropriateness of the various symbol systems for specific communicative purposes (Labbo and Kuhn, 1998, p. 87).

The opportunity to respond to texts may be an important means of deciding what texts are all about and what purposes they fulfil. Response options may be built

into IMM software such as storybooks. For example, *Reader Rabbit's Reading Development Library 2* (1997) includes response options, such as the opportunity to write letters to the characters and print them out.

When using IMM, negative attitudes towards reading may be less likely to develop (McKenna, 1998) as supported reading environments can facilitate early reading success. Positive attitudes and motivation to read may also be encouraged by IMM because of its enjoyable, engaging interface, and because it is usually under the control of the user. Research evidence suggests that IMM can promote motivation in reluctant readers and that this new found motivation can be transferred to reading in traditional print contexts (Adam & Wild, 1997). Motivation can also allow students to succeed in reading where in other contexts they have failed (Nixon, 1999). Hasselbring, Goin, Taylor, Bottge and Daley (1997) found that low-achieving readers experienced reading in a computer context as less risky and less embarrassing; it provided a safe place to fall, and encouraged low achievers to try. McClain (2000) reports on a study in which general improvement in behaviour and school attendance was brought about by the use of computers in schools. This improved behaviour and attendance may, in turn, improve reading by allowing more time and focussed attention devoted to reading activities.

Critically analysing texts

The ability to analyse texts critically can be promoted by the use of IMM. IMM may give readers control over the sequence of reading, thus partially eroding the authority of the text and its author. Also, readers may be able to intervene in electronic texts and make alterations, rendering the author-text-reader relationship more egalitarian (Bolter, 1998). Readers may also discuss texts with other readers and even the author on the Internet, thus increasing opportunities to examine them from multiple perspectives. In short, it is proposed that the fact that readers are given choices and control over what is read increases their status in relation to the author (Bolter, 1998, p. 6). Hypermedia allows the juxtaposition of multiple texts, and thus multiple meanings. It may therefore facilitate the exposure of different underlying ideologies, although examples of this happening in practice are not yet available (Myers, Hammett, & McKillop, 1998).

Although I have discussed the use of IMM in terms of Freebody's (1992) four practices, the aspects of reading that were identified by participating teachers as pedagogical goals, namely fluency and comprehension can easily be conceived of in terms of this framework. Comprehension is closely aligned with the text participant practice, as well as the text analyst practice, which involves evaluative comprehension of text, and the text user practice, which involves knowing about the structure and purpose of text. Code-breaking is often necessary in order to bring the other three practices into play (although in IMM contexts, computers can do much of the code-breaking). Fluency involves all four practices, although there is more emphasis on code-breaking, in that word recognition is of great importance, as is an understanding of punctuation. As explained previously, fluency is closely bound up with comprehension.

How Children Use IMM

Research indicates that children may use IMM in ways not intended by the producers. Because such patterns of use may be perceived as inhibitive or facilitative factors, theory and research concerning such behaviours needs to be included in the literature review.

It has been shown that children tend to access only a few of the available features, the most accessed in talking books being the verbal narrative (DeJean, Miller, & Olsen, 1995; Miller et al., 1994). It has also been observed that children may spend a lot of time accessing 'cool' elements such as animation hotspots, which tend to distract from the learning process (Lau, 1996b; Perzyllo & Oliver, 1992).

When reading talking books, some children tend to click on words they already know, termed 'overaccessing', and others tend not to click on words they don't know, termed 'underaccessing' (Collins et al., 1997, p. 34). Collins et al. (1997) found that underaccessing occurred most frequently when semantically possible miscues were made. It has also been found that children's patterns of clicking tend to change over time, usually with decreasing clicking (Chu, 1995; Miller et al., 1994). Thus, it appears that the relationship between accessing IMM elements and learning is not simple.

It is claimed that although talking about texts, and reflection, can enhance comprehension, children do not spontaneously talk to each other about the IMM-

based stories as they read them (Collins et al., 1997, p. 34). However, it must be noted that spontaneous talk is not automatic in the primary classroom and the teacher is often required to encourage and scaffold oral language.

Another aspect of how students tend to use ICT in the classroom involves peripherals such as the keyboard and the mouse, with disputes regarding who is going to have control not uncommon (Dejean et al., 1995). Using IMM in group contexts, therefore, is not automatically beneficial. The teacher needs to decide which children are likely to work together well in IMM contexts.

The ElectroText project (Horney & Anderson-Inman, 1994) spanned three years and focussed on ways in which students interacted with software. The ElectroText Authoring System was used to create hypertext versions of several short stories for students with low reading levels, and an electronic monitor recorded the students' interactions with the documents created. These recordings were analysed to isolate the patterns for interacting with the text that the students with low levels of reading ability demonstrated. It was found that the students engaged in skimming, checking, reading, responding, studying, and reviewing and it was concluded that students with access to supported text tended to use the studying pattern more frequently than any other (Horney and Anderson-Inman, 1994, p.33-4). Studying entails moving through the text in a systematic fashion, spending enough time on the text to thoroughly read it, and using supporting resources in an integrated way. However, it was found that the specific situation greatly influenced reading patterns.

Horney and Anderson-Inman (1999) have attempted to allocate specific 'reader profiles' to individual students and then compare them with the students' levels of comprehension and satisfaction with electronic reading. Results from the electronic monitor and comprehension scores as measured through story retells indicated that at least three types of supported-text readers were identifiable. 'Book lovers' read the electronic text as though they were reading printed texts, in a sequential fashion, paying little attention to embedded resources. These students preferred printed texts, often because of the physical nature of the book. 'Students' used electronic text in depth and accessed embedded resources frequently. They recalled the story in greater detail than did the 'Book lovers' and expressed pleasure in using electronic texts. Finally, 'resource junkies' did not take reading in an electronic environment seriously and spent much time accessing the various

multimedia elements, particularly the digitised pronunciations. Story retells for this group were very poor, although the students indicated that they enjoyed reading electronic texts. From these results it would appear that if students can be taught how to behave like 'studiers' they might achieve better results.

Bangert-Drowns and Pyke (2002) have compiled a taxonomy of the ways in which students can engage with educational software, which includes problematic forms of engagement, competent engagement and personalised/sophisticated engagement. These modes are further described in Figure 3.2.

Modes of student engagement with educational software	
Name of mode	Description
<i>Three problematic forms of engagement:</i> Disengagement Unsystematic engagement Frustrated engagement	<p>Student avoids or discontinues software interaction; sometimes inattentive, purposeless, disinterested tinkering with software elements</p> <p>Student shows no higher-order goals with software; moves from one activity to another without apparent reason.</p> <p>Student attempts to achieve specific software goals unsuccessfully.</p>
<i>Competent engagement:</i> Structure dependent engagement <i>Three increasingly personalised and sophisticated forms of engagement:</i> Self regulated interest Critical engagement Literate thinking	<p>Student navigates and operates software competently to pursue goals communicated by the software or teacher</p> <p>Student adjusts software features to sustain deeply involved, interesting, or challenging interactions for personally defined purposes.</p> <p>Student manipulates software to test personal understandings or operational or content-related limitations of software representations.</p> <p>Student explores software from multiple, personally meaningful perspectives; uses perspective-sensitive interpretations to reflect on personal values or experiences.</p>

Figure 3.2. Different types of student engagement in ICT contexts. From Bangert-Drowns and Pyke (2002).

It has been shown in this section that there are variations in the ways students interact with software and with other students in IMM contexts. Some of these modes of behaviour may be detrimental to learning and not what software designers anticipated. When integrating IMM in the classroom to assist children with reading difficulties, it seems necessary for teachers to be aware of these modes of interaction and to endeavour to reduce the impact of problematic forms.

How Teachers Use IMM to Help Students Who Experience Reading Difficulties

Educators have for some time appeared to be confused regarding why and how IMM may help students learn to read (Downes & Fatouros, 1995), and there is still little research evidence available to change this situation. Indeed, it has been argued that ICT has had little effect on formal education so far, partly because of the way teachers seem unwilling to diverge from traditional practices, which often incorporate a transmission view of learning (Salomon, 2002).

In preparing lesson plans and language programs, it has been found that educators may not always set objectives for using software and may not explain their purposes for using it. Thus, teaching using computers can be less 'targeted' and less well-planned than teaching that does not involve computers (Balajthy, Reuber & Damon, 1999). How IMM can be integrated into the wider language curriculum also seems to be problematic. Balajthy (1994) has shown that it is possible to integrate IMM into a 'whole language' program in a kindergarten setting. Nevertheless, research relating to integrating IMM into the literacy curriculum is still relatively limited.

One problem that educators face is the selection of appropriate software: they often do not find it easy to determine what aspects of IMM are educationally important (Lewin, 1997). Also, software they do select often matches their existing classroom practices (Collins et al., 1997), negating any possibility that students may benefit from the potentially transformational qualities of IMM, such as student control, non-linearity and the freedom to construct their own knowledge. Balajthy and his colleagues (1999) found that many teachers over-relied on software that emphasised drill and practice. In their study, the researchers were also surprised at the limited use educators made of available electronic books. It was hypothesised that

educators may see electronic books as mere 'edutainment'¹⁰, which may encourage too much 'off' task' behaviour. Balajthy et al. (1999) also found that the educators in their study, who were Master of Education students specialising in reading difficulties, did not make much use of the Internet, stating that they found it difficult to find material that was appropriate for the students they were teaching.

Moreover, it would appear that educators are not sure what their role should be when students are using computers. Thus, teachers often intervene minimally, even though a degree of supervision is essential if IMM is not to become of little more educational value than computer games (Mathew, 1997). When using ICT for learning, it may be appropriate for teachers to adopt a 'power with' stance as opposed to a traditional 'power over' stance (Bansel, 1998). That is, teachers and students should share power and collaborate in order to facilitate learning. Teachers may find it useful to see themselves as 'facilitators' or 'co-constructors' (Beccher & Arthur, 2001) who empower students to learn, rather than as repositories and transmitters of knowledge.

There are several documented difficulties or barriers (Bailey, Ross, & Griffin, 1995; Baker & O'Neil, 1994; Dias, 1999; Lund & Sanderson, 1999; Pelgrum, 2001) and catalysts to the use or the integration of ICT into the curriculum (Holland, 2001). According to Byrom's (1998) literature review on the integration of technology into educational programs, the main barriers to teachers' use of ICT can be grouped into five main categories, namely: lack of teacher time; lack of access to hardware and software; lack of vision in leadership and planning; lack of teacher training and support; and current assessment practices, which may not reflect what students learn with technology. All of these factors impinge on the ways in which teachers use ICT in the classroom.

Many difficulties in integrating ICT into the literacy curriculum may be because, as Salomon (2002) has suggested, the curriculum itself needs to be changed to accommodate new kinds of learning and new kinds of knowledge. However, much curriculum design is outside the control of individual teachers.

¹⁰ 'Edutainment' is the term used for software that is both entertaining and educational. Sometimes such software seems to be minimally educational in that it encourages students to focus on supposedly entertaining features, such as hotspots, electronic shooting games and electronic colouring in.

Catalysts to the integration of ICT into the literacy curriculum include effective leadership and the development of a shared vision regarding the benefits of using ICT to improve learning outcomes (Byrom, 1998), committed teachers, collaborative school cultures, and onsite and ongoing professional development (Holland, 2001). It has also been suggested that teachers' flexibility or adaptability to change and technology in general is an important factor (Byrom, 1998).

Summary of Literature on IMM and Reading

In examining the research on IMM and learning, it appears that there can be no 'one best way' to use IMM. It can incorporate a diversity of different learning theories, and this will to a large extent dictate its use. Because there are so many types of IMM, and thus no straightforward principles about how it can be used, it seems that teachers need to be exposed to and proficient in the use of a range of different programs, and through a diagnostic approach, become able to judge the 'fit' between IMM-based activities and the needs of individual students.

In order that teachers might better use IMM to help students who experience reading difficulties, they require adequate initial teacher training and professional development. The literature in this area is reviewed in the following section.

Teacher Education and Professional Development

Professional Development

It seems to be widely acknowledged that:

'The capacity of teachers to use technology in classroom instruction has not kept pace with the increased access to technology in schools.'
(Sandholtz, 2001, p. 349)

The issue of the professional development of teachers in the area of literacy and ICT, however, is complicated, not least by the fact that new technologies are continually changing, necessitating the provision of ongoing professional development (DEST, 2002; Wepner et al., 2000). Furthermore, there seems to be no consensus on the types of competencies and attitudes required by teachers and how best to encourage the development of these attributes.

What Do Teachers Need To Know?

Ramsay(2000, p. 71) has stated that teachers need:

'[L]evels of essential competence which will enable them to integrate information technology in ways which broaden and deepen the learning environments they create for students.' (Ramsay, 2002, p. 71)

This entails a degree of technical competence as well as pedagogical knowledge regarding how to use computers to facilitate learning. As stated in *Raising the Standards* (DEST, 2002):

The type of ICT competence needed by teachers is a collection of knowledge, skills, understandings and attitudes that are inextricably bound up with context and pedagogy (DEST, 2002, p. 13)

However, much of the training provided to teachers seems to focus on the operation of computers and computer programs instead of on how to use technology as a teaching tool and how to integrate it across the curriculum (Zhao, Pugh, Sheldon, & Byers, 2002). Sandholz has stressed that:

Both pre-service and in-service teacher education must address the issue of preparing teachers to not only use technology but to integrate it into instruction. (Sandholtz, 2001, p. 350)

It is not expected, however, that all teachers should reach identical levels of competence (DEST, 2002). Depending on their interests and aptitudes, some teachers should develop a high level of competency and become leaders in the field, offering support to their peers, whilst others should reach a basic level of competency, which involves being able to operate a computer and several software applications for use in the classroom. Burns has suggested that 'just enough' knowledge is adequate for most teachers and that it is unnecessary for all teachers to reach a high level of expertise (Burns, 2002). Depending on what role they are expected to play in the implementation of IMM to help children who experience reading difficulties, and how much support they receive, this viewpoint may have some merit.

A fundamental difficulty in the area of teacher professional development in the use of ICT in the curriculum is a shortage of exemplars (DEST, 2002). That is, there has been a relative lack of documentation and analysis of 'best practice'. This makes it difficult for teacher educators to identify and use effective strategies and principles. Also, there is the question as to whether teachers are to be taught to 'assimilate'

technology into literacy instruction, which entails fitting the new technology into existing conceptions of literacy and pedagogy, or 'accommodate' technology into literacy teaching, which will necessarily involve the deconstruction of existing ideas about how literacy should be taught and subsequent pedagogical transformation (Reinking, Labbo, & McKenna, 2000).

Furthermore, there are questions regarding which is the best model of professional development to use in this context.

How Do Teachers Learn About ICT and the Curriculum?

Phases of teacher development

It must be recognised when providing professional development that different teachers are at different levels of development with reference to the use of ICT in the curriculum, and several different continua exist to help in the identification and classification of teachers' levels of expertise. Their location on a continuum should to some extent determine the type of professional development they receive.

Education Queensland (2002) suggests four stages of development, namely 'minimum', 'developmental', 'innovator' and 'leader'. Teachers at the first level of development have minimal knowledge of ICT and how to use it to facilitate learning. At the developmental level, they are beginning to use ICT in the classroom and may be proficient with one or two programs. Innovators have more knowledge and confidence and begin to use ICT innovatively to facilitate learning. Leaders have a high level of expertise in the use of ICT to facilitate learning and are in a position to educate and support other teachers in this area.

Holland (2001) uses the terms: 'non-readiness', 'survival', 'mastery', 'impact', and 'innovation'. In this continuum, 'non-readiness' refers to those teachers who are fundamentally resistant to using computers and have little if any knowledge of how to use them. Such teachers often dismiss the value of technology for their personal or instructional use and may criticise technology as just another educational 'bandwagon'. 'Non-ready' teachers often show fear when using computers and state that they are afraid of damaging the hardware or the software. Also, they often see the use of technology as 'complex and troublesome' (Holland, p. 250).

Teachers at the 'survival' level of development are essentially focused on their own personal learning and use of technology. According to Holland, (2001, p. 251):

Teachers at this level of professional development in technology tend to be preoccupied with their own learning about technology and how they themselves can use it. These teachers may have acquired proficiency in one or more particular computer applications, such as word processing or *PowerPoint* (1997) presentations, but they have not yet developed either sufficient skill or confidence to look beyond technology as a thing in itself, to see it as a tool that can be used to further their curricular goals.

Such teachers often find it difficult to deal with technical problems, which can hinder their use of ICT in the curriculum. Teachers at this level need support and many opportunities to build their level of competence and confidence.

At the 'mastery' level of development, the unevenness of teachers' development becomes apparent. Teachers may demonstrate a high degree of competence in the programs most relevant to the curriculum areas taught. Thus, their needs and interests begin to influence the direction of their development. Because teachers have achieved mastery in the use of particular items of hardware and software, it does not necessarily follow that they have achieved mastery in the pedagogy of using the technology to maximize students' learning. Often they tend to see the technology itself as a main focus, rather than the curriculum content (Holland, 2002).

At the 'impact' level of professional development, teachers are beginning to see the use of technology as a means to an end rather than an end in itself. They have shifted their attention from their own personal use of computers to how they might be used as instructional tools. According to Holland (2002), it is not until teachers have completely mastered the use of computers for their personal purposes that they are fully ready to attend to how they can be used in the classroom. Teachers at this level are typically familiar with several technology applications in the classroom and require their students to use one or more of these on a weekly basis. Such teachers attempt to design ICT based activities that require a degree of higher-level thinking, and they are often independent of technical support personnel.

At the 'innovation' level of professional development as outlined by Holland (2002), teachers change their instructional practice and also use technology in

sophisticated ways to plan, manage and research their teaching. Largely because of constraints on their decision-making due to school and district requirements, few teachers actually attain the innovation level of professional development, at least in the US where Holland conducted her survey.

Dwyer, Ringstaff and Sandholz (1990) use a similar continuum, with the terms 'entry', 'adoption', 'adaptation', 'appropriation' and 'invention', which are similar to the phases described above. At the entry level, teachers have minimal knowledge about ICT and its use in the classroom, at the adoption stage, they begin to use ICT in the classroom, at the adaptation stage they have the confidence and knowledge to adapt or modify ICT to their particular purposes, at the appropriation stage they have a sense of ownership of the ICT, and at the invention stage they are highly inventive and can use ICT in novel ways for novel purposes, and may even design their own multimedia programs.

All of the above continua describe teachers at different points of their learning journey in how to use ICT to facilitate their students' learning. However, they all focus on ICT independently, out of the complex classroom context. It may not be valuable to gauge a teacher's competency in such a simplistic manner, as the use of ICT in the classroom is necessarily closely intertwined with a number of other teacher competencies, such as identifying needs and assessing outcomes.

'Designer' and 'consumer' teachers

A distinction has been made between 'designer' and 'consumer' teachers. A designer teacher is one who feels empowered and has:

[A]ssumed the responsibility to become a *designer* of instruction and to reflect on teaching practices to improve instruction. Contrast the designer teacher to the less active, less involved *consumer* teacher, who implements someone else's philosophy, materials, and methods. (Pasch, Sparks-Langer, Gardner, Staiko, & Moody, 1991, p. 1)

It has been claimed that teachers in Australia are all too often 'consumer' teachers, who overrely on packaged instructional solutions provided by commercial bodies (Luke, 2001; Snyder, 1999). It would seem that teachers at the more advanced points of the continua outlined previously would be most likely to have the knowledge and confidence to become 'designer' teachers, not only in the context of IMM and learning but in all areas of classroom teaching.

It has been suggested that teachers need to learn about how to use hardware and software for their own purposes before they are ready to learn about how to use ICT in a classroom context. However, there is no consensus on exactly how this should be done. As will be discussed, there are several theoretical models of teacher education and professional development.

Models of Professional Development

Mouza (2003) has reviewed the literature in this area and states that there are four main reasons why many professional development models fail. Firstly, much professional development takes place away from the school site, and is often decontextualised from classroom learning. Secondly, teachers often find that the activities they learn about are irrelevant to their classroom practices. Thirdly, 'one-shot' workshops are often conducted without any follow-up support for teachers. Finally, the individual needs and concerns of teachers are rarely addressed. For example, prior knowledge about ICT or level of development (Dwyer et al., 1990; Holland, 2001) of the teacher, is often ignored.

The 'training' model of teacher professional development, which entails one-off sessions away from the classroom context, has traditionally been the dominant means of professional development. However, it has been suggested that teachers best learn through programs in a context of practice, which allow them to observe and work in classrooms with students. 'Situated teacher development', developed as a result of the Apple Computers for Tomorrow Project (ACOT) (Dwyer et al., 1990) is an alternative to the training model. It allows participants to watch and engage with expert teachers, who model instructional practices as they work with students within a classroom context. In this way, the experts can 'provide teachers with a framework in which they can examine the results of these practices on student work and interactions' (Sandholtz, 2001, p. 355).

Through situated teacher development, teachers can experience innovative uses of technology in authentic contexts, and can see the processes the expert teacher uses, such as decision making, as well as the abandonment and modification of plans. In this model, theory and practice are closely integrated, which may facilitate reflective practice.

Similar to the situated teacher development model is 'mentoring', which involves one teacher supporting another through activities such as observation in each other's classrooms, demonstration and coaching, conferencing and providing feedback and joint preparation (Alderman & Milne, 1998).

According to Sandholz (2001), further essential components of effective technology programs for teachers include: teacher input into the design, participant choice, administrator involvement, situated teacher development, participant collaboration, constructivist environment, flexibility, and adequate funding.

Effective mentoring is essentially based on interpersonal communication, through which mentors and their protégés can develop along the three phases of the mentor/protégé relationship. These three phases involve the establishment of the relationship, working together, and evaluation/follow-up (Alderman & Milne, 1998).

In-service professional development differs from initial teacher education in that experienced teachers are likely to have more established philosophies and routines than pre-service teachers and thus be more resistant to change. King (2002) is of the opinion that 'transformational learning theory' may be used to help educators overcome such resistance. She states that transformational learning theory can provide insight into the way adults learn through a process of critical reflection and self-examination of their world-view, taking into account new knowledge. Adult learners must often shift their view of the world in order to incorporate new knowledge, values and expectations. Thus, the frame of reference of the learner is constantly evaluated and re-evaluated in the light of new knowledge. As it is dissonance between old and new ideas that often impedes the accommodation of new knowledge, it seems reasonable that learners need to somehow build bridges between the two. According to this model, teacher attitudes and values, as well as prior knowledge, are deemed to be critical.

Teachers are not passive consumers of research findings and associated theory. 'The current conception of a teacher describes a person who mediates ideas and constructs meaning and knowledge, and acts on them.' (Richardson & Anders, 1994, p. 202). Not only do teachers filter knowledge through their own perspectives, they also receive knowledge from a variety of sources, some of which may be of inferior quality. They gather it from peers, non peer-reviewed articles and websites, peer-

reviewed articles and commercial books, as well as from reflections on their own experience. Much of this knowledge may remain tacit and is thus less amenable to critical evaluation and reflection. Transformational learning theory is one means by which this tacit knowledge can be made explicit and thus amenable to reflection and critique. In order to facilitate on-going professional development, it has been suggested that 'collaborative decision-making cultures' be encouraged. These cultures constitute good venues in which discussion and reflection might take place (Richardson & Anders, 1994).

Darling-Hammond (1998, p. 5) points out that successful professional development strategies share several features, such as engaging teachers in concrete tasks, being grounded in teachers' questions, being linked to teachers' work, and being supported by sustained modelling, coaching and problem-solving.

Similarly, Beavers (2001) has suggested three models for effectively integrating technology into the curriculum, namely, peer coaching, study groups and thematic curriculum. As the name suggests, peer coaching involves teachers supporting each other through sharing their knowledge and providing ongoing monitoring. Study groups, according to Beavers, should be mandatory and consist of no more than six members. These groups should conduct research into areas of interest and need to be related to their professional development in the area of integrating ICT into the curriculum.

Initial (Preservice) Teacher Education

According to the US National Reading Panel (National Institute of Child Health and Human Development, 2000), there is a correlation between the quantity and quality of inservice teacher education and student outcomes, whereas the link between preservice professional development and student outcomes is less clear. However, others have found that there is a link between *quality* initial teacher education and excellence in classroom teaching in the area of literacy (Maloch, 2003). The U.S. National Commission and Sites of Excellence in Reading Teacher Education (SERTE) found that teacher education sites which provided exemplary initial teacher education programs were marked by several features, including the articulation of a clear mission and faculty members who had commitment and vision regarding their programs, and who used personalised teaching to meet their students' needs. Also,

such institutions often used apprenticeship models of teaching, including closely supervised field experiences or practicums that were clearly integrated with course content, and the development of communities of practice, as well as the insistence upon high standards. Finally, faculty exercised autonomy in that they were able to use creative and flexible and creative approaches to meet the needs of preservice teachers. Teachers graduating from the SERTE sites tended to be superior to others in instructional decision making, self-efficacy, meeting students' individual needs, reflecting upon their practice, and seeking to become part of professional learning communities (Maloch, 2003).

Because of the link between preservice teacher education and teacher performance and professional characteristics, it appears that it is essential to address the integration of ICT into curriculum areas during preservice teacher education. Indeed, Morrow, Barnhart and Rooyackers (2002, p. 220) have suggested that the use of technology should be integrated into the teaching of student teachers, as this will model how technology can be used as well as emphasise the importance of the use of technology in education. Thus, they should be taught *through* and with ICT, not just *about* ICT. This view is supported by the IRA's 'position statement' (International Reading Association, 2001).

However, Sandholz (2001, p. 351) has pointed out that most student teachers do not routinely use technology during their periods of practical school experience and do not get the chance to work with 'master' teachers and university supervisors who can advise and support them in this area. Sandholz (2001) asserts that if student teachers do not observe the use of technology in classroom contexts, it is not highly likely that they will integrate technology into their own teaching, even if they have learnt the potential uses of technology in their university based teacher education.

A further difficulty is that many preservice teachers appear to be overconfident in their ability to use ICT when compared to their actual practice (Whetstone & Carr-Chellman, 2001). That is, because they have used computers for such tasks as word processing and accessing the Internet during their undergraduate studies, they think that these skills will suffice in the classroom.

Teale, Leu, Labbo and Kinzer (2002) have suggested that preservice teachers best learn complex skills through a case study approach, whereby they learn to think

like an 'expert'. Through interacting and working with experts or mentors, discussions with peers, reflection and scaffolded guidance from mentors, novices can learn to think like their more experienced counterparts. In this way, they can gain conditional knowledge, which is the ability to analyse effectively and creatively. This seems to be a necessary precursor to invention, although it must be acknowledged that in Western Australian schools there seem to be few ICT experts who could play the role of mentor at the present time.

King (2002) has suggested that preservice teachers should be viewed as adult learners and, as such, the adult learning theory of transformational learning provides a good framework from which to view their development in educational technology. This theory acknowledges that adult learners have prior conceptions that may conflict with the new learning, and that they often need to critically examine their beliefs, assumptions, and values in the light of new knowledge. Adult learners often have to change their worldviews in order to incorporate new knowledge, values and expectations. In this way, teacher resistance to change may be reduced. Thus, the importance of reflection and critical thinking in formats of discussion, journal keeping, small group projects and 'hands-on' experiences with technology must be emphasised.

Summary of Literature on Teacher Education in Integrating ICT into the Literacy Curriculum

To summarise the literature on teacher education into the use of ICT, including DMM, it appears that there is a great degree of support for education that is contextualised, or that takes place in the classroom context. Professional development appears to be more effective if it is ongoing and supported by mentors or experts, who can take into account individual teachers' needs, attitudes, values and prior knowledge.

Preservice teacher education is an area that appears to deserve further emphasis, as there appears to be a link between it and teacher performance (Maloch, 2003). The literature suggests that preservice teachers need to be involved in learning through and learning about ICT throughout their education, both at university and in schools. Ideally, they need to work with expert teachers on their school placements,

who will guide them through the processes of using ICT to assist children learn literacy.

Conclusion of Literature Review

It has been shown in this chapter and in Chapter Two that, although there is some literature on how teachers might use IMM to help students learn to read, there is little literature to date on the ways in which they might go about the process of using IMM in order to address the learning needs of individual children who experience reading difficulties. Furthermore, there is limited literature on the problems and successes teachers might encounter when using a diagnostic and formative approach in order to do this. This study is intended to go some way towards narrowing this gap.

CHAPTER FOUR

METHODOLOGY

This chapter begins with a discussion of the limitations of traditional research methods and why the formative experiment was selected as the most appropriate methodology for this particular study. Also in this chapter, the measures used in this study (standardised and informal assessments) are described, along with the procedure, the participants from four different schools, data collection and analysis and issues of reliability. Finally, ethical considerations are discussed.

Limitations of Traditional Research Methodologies in Relation to Research Into IMM and Reading

The primary goal of this study was to explore the facilitative factors, inhibitive factors and unexpected outcomes that arose when educators used IMM to help participating students overcome particular reading difficulties. Because the study involved making modifications to instructional strategies and/or the educational environment, a research methodology that accommodated the researcher as an agent of change was essential. After consideration of various methodologies, it seemed that the formative experimental design was the most appropriate. The inadequacies of traditional methodologies in relation to this type of research and the advantages of the formative experiment methodology are discussed below.

Although the U.S. National Reading Panel have acknowledged that there has not been a great deal of it (National Institute of Child Health and Human Development, 2000), much of the research to date on IMM and reading has been quantitative. However, a major problem of using quantitative research methodologies in researching literacy in an IMM context is the impossibility of controlling the many variables that might explain differences between experimental and control groups (Reinking & Bridwell-Bowles, 1991). In addition to this, comparison between conditions (IMM versus non-IMM) may be invalid in that the instructional method associated with the IMM may be what causes the effect, and not the IMM per se

(Ayersman, 1995; Salomon, 2002). Also, many of the quantitative studies carried out can be criticised on the grounds of methodological flaws, such as small, non-random samples. For example, an often-quoted experimental design study by (Miller et al., 1994) was based on only four subjects.

Mercer and Scrimshaw (1993, p.187) point out that:

[T]he findings of experimental studies appear to have little apparent validity for teachers, if the experiments appear to screen out too many factors which operate in real classrooms, making their findings only partly applicable there. In short, for practitioners, experimental studies often provide a spur for reflection and further enquiry, but not a source of answers to problems of classroom implementation.

On the other hand, existing qualitative research in the area of IMM and reading can often be criticised for failing to adhere to recommendations for ensuring 'trustworthiness'. A prolonged period of time in the field, the triangulation of methods and data sources and seeking verification of interpretations from participants and others (Guba & Lincoln, 1982) are examples of recommendations for research that have not always been followed. Furthermore, it could be argued that traditional qualitative research designs are inadequate in the context of helping educators improve practice because they tend to focus on 'what is', rather than 'what could be'.

The U.S. Center for Applied Research in Technology (CARET), which was established to review research and evaluation studies to identify, summarise, and disseminate any practical implications, has listed major weaknesses of the 650 studies it reviewed (Cradler, 2003). According to CARET, a fundamental weakness of many studies into using technology in education was that the researchers did not clearly state what research or evaluation questions they were seeking to answer. CARET claims that many studies were also flawed because they were purely descriptive with no quantitative measures, and because they did not include control or comparison groups. As already discussed, however, comparison studies are often unable to take into account complex contextual factors and tend to over focus on the product at the expense of the process and the context.

In addition, CARET states that many studies that did have an 'appropriate statistical design' and that they failed to describe the intervention adequately in that the context and conditions under which the intervention took place were not

adequately described or linked to findings and subsequent conclusions. CARET also states that conclusions reached by researchers into ICT and education were often not supported by the data collected.

Another limitation of quantitative studies in the area of learning and ICT is that, when standardised tests of academic achievement have been used, they have sometimes failed to relate clearly to the intended outcome or the teaching/learning strategies and resources used, rendering the studies invalid. On occasion, inadequate measures have been used, for example subjective or unvalidated tests (Cradler, 2003, p. 3).

The formative experiment, although having some limitations of its own, is a means of minimising the shortcomings of much previous research into the use of IMM to facilitate learning (Reinking & Watkins, 2000).

Formative Research

The limitations of traditional methods of inquiry in educational research are such that they have not been able to satisfactorily address two questions that are crucial to instruction. These questions are:

What factors add to or detract from an intervention's success in accomplishing a valued pedagogical goal?

How might the intervention be adapted in response to those factors to better accomplish that goal? (Reinking & Watkins, 2000, p.4)

Formative research design overcomes these problems as it allows researchers to become actively involved with the participants and institutions involved in their research (Jimenez, 1997) and to encourage change. Jacob (1992) has pointed out that formative experiments aim to improve instruction through the combination of qualitative methods of investigation and interventions in learning situations. The epistemological stance associated with formative experiments is pragmatism (Reinking & Watkins, 2000). In other words, data collection, analysis and interpretation are focussed on the pedagogical goal(s).

It must be noted that there are several varieties of formative research, such as action research and formative evaluation research. These two particular forms of

research are related to each other but are not yet clearly distinguishable (Reinking & Watkins, 2000).

Action research can be defined as follows:

Action research is any systematic inquiry conducted by teacher researchers, principals, school counsellors, or any other stakeholders in the teaching/learning environment, to gather information about the ways that their particular schools operate, how they teach, and how well their students learn. This information is gathered with the goal of gaining insight, developing reflective practice, effecting positive change in the school environment (and on educational practices in general), and improving student outcomes and the lives of those involved. (Mills, 2000, p.4)

Action research is clearly similar to the formative experiment in that it focuses on gathering information with the goal of effecting educational change. It involves identifying an area of focus, collecting data, analysing and interpreting data and developing an action plan. It is also similar to formative experiments in that it is an 'approach to improving education through change, by encouraging teachers to be aware of their own practice, to be critical of that practice, and to be prepared to change it' (McNiff, 1988, p. 4).

However, action research differs from the formative experiment in that it is usually conducted by teachers for teachers and is not imposed on them by someone else (Mills, 2000). In action research, the teachers themselves choose the area of focus, determine research collection techniques, collect, analyse and interpret the data, and develop action plans, whereas in a formative experiment they may participate in these processes but they do not enjoy the same degree of autonomy. Furthermore, the results of action research are often not disseminated beyond the school itself

Formative evaluation is a method used for looking at innovations, educational or otherwise. The information gained is for the developer of the innovation (i.e. the researcher/teacher) to use in order to inform modifications:

The developers introduce the innovation into a suitable context, or a small number of contexts. They then monitor its use to determine how its features work, with the goal being to make appropriate modifications to the innovation. (Bruce & Rubin, 2000, p.6)

According to this description, formative evaluation research seems almost indistinguishable from formative experiments. However, formative experiments are broader in their scope than evaluation research and they do not necessarily restrict their audience to the 'developer' of the innovation. Formative evaluation is an important component of formative experiments, but is not the same thing.

Formative experiments have been defined by Newman (1990, p.10) as follows: 'In a formative experiment, the researcher sets a pedagogical goal and finds out what it takes in terms of materials, organisation, or changes ... to reach the goal.' There are also some similarities between formative research and 'reflective practice' (Henderson, 1992) and 'diagnostic teaching' (Walker, 2000), which many teachers practise as a matter of course. Van Lier (1996) has suggested that reflective practice and academic research can be seen as the two extremes of a continuum, with increasing systematisation, documentation and sharpening of questions marking the academic research. The formative experiments implemented in the present study were systematic and well documented, and thus distinguishable from teachers' everyday reflective or diagnostic teaching. The relationship of this type of research to reflective practice and to academic research in general is illustrated in Figure 4.1.

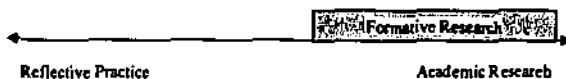


Figure 4.1. The relationship between formative research, reflective practice, and academic research.

The formative experiment as a research design is still evolving, but has been used successfully in several studies. Jiménez (1997) used this design in order to help teachers improve their practice in teaching five low-literacy Latina/o readers in middle school. The formative experimental design was selected because there was a desire to go beyond the typical qualitative research foci of observation, interviews and document analysis, and to become actively involved with the participants in order to bring about change. In this instance, a series of cognitive strategy lessons was carried out, with responses systematically recorded. These responses were then used to shape and modify the experiment in various ways so as to achieve the pedagogical goal, which was to improve the students' comprehension of text. All five

students were reported to have derived some benefit from the cognitive strategy lessons.

Reinking & Watkins (2000) used a formative experimental design to find out how the use of multimedia book reviews might increase the independent reading of elementary students. Diverse qualitative and quantitative data were gathered during two academic years in four 4th grade and five 5th grade classrooms in three schools. The first six weeks were spent gathering qualitative data in order to gain a thorough understanding of the students, teachers, classrooms and schools. Observational field notes and interviews with students and teachers were the main methods of data collection in this phase. Quantitative data were also collected to establish a baseline to facilitate the comparison of the amount of independent reading before and after the intervention. Students were then taught how to write multimedia book reviews using the multimedia software *HyperCard*. Four students were chosen in each classroom, although they were not aware that they were the focus of attention. A formative experiment was conducted with the goal of increasing the students' independent reading. This pedagogical goal was reached and several unplanned consequences were identified. Because data were collected across more than one classroom context, it was also possible for the researchers to observe variations in the effects of the intervention, and to speculate about the mitigating factors involved. Reinking & Watkins conclude that formative experiment methodology has the potential to be a very useful means of exploring the use of technology in order to enhance reading. Formative experiments have also been used in areas of educational research other than literacy research, such as the analysis of team teaching within a classroom context (Welch, 2000).

Formative research typically follows a case study approach as case studies can accommodate studies that are exploratory in nature, and lend themselves well to teacher-researcher collaboration. Formative research involves 'designed cases' rather than 'naturalistic' cases, as the researcher manipulates the situation under investigation and then 'formatively evaluates the instantiation' (Reigeluth & Frith, 1999, p.637).

This type of research has, however, been criticised for its tendency to be 'atheoretical' (Pigott & Barr, 1998) and its lack of applicability to contexts other than the one it investigates. Pigott and Barr have suggested that these limitations can be

assuaged by grounding all formative experiments in theory and by clearly reporting what works, for whom, and why. Alternative explanations for results and confounding factors must also be sought.

Design of the Study

The formative experiment design used in the study was informed by two sets of data. Firstly, baseline data were collected. This described what was happening in each of the four participating schools, in terms of teachers' experience, teaching strategies and perceptions. Data describing individual students with reading difficulties were also collected, as were details regarding how teachers normally helped them overcome these difficulties and what role IMM played in this.

Secondly, data were collected on how educators (classroom teachers and support teachers, with the assistance of the researcher) took a formative approach to planning, implementing, evaluating and modifying IMM-based activities for particular students with reading difficulties. This entailed constantly monitoring and evaluating the effects of the activities and modifying them accordingly, with reference to the specific pedagogical goal(s) identified by the teachers. Qualitative and quantitative data were gathered in order to trace the impact of the implementation in terms of the extent to which the pedagogical goals were achieved. Also, facilitative and inhibitive factors were identified and used to inform modifications to the IMM-based activities.

The study, therefore, focused on educational problem solving (Henderson, 1992) in the form of a series of cycles of activity, which can be defined as formative experiments. The stages of the cycle have been labelled according to a modification of Trochim's (2002) planning-evaluation cycle. Trochim's cycle starts with the formulation of the problem (or identification of students' learning needs). Secondly, possible (teaching-learning) strategies are conceptualised. Thirdly, these alternatives are assessed and the most appropriate selected. Fourthly, the implementation is carried out. Fifthly, evaluation techniques are devised and implemented, and finally the evaluation data are analysed and the results used to inform modifications and the design of subsequent cycles.

The Planning-Implementation-Evaluation (PIE) cycle is illustrated in Figure 4.2. and is a modification of a cycle originally designed as a management tool. It is similar to many found in the educational arena, such as the 'cycle of reflective learning' (Pollard & Tann, 1993) and the generic action research cycle (Macintyre, 2000, p.1). It fits with the process of the formative experiment in that it is concerned with stages of planning, implementation and evaluation, but it also involves more detailed steps, such as the formulation of the problem (learning needs) and the conceptualisation of possible strategies. The cycle appears to offer a logical sequence in which to search for data and to finally display and discuss the findings, although it is a highly simplified representation of the process. It must be noted that within the PIE cycle there may be 'micro cycles' of planning, implementation and evaluation.

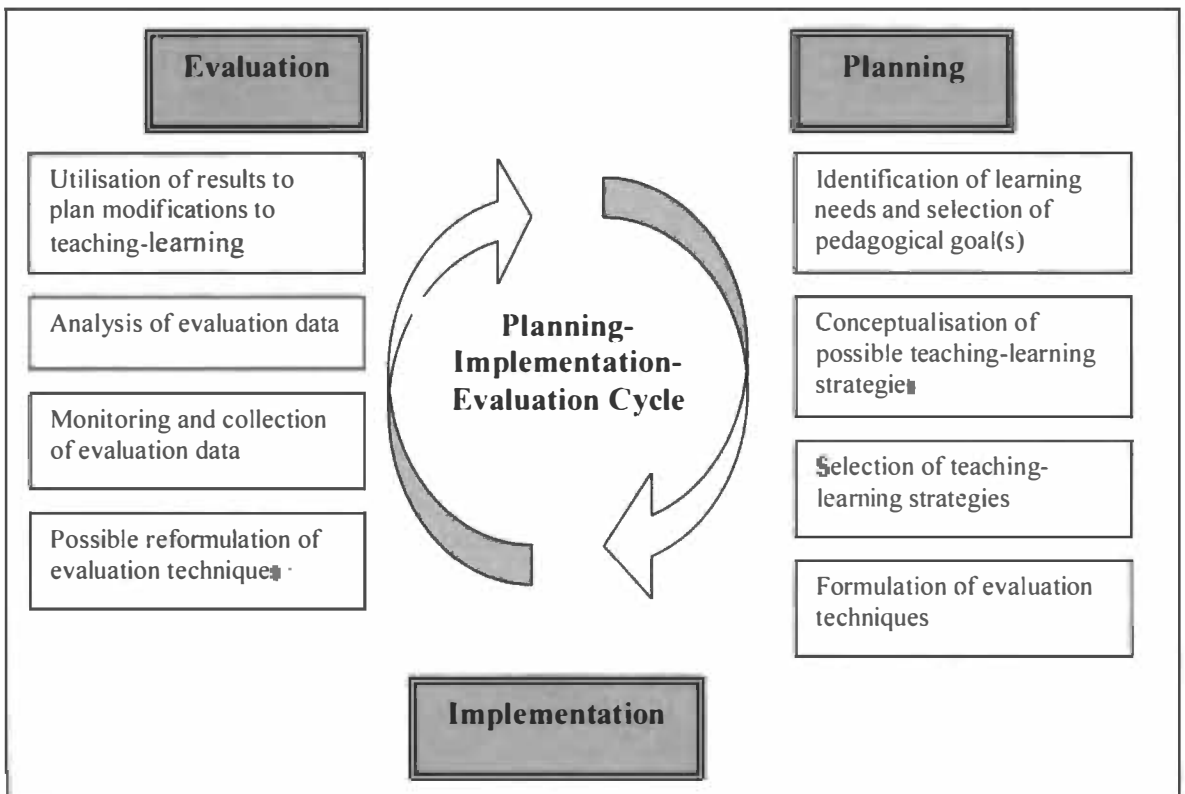


Figure 4.2. Planning Implementation Evaluation (PIE) cycle (modification of Trochim, 2002)

Procedure

A pilot study was carried out prior to the main study, which is described in Appendix One. For each case in the main study the following schedule (see Table 4.1) was followed:

Table 4.1. Schedule of research

Activity	Participants
Distributed letters of consent and transfer of information (if appropriate) forms that were completed before data collection started.	All
Met participating teachers to decide which students with reading difficulties (approximately 4-5 in each class) would participate in the study. Teachers brought information about students with reading difficulties to facilitate the decision-making. Duration: 1-2 hours (each teacher).	Teachers Researcher
Met participating teacher(s) individually for tape-recorded interview to gain background information about the selected students and the teacher's beliefs/experiences. Duration: Approx ½ - 1 hour (each teacher).	Individual teachers Researcher
Met participating students individually for informal 'get to know you' talk about likes/dislikes and to administer Elementary Reading Attitude Survey. Duration: ½ hour each student.	Individual students Researcher
Met participating students to carry out reading assessments (e.g. Neale Analysis of Reading Ability, Peabody Picture Vocabulary Test), Multidimensional Fluency Scale. Duration: Approx 30 - 60 minutes each student.	Individual students Researcher
Observed in classroom to find out how the selected students worked in classroom context. Several sessions throughout the study. (Fieldnotes/Informal discussions with teachers).	Researcher
Viewed/analysed students' work samples, available records/documents.	Researcher
Met with teachers to discuss background/theory of using IMM to help students with reading difficulties - some strategies that could be used. Duration: ½ - 1 hour (each teacher).	Teachers Researcher
Met with teacher/s to discuss and plan IMM based activities. Duration: 2-4 hours.	Teachers Researcher
Other pre-intervention assessments carried out, depending on the pedagogical goal(s) to be focussed on.	All
Teachers and researcher implemented the IMM based activities. Observation by researcher (video) and teacher. All participants kept journals. Duration: Several weeks for each case (10-15).	All
Teacher(s) and researcher met regularly (approximately fortnightly) to view video recordings and discuss the implementation(s). Discussed problems and successes observed/experienced by all participants and possible modifications. Duration: ½ - 1 hour	Teachers Researcher

Modified implementation (started cycle again) and observed the effects. Duration: Several weeks for each case.	All
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Because the pedagogical goals varied between cases, the procedure also varied somewhat from case to case in that different implementations were selected and therefore different ways of teaching the students, observing the implementation and evaluating the implementation were employed. These variations will be discussed in full in each case study chapter.

Participants

A purposive sample was used, which involves selecting potentially 'information rich' (Patton, 1990) cases for study in depth, as opposed to the random sampling usually used by quantitative researchers. Participants were selected on the basis of specific attributes, which are described below.

Schools

Two government schools that were designated 'Technology Focus'¹¹ schools were selected, as it was considered that these cases would yield more fruitful data than non-technology focus schools. It was assumed that teachers in these schools would have had a higher degree of training in the use of ICT for learning than would teachers in other schools, and that such schools would have better access to hardware, software, and technical support. It was anticipated, therefore, that the study would be easier to 'get off the ground' and 'keep off the ground' in such schools, and that questions about what *could be* would more readily be answered.

All five designated 'Technology Focus' primary schools in the Perth Metropolitan area were invited by letter to participate. One of these schools did not respond, and the other four initially expressed an interest in participating. However, one of these schools could not participate because of a change of Principal and Technology Co-ordinator and another because the only teacher interested in participating said that he did not have any students with reading difficulties in his class. The remaining two of the five schools agreed to participate in the study.

Two private schools were also contacted. They were selected because I knew them as being committed to the use of Information and Communications

¹¹ Technology Focus Schools will be described in Chapter Seven

Technologies (ICT) for learning. One of the schools was a 'laptop' school, where each student in Year 5 or above had her own laptop. Both private schools agreed to participate in this study. One of these schools became the pilot study (see Appendix One), as it was the first school to allow access, the other participated in the main study

Participating educators

The participating teachers were from Perth (Australia) metropolitan Primary School teachers (Year 4 and 5). Each teacher was interested in using IMM to help students with reading difficulties and wanted to develop his/her practice in this area. In addition, each teacher worked at a school that was committed to the use of technology to facilitate learning (as described above). The researcher was a participant-observer in some phases of the study and an observer in others.

Participating students

The students were in Years 4 and 5 and experienced some reading difficulties, as identified by their teachers on the basis of existing records such as benchmark test results, personal observations, and other classroom records. This age group was selected because it could be argued that, if their reading difficulties were not resolved by this relatively late stage, their need for an alternative approach was great. It was decided to allow the teachers to identify the students who were experiencing difficulties as this is how identification is normally carried out in Western Australia, and the purpose of this study was to detect facilitative and inhibitive factors in identifying and assisting such students. It would hence not have been logical for the researcher to select students for the teachers, as it would have truncated the formative experiment and reduced the 'authenticity' of the study.

Participant researcher

In the formative experimental design, it is usual for the researcher to collaborate with the other participants to attempt to bring about change, or a desired outcome. The role that I played varied in this study, both within and between cases, although according to the possible roles for researchers outlined by (Gold, 1969), I played the roles of either 'participant-as-observer', 'observer-as-participant', or 'complete observer'. The participant-as-observer fully participates with the group and the group knows her identity as a researcher. The observer-as-participant is

known to the group as a researcher but makes little attempt to participate, and the complete observer observes without being involved in the activities of the group.

As a participant as well as a researcher it seems necessary to provide some background information about myself. My academic qualifications include a Bachelor of Arts (Hons) in Organisational Studies, which I completed at the Management School at Lancaster University in the United Kingdom in 1988. In 1993, I completed a Graduate Diploma in Education (Primary) at Murdoch University in Western Australia and in 2000 I completed a Master of Education at Edith Cowan University, Western Australia. For my Master of Education degree I completed a project that synthesised and evaluated research on the use of IMM to help students learn to read.

I have had some years of classroom experience, mainly as a middle primary teacher (Years 4 and 5), a relief teacher, and a Languages Other than English (LOTE) teacher. In addition, I have had experience in many other realms of work, including management, human resources and sales. I was employed throughout 1999 as a computer technician at a rural District High School and was responsible for maintaining the twelve computers in the school laboratory and approximately another ten in the classrooms. I dealt with hardware, network and software issues and took a keen interest in how the teachers were and were not using ICT to enhance their students' learning. I was also asked to educate the townspeople about the Internet and became a TAFE (Tertiary and Further Education) lecturer of a course called, 'Introduction to the Internet', which I had to write as well as deliver myself. I am currently a part-time lecturer in Language and Literacy, teaching pre-service teachers at Edith Cowan University, a role that some of the teachers with whom I collaborated in the study may have found slightly threatening.

I have used computers for many years, bought my first computer (a Dragon 32) in 1978 and taught myself BASIC programming. Since then, I have always had at least one computer at home, which I have used for work as well as recreation. All of the computer skills and knowledge I possess are self-taught (through reading and trial and error) and as a consequence of this, there may well be gaps in my knowledge as well as misconceptions. I have had no Professional Development in a school context on using ICT to further learning. The last time I was employed as a full-time classroom teacher, in the mid 1990s, my classroom was equipped with an

old BBC microcomputer with virtually no software, which was rarely used due to its limited functionality. My interest in ICT and literacy education was sparked by the literature in this area, as well as having two pre-school children who seemed to benefit from using CD-ROMs.

Table 4.2. displays an overview of the participating schools, students and teachers.

Table 4.2. The participants

School	Year	Students	Teacher	Support Teacher
St Clair's College Private	5	Brianna Claudia Becky	Nicole Nielsen	Susan Alessi
St Clair's College Private	4	Tamara Monique Bridget Amanda	Catherine Williams	N/A
Hillview Primary School Government	4	Andrew Ryan Anita Nada Rosie	Linda Harris	N/A
Morland Primary School Government	4/5	Mitchell Luke Zara Kerri	Sarah Fox	N/A
West Coast College Private (Pilot Study) ¹²	4	Hurry James Craig	Wesley James	Liz McDonald

¹² All names used in this study are pseudonyms

Full descriptions of the participants can be found in the following chapters.

Data Collection

The data were collected through a pilot case study that informed the main four case studies. Each case consisted of a classroom teacher, support teacher (if applicable), the researcher, and the participating students. Case studies are appropriate contexts for data collection in this study because they are holistic, and they provide a situation in which the complexities of integrated systems, such as reading in an IMM context, can be studied (Merriam, 1998; Miller & Olsen, 1998; Yin, 1994). Further, they can accommodate teacher-researcher collaboration

¹² See Appendix I.1 for details of this.

(Reigeluth & Frick, 1999). Because case studies are essentially dynamic (Yin, 1984), they are able to accommodate the formative nature of the study

Data collection and analysis followed many of the recommendations of (Miles & Huberman, 1984) in that there were some pre-existing conceptual frameworks that were subject to later revision. The pilot study also yielded pre-designed research instruments, such as observation guides, interview guides and a 'start list' of codes to facilitate classification (see Appendix 4.1). Data collection was guided by pre-existing orientations, the PIE cycle (Figure 4.2.) and by ongoing analysis.

The following data-collection techniques were employed:

- unstructured, semi-structured and structured interviews with teachers and students;
- journals- teacher(s), student(s), researcher;
- observation - field notes;
- examination of artefacts (eg teachers' records, lesson plans, programs, students' work samples);
- assessment of students to facilitate description (eg The Peabody Picture Vocabulary Test (Dunn & Dunn, 1997), The Neale Analysis of Reading Ability (Neale, 1988), the Elementary Reading Attitude Survey (ERAS) (McKenna & Kear, 1990);
- video recordings to facilitate discussion between teacher and researcher and to help inform further planning, implementation and evaluation.

How the data collection techniques relate to the research questions is illustrated in Table 4.3.

Table 4.3. Data collection techniques used to answer research questions

Research Question	Data Collection Methods
1) How do the participating educators typically help students who experience reading difficulties, and what role does Interactive MotiMandis (IMM) play in this?	Observation Semi-structured interview
2) How could the participating educators use a 'formative approach' to plan, implement, evaluate and modify IMM-based activities and programs to help students who experience reading difficulties achieve particular pedagogical goals? Sub-questions to guide the main question: 2a) What inhibitive and facilitative factors might educators encounter when planning, implementing and evaluating IMM-based innovations for students with reading difficulties?	Observation Video recordings Standardised tests e.g. Neale Reading Analysis, Peabody Vocabulary Test Journals Interviews: unstructured, semi-structured Analysis of work samples Analysis of other student records
2b) How can educators establish 'preferability' of the IMM based over 'traditional' activities?	Observation Video recordings Journals Interviews: unstructured, semi-structured with teachers Test results Informal assessment of students' work Interviews with students
2c) What 'unplanned outcomes' might result from using IMM based activities to assist students who experience reading difficulties?	Observation Video recordings Journals Interviews: unstructured, semi-structured with teachers Test results Informal assessment of students' work Interviews with students

Assessments Used in the study

Several standardised assessments were used at the beginning of the study and after the interventions. The purpose of these tests was to help diagnose the learning needs of the students as well as to measure any gains after the interventions had taken place.

Elementary Reading Attitude Survey (ERAS)

The Elementary Reading Attitude Survey (ERAS) (McKenna & Kear, 1990) is a North American standardised measure of reading attitude for students from Grade 1

to Grade 6. It contains 20 items, 10 of which inquire about recreational reading and 10 of which relate to academic reading or reading to learn (see Appendix 4.5). The items were selected from an item pool that was created from several earlier surveys. For the sake of consistency and to avoid respondents thinking that there are 'right' and 'wrong' answers, each item is worded with a uniform beginning, 'How do you feel ...'

The test has an engaging pictorial format, featuring the well-known comic-strip character, Garfield. Each item shows Garfield in four poses, ranging from very happy to very unhappy. An even number of scale points is intended to prevent respondents circling the central, neutral category.

This normed test can be given to an entire class, and must be administered according to the directions for use. This process involves familiarising the students with the test and with the purposes for giving it. The teacher then reads the items aloud and the students mark their responses. In this study, the ERAS was administered according to the directions of use to small groups of three to five students. The students were spread around the room to discourage them from copying each other's responses.

McKenna and Kear (1990, p. 628) identify strengths and weaknesses of the ERAS. Firstly, the test claims to provide quantitative estimates of two aspects of students' attitudes towards reading, but makes no claims regarding the identification of causes for poor attitudes or instructional techniques likely to improve attitudes. It is claimed, however, that the ERAS can be used to:

- (a) Make possible initial conjecture about the attitudes of specific students;
- (b) provide a convenient group profile of a class (or larger unit); or
- (c) serve as a means of monitoring the attitudinal impact of instructional programs. (McKenna & Kear, 1990, p. 628)

The ERAS was selected for use in this study because of its ability to make possible initial conjectures about the participating students as this was deemed to be important baseline information; it is widely recognised that a poor attitude towards reading adversely affects a student's reading performance (Lipson & Wixson, 1997).

McKenna and Kear (1990) claim that reliability of the ERAS is ensured by a high Cronbach alpha, a statistic that measures internal consistency of attitude scales. McKenna and Kear also provide evidence of construct validity.

A potential disadvantage of using the ERAS for Australian students is that some of the questions use North American terminology that Australian students may not understand. For example, item 7 asks, 'How do you feel about reading during summer vacation?', and item 9 asks, 'How do you feel about going to a bookstore?' To guard against any misinterpretation, the words 'holiday' and 'bookshop' were substituted for 'vacation' and 'bookstore' when read out by the examiner.

A further limitation of this test with reference to Australian students is the fact that the norming group was from North America. A Grade 4 student in North America would not be strictly comparable to a Year 4 student in Western Australia, not least because they may have started school at a different age. However, it was hoped that the results would at least provide scores for each participating student that were accurate in a relative if not an absolute sense.

The Neale Analysis of Reading Ability (NARA)

The Neale Analysis of Reading Ability (NARA) (Neale, 1988) is a standardised test of reading ability, intended for students from 6 to 12 years of age. It takes approximately 20 minutes to administer and consists of a series of graded passages for testing the rate, accuracy and comprehension of oral reading. Two sets of such passages are provided, along with comprehension questions, and there are parallel forms so that the test can be used for pre- and post-intervention testing.

The passages are presented in the form of a book, which Neale (1988) claims is an important symbol of literacy. Pictures designed to set the scene accompany each narrative text. There are four comprehension questions for the level 1¹³ narrative in each form and eight comprehension questions for the subsequent five passages. The comprehension questions test immediate recall of the main idea of the narrative, the sequence of events and other details, as well as inference. Comprehension is thus limited to literal and some inferential questions. The evaluative/appreciative dimensions of comprehension (Barrett, 1972) is not tested, which means that the 'text analyst' practice (Luke & Freebody, 1999) is ignored.

Recording the reader's errors assesses accuracy. The examiner is permitted to correct errors during testing. This facilitates the flow of oral reading and assists the reader in maintaining meaning. Errors are categorised as mispronunciations

¹³ See Appendix 4.4 for examples of the passages.

(decoding errors), substitutions, refusals, additions, omissions or reversals. Mispronunciations are words that are pronounced incorrectly, distorted or partially decoded. They are transcribed phonetically onto the recording sheet by the examiner and provide information on the way a child decodes words. Substitutions are real words that are used instead of the words in the passage, for example, 'lunch' instead of 'launch'. If the child pauses for 4 to 6 seconds without reading a word, the examiner supplies the word and records the failure as a refusal. When words or parts of words are inserted, they are recorded as additions. Omissions occur when words are omitted from the text. When a child substitutes a word for a reversal of the word, such as 'on' instead of 'no' or 'was' instead of 'saw', it is recorded as a reversal. Self-corrections are not counted as errors.

Rate is assessed by timing how many seconds the individual takes to read a passage and then calculating how many words were read per minute. This raw score is then used as a basis for finding the percentile rank, the stanine and for the reading age of the student in the conversion tables provided in the NARA manual.

The NARA provides detailed directions for administration, which were followed strictly in this study in all but one instance, which will be discussed in Chapter Six. Testing starts with the administration of a practice passage and proceeds until the student has made 16 errors, or 20 errors for passage level 6. If the individual exceeds the maximum permissible number of errors, the comprehension questions for that passage are not given. If the individual supplies an incorrect answer to a comprehension question, the examiner does not supply the correct answer.

The NARA was originally devised in the United Kingdom in the 1950s and has since been revised. The version used for this study was normed with reference to approximately 1100 students from South Australia and Victoria. The passages were written especially for the test and graded according to vocabulary, syntactic complexity and the length of the narrative. It is noted that no genres other than narrative are provided.

The reliability of the NARA is documented in the manual. Testing all of the students in the standardised sample with one form and then retesting them with another form approximately two weeks later determined reliability. The correlation coefficients between the parallel forms were .88 and .89 for rate, .98 for accuracy,

and .94 and .95 for comprehension. All of the correlations were statistically reliable above the .001 level of confidence.

Internal consistency refers to the extent to which items in a test all measure the same thing. Neale (1989) used the Kuder-Richardson reliability coefficient (KR 20) for this purpose. The overall coefficient for accuracy was .81 and for comprehension it was .90. Rate was not calculated.

The validity of the NARA has been ascertained in several ways. With reference to content validity, the selection of words in the passages was based on word lists such as the Dolch (1951) and, in the revised version, words were chosen that were in current use by students determined through the examination of contemporary instructional reading schemes. The criterion-related validity of the test was established by the use of the test to predict later performance or by correlating its score with other valued measures. Testing of over 1000 students in a standardisation sample and analysing the means and standard deviations for each age range assured construct validity.

The Peabody Picture Vocabulary Test - Revised (PPVT-R)

The Peabody Picture Vocabulary Test - Revised is 'designed primarily to measure a subject's receptive (hearing) vocabulary for Standard American English' (Dunn & Dunn, 1997). It can be used to provide a quick estimate of the verbal ability of students who have grown up in a standard English-speaking environment. It is also useful for gauging the vocabulary knowledge of bilingual students. Dunn and Dunn (1997) claim that oral language, and more specifically receptive vocabulary knowledge, is an important prerequisite to success at school in general and reading in particular.

The subject is shown a page containing four pictures. The examiner reads out a word, and the subject must either point to the corresponding picture or tell the examiner its number. As the PPVT-R does not require subjects to read or write, it is especially appropriate for people who have difficulties with written language.

Dunn and Dunn (1997) show that the reliability of the PPVT-R meets the criteria for inter-test reliability, which have been determined by correlations between test administrations. Internal consistency of the PPVT-R was by the split-half procedure. The split-half reliability coefficients for form M (the one administered in

this study as it is generally considered to be the more appropriate for Australian children) ranged from .75 to .85.

Alternate-forms reliability coefficients based on an immediate retest and delayed retest of subjects using the alternative form are also available. With a median of .82 for the immediate retest groups and a median of .78 for the delayed retest groups, the reliability of the PPVT-R appears to be adequate. The validity of the PPVT-R, or the degree to which the test measures what it claims to measure, is discussed in some depth in the manual.

Some limitations associated with the PPVT-R are as follows. Firstly, it measures only hearing vocabulary, which is just one aspect of language. Secondly, 'casual administration and scoring' of the test can be a serious limitation (Dunn & Dutu, 1997). However, in this study, all aspects of the administration were strictly carried out according to the manual. Through using Form M, all of the vocabulary items were words that are in common usage in Australia and did not include North American words such as 'closet' and 'vacation' (found in Form L).

The Multidimensional Fluency Scale

Zutell and Rasinski (1991) devised the Multidimensional Fluency Scale (MFS) (see Appendix 4.7.) as a means of facilitating the assessment of oral reading fluency. The dimensions it measures are phrasing, smoothness and pace, which can be rated on four-point scales. Although this is not a standardised test, it is a useful way to track a student's progress on these dimensions. Although it does not measure comprehension, this can to some extent be inferred if phrasing, smoothness and pace are appropriate for the text.

Data Analysis

Data analysis can be defined as 'working with data, organizing them, breaking them into manageable units, synthesizing them, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others.' (Bogdan & Biklen, 1992, p.153)

During the study, data analysis was not seen as a distinct stage of research. In formative experiments, data analysis is iterative and ongoing, and informs the

advancement of the formative experiment and subsequent data collection. Coffey and Atkinson (1996) have suggested that data analysis should be seen as:

[A] reflexive activity that should inform data collection, writing, further data collection, and so forth. Analysis is not, then, the last phase of the research process. It should be seen as part of the research design and of the data collection. The research process, of which analysis is one aspect, is a cyclical one. (Coffey & Atkinson, 1996, p. 6)

Miles and Huberman (1984) have also pointed out that data analysis often starts (frequently subconsciously) at the very beginning of a research project, before the researcher has entered the research sites, and is not necessarily something that begins during or after data collection. This is because the researcher has often generated a theoretical framework and various hypotheses, which they think about during the early stages of the research process. In the case of a formative experiment, it seems appropriate to see data analysis in this light because the impetus for such experiments is often some kind of problem or issue that the researcher has become aware of and has probably reflected upon to some extent. The research cycle adopted in this study is illustrated in Figure 4.3.

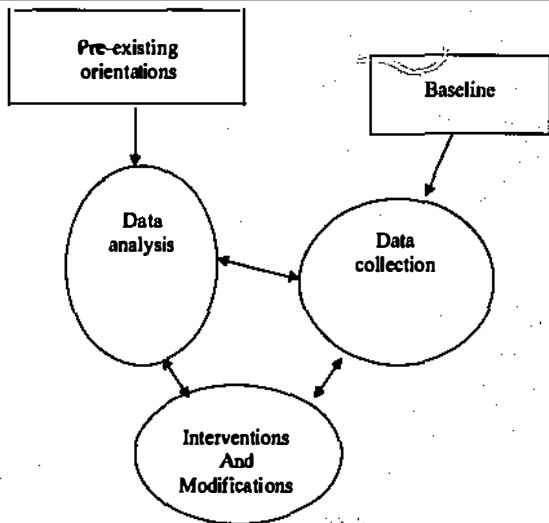


Figure 4.3. Data collection/analysis cycle in formative experiments

The use of techniques recommended by Miles and Huberman (1984) facilitated ongoing analysis. Techniques included:

- writing up field notes and transcribing tape recording soon after the contact, including reflective remarks;
- using 'Contact Summary Sheets' to summarise each contact;
- using 'Document Summary Forms' to clarify and summarise documents and note their possible significance;
- using 'descriptive coding' and 'pattern coding', with the assistance of NUD*IST software (N5)(2001);
- the isolation of several 'key events' or critical incidents (Patton, 1990)
- writing memos (ideas and theories about codes and their possible inter-relationships);
- displaying data in charts, narrative form, flow charts, and matrixes in order to facilitate the development of ideas about categories and inter-relationships.

The first stage of analysis took place as 'anticipatory data reduction' (Miles & Huberman, 1984, p. 21) when possible conceptual frameworks were being

considered, and when research questions, research sites, and participants were being decided upon. Most of this 'anticipatory' analysis was articulated in the research proposal for this study.

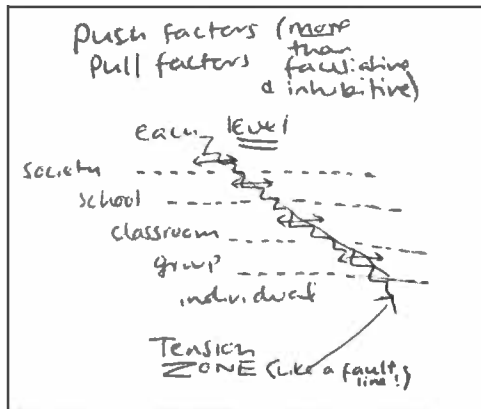
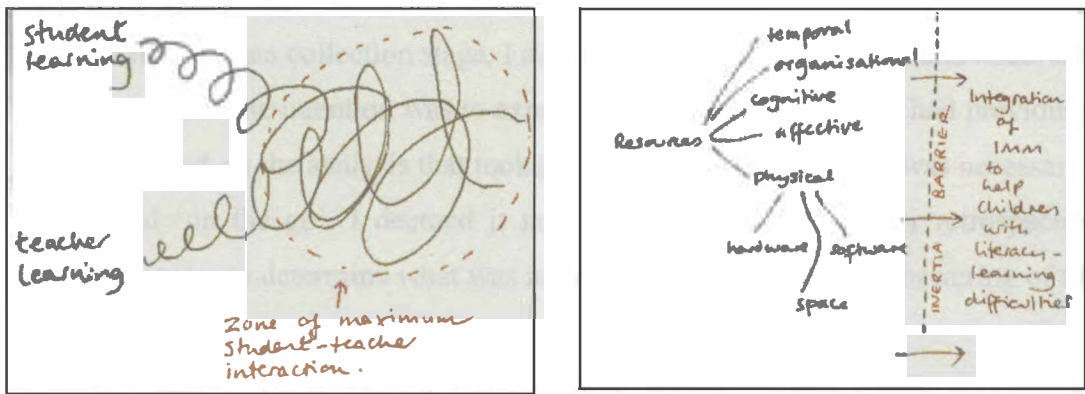
During the data collection stage, data were entered into the software for qualitative data analysis, N5 (2001) and memos and annotations were continually added in the light of data collected later, and in the light of emerging ideas. Some 'open' coding (Strauss & Corbin, 1990) was performed at this stage. In N5 this is known as creating 'free' nodes, which equate to files in which the researcher can store relevant data. For example, some free nodes created for St Clair's college during data collection were entitled, 'expectations', 'fun', 'purpose', 'license and copyright', and 'conflict'. In addition, data were coded according to the 'tree nodes' that had already been created (the 'start list' of codes) through anticipatory analysis and analysis of the pilot study. Thus, analysis could be said to be both 'top down' and 'bottom up' (Coffey & Atkinson, 1996). Nodes were subsequently manipulated (merged, moved, deleted, ordered, renamed) to reflect changing conceptions.

As Coffey and Atkinson (1996, p. 46) point out, coding is not synonymous with analysis. Once coding has been completed, the data must be interrogated and 'systematically explored to generate meaning.' It is necessary to think about how the codes relate to the original data, to other data, and to theoretical ideas. In short, 'interpretation' is necessary (Patton, 1990).

Miles and Huberman (1984) recommend data display as an important aspect of analysis, as it allows researchers to 'see' the data more clearly, thus facilitating interpretation. They define data display as follows:

We define a 'display' as an organized assembly of information that permits conclusion drawing and action taking. (Miles & Huberman, 1984, p. 21)

Rough data displays were used in the study, in the form of point form notes, flow charts, printouts from N5, and tables. These helped the researcher and teachers to draw conclusions and take further action. Examples are shown in Figure 4.4.



Power : Leaders, Followers, Tensions, Advances and Retreats

Resources: Hardware, software, knowledge, time, space, support

Communication and Culture

Philosophy: Values and beliefs

Creative Problem-Solving: Innovation

Resistance to Change – Individual and Organisational

Lewin's (1951) Three Step model of change– Unfreezing, Change, Refreezing. Driving forces and Restraining forces.

Oakley's Three Skid Model: Unfreezing, Change, Semi-Freezing ('slush'). In circumstances where CHANGE is FREQUENT and ONGOING.

TURBULENCE, TOLERANCE v PETRIFICATION

Figure 4.4. Examples of data displays

After the data collection stage, I attempted to take a 'step back' and undertake further analysis. The intention was to expose patterns and themes that had previously been uncovered, as the analysis that took place during data collection was necessarily hurried and 'on the go'. I deemed it necessary to carry out further retrospective analysis in order to determine what was missed, and to facilitate the answering of the research questions.

Reading and rereading the literature, constantly relating it to the data and writing drafts of the thesis also facilitated analysis. Coffey and Atkinson draw attention to the need to use the literature in order to generate ideas and analyses. Strauss and Corbin (1990) have indicated the importance of using the literature as a source of 'theoretical sensitivity', which is essential to good data analysis. They define 'theoretical sensitivity' as follows:

Theoretical sensitivity refers to the attribute of having insight, the ability to give meaning to data, the capacity to understand, and capability to separate the pertinent from that which isn't. (Strauss & Corbin, 1990, p. 42).

According to Coffey and Atkinson (1996, p. 109), we must also view 'writing up' of research as an analytic task, as 'writing and representing are powerful ways of thinking about one's data.' They remind us that writing encourages us to think about the data in 'new and different' ways, and also forces us to think about the 'meanings and understandings, voices and experiences present in the data'. Analytic ideas are explored, developed and deepened during the process of writing and representing.

As well as analysing each case individually, cross-case analysis was undertaken in an attempt to isolate any patterns that were evident across cases and to find out and attempt to explain any differences. This was achieved by 'merging' the different cases in N5 and carrying out text and node searches to find repeated themes and issues.

Issues of Validity and Reliability

Validity has been defined as the 'correctness or credibility of a description, conclusion, explanation, interpretation, or other sort of account' (Maxwell, 1996).

As data collection and analysis methods were mostly qualitative, adhering as far as possible to Guba and Lincoln's (1992) recommendations helped ensure the

'credibility' of the data. For example, member checks took place to ensure that participants agreed with the interpretations that the researcher had made. Input was not only solicited from participants whilst 'in the field', but also after the analysis and reporting had been completed (LeCompte, 2000). However, member checks can be criticised because the same considerations that threaten the validity or veracity of the researcher's interpretations may also threaten the veracity of the member's (Bloor, 1997). Also, members may falsely corroborate descriptions and interpretations for ego-defensive reasons, or because of a sense of loyalty to the researcher. Worse, members may withhold assent to descriptions and interpretations that are, perhaps, painfully accurate and 'valid', as experienced in Chapter Six.

Triangulation of different methods and sources of data-collection occurred, with the aim of building a whole picture. It is acknowledged, however, that 'triangulation' must be conducted with caution, as there is always the risk of trying to 'replicate chalk with cheese' (Bloor, 1997, p. 41).

The opinions of colleagues, particularly supervisors, were sought regularly to ensure that the categories and theories developed by the researcher were accurate and reasonable. In addition, two peer-reviewed articles relating to this study have so far been published (Oakley, 2002a, 2003b). Feedback was also received from delegates at several literacy and technology-related conferences (Oakley, 2001a, 2001b, 2002c, 2002d, 2003a).

An appropriate period of time (at least 2 school terms or a 3 term school year) was spent in the field in order to help ensure internal validity or credibility (Reinking & Watkins, 2000), and records (which included memos or records of reflections) were kept in such a way that 'auditability' was possible in that another person could track the researcher's data collection and thought processes. The use of NV, which enables very thorough organization of data, facilitated this.

The analysis of multiple cases is also a means of increasing external validity (generalisability) in qualitative studies (Miles & Huberman, 1994, p. 29). This was done in the study, although it must be noted that the cases are in many ways not comparable as they focussed on divergent pedagogical goals, used different software, and had different participants with a variety of different needs. Despite this, several broad commonalities between the cases were identified.

The use of the qualitative data analysis (QDA) program, N5, made it possible to keep the data and their contexts connected, making it easy to access and check relevant raw data whenever necessary. QDAs also make it easier to consider all of the data thoroughly (Durkin, 1997), therefore ensuring 'completeness'. As discussed by Maxwell (1996), 'incompleteness' is a serious threat to validity.

According to Reigeluth and Frith (1999), in formative research the major concern is not validity, but preferability, or the extent to which one method is 'better' than other known methods for attaining a pedagogical goal. They suggest three dimensions of preferability: 'effectiveness' (the degree to which the intervention led to the attainment of the pedagogical goal); 'efficiency' (the degree to which the intervention was cost and time effective); and 'appeal' (how enjoyable the intervention was for all people associated with them). As most of the data collection methods in this study were essentially qualitative, validity remains an important consideration. However, preferability was also considered.

Limitations

A limitation of the study is that the sample size was relatively small and was to some extent selected on an 'opportunity' basis. With reference to the use of particular software and learning activities, it was not an objective of this research to provide results that are generalisable to a wider population of students with reading difficulties. That is, it is not possible to show that the use of a particular item of software will work for all students with a particular learning difficulty in all situations. However, the descriptions of the formative experiments in the form of 'vignettes' may be used as starting points and may present ideas and insights to teachers who are trying to formatively plan, implement and evaluate IMM-based activities for students with reading difficulties. Understanding the processes of planning, implementing and evaluating IMM-based activities for students with reading difficulties, and the successes and difficulties associated with these, was a main focus of this study. These broad understandings may be applicable to a wider population.

Another limitation of this study involves the relatively short period of time spent 'in the field' (one to two school terms for each case). It was beyond the scope of this study to spend extended periods of time in the field and, in any case, the nature

of this study, which involved relatively short-term activities, did not strictly warrant extended periods in the field.

As in any predominantly qualitative research project, the fact that the researcher was a main 'instrument' may be perceived as a limitation (Merriam, 1998), as the researcher's perceptions may distort the data collected.

Ethical Considerations

Informed Consent

In order to protect the rights and wellbeing of participants, certain ethical considerations were observed. The participants and the parents or legal guardians of child participants were informed as fully as possible about the procedure and aims of the study. Participants and the parents of child participants were informed that participants could withdraw or be withdrawn from the study at any time (see Appendices 4.2 to 4.4).

Risks

There were no foreseen risks entailed in the study, although some students missed some of their normal classroom activities in order to participate in the study. It is suggested that they were not in any way disadvantaged by this and that indeed, they derived some benefit from participating in the study.

As risks normally associated with the use of computers were present, school guidelines regarding posture and length of time sitting at the computer were adhered to. Also, as some parents may have been concerned that students could have accessed unsuitable sites on the WWW, adult supervision was maintained at all times. School policies on safe computer use were adhered to.

Confidentiality and Security

Data were kept confidential, and participants and their parents informed of this to ensure that the rights and the well being of participants were protected. Pseudonyms were used, and all possible efforts made to ensure that participants could not be identified. Audio and video recordings were accessible only by the teacher(s), myself and two supervisors from Edith Cowan University, who helped verify observations and interpretations. These recordings were destroyed after use.

The video camera was placed behind the participants and took 'over the shoulder' footage of the computer monitor. All data were kept securely in a locked filing cabinet in the researcher's home, and were not left unattended or unsecured in university premises.

Summary of Chapter

In this chapter, the general procedure that was used to carry out the formative experiments with reference to 16 students and 4 classroom teachers has been explained.

The following four chapters describe in detail the formative experiments carried out at the participating schools. As explained in Chapter One, these are written in the first person for the sake of clarity. Each chapter focuses on a separate case and describes and discusses the school context, the teachers, the classroom context, the participating students, existing instructional strategies, the pedagogical goal and the formative experiment. In particular, inhibitive and facilitative factors that emerged during the formative experiment are described and analysed. Unplanned outcomes of the intervention and the extent to which it was preferable to traditional methods are also considered. Each chapter is preceded by an overview, giving brief details about the school, the participants and the software.

As indicated previously in this chapter, 2 classroom teachers from St Clair's College participated in this study: a Year 4 teacher and 4 of her students and a Year 5 teacher and 3 of her students. These will be treated as separate cases. The Year 5 case will be presented in Chapter Five and the Year 4 case will be presented in Chapter Eight. The school contexts will be described in Chapter Five and will not be repeated.

For ease of interpreting cross-case analyses an overview of the case is presented at the beginning of each chapter.

CHAPTER FIVE.

ST CLAIR'S COLLEGE: YEAR 5

Overview of Case

IMM-assisted repeated readings (IMMARR) and the creation of electronic books were used as strategies to improve three students' oral reading fluency. Some aspects of this case have been reported in Oakley (2003b) (see <http://www.readingonline.org/articles/oakley>).

Government/private school:	Private girls' school
Number of students in class:	28
Number of students in school:	Approximately 1000
Socio-economic status:	High
Pedagogical goal(s):	Improved oral reading fluency

Table 5.1. Participants: St Clair's College (Year 5)

Participating Students				
Name	Year	Age at beginning of study	Estimated hours spent doing IMM-based activities	Estimated hours spent doing IMM based activities independently
Claudia	5	9.6	40	30
Brianna	5	9.6	40	30
Becki	5	10.0	40	30
Participating Teacher				
Name	Teaching experience	ICI experience		
Nicole Nielsen	4 years	Substantial		

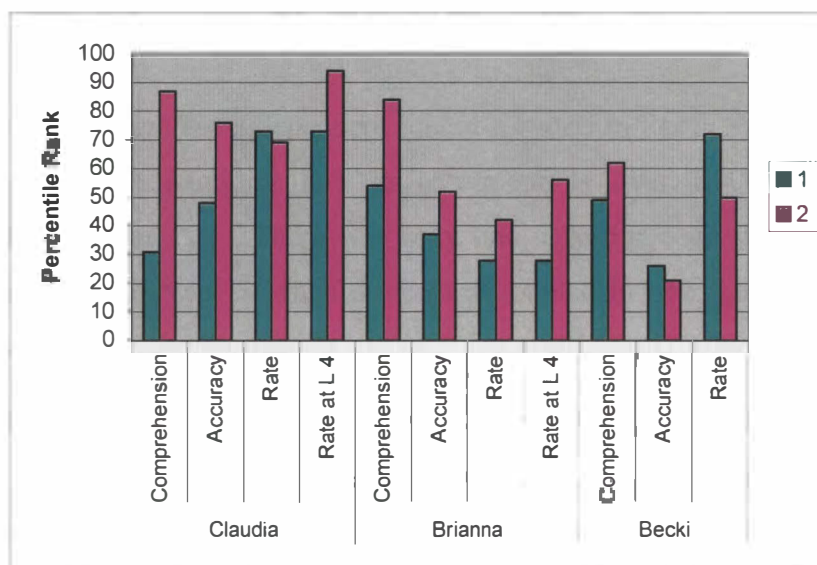


Figure 5.1. Pre- and post-intervention results of the Neale Analysis of Reading Ability (NARA): St Clair's (Year 5)

Table 5.2. Hardware available

Computers	Specifications
Laptop computers	Each student had a laptop. ME Operating system. Connected to school intranet and the Internet. Soundcard. Pentium processor.
Classroom computers	None in this classroom
Computer Laboratory	'Hub room' with 12 computers. Rarely used by these students.

Table 5.3. Software used during the study: St Clair's College (Year 5)

Software Used	Description
Aesop's fables (1994).	Electronic storybook. Short texts.
Arthur's birthday (1994).	Electronic storybook.
Arthur's teacher troubles (1993).	Electronic storybook.
Cinderella (1994).	Electronic storybook.
Harry and the haunted house (1994).	Electronic storybook
Illuminatus (1999). (Version 4.5).	Multimedia authoring program.
Illuminatus opus (2001) (version 2.6).	Multimedia authoring program.
Just me and my dad (1997).	Electronic storybook.
Paintshop Pro 4. (1998). (Version 4.15SE).	Graphics program.
Reading for literacy 3. (2000).	Reading program (electronic texts and comprehension activities).
Reading for literacy 4 (2000).	As above.
Reading for literacy 5 (2001).	As above.
Speech Analyser (2000). (Version 1.5.) (SIL)	Sound recorder and speech analysis.
Stellaluna (1996).	Electronic talking book.

The School Context

St Clair's is a high fee independent school for girls in Perth, Western Australia. At the time of the study, it had an enrolment of over 1,000 students from Kindergarten to Year 12. There was only one class for each year group in the primary school, until Year 5, when the cohort doubled in size (i.e. most years had two classes).

According to the school handbook, St Clair's prided itself on 'high academic standards', a 'friendly supportive environment' and an emphasis on developing 'lifelong, active learning, critical thinking, communication skills and self-esteem'. The school was committed to the use of technology in education and viewed the acquisition and integration of technology across the curriculum as a priority. According to school documents, one of the school's main aims was to 'ensure that each student has the technological skills and competencies necessary to live effectively in the global community'.

ICT at St Clair's

The school had several small 'pods' of up-to-date computers, as well as laboratories equipped with computers. Students from Year 5 to Year 12 were required to provide their own laptop computer for use at school. All computers, including laptops, were networked, providing students with access to the Resource Centre, which included a range of CD-ROMs, the library catalogue, the college intranet, the Internet, and e-mail. The school had an 'acceptable use' policy, which was easily accessible by the students as it was published each year in the College Handbook. In addition, the school had ergonomics experts on staff in order to ensure that students adopted the correct posture when using computers and to ensure that injuries were avoided when transporting laptop computers.

St Clair's had a team of technology services staff who provided technical support and maintained the network and the hardware. In addition, the Primary School had a technology coordinator, Susan Alessi, who coordinated teacher Professional Development in using ICT for learning and was available to give advice and assistance on the use of software and hardware. This teacher, however, had teaching duties of her own and was not available to other teachers at all times.

St Clair's literacy policy

At the time of the study, the school's literacy policy was in the process of being revised. The existing policy defined literacy as:

- a developmental process, which begins in infancy;
- a system by which knowledge, ideas and culture are transmitted and received;
- a means by which learning takes place;
- the ability to communicate effectively through reading, viewing, speaking and listening.

According to the policy, reading was seen as an active process in which the reader constructs meaning using semantic, syntactic and grapho-phonetic cues. Students were seen as doing this by predicting, sampling and confirming hypotheses about print. The objectives of the school in terms of literacy were to ensure that students: 'develop a positive attitude towards reading; understand what they read by responding to literal, inferential and evaluative questions; recognise the purposes of reading; and gain access to and use a wide range of reading strategies.'

Students at 'Educational Risk' (SAER)¹⁴ Policy

This independent school, unlike Western Australian government schools, did not have a SAER (Students at Educational Risk) policy, although all students having difficulties were given 'appropriate' work within the classroom context (Literacy Policy), in that the classroom teacher modified the normal curriculum for them. A support teacher was often available to assist teachers and often supported small groups of students in a normal classroom context. If there was still a concern about a child's progress, she was referred to the school counsellor to undergo further assessments to ascertain whether additional assistance outside of the classroom context would be beneficial.

¹⁴ Students at educational risk are defined as 'those students not achieving the major learning outcomes, and thus their full potential. They are students whose performance or rate of progress has changed dramatically, those who are under-achievers and those not participating in school life' (Department of Education and Training, 2003, n.p.)

Nicole Nielsen's Class

The Classroom Environment

The Year 5 classroom environment was positive, stimulating, and supportive, with students always seeming confident, relaxed and engaged in their work. The classroom was generally calm and orderly, even when the students were engaged in collaborative work, and classroom members appeared to speak to each other with respect and maturity. The desks were arranged so that the students sat in groups of approximately six.

The classroom was decorated with students' artwork, writing and various commercial and teacher-made charts. Wall charts relating to reading included:

- charts explaining the three 'levels' of comprehension (literal, inferential, and evaluative), and some example questions of each type;
- charts explaining the 'parts of speech' - nouns, adjectives, adverbs;
- charts showing the structure and text features of different genres; and charts showing some comprehension strategies (predicting, questioning, clarifying, and summarising).

Collaborative learning was common in this classroom with pairs, small groups, and larger groupings being used for different types of activities. However, as this was a 'laptop' class, with each student having a laptop computer on her desk, the students also engaged in many individual activities that used the laptops.

The Classroom Teacher (Nicole Nielsen)

Nicole was in her twenties and had been teaching at St Clair's for four years when the study commenced. She had a Bachelor of Education and a Diploma of Teaching from a Western Australian university. Nicole stated that she had a 'balanced' view of reading and believed that students learn to read by engaging in many different literacy experiences. She recognised that some students, such as those who participated in this study, needed more explicit instruction than others.

Nicole was of the opinion that her University training (Bachelor of Education) provided her with only a brief and somewhat inadequate background in using ICT to facilitate learning. However, she undertook a fourth year unit in ICT which helped her, although she stated that if St Clair's did not have such a supportive

culture, with staff sharing ideas and knowledge at three-quarter hour sessions each week, she would certainly have found it difficult to incorporate ICT into her teaching.

Even though some structured professional development was provided by St Clair's, it was essentially the teachers' own responsibility to keep abreast of ICT issues. Professional development provided by St Clair's consisted of the sharing sessions mentioned above as well as regular workshops conducted by other staff members, such as the technology coordinator of the school, on such topics as website authoring and using a range of open software, for example the concept-mapping software, *Inspiration* (2000) and the website authoring program *Dreamweaver 4* (2001). Nicole furthered her professional development in this area by 'keeping her eye' on the Internet, trade catalogues and magazines and also by attending conferences. In addition, informal sharing of information and insights between teachers was an important source of new ideas.

How Was Reading Usually Taught In Nicole Nielsen's Classroom?

Many different strategies were used in Nicole's classroom to teach reading, although the main ones were reciprocal reading (Palincsar & Brown, 1984), paired reading (Topping, 1987), Uninterrupted Sustained Silent Reading (USSR) (Gambrell, 1978), and class novel (read aloud by the teacher to the whole class and then read independently by the students). The teacher also modelled fluent reading and reading strategies by reading aloud and 'thinking aloud' (see Duke & Pearson, 2002; Rasinski & Padak, 2000).

In order to develop their comprehension, students took part in activities such as making story maps and character maps, sometimes using the concept mapping software *Inspiration* (2000). They also engaged in read and retell, responded to and created oral and written questions, and used ERICA (Effective Reading in Content Areas) strategies (Morris & Stewart-Dore, 1984), literary or 'hot seat' interviews (Education Department of Western Australia, 1997b), cloze, writing from multiple viewpoints, and word banks, as well as comparing different texts. Several pre-reading strategies were taught, such as brainstorming, predicting, and clarifying the purpose of reading the text.

To develop oral reading, strategies included: Reader's theatre (Hill, 1990); choral reading; paired reading (Topping, 1987); dramatic interpretation of text; and teacher modelling (Irwin, 1991; Young et al., 1996). No explicit teaching in fluency was given, although the teacher modelled oral reading on a regular basis and was of the opinion that the strategies used to improve reading and comprehension generally should benefit reading fluency, both oral and silent.

A wide variety of reading materials was available to the students in Nicole's classroom, including novels and scheme books, CD-ROM encyclopaedias, magazines, non-fiction books, poetry, material on the WWW and student-created texts. Most of these resources were recently published.

How Was ICT Used In Nicole Nielsen's Classroom?

Since this class was a 'laptop' class, every student had her own laptop, which she used repeatedly throughout each school day. It was taken out of its case first thing in the morning, plugged into the power and the school's network, and was ready for use at all times.

The students used their laptops largely for word-processing and for conducting research on the Internet. As well, they used *Inspiration* (2000) to create concept maps (see Appendix 5.1.), *PowerPoint* (1997) to create presentations and *Publisher* (2000) for desktop publishing. They used a typing tutor program to improve their typing skills, as well as CD-ROM encyclopaedias from the library. They had not used or made electronic storybooks before this study. Neither had they used ICT specifically to improve fluency, although it could be argued that any activities involving reading and writing on the computer could contribute towards improving reading fluency.

Because the students had their own PC laptops, they primarily used them individually; they rarely sat in groups to work collaboratively around a single computer. The students were highly proficient in using the laptops by the time the study commenced and could execute many operations, such as opening and closing programs, cutting, pasting, editing and saving. They had no difficulty selecting options from menus, skipping between programs using ALT+TAB and changing desktop properties, and were familiar with a range of common programs, such as

Word (1997) and *PowerPoint* (1997). They were, however, less experienced in installing new programs.

In the following sections, the three Year 5 students who participated in the study will be introduced. Their strengths and areas of need in reading will be described, as will the computer-based interventions designed for them. Facilitative and inhibitive factors will be identified and any modifications to the intervention that resulted from these factors will be explained. Unexpected outcomes and how 'preferability' was determined will also be described.

Identification of Reading Needs and Selection of Pedagogical Goals

After hearing that in the pilot study¹⁵ I had used repeated readings of electronic storybooks to help three boys improve their oral reading fluency, Nicole became interested in exploring this as an instructional technique. She selected three girls in her class whom she thought would benefit from this kind of fluency training, (and whom she knew would be allowed by their parents to stay after school for extra lessons). Thus, in this case, the pedagogical goal and the instructional strategies were decided upon before selecting struggling students who had corresponding reading needs. This procedure was deemed to be valid for the area of using IMM to facilitate the teaching of reading fluency, where few instructional strategies have been designed and researched. In this instance, the pedagogical goals selected can be seen as 'traditional' pedagogical goals and were not selected with any particular electronic storybooks in mind.

Assessments were carried out to ensure that the students nominated would indeed benefit from fluency training. The students and their reading strengths and needs are described in the following section.

The Students

Claudia

Claudia was a talkative and hard working girl who had joined St Clair's at the beginning of Term 1 of the year in which the study was conducted (the study began

¹⁵ See Appendix 1.1.

at the beginning of Tenn 2). She had spent her previous school years at a nearby government school, where she had been viewed as an above average student.

According to school reports from her previous school, Claudia had not been considered to be struggling with her reading, although her use of punctuation and understanding of text structures had been considered less proficient than her comprehension, oral reading and word recognition skills. It is noted that understanding of how punctuation and text structures work appear to be important determinants of reading fluency (Rasinski, 1994).

After her arrival at St Clair's, standardised tests, teacher observations and informal assessments had revealed that Claudia experienced some difficulties in comprehending texts and that her oral reading fluency was not at the level of most of her peers, many of whom were performing well above the national average according to benchmark¹⁶ testing results. At the beginning of this study, several standardised tests were carried out in order to obtain baseline data. This was done for two purposes. Firstly, it was hoped that the tests would provide diagnostic data that would facilitate the design of a fitting intervention for Claudia, or at least verify the appropriateness of computer-based repeated readings, which had been tentatively chosen as an instructional technique by her teacher. Secondly, it was intended to administer some post-testing at the end of the intervention in order to identify and verify any gains in performance.

The tests administered were the Neale Analysis of Reading Ability (NARA) (Neale, 1988), The Elementary Reading Attitude Scale (ERAS) (McKenna & Kear, 1990), and the Peabody Picture Vocabulary Test III (PPVT-R) (Dunn & Dunn, 1997). These tests are described in detail in Chapter Four.

According to the NARA, Claudia was not experiencing significant difficulties in accuracy or rate of reading, although her comprehension was somewhat below average, at the 31st percentile. With reference to accuracy, which was at the 48th percentile, most of Claudia's errors (62.5%) were mispronunciations that resulted in loss of meaning, whilst the rest (37.5%) were substitutions, some of which made

¹⁶ Benchmark tests are carried out at the end of Year 3 and Year 5 in all Australian schools. Reading, writing, spelling and mathematics are tested and the scores compared to national benchmarks, which have been set by panels of experts, including teachers.

sense. She read word by word on the more difficult texts, although she mostly read with expression. She read at a high average rate, at the 73rd percentile.

Nicole Nielsen had also recently carried out the TORCH test of comprehension (Mossenson, Hill, & Masters, 1987), which indicated that Claudia was at the 30th percentile for comprehension. This supported the comprehension score from the NARA.

The PPVT-R (Dunn & Dunn, 1997) indicated that Claudia was at the 18th percentile for receptive vocabulary. This may partially explain her low comprehension score in the NARA and the TORCH test of comprehension, as receptive vocabulary and reading are closely related (Snow et al., 1998).

The ERAS (McKenna & Kear, 1990) indicated that despite her difficulties, Claudia had a positive attitude to reading, especially recreational reading. Her overall score was at the 95th percentile (for reading attitude for a mid-year 5th grade student¹⁷). She indicated that she read a lot at home for pleasure and enjoyed reading at school, both for pleasure and to learn.

In addition to standardised tests, Nicole Nielsen listened to tape recordings of Claudia's oral reading for the NARA. For the two most difficult passages successfully completed by Claudia (that is, with fewer than 16 errors), Nicole completed a Multidimensional Fluency Scale (see Appendix 4.7.), an instrument that facilitates the rating of reading fluency on the dimensions of phrasing, smoothness and pace. For the level 3 passage, *Ali*, Nicole judged Claudia's phrasing, smoothness and pace to be satisfactory. On the more difficult level 4 passage, *Jan*, Claudia's phrasing was still judged to be satisfactory, although her smoothness and pace had deteriorated (see Table 5.4. below). It must be noted that, during the NARA, the tester was permitted to supply unknown words to the reader after a five second hesitation and to correct miscues, although these words were not scored as correct. This may have slightly influenced the way the texts were read in terms of pace, smoothness and phrasing.

¹⁷ As explained in Chapter 4, the NARA was normed with reference to North American fifth grade students, not Western Australian Year 5 students. Percentile ranking may thus not be strictly applicable.

Table 5.4. Pre-intervention results of the Multidimensional Fluency Scale (Claudia)

	Pace/Rate	Smoothness	Phrasing	Teacher Comments^a
Text: Ali Level 3 Score: 6/9	Uneven mixture of fast and slow.	Occasional breaks in smoothness caused by difficulties with specific words and/or structures.	Mixture of run-ons, mid-sentence pauses for breath, and possibly choppy, reasonable stress/intonation.	'Sounds to be quite nervous.'
Text: Jan Level 4 Score: 4/9	Moderately Slow	Several 'rough spots' in text where extended pauses, hesitations etc., are more frequent and disruptive.	Mixture of run-ons, mid-sentence pauses for breath, and possibly choppy, reasonable stress/intonation.	'Again, a little nervous and perhaps rushing. However, I still feel it's a true indication of ability.'

^a Comments written on the Multidimensional Fluency Scale sheet by the classroom teacher, Nicole Nielsen.

In summary, Claudia's reading comprehension was weak; however her reading accuracy was average and her reading rate satisfactory to Nicole, although her reading was slow in places. Her phrasing needed improvement as she frequently disregarded punctuation, paused for breath mid-sentence and read in a somewhat 'choppy' fashion. Her expression, however, was appropriate.

Brianna

Brianna had attended St Clair's College since Pre-Primary (at the age of four). According to her school report (Term 1, the year in which the study took place), she was a 'polite, cooperative girl with good social skills and work habits'. She was also a 'good listener', who always tried to complete the work given to her in class.

At the beginning of the study, Brianna was achieving at expected levels in many aspects of reading, according to school records. She participated in reading with interest, was able to sight read high frequency words, and used multiple strategies to identify unknown words. However, according to her teacher, she needed to develop in the areas of reading orally with confidence, fluency and expression as well as comprehending texts at the three levels of meaning (literal, inferential and evaluative). According to her school report from the previous year (Term 1), however, Brianna had been achieving expected outcomes in all aspects of reading,

¹¹ 'Choppiness' is a lack of smoothness, or 'janky' reading.

including literal and inferential comprehension and reading orally with confidence, fluency and expression. Brianna enjoyed story writing and was fairly imaginative in this domain.

According to the pre-test NARA, Brianna's comprehension skills were at the 54th percentile. However, her reading was slow and laboured (28th percentile) with low average accuracy (37th percentile). This conflicted to some extent with her school report, which stated that she had a good store of sight words and used strategies to decode unknown words. According to the TORCH comprehension test, which was administered by the teacher in Term 1, 2001, Brianna scored at the 56th percentile for comprehension. These results were very close to those of the NARA.

According to the ERAS, Brianna's attitude towards reading was at the 29th percentile. Her attitude towards recreational reading was slightly more positive (36th percentile) than was her attitude towards academic reading (31st percentile).

The PPVT-R indicated that her receptive vocabulary was high average, at the 79th percentile. This wide vocabulary may partially explain why her comprehension was at an average level whilst her accuracy and rate were below average.

In addition, the classroom teacher assessed Brianna's oral reading fluency using the Multidimensional Fluency Scale. This was done from tape recordings of Brianna's readings of two of the texts read for the NARA. Brianna read both of the texts at a 'moderately slow' pace, and several 'rough spots' in the text, where there were extended pauses and hesitations, interrupted the smoothness of her reading. In the easier of the two texts, *Ali*, Brianna's phrasing was marked by a mixture of run-ons (failing to attend to commas and full-stops), pauses for breath and choppiness. However, she read with expression (pitch, intonation) that was judged to be appropriate to the story. With reference to the more difficult (level 4) text, *Jan*, Brianna had great difficulty with the phrasing. She read in two and three word phrases, giving the impression of choppiness. She read with improper stress and intonation that did not mark the ends of sentences and clauses (see Table 5.5).

Table 5.5. Pre-intervention: Multidimensional Fluency Scale (Brianna)

	Pace/Rate	Smoothness	Phrasing	Teacher Comments
Text: All Level 3 Score: 4/9	Moderately slow	Several 'rough spots' in text where extended pauses, hesitations etc., are more frequent and disruptive.	Mixture of run-ons, mid-sentence pauses for breath, and possibly choppy reading. Reasonable stress/intonation.	None.
Text: Jan Level 4 Score: 3/9	Moderately Slow	Several 'rough spots' in text where extended pauses, hesitations etc., are more frequent and disruptive.	Frequent two and three word phrases giving the impression of choppy reading; improper stress and intonation that fails to mark the end of sentences and clauses.	None.

In summary, Brianna's reading comprehension was average, at the 54th percentile, and her receptive vocabulary was good, at the 79th percentile. However, her rate of reading was extremely slow, at the 28th percentile. Furthermore, her accuracy was low average (37th percentile), resulting in roughness. Her phrasing required improvement as she often disregarded punctuation, paused mid-sentence for breath and read in two and three word phrases, giving the impression of choppy reading. In more difficult texts, her stress and intonation did not mark the end of sentences and clauses. Her attitude to reading was negative, at the 29th percentile.

Becki

Becki joined St Clair's College at the beginning of Year 5. An old school report stated that she was either 'consistently achieving' or 'usually achieving' the required levels in reading, spelling, writing or oral language, although in handwriting she was deemed to be 'developing'.

Becki was a friendly, talkative student who, according to Nicole Nielsen, tended to rush through her work and consequently did not always reach her potential. In a 'Reading Interview Sheet'¹⁹ (Figure 5.2.) administered by Nicole at the beginning of the academic year, Becki responded to the questions as follows:

¹⁹ Note: Work samples and other data collected may not be consistent between students because their portfolios and school records did not always contain consistent items.

Do you enjoy reading?	Sometimes I do and Sometimes I don't
What do you like to read?	Poems, Fairy Tales
What do you like about reading?	I do not know
Is there anything you don't like about reading?	SCRIPTURE IS boring.
What is the best book you have read?	Riding School Rivals.
Who is your favorite author?	Susan Saunders
Who is your favorite character?	Sandy Rabinowitz
Where do you borrow books from?	library, Book store,
How often do you read a book?	Not that often

Figure 5.2. Reading Interview Sheet: Becki

According to the NARA, Becki scored at the 49th percentile in comprehension and at the 72nd for rate. However, her accuracy was low, at the 26th percentile, and although she read quickly, much of what she was reading was inaccurate. Seventy two percent of her errors were substitutions and 24% were mispronunciations, a few of which were non-words. For example, Becki said 'dinkly' /dɪŋkli/ instead of 'dinghy', and 'welfare' /wɔɪlfɛə/ instead of 'welfare'. She also tended to race through the texts, paying little attention to punctuation. As many of her errors were substitutions that were not semantically correct, it seems remarkable that she managed to make meaning of the texts. It must be noted that Becki did look at the text a few times in order to help her answer comprehension questions, something that is discouraged in the NARA, even though classroom teachers may encourage it in other reading contexts. Becki had scored at the 49th percentile on the recently administered TORCH test of comprehension, a result that matched her NARA score.

According to the ERAS, Becki had a positive attitude towards reading, with an overall score at the 84th percentile. For academic reading she scored at the 77th percentile and for recreational reading at the 87th. These results conflicted to some

extent with the results of the 'Reading Interview Sheet' administered by the teacher, in which Becki indicated a slightly mixed attitude towards reading.

The PPVT-R indicated that at the beginning of the study, Becki had a low average receptive vocabulary, scoring at the 34th percentile. This may help explain her low accuracy score and also her low average comprehension score.

The Multidimensional Fluency Scale carried out by Nicole Nielsen revealed that in the level 3 text, *Ali*, Becki's smoothness was broken occasionally because of word recognition difficulties, and that her phrasing was marked by a mixture of run-ons (the failure to stop at full stops or pause at commas), mid sentence pauses for breath and choppiness. Her intonation was a little monotonous. At the more difficult level of text (level 4), *Jan*, Becki's reading was consistently slow in pace and smoothness was interrupted by difficulties in recognising words. Phrasing was marked by frequent two and three word chunks, giving the impression of choppiness. Stress and intonation were inappropriate and did not mark the beginning and ending of sentences and clauses (see Table 5.6.).

Table 5.6. Pre-intervention results of the Multidimensional Fluency Scale (Becki)

	Pace/Rate	Smoothness	Phrasing	Teacher Comments
Text: <i>Ali</i> Level 3 Score: 6/9	Uneven mixture of fast and slow reading.	Occasional breaks in smoothness caused by difficulties with specific words and/or structures.	Mixture of run-ons, mid-sentence pauses for breath, and possibly choppiness. Reasonable stress/intonation.	'Stress and intonation was a little rushed and monotone.'
Text: <i>Jan</i> Level 4 Score: 4/9	Moderately Slow	Occasional breaks in smoothness caused by difficulties with specific words and/or structures.	Frequent two and three word phrases giving the impression of choppy reading; improper stress and intonation that fails to mark the end of sentences and clauses.	'Lacking expression. Perhaps trying to rush through and 'finish quickly?'

In summary, the assessments indicated that Becki's reading comprehension was at the 49th percentile, whilst her reading accuracy and rate were at the 26th and 72nd percentiles respectively. Although she read quickly, her phrasing was poor, with frequent run-ons. Her expression often did not fit the meaning of the text. As for reading attitude, the PPVT-R showed that Becki had positive attitudes to both academic and recreational reading.

The graphs below summarise the NARA, PPVT-R and ERAS test results of the three participating Year 5 students:

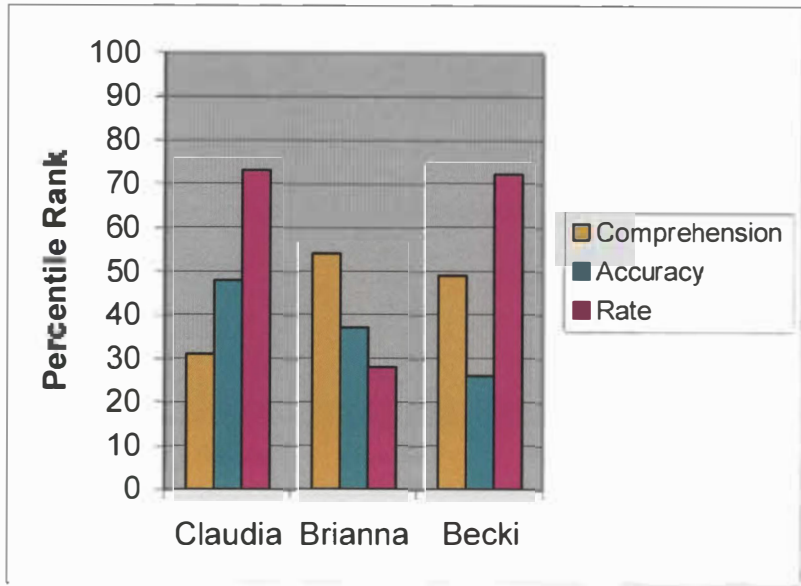


Figure 5.3. Pre- intervention Neale Analysis of Reading Ability (NARA) results: St Clair’s, Year 5.

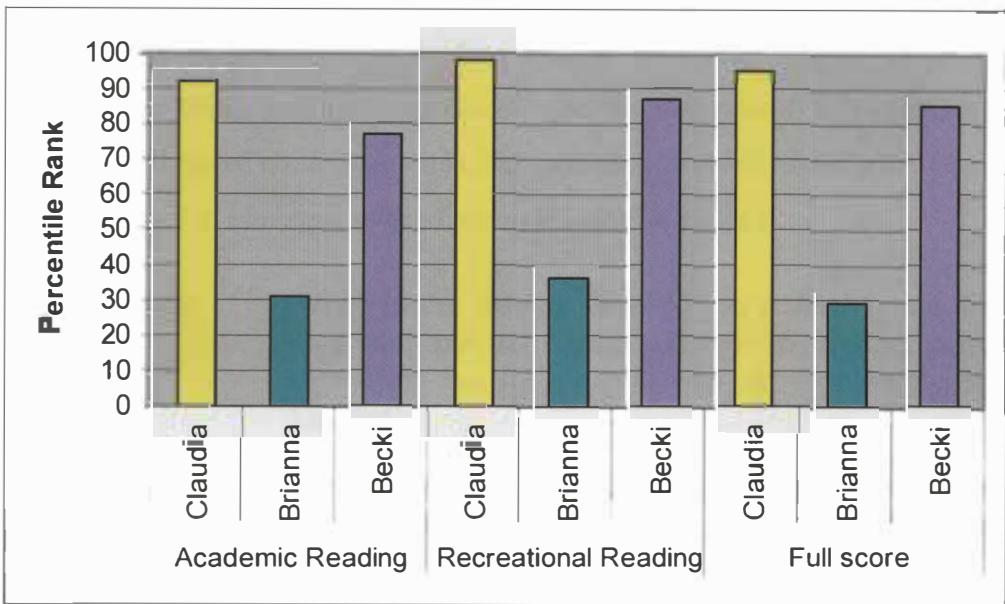


Figure 5.4. Pre- intervention Elementary Reading Attitude Survey (ERAS) results: St Clair’s, Year 5.

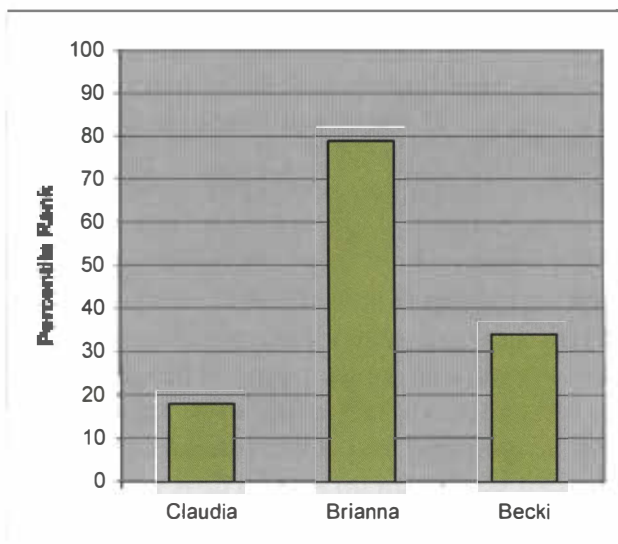


Figure 5.5. Pre-intervention PPVT-R results: St Clair’s, Year 5.

In addition to the administration of the above assessments, participating students were asked about their conceptions of reading fluency through the question, “What do you do when you’re reading fluently, with expression?” Their responses seemed to indicate that they understood that fluency related to rate/pace and that expression involved changes in pitch and volume. However, no mention was made of the importance of phrasing, or reading in meaningful chunks:

Brianna: [When you’re reading fluently] you’re reading not too slow and not too fast, and you’re reading with expression for the people who are speaking [the dialogue].

Claudia: Your voice changes when you’re trying to act like someone else. I think that you are ... going at the right speed.

Becki: Fluency is when someone is speaking and it’s like, it’s like, in capital letters, you actually say it loudly.

Verifying the Significance and Appropriateness of the Pedagogical Goal

After assessing the students to verify that oral reading fluency was indeed an area that needed strengthening, it was necessary to be sure that the pedagogical goal was significant and appropriate:

Nicole: So, what do you feel in terms of going on with fluency, or do you feel there's a more beneficial direction?

Researcher: It depends on what aspects of fluency you think are important, what your definition of fluency is, and what outcomes you'd like to see.

Nicole: Yesterday Becki was doing some reading for the class and she was having ... spending so much time decoding it was obviously affecting her comprehension. Fluency is needed perhaps in order to ensure they're comprehending what they're reading ... they need to have fluency. You do need comprehension in order to be fluent but you also need to be fluent to comprehend. I think [the pedagogical goal should be] fluency with a focus on improving their comprehension ... which it will do.

Thus, Nicole was of the opinion that the pedagogical goal of improving the students' fluency was appropriate, with the pedagogical goal of improving Becki's accuracy simultaneously being addressed by the THRASS program (Teaching Handwriting, Reading and Spelling Skills) (Davies & Ritchie, 1996). THRASS is a teaching system used by teachers to help them teach grapho-phonetic relationships to students. It is highly structured and involves a high degree of explicit teaching of letter clusters. Additionally, Nicole also recognised that Becki needed to improve her store of sight words in order to facilitate fluency.

The Conceptualisation of Possible Learning Strategies

Before conceptualising possible IMM-based learning strategies to improve reading fluency, it seemed desirable to analyse the traditional strategies that had Nicole had already tried, and to attempt to gauge their effectiveness with reference to the three participating students.

How did Nicole Typically Help Students Who Experienced Reading Difficulties Improve Their Oral Reading Fluency?

Nicole reported that she did not teach fluency *per se*, but expected that it would improve through the other reading activities she offered:

Nicole: Well, I guess it's just within our reading groups, having different levels ... we do that [have different reading groups],

and then we do oral reading in other subjects, but there's nothing specific for fluency as such - it's just incidental. Well, not too much incidental - we focus on oral reading in talking about expression in your voice, and making sure it flows and watching the punctuation and things like that. They are the sorts of things that I would do -

Thus, according to Nicole, many of the activities that are described below and intended to improve the students' general reading ability should 'flow over' and improve their reading fluency.

Her class was divided (according to ability) into 3 groups of 9 or 10 students. Although these three groups engaged in similar types of activities, often using the same texts, they worked at their own level and at their own pace and were given different levels of teacher support. All three of the students who participated in this study were in the lowest ability group.

At the beginning of the study in Term 2, the three participating students were taking part in once-weekly, half-hour THRASS lessons (Davies & Ritchie, 1996). The support teacher, Susan Alessi, taught these lessons in another classroom. By the end of Term 3, Claudia and Becki were no longer deemed to need these lessons as their knowledge of grapho-phonetic relationships was seen to be adequate. Twice a week, the three girls also went into another classroom for reading lessons given by Susan. Half way through the study, at the beginning of Term 3, it was felt that Claudia and Becki no longer needed to go to Susan's room for lessons, but Brianna continued to attend.

Susan's group was a 'novel reading' group in which the novel was often read aloud in sections by the teacher (the students sometimes read along) and was occasionally read by the students in round-robin style. Susan encouraged students to use 'before', 'during' and 'after' reading strategies²⁰ for comprehending the novels. Although the teacher modelled fluent reading of texts, no specific fluency strategies such as discussion of what fluent reading sounds like, repeated readings, self-monitoring, or phrasing of texts appeared to be used.

As has been explained, in addition to her role as a support teacher, Susan was also the technology coordinator for the primary school and sometimes used

²⁰ Before, during and after reading strategies include a range of activities designed to facilitate comprehension (Sadler, 2001).

technology such as the concept-mapping software *Inspiration* (2000) to facilitate the girls' comprehension.

In summary, before the study commenced, fluency was not explicitly taught to the students, although they were often engaged in activities that may have incidentally improved their fluency. Further, IMM appeared to play a minimal part in the way the three participating students were taught to read fluently, although they occasionally created *PowerPoint* (1997) presentations that they later read aloud to peers and they sometimes accessed multimedia encyclopaedias, which may have supported their reading skills through the provision of narrations and video clips. The use of *Inspiration* (2000) may also have helped them read fluently through improving their comprehension.

Selection of Learning Strategy: IMM Assisted Repeated Readings (IMMARR)

After analysis of the students' assessment data and discussion of their individual needs, Nicole decided that she would still like to try IMM assisted repeated readings (IMMARR) with the three participating students. This decision was based on the students' learning needs as well as the fact that the repeated readings strategy had a strong research justification. Nicole also hoped that IMM texts would provide motivation and extra support to the participating students.

As explained in Chapter Two, there is considerable evidence to support the repeated readings technique as an effective means of improving students' oral reading fluency in a traditional context (Dowhower, 1987; Samuels, 1979). The technique has been found to improve fluency in a wide range of students, and has also resulted in improved comprehension (Husbrouck et al., 1999; National Institute of Child Health and Human Development, 2000; National Reading Panel, 2000). Furthermore, it has been shown that the facilitative effects of repeated readings can be transferred to new, previously unread passages (Dowhower, 1987; Samuels, 1979).

Also, as explained in Chapter Two, repeated readings involves students repeatedly reading a short section of text (approximately 50 to 200 words) until they can read it fluently. Husbrouck et al. (1999) have suggested that this can be extended

to 350 words for students in upper primary grades. The passage chosen for repeated readings should be interesting to the child and 'easy' (Rasinski & Padak, 1996), which would usually equate to an accuracy rate of 95% (Stickland et al., 2002). Reading rate or speed is an initial focus of repeated readings and can be graphed after each performance to facilitate monitoring of performance and as a motivational aid. Once students have reached a satisfactory rate, emphasis is changed from reading quickly to sounding 'good, entertaining, and communicating meaning and feeling' (Clark, 1995).

One of the limitations of the use of repeated readings in a traditional context is the breakdown of speed and comprehension that occurs when a child is unable to decode a particular word, or is unable to do so quickly. As LaBerge and Samuels (1974) have pointed out, if word identification does not occur automatically, there may be less cognitive capacity left over to engage in the higher order processes necessary for comprehension.

Electronic storybooks may be used to reduce the above problem in that students can select unknown words and immediately obtain a pronunciation, thereby maintaining the speed and accuracy that is necessary for fluency. Repeated readings using electronic storybooks instead of paper-based books can also be motivational to students (Glasgow, 1996-7).

Electronic storybooks can offer support not only in the form of pronunciations, but also in the form of modelling of fluent reading. Furthermore, text highlighting can also model how to break sentences into smaller meaningful units or 'phrases'. Work carried out by Ford et al. (1995) has shown that CD-ROM storybooks can be used to help students improve their oral reading through repeated readings, although they found that this approach is preferable only in that it frees up valuable teacher time. Despite the findings of Ford et al. (1995), it was decided that it was worth trying this strategy because Ford et al. had not used a formative approach, whereby changes and improvements could be made to the intervention as facilitative and inhibitive factors were gathered. It was hoped that suitable software and procedures would be adjusted as the formative experiment progressed.

Although we had a rationale for using electronic storybooks as a context for repeated readings, the teacher and I knew that it was an experimental strategy and that it was not fully justified by the literature. The rationale was constructed from

the fact that repeated readings seems to be an effective means of improving oral reading fluency (Dowhower, 1987; Meyer & Felton, 1999a; Samuels, 1979). Furthermore, there is evidence that NIM (Neurological Impress Method) (Heckelman, 1969) is a useful strategy for teaching oral reading fluency. We believed that if the students engaged in a hybrid of these two strategies in the context of electronic storybooks, with the additional benefits of fluent models of reading, access to pronunciations, and a degree of independence, their oral reading fluency should benefit.

This involved the teacher being willing to take a risk, which was somewhat stressful for both the teacher and myself in that we did not want to waste valuable student time. It was, perhaps, even more stressful because of the school context; as St Clair's was a school with parents who took a particular interest in the techniques used to teach their students, Nicole needed to be able to justify the intervention to them in detail.

Availability of Software and Hardware

In order to plan the intervention, the availability of appropriate hardware and software had to be assessed. This process is described in the section below.²¹

Software

The process of finding and choosing the electronic books was relatively difficult, as there seemed to be no comprehensive catalogue of educational and students' commercial software available in Australia, although several Australian Education Departments had review sites that described some available software. I also discovered several other review sites on the WWW, but these were usually North American and the software reviewed may not have been as useful to Australian students in terms of relevance and spellings. Nicole had not heard of or used any of these sources.

I had started collecting CD-ROM electronic storybooks and other reading software several months before the study began. I heard about them through the following methods:

- browsing through software in computer shops;

²¹ This procedure will not be explained again in future chapters.

- reading and hearing about them in educational catalogues and at conferences;
- reading about them in journal articles and in computer magazines such as *PC User*;
- accessing software review sites on the Internet (see Appendix 5.2.);
- searching the Internet using search terms such as 'educational software', 'reading software', 'electronic storybooks', 'CD-ROM talking books' and 'electronic talking books';
- personal recommendation.

I purchased a selection of software according to the following criteria:

- moderate price;
- availability in Australia²²;
- favourable reviews and personal recommendations;
- trial period (not all vendors permitted this);
- suitability for older students (ages 8-12).

Below are some of my journal entries that refer to the process of reviewing and selecting software:

Looking at software to use with girls at [St Clair's] for repeated readings to increase their fluency. Looked at Disney CD-ROMs eg *Pocahontas* but won't be able to use them as they specify that they're for non-govenunental use. Does this mean schools? Unclear about licensing and copyright. Hard to interpret them sometimes.

Looked at *Reading Blaster* (2000) for ages 7 - 8. It has 25 storybooks in it - which looked promising. I couldn't find them anywhere - navigational aids inadequate! Finally found them in the 'Juice Shack' but they have no narration or highlighting. I don't see the point. They're just ordinary books transferred onto a screen. They have the sound of a page turning over and that's it!

Looked at some Discis books - *Moving Gives Me Stomach Ache* (1993)- very fiddly to install. Hasn't been updated since 1993. There doesn't seem to be any new versions available, which is a shame as they have word definitions and fewer 'hotspots'.

As far as Nicole knew, there were no electronic storybooks available in the school library, although the school's preprimary and kindergarten classes were in

²² Although it would have been possible to purchase software from international sources, I generally elected not to do this because of the difficulty entailed in returning unsuitable software.

possession of a few she could have borrowed if required. However, Nicole thought that these might be too 'babyish' for her Year 5 students.

Nicole informed me that the school usually bought its software from one of Western Australia's educational suppliers. As the supplier in question did not catalogue and stock all software available (although it could usually order, if requested), the school's choice of software was limited. Two key people usually chose software for the primary school, namely the school librarian and the primary school technology coordinator. Other teachers could make requests but seldom seemed to do so, largely because they didn't have access to information about the software available and how they might use it in their classrooms.

After taking a selection of six of my CD-ROMs home and viewing them, Nicole chose *Me and My Dad* (1996) for Claudia, *Aesop's Fables* (1994) for Becki and *Arthur's Teacher Troubles* (1992) for Brianna. She selected these according to the complexity of the vocabulary and sentence structure, the rate and expressiveness of the narrations and whether or not she thought the content or story would be of interest to the student in question.

Several of the CD-ROMs, such as *Arthur's Birthday Party* (1994) and *Harry and the Haunted House* (1994), would not run on Nicole's laptop computer, which had the *Windows ME* operating system installed. These CD-ROMs were later tried on the students' laptops and would not run on them either. Nor would they run on my laptop, which also had *Windows ME* as its operating system, although they would run on other computers running *Windows 95* and *Windows 98*. Although some of these disks may have been appropriate for the students, they could not be used because the students did not have access to computers other than their laptops.

Nicole ruled out *Stellatuna* (1996) because she thought the narration was too slow and stilted and did not provide a good model of fluent reading. There was not a wide range of electronic storybooks to choose from for older students, and what was available had to be distributed between the three students in Nicole's classroom as well as four students in a Year 4 classroom (see Chapter Six). Furthermore, it was not permissible for more than one student to use a CD-ROM at any one time unless a site license was acquired. As the teacher was still evaluating the software, she had no wish to purchase site licenses.

Hardware

Because each of the students in Year 5 had a laptop, the issue of hardware availability was not anticipated to be an impediment to this project. The students' laptops were all reasonably up to date, with CD-ROM drives and speakers, and fulfilled the system requirements for running most electronic storybooks. However, as explained above, the *Windows ME* operating system proved to be incompatible with some of the electronic storybooks.

Planning the Administration of the Implementation

It was necessary to consider where and when the OMMAR sessions would take place, and who would teach and supervise them. Nicole and I decided that some of the sessions would be held in the classroom during class time, others in the classroom after school, and in the students' homes. It was agreed that I would initially show the students and Nicole the procedure and then the students would undertake the sessions independently. If necessary, Nicole or I would supervise them when they were at school.

Formulation of Evaluation Techniques

It was decided that the strategy would be evaluated in the following ways:

- the use of timing records to judge speed and accuracy;
- the use of the Multidimensional Fluency Scale to assess smoothness, rate and phrasing;
- informal classroom observations carried out by the teacher and the researcher;
- teacher, student and researcher journal entries and interviews.

Because this was a formative experiment, it was acknowledged that these techniques were tentative and might need to be modified in response to issues emerging during the implementation.

The Implementation

In the next section of this chapter I describe how Nicole and I implemented an IMM assisted repeated readings intervention using electronic storybooks with the three students. The inhibitive and facilitative factors and unplanned outcomes that emerged are also outlined.

This implementation took place over a 5-week period, in twice weekly 1-hour sessions. A further 10 weeks were spent creating an electronic book, which will be described in the following section of this chapter.

Claudia

Nicole thought that Claudia would find the CD-ROM *Just Me and My Dad* (1997) (see Figure 5.6.) enjoyable and beneficial, even though she predicted that it might be slightly ‘easy’. However, we did not at this point attempt to ascertain the ‘readability’ of the text according to criteria such as the Fry Readability Graph (Fry, 1968). We thought that *Just Me and My Dad* (1997) provided a good model of fluent, expressive reading, even though it was somewhat simple in terms of sentence structure and vocabulary. It must be noted that Nicole considered the fact that the narrator had a North American accent (including pronunciation, stress and intonation) to be slightly disadvantageous.

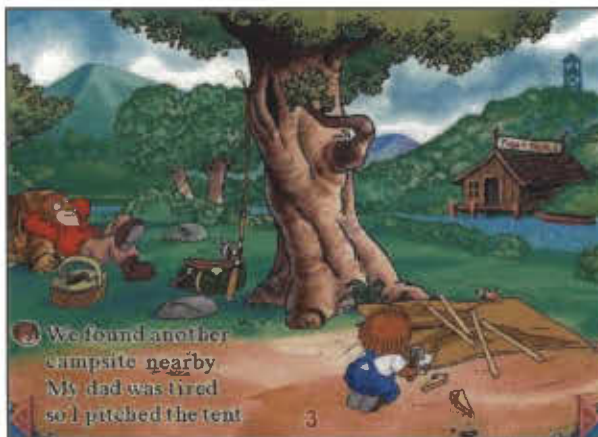


Figure 5.6. *Just Me and My Dad* (1997).

We planned to first ask Claudia to read²³ the electronic storybook from the screen with the sound turned down in order to ascertain whether the text would be 'easy' (95%+ accuracy), 'instructional' (90-94% accuracy) or 'frustrational' (89% accuracy or less) in a traditional context, although we hypothesised that the readers might be able to cope with more difficult texts in an electronic storybook format because of the support offered (i.e. narrations and pronunciations). The issue of 'readability' in relation to electronic storybooks is discussed in Chapter 10.

Because of some of the characteristics of the software²⁴, it was not possible for Claudia to do her initial reading from the screen with the sound turned down, so she was asked to read from a typed copy of the text, without pictures. It would have been possible to do screen dumps for her to read but the teacher and I were unsure of the legality of copying. I explained to Claudia that the aim was to read the text fluently, reasonably quickly, as accurately as possible and with expression and comprehension. Claudia read the text with 98.7% accuracy at a speed of 146 words per minute. She read it smoothly with appropriate phrasing and expression. Nevertheless, we decided to go ahead and let her read the electronic storybook, as she was eager to do so.

I showed Claudia how to install the software and how to manually change the screen resolution, which was necessary with this software. Although Claudia was alarmed at the new screen resolution, saying, "It's never been like this before!" she quickly learnt how to change it.

Claudia tried to open the program from the 'Dad' icon that I had created on the desktop but it did not respond. After re-starting the computer, the program still would not start from the desktop shortcut. It was therefore necessary to go into 'My Computer' and launch the software from there, which seemed to be somewhat confusing for Claudia. This would probably have made it difficult for her to open the software independently

²³ It is noted that it has been suggested that people do not 'read' but 'explore' hypertext texts. This term encompasses the reception of a range of sign systems (Eagleton, 2001), as well as printed language.

²⁴ The characteristics of the software that prevented Claudia doing the initial reading from the screen were the fact that the highlighting, which may have been a distraction, could not be turned off. Also, the animated sections at the end of each screen could not be disabled, meaning that Claudia would have been unable to turn each page quickly after reading it.

Although it may seem that it would have been prudent for Nicole or me to go through a 'trial run' of the installation of this software on another computer before the session with Claudia, this would not necessarily have been beneficial as, due to her particular system, problems may still have arisen on Claudia's laptop.

When the software was eventually launched, Claudia watched and listened to the text attentively, even though animation interrupted the narration. We could not find a way to skip the animations, which was disadvantageous with reference to using this text for IMMARR. Claudia used this software almost intuitively, apart from being told that she must click on the bottom corners to turn the pages.

Although this 161-word electronic storybook was aimed at younger students, the rate at which the narrator read the text was approximately 145 words per minute, which was almost identical to the rate at which Claudia had read the text from a paper printout. However, the narration was extremely fragmented by animation, and sometimes only one sentence was read before another animation appeared. For example, many pages with approximately 15 or 16 words of text, which the narrator read in 6 or 7 seconds, took 30 to 60 seconds to play through.

After engaging with the text, Claudia went into 'Play Mode' and explored the 'hotspots'²³. Hotspots sometimes add meaning to the story, but are often somewhat superfluous (Collins et al., 1997). Claudia laughed out loud several times; this may have been beneficial in that it may have helped reduce any anxiety she may have felt. As previously noted, she occasionally suffered from anxiety when reading. Humour can also be beneficial in reading in that it can facilitate engagement in the imaginary world of the story (Mallan, 1993).

After engaging with the software, we had problems exiting it part way through; the escape key (ESC) did not respond and we could not find any instructions regarding quitting the program. We eventually found, by trial and error, that the 'enter' allowed us to exit, although we could have resorted to CTR+ALT+DEL if we had needed to. Despite these minor frustrations, Claudia seemed to have enjoyed the session.

²³ 'Hotspots' are areas of the computer screen that, when clicked, activate an action, which may be sound, video, animation or written text.

Nicole and I discussed the fact that this electronic storybook was probably too easy to be beneficial to Claudia and we decided to let her choose between three other CD-ROMs I had suggested. These were *Reading for Literacy 4* (2000), which highlighted sentence-by-sentence as opposed to phrase-by-phrase, and *PM Storybooks Silver* (2000), which had no text highlighting at all. Both of these CD-ROMs were Australian, with narrations in Australian accents and, according to Nicole, seemed to be at an appropriate level for Claudia. Also available was *Fables* (1993).

Claudia was asked to choose from this small selection. However, this was problematic as she was asked to make the decision on the basis of only a brief description of the software and by examining the CD-ROM covers. In retrospect, it may have been preferable to allow her to view the CD-ROMs, although this may have been time-consuming in that it would have involved installing CD-ROMs on her laptop and then uninstalling them again in order to comply with licensing regulations.

Claudia expressed disappointment and frustration that the available *Living Books* CD-ROMs such as *Harry and the Haunted House* (1994) would not run on her laptop; she did not see the alternative CD-ROMs as being as much "fun", *PM Storybooks Silver* (2000) (see Figure 5.7.) and *Reading for Literacy 4* (2000) emphasise education rather than 'edutainment' and have fewer hotspots and multimedia effects than do the *Living Books* electronic storybooks. Further, Claudia disliked fables and was not interested in using the *Fables* (1993) CD-ROM. She stated that she wanted to use 'fun' software, like Brianna and Becki's (i.e. *Living Books*). She clearly had expectations that software ought to be entertaining.

She eventually selected *PM Storybooks Silver* (2000) and began to read aloud a story called Kerry, along with the narrator. No highlighting was available so Claudia tracked the text with her mouse. She stopped reading and exited this story after a few pages, saying, "This is getting boring!" This story, at approximately 900 words, was perhaps too long for her (although she would have been asked to select only a 100 to 200-word section for repeated readings).

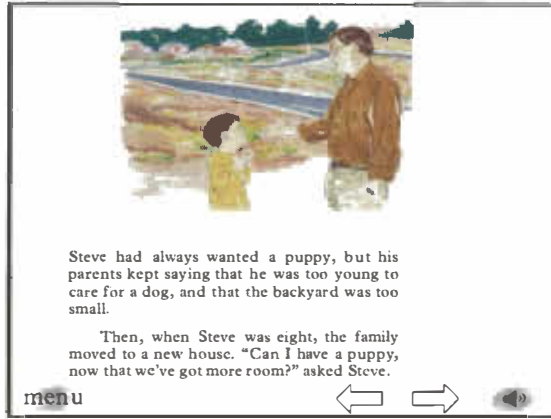


Figure 5.7. *PM Storybooks Silver (2000).*

Next, Claudia selected *Reading for Literacy 4 (2000)*, which contained several short texts of 100 to 200 words. Various genres, such as narrative, reports and poems were available. First, Claudia chose a 324-word narrative, *Master Frog* (see Figure 5.8.). For the initial reading, I asked her to read aloud from the screen, without computer narration or highlighting. Again, Claudia tracked the text with her mouse. This reading was tape-recorded and a running record was taken. She read the text with 99.3% accuracy at 122 words per minute.

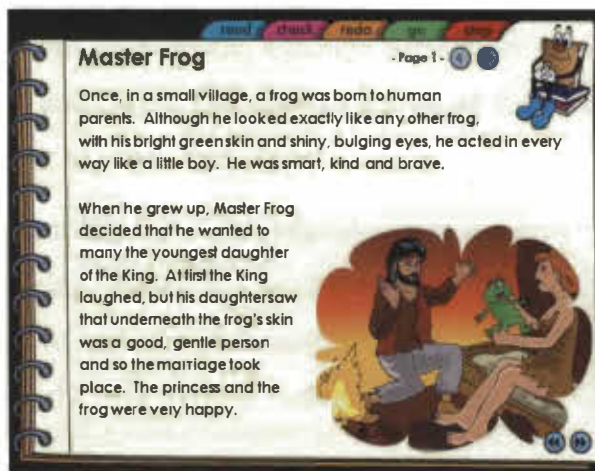


Figure 5.8. *Reading For Literacy 4 (2000).* Master Frog.

She was then asked to reread the story (aloud), along with the computer narrator, and provide an oral retell. Her retell was reasonably detailed and in addition she satisfactorily answered a set of teacher-made literal and inferential comprehension questions (see Appendix 5.1.).

Although this electronic text seemed somewhat easy for Claudia, Nicole and I decided that she should continue with it because her comprehension score had been low on the NARA (31st percentile). We were of the opinion that the comprehension activities at the end of each text, such as the cloze activity (Figure 5.9.) might be beneficial to her. Again, she learnt to operate the software quickly.

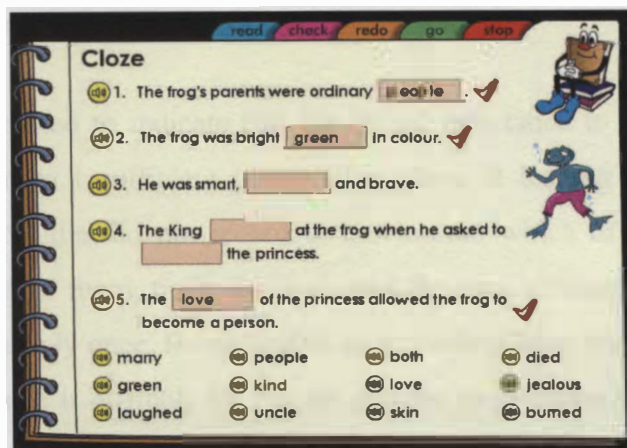


Figure 5.9. *Reading For Literacy 4* (2000).

In *Reading For Literacy 4* (2000) spoken instructions were provided to help students understand what was required of them during the activities, although they were not provided in written form. Claudia's well-developed listening skills meant that she did not find this problematic, although some other students in this study did (see Chapters Seven and Eight). She answered most of the comprehension activities correctly, allowing her to experience success.

Feedback regarding incorrect responses was not provided by the software, other than an 'X' being displayed. Claudia would retry until a tick was displayed. Although this type of activity permitted users to guess answers, she certainly appeared to be taking the time to think before responding.

Claudia was asked to take the CD-ROM home so that she could reread the text in her own time using her laptop, reading along with the narrator in a 'soft voice'. She was also asked to complete the rest of the comprehension activities associated with the text, Master Frog.

She subsequently wrote in her journal (Figure 5.8.):

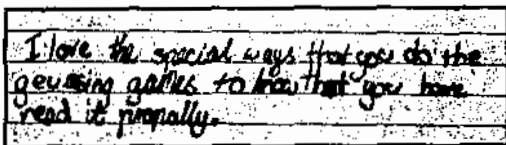


Figure 5.8. Claudia's Journal (1)

This seemed to indicate that her initial reluctance to use this software may have been due to insufficient information about it leading to false expectations. Regrettably, Claudia did not record in her journal which of the activities she had completed or how many times she had read the text, although she told me she had read it at home only once. Being unable to accurately keep track of what the students were doing made it difficult for Nicole and me to evaluate the intervention, as we were not sure of the nature and extent of the students' engagement. Although it was possible to print out records of what activities a student had completed with *Reading for Literacy 4* (2000), details about how many times a text had been accessed were not available; an activity was not recorded as completed until a student achieved 100%, which may entail several attempts. If a student gave up before achieving 100%, their score, or even the fact that they had attempted the activity, was not recorded. This rendered the software's recording facilities of limited value to teachers.

In the following session, I took a second running record of Claudia reading *Master Frog*. She had increased her rate (pace) to 140 words per minute and her accuracy to 99.7%, and read the text smoothly and with appropriate phrasing and expression. Her increase in rate was encouraging, but it was not possible to make a judgement about whether using the software was preferable to any other strategies or contexts²⁶ that we might have used with the aim of increasing her oral reading fluency of this text.

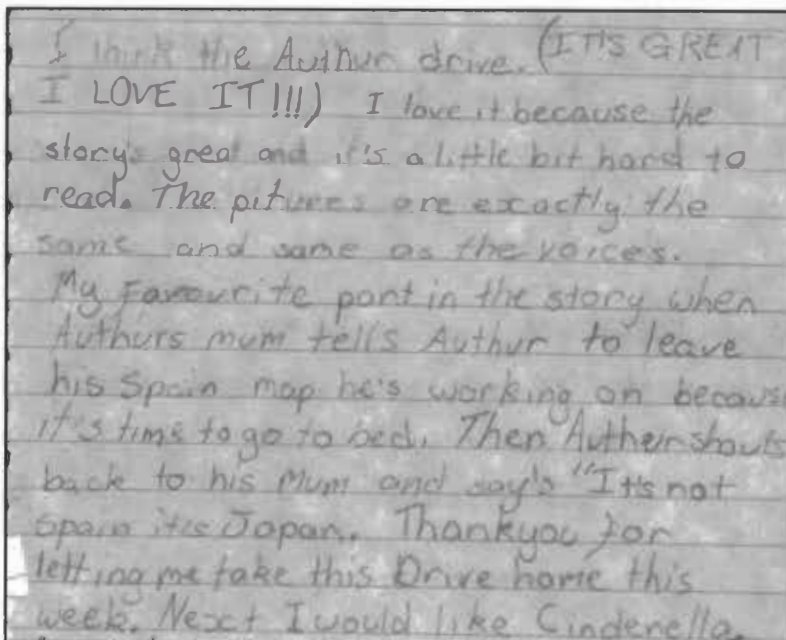
During this session, Claudia explored several more texts in *Reading for Literacy 4* (2000) and completed the comprehension activities. She sometimes read aloud with the narrator, but did not read the texts repeatedly. Because her classmate,

²⁶ Such as repeated readings of the text from a traditional paper-based book, or paired reading of the text from a traditional printed book.

Brianna, was reading *Arthur's Teacher Troubles* (1992), Claudia stated that she was dissatisfied with *Reading for Literacy 4* (2000) and that she was eager to read *Arthur's Teacher Troubles* (1992), which had hotspots. She did not want to continue with *Reading for Literacy 4* (2000), even though she had enjoyed using it.

In the context of electronic storybooks, Claudia was always eager to explore the next text or CD-ROM. It has been suggested that multimedia texts can encourage readers to read 'extensively' rather than 'intensively' (Leu, 1996a). That is, readers tend to read a lot of texts in a somewhat superficial manner rather than reading fewer texts 'deeply'. This certainly seemed to be the case with Claudia, although this tendency could have diminished once the initial excitement of reading electronic storybooks had worn off. The 'novelty effect' has often been argued to be a short-lived facilitative factor in that it can provide motivation (Tergan, 1997). However, in this study, novelty seemed in some ways to be an inhibitive factor in that it generated over-excitement and an inability to concentrate on the 'here and now'. Nevertheless, for the students at St Clair's, who had used computers extensively, this tendency seemed to be minimal compared to some of the students in other participating schools (see Chapters Six and Seven).

In the following session, Claudia read *Arthur's Teacher Troubles* (1992), which was read by the narrator at approximately 114 words per minute. Regarding this electronic storybook, she wrote in her journal (Figure 5.10.):



I think the Arthur drive. (IT'S GREAT I LOVE IT!!!) I love it because the story's good and it's a little bit hard to read. The pictures are exactly the same and same as the voices. My favourite part in the story when Arthur's mum tells Arthur to leave his Spain map he's working on because it's time to go to bed. Then Arthur shouts back to his Mum and says "It's not Spain it's Japan. Thankyou for letting me take this Drive home this week. Next I would like Cinderella.

Figure 5.10. Claudia's journal (2)

Again, Claudia did not record how many times she had read the story, and whether or not she had read aloud with the narrator, despite the clear 'How to use this journal' instructions (Appendix 5.4.) that were pasted to the inside cover of her journal. In response to this shortcoming, I designed a 'Record Sheet' (see Appendix 5.5.). However, the students did not write accurate records in this format, either.

Claudia also wrote in her journal (Figure 5.11.) that it was difficult to find time to read the electronic books at home:

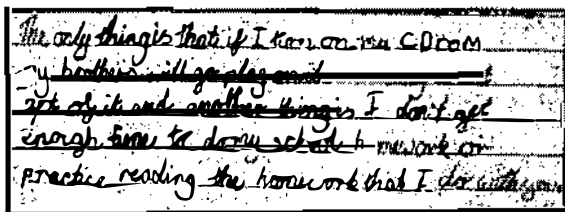


Figure 5.11. Claudia's journal (3)

In response to this problem, Nicole made reading the electronic storybooks 'official homework', which was written in Claudia's homework diary each night. In this way, she hoped to elicit the support of Claudia's parents so that they could ensure her siblings did not disturb her as well as help her manage her time.

Claudia read electronic storybooks during class time on several occasions. Nicole informed me that this was not problematic, either for Claudia or the rest of the class; the narrations were listened to at a low volume and Claudia read along in a barely audible 'soft voice'. Other members of the class were not distracted, although they were curious.

In summary, Claudia read several electronic storybooks in an attempt to improve her oral reading fluency, the strategy being SMM assisted repeated readings. After five weeks of using this strategy, Nicole and the students decided that it was a somewhat dull strategy and that they would like to create their own electronic storybooks instead. The major inhibitive factors are listed in Table 5.7., at the end of the section about IMMARR.

Brianna

Nicole chose *Arthur's Teacher Troubles* (1993) (see Figure 5.12) for Brianna. Initially, Brianna was asked to read the first 185 words of the text from a typed sheet, without pictures²⁷. I explained to her that the aim was to read fluently, reasonably quickly, as accurately as possible, and with expression and comprehension. She was also reminded to use punctuation as a guide, pausing at commas and full stops.

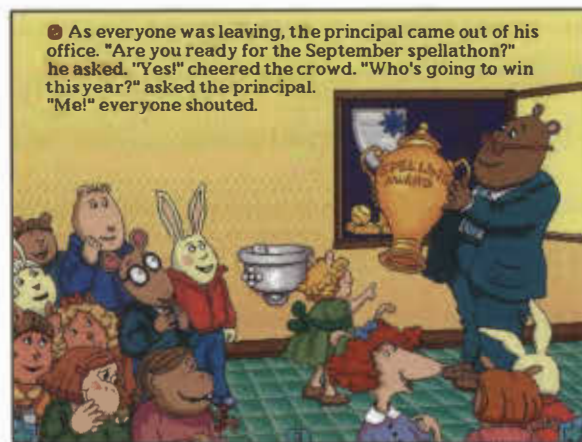


Figure 5.12. *Arthur's Teacher Troubles* (1993).

Brianna read the text with 94% accuracy, which would have been at an 'instructional' level in a traditional printed form. She read it at 105 words per minute, which was much quicker than her rate during the NARA. In terms of smoothness, there were occasional breaks caused by difficulties with specific words and/or structures. There was a mixture of run-ons, mid-sentence pauses for breath, and some choppiness caused by word-by-word reading, although she read with reasonable stress/intonation.

I installed the software on her laptop without technical problems, although it was necessary to change the screen resolution manually, as this software did not do this automatically. This did not prove to be a problem for Brianna, who was confident and competent when using her computer; she was thereafter able to change the screen resolution independently when necessary.

I demonstrated to Brianna how to use the 'Read to Me' and 'Play' modes of the software. 'Read to Me' is where the narrator reads the text all the way through without interruptions, whereas in 'Play' mode the narrator stops after each page or

²⁷ See p. 107 for reasons.

screen, enabling the reader to engage with the hotspots. Readers can also re-read the text independently, clicking on individual words to access pronunciations. Brianna accessed approximately four hotspots but did not seem to be particularly interested in them.

She read along silently and listened to the whole text, smiling all the way through; she had not been asked to read aloud with the narrator on this occasion, as reading for enjoyment and comprehension seemed to be important in the initial reading. As requested, she reread the first ten pages of the text in a soft voice, twice. She was then asked to draw a picture of her favourite page and add a speech bubble.

Brianna was also asked to take the electronic storybook home to reread it, although she was informed that she could do some of these readings during classroom time if she got the opportunity. She was asked to read to page six (approximately 200 words) up to five times in total, whilst reading aloud ('soft voice') with the narrator. In her journal, Brianna wrote:

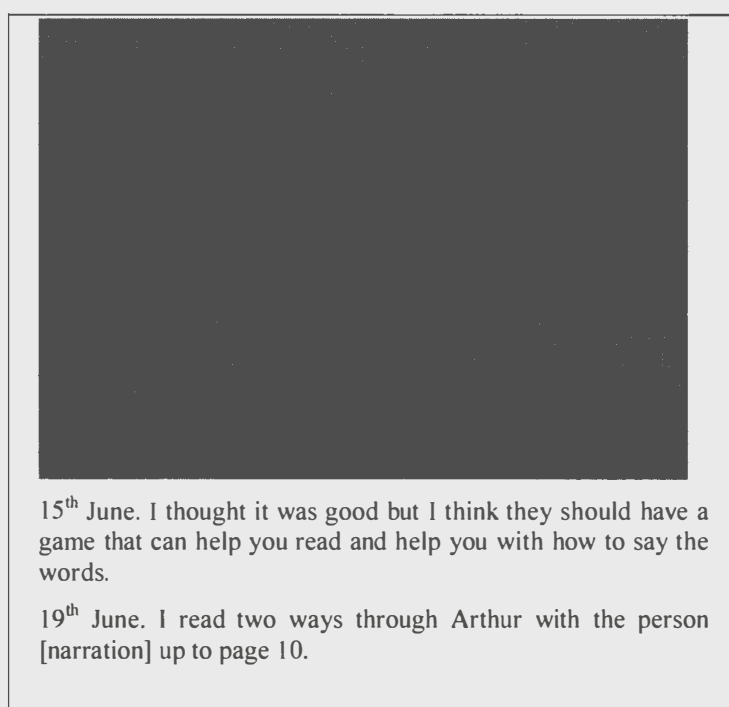


Figure 5.13. Brianna's journal (1)

Although she recorded that she had read the story twice (to page 10), Brianna did not specify whether she had read it aloud with the narrator, merely listened to the narrator, or read it silently or aloud without the narrator (see Figure 5.13.).

Some comprehension activities were also planned and implemented, because of the link between oral reading fluency and comprehension. After listening to and reading along with the narrator all the way through the text, Brianna was asked to provide an oral retell of the story. Her retell was brief (58 words) and had important events missing, although the events mentioned were in the correct sequence. Several comprehension questions were also asked. She answered these satisfactorily but without much confidence.

The next electronic storybook Brianna chose to read was *Cinderella* (1994). On this occasion, we did not ask her to read a section of the text from a paper printout prior to permitting her to access the electronic storybook. Although this later made it difficult to gauge whether or not she had improved her rate, accuracy and smoothness with reference to this particular text, we speculated that requiring students to read from paper printouts prior to accessing the electronic books on every occasion would reduce their enjoyment and motivation.

Brianna reported that she found *Cinderella* (1994) slow and "a bit boring". She claimed to find the story unexciting because she knew it already. Because many CD-ROMs are based on classic tales due to copyright issues (Bennett, 1994), this is a relatively common shortcoming. She also disliked the "boring" grey background and the "boring" background music. As well, she was disappointed that there were no hotspots in this electronic storybook, even though she had barely accessed them in *Arthur's Teacher Troubles* (1993). In addition, she found the fact that there was no way of skipping to the beginning of the story without going through all of the pages 'annoying'. Despite these frustrations, she later wrote in her journal that she had read her selected section of the text 6 times, although again she did not indicate whether she had read aloud along with the narrator. This was despite the fact that she had been given the new record sheet to facilitate record keeping.

In the next session, Brianna selected *Reading for Literacy 4* (2000). From this CD-ROM, she chose a narrative, *Tosca*. In almost all instances during this study, students initially chose narrative texts rather than other genres. Brianna read *Tosca* three times, voluntarily reading along in a soft voice. She then proceeded to score 6/6 in the cloze exercise. When doing the activities, she always requested the computer to read out the instructions and passages, rather than attempting to read them herself. In this sense, she was displaying what has been called 'over accessing' (Collins et al.,

1997). This could be an indication of her low level of confidence in reading, or it could have been because she found it less arduous, or because of the so-called novelty factor.

In summary, Brianna used the OMMARR strategy faithfully to read several electronic texts. The facilitative and inhibitive factors that emerged were in the main the same as those for Claudia (see Table 5.7.). A further facilitative factor in the case of Brianna was her faithfulness in following instructions. When asked to read aloud, she generally did so. When asked to read a section of text three to five times, she did this.

Becki

Nicole selected the CD-ROM, *Aesop's Fables* (1994) for Becki to read. She was aware that this CD-ROM had fewer 'bells and whistles' than the ones she'd initially selected for Claudia and Brianna, but thought that Becki would still find this CD-ROM exciting because she was relatively new to the school and had not had as much experience with computers as Claudia and Brianna had. In other words, she thought that Becki's expectations would be different.

Before viewing the fable, *The Town Mouse and the Country Mouse*, Becki was asked to read the first half of the text (171 words) from a paper printout. The whole text was 16 pages and 347 words. Becki's oral reading was tape-recorded and a running record later taken. Her accuracy rate was 93%, indicating that in a traditional context, this text would have been in her 'instructional' range, which is recommended for paired or assisted reading. Becki read the text at 111 words per minute, which was acceptable. However, her reading was slightly choppy and without expression. She disregarded punctuation several times. After reading the paperprintout, she indicated that she "hated" fables.

In my journal, I wrote:

Becki stated that she didn't like the Discis CD-ROM as it's boring and she 'hates' fables. Does this mean we should change it straight away, or should we encourage her to 'give it a try'? This is a problem that has obviously arisen through not giving the students the opportunity to CHOOSE their texts - it has resulted in time wasted. However, we felt we couldn't let them choose as we didn't have many CDs at our disposal to choose from, and appropriateness in terms of reading level

and features of the software (such as availability of highlighting, speed of reading) seemed to be more important.

Nicole and I later discussed dislike of fables and Nicole decided that it would be useful to continue with this software to "see how it goes", especially as Becki would only be reading the fables for a short time.

Even though this software was almost 10 years old, it ran well on Becki's laptop under *Windows ME*. However, it must be noted that the installation process of Discis books seems somewhat cumbersome. It was also necessary to manually change the screen resolution.

When Becki opened the software she immediately stated that she didn't like the look of it. Nevertheless, she read the fable aloud in its entirety. However, much of the time she read out of synchronisation with the computer narrator and the highlighting (faster), although she performed better on the section of text she had previously read from a printout. Despite the computer narration, she mispronounced several words.

After reading the text, Becki announced that it was "boring" and that she hated fables. She also informed me that she had disliked the background music and the narrator's voice, which was that of a North American male. She also indicated that the illustrations were not varied enough in this software; the same illustrations were often used on several consecutive screens. She appealed to me not to ask her to reread the story, so I did not insist on this.

She and I discussed the possibility of her reading either *Arthur's Teacher Troubles* (1992) or *Arthur's Birthday* (1994) next and she was excited at the prospect, saying, "I've seen every Arthur show!" She previewed parts of *Arthur's Teacher Troubles* (1993) on Brianna's computer and said that she loved it. In her journal (see Figure 5.14), she wrote:

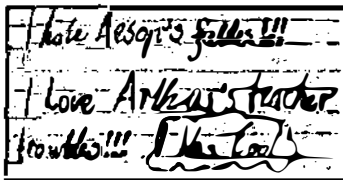


Figure 5.14. Becki's journal(1)

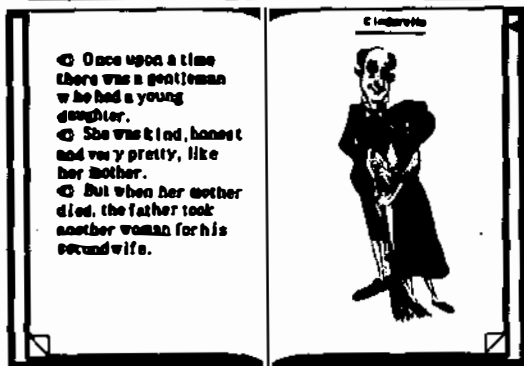


Figure 5.15. *Cinderella*. (Discs Books)

In the next session, we unsuccessfully tried to run *Ruff's Bone* (1994) and *Arthur's Birthday Party* (1994) on her laptop, which had the *Windows ME* operating system installed. It was frustrating that these CD-ROMs would not run despite the fact that *Arthur's Teacher Troubles* (1993), another electronic storybook by Living Books, had run successfully on the same computer earlier in the week. Becki was able to install these CD-ROMs herself, although she did not know how to uninstall them.

Becki was disappointed about the CD-ROMs failing to run on her computer and, because of a limited supply of available electronic storybooks, had no alternative but to read *Cinderella* (1994) (see Figure 5.15.), which she had initially rejected. She read several previously unread pages from the screen with the highlighting and sound switched off and I tape-recorded this to analyse for speed, accuracy and smoothness. She read the text at 93% accuracy, which would indicate that in a traditional context, this text would be at an instructional level for her. She read the text at 88 words per minutes with a mixture of fast and slow reading. In some places her reading was choppy and without expression. She used her mouse/arrow to track as she read, indicating that she found it difficult to track the text on the screen with her eyes when the highlighting was not present.

After reading this 318-word section of the text, Becki went back to the beginning of the story and listened to the computer narration. She appeared to find it difficult to concentrate and left her seat several times in order to look over the

shoulders of Brianna and Claudia. She did not read along with the narrator at all. After listening to the whole story, which was somewhat long, I asked Becki to do an oral retell. She responded that she could not do this. I then asked her some comprehension questions and most of her answers were adequate, although she still did not seem to be fully concentrating. She took the CD-ROM home to read it as homework.

During the next two or three days (individual entries were undated), she wrote in her journal (Figure 5.16):

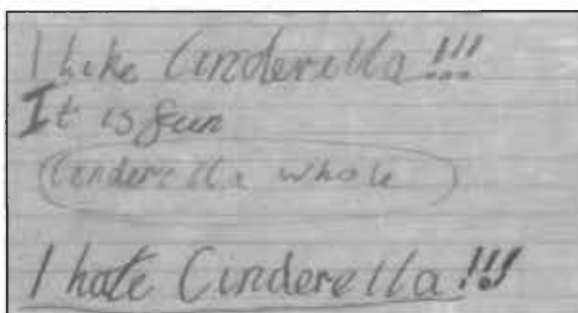


Figure 5.16. Becki's journal (2)

In the next session, Becki chose to read *Reading For Literacy 4* (2000). The first text she selected was the narrative, *The Creek*. Although she had been requested to 'soft read' along with the computer narration, she expressed a preference for reading along silently. She seemed to find it difficult to synchronise her reading with that of the computer narrator, either racing ahead or lagging behind. She read the text once and then accessed the comprehension activities. She took this CD-ROM home and read eight of the texts. Even though these texts did not feature hotspots and animation, Becki seemed to prefer *Reading For Literacy 4* (2000) to *Cinderella* (1994) and *Fables* (1993). In *Reading for Literacy 4* (2000), the texts were short, the narrator was Australian, and there were comprehension activities or games at the end of each text.

To summarise, Becki read several electronic storybooks but did not comply with the requirements of the IMMARR strategy.

Facilitative and inhibitive factors associated with IMMARR: St Clair's, Year 5

Major facilitative and inhibitive factors noted in this formative experiment are listed in Table 5.7. below. The factors are marked with reference to each student.

The student displayed some reluctance to read texts aloud with the computer narration.			
The student displayed some reluctance to read texts repeatedly.			

These factors will be discussed in greater depth in Chapter Ten.

Concluding the IMMARR strategy with the Year 5 students

Because of the shortage of suitable electronic storybooks available for students of this age and ability, and because the students were excited about the possibility of making their own electronic storybooks, we decided to move on to the creation of electronic storybooks as a context for improving oral reading fluency after each student had read only three commercial electronic storybooks. No formal assessments regarding their oral reading fluency were made at this point, as this first intervention was very short.

Selection of Learning Strategy: Electronic Storybook Authoring

Availability of Software and Hardware

I had already trialled a variety of amateur multimedia authoring packages that might be simple enough for students of this age group to learn, including *PowerPoint* (1997) and *Hyperstudio* (2000). After discussion with Nicole, *Illuminatus* (2001) was chosen, as it was the only one that allowed text highlighting to be easily synchronised with speech.

Planning the Administration of the Implementation

It was decided that the electronic storybook authoring would take place in several different contexts: after school; during school time (when the rest of the class was with specialist teachers, for example during art and physical education), and during school time when the rest of the class was present. Because of the nature of

this activity, and because the students did not have the necessary software on their computers²⁸, they were unable to work on the electronic storybook at home.

The Implementation of Creating Electronic Storybooks

Nicole and I began by showing the three participating students the first two screens of an electronic storybook that I had started making, called *Eric The Magic Elephant*. The students enjoyed this story and asked if they could use these first two screens as a 'story starter'. After the selection of the main character and setting, the first task in the creation of the electronic storybook was to make a paper storyboard. A storyboard is a series of sketches of each page or screen, showing text and pictures. It also notes what interactivity each page will feature, for example, what will happen if the user clicks on a certain picture, and what sounds and animations each page will feature. The creation of a storyboard was facilitated in this project by the fact that the students had sampled a range of commercially produced electronic storybooks, as discussed above, and they had created storyboards for picture books. The students therefore had an idea about what electronic storybooks might look like and what sorts of features they may contain.

The purpose of the storyboards was explained to the students:

Becki: Are we going to have to put our story on that? [pointing at the paper storyboard template, and frowning].

Researcher: Yes. You'll need to do that so that it's [the electronic storybook] properly planned. If you don't plan it, especially when you're using multimedia, it can mean such a lot of wasted time and work. It can take quite a while to get the talking on, and all the sounds, so you want to get it right first time.

Nicole: Actually, it's a little bit like the storyboard where you had the little boxes for your picture book, so you knew exactly what pictures you were going to put in.

Researcher: You have to be able to say what pictures you're going to have, and what's going to happen when you click on things ... and also the text and the page number.

²⁸ The students were not allowed by the school's technical staff to install *Illuminatus* on their laptops due to restricted hard drive space.

As illustrated in the transcript above, the students found the idea of writing the storyboard on paper somewhat onerous and frustrating. As has been discussed, they were accustomed to using technology in a wide range of circumstances as they each had a laptop in class, which was used for word-processing, keyboard practice, creating presentations and desktop publishing, as well as accessing CD-ROM encyclopaedias and the WWW for research purposes. Because the students were eager to use the computer as soon as possible, we completed the paper storyboard for the first half dozen screens or pages only. In addition, as a group we discussed the setting, characters, introduction, complication and resolution and made brief notes about how the story might go. As this was their first attempt at creating an electronic storybook, it seemed reasonable to allow the students to experiment with the capabilities of the software and to 'play' with the interactive possibilities, instead of committing them to a story plan too early.

Nicole and I decided that the electronic storybook should be limited to approximately 10 to 12 pages, with a total word count of 100 to 200 words. This way, it would be a potentially useful resource for other students to use for IMM-assisted repeated readings. Another reason to limit length was a restricted time frame in which to produce the electronic book.

The students were initially keen on the idea of creating individual electronic storybooks rather than a single collaborative one. Two factors prevented this from happening. Firstly, the students and the teacher decided that an electronic storybook featuring only one person's voice would be somewhat boring, like some of the commercially produced ones we had explored. Secondly, because multimedia productions can take up a great deal of the computer's hard drive, the school's technical services team were not in favour of *Illuminatus* (1999) being installed on any of the students' laptops. This meant that they had to share a computer that had the software installed. We used my laptop for this purpose because it had a large amount of space on its hard drive. It also had a Zip drive, which later facilitated the transfer of the electronic storybook onto a computer that had a CD-ROM recorder. A school computer with plenty of hard drive space, a sound card, speakers, a microphone and a CD-ROM burner or Zip drive could have been used but we went ahead and used my laptop to enable me to view the production at home and also to complete tasks away from the school.

Each of the three students took turns to be the 'scribe', who typed the story into *Illuminatus* (1999). This process was facilitated by the fact that in many ways *Illuminatus* (1999) has an interface similar to that of a word processor. The students already knew how to create a text box and select font types and sizes. For each page, the three students came to an agreement about what they would write, sometimes jotting it down on paper, and the scribe typed. Sometimes the teacher or I would suggest more complex vocabulary or sentence structure. When they were not playing the role of scribe, students were vigilant and attentive to what the scribe was doing, and in most instances quickly pointed out spelling and punctuation errors. However, this was not always the case, so we upgraded to *Illuminatus Opus* (2001), which has an inbuilt spellchecker.

The students claimed they had not engaged in much collaborative writing since Year 4, as they did most of their writing on an independent basis on their laptops. Because of this, there were some teething problems in getting them to work efficiently as a team in this context. One such problem was 'keyboard envy', where they all wanted to be the scribe. Roles and rules were established, after which they worked together with relatively little time-consuming conflict.

Font and background colours were tentatively decided upon whilst typing in the written text but the students were asked not to spend too much time on this after it became apparent that, left to their own devices, they would spend a lot of time 'chopping and changing' the fonts and colours. The students were also asked to think about what pictures and animations might suit each page, although no graphics were created at this stage. They were reminded that, as in picture books, pictures and written text complement each other but don't necessarily overlap. That is, there are occasions when the picture can tell the story or add to the story, rather than merely illustrate it. They were also asked to think about how interactivity and animation might play a role in enhancing the story.

After typing three of four pages, we asked the students to record some narrations. Wave editing software is required to record narrations and, although the Windows operating system includes a program called *Sound Recorder* (2001), this program was not used because the sound recordings it produced were not deemed to be of a high enough quality. Instead, we used *Speech Analyser* (2000), which had the added advantage of waveform diagrams (see Figure 5.17.).

Initially, the students practised the narrations (one page at a time) away from the computer and when they were happy with them, they recorded them on the computer. However, it soon transpired that they preferred to practise their readings whilst recording them on the computer, as they found it useful to hear the ‘replays’ and to see the wave patterns or ‘waveforms’ on the screen. The sound recordings and wave patterns facilitated some very interesting discussions between the students about what ‘fluent reading’ should sound and look like. For example, they often gave each other advice about intonation, volume, pronunciations and phrasing. They usually recorded narrations three or four times before they were satisfied with the sound and ‘look’ of it. On several occasions they were influenced by the waveform. If it was ‘fat’, they would laugh and say they must have been speaking too loudly. If it was particularly ‘skinny’, they said their narration must have been too quiet. If there was a big gap, they discussed whether they had paused for too long. Below (Figure 5.17) is a screen capture of a ‘waveform’ of the narration from page 20 of *The Magic Elephant*. The screen itself is illustrated in Figure 5.18.

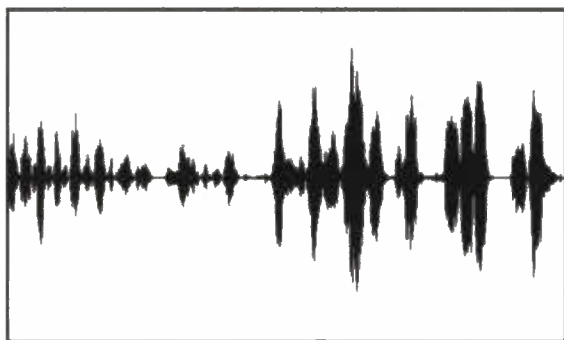


Figure 5.17. Waveform of page 20 of *The Magic Elephant*

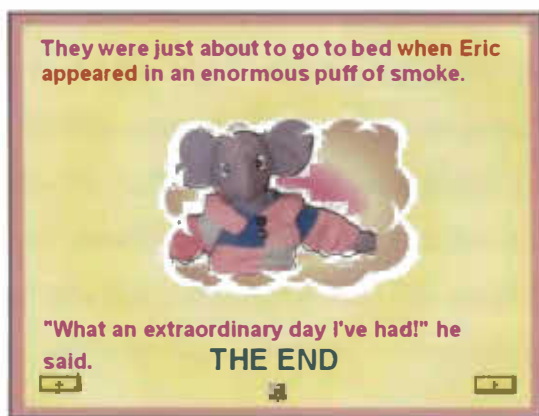


Figure 5.18. Screen capture from *The Magic Elephant*

At the beginning of each session the students reviewed what they had already written. This necessitated a form of repeated readings, which may have helped improve their oral reading fluency and word recognition. However, as the book grew, the repeated readings took longer until, towards the end of the project, the review took up to fifteen minutes, which became somewhat dull and time-consuming. The electronic book grew to be much longer than the 10 or 12 pages planned; it grew into a 43-page story with multiple endings and a quiz at the end. The multiple endings were included to allow each of the three authors a chance to provide an ending and also as a means of encouraging the audience to repeatedly read the story.

In terms of graphics for the project, the initial intention was to produce and scan in hand-drawn pictures. We did not want to use existing pictures because of copyright issues. However, as the project grew, it became apparent that drawing and painting all the pictures would be inhibitive time-consuming. We therefore decided to take digital photographs of toy elephants. We acquired one of the school's two digital cameras, which were always in great demand by other teachers and students, and then we spent some time in the school grounds taking photographs. The students had already taken several photographs under Nicole's supervision, but were not happy that these illustrated or advanced the story satisfactorily. Because Nicole also had to supervise the rest of the class, the participating students had not been allowed to venture far from the classroom door.

Under my supervision, they were able to venture further into the playground and take photographs of the elephants in locations that resembled the zoo, the park, and down a hole. Once the photographs were imported into *Illuminatus Opus* (2001) and touched up with *Paintshop Pro* (1998), we added sound effects and animation to the story. The students found this highly entertaining and put a great deal of thought into how best to use animation and sound effects to add to the story without creating too many distractions for the audience. To add entertainment and educational value to the audience, we also constructed a small quiz at the end of the story, which contained mainly literal and inferential questions. The construction of the quiz may have improved the participating students' comprehension strategies and metacognitive awareness.

The ability to split sentences into 'chunks' is an important aspect of fluency (Rasinski & Padak, 2000) and is also important to comprehension (Irwin, 1991). A

central aim of this project was to create electronic storybooks as a context in which students could practise chunking. It was necessary for them to chunk the sentences when deciding where the text highlighting should go.

Before adding the highlighting to the text, we gave the students a one-off lesson on 'phrasing' or 'chunking' text, away from the computer, as they had not received explicit instruction on this. We did this in a half-hour session. I explained to them how they might split sentences into 'meaningful chunks', using punctuation and meaning as clues. We collaboratively chunked some texts and drew slashes on the paper to mark chunk boundaries. Later, the students carried out a similar activity independently. They then individually divided text from *The Magic Elephant* into chunks (see Figure 5.19). After they had each done this, we discussed their attempts at chunking the text and came to an agreement about where the highlighting would go in the electronic storybook. Most of the time there was a high degree of agreement among them as to where the highlighting should go, and they were usually able to justify their decisions.



Figure 5.19- Claudia's 'chunking' of page 3 of *The Magic Elephant*

There was insufficient time to check these paper-based judgements about where phrase boundaries should be against the recorded narrations, as the end of the school year was approaching. Such cross-checking would be a worthwhile addition to any future projects of this kind. Or, perhaps better still, the paper-based chunking could be done prior to the narrations being recorded.

Because the students' time was limited, I inserted most of the auto-narrations (a feature in *Illuminatus Opus* that links audio files with text and creates text highlighting) and edited the text highlighting. This can be a somewhat time-

consuming process and, although the students were capable of doing this themselves, it would be more expedient if parents or other volunteers were recruited to do this job in future projects.

The story was finally 'published' onto CD-ROMs, meaning that it could be run on most PCs as it was not necessary to have *Illuminatus Opus* (2001) installed in order to run its publication. There was also a facility in *Illuminatus Opus* (2001) to publish onto the WWW, although such publications need to be much 'leaner' in terms of WAV (sound) files and pictures than our production. The students expressed great pride in the finished product.

The Assessment Results

A major objective of this study was to identify facilitative and inhibitive factors associated with using IMM in particular ways to attain particular pedagogical goals, and then to use this information to modify the implementation. In order to evaluate the learning strategies, it is also necessary to discuss the extent to which participating students achieved the pedagogical goal(s). Moreover, this assessment data is required to assess the preferability of the intervention.

According to the formative experiment guidelines outlined by Reinking and Watkins (2000), unplanned outcomes should also be identified and analysed for use in the preferability equation. In the next section of this chapter, this data is presented and examined.

Throughout the study, Nicole assessed the students' oral reading fluency performances informally by observation, through assessing their performance in other literacy tasks and by administering the Multidimensional Fluency Scale when they read classroom texts. Through these assessments, she was confident that she could see improvements in their fluency, such as improvements in their attention to punctuation and reading with expression. However, because of the complexity of the interventions and the classroom environment, it was difficult to ascertain exactly which factors were contributing to the improvements. This made judgements about preferability problematic.

Claudia

At the end of the project the NARA (parallel form) was administered, as was the Multidimensional Fluency Scale. These assessments indicated that Claudia had substantially improved her oral reading fluency in terms of rate, accuracy, comprehension, phrasing and smoothness. In general, she read the NARA texts fluently with good expression and phrasing, although there were some pauses and ‘choppiness’ on very difficult texts, such as the level 6 text, Everest. With reference to the level 3 NARA text, she scored at the highest level in all three dimensions (pace, smoothness and phrasing) of the Multidimensional Fluency Scale. In order to represent performances in reading fluency graphically, it is possible to score the Multidimensional Fluency Score numerically. If the lowest level of achievement in each dimension is given zero points and the highest is given three points, a student can score between zero and nine points on any particular text. For the level 3 NARA text, Claudia scored the maximum of 9 points. Four months earlier, she had scored only 6 points on this level of text. For the more difficult level 4 NARA text, she improved her score from 4 points to 6 points (see Figure 5.20.).

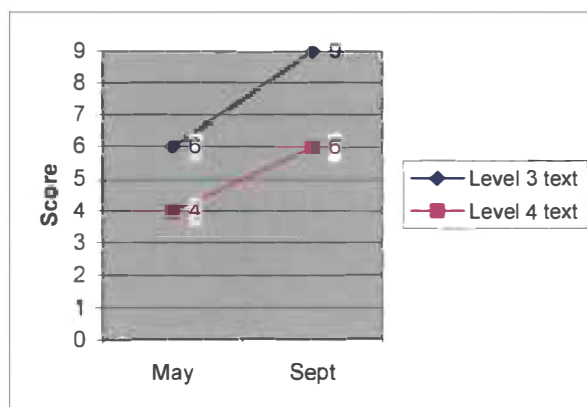


Figure 5.20. Pre- and post-intervention results of the Multidimensional Fluency Scale: Claudia.

According to the NARA, Claudia's accuracy increased from the 48th to the 76th percentile in the four months from the beginning of the study. Her comprehension increased from the 31st percentile to the 87th and her rate decreased from the 73rd percentile to the 69th (see Figure 5.21.). However, her rate would have increased to the 94th percentile had she read only to the same level of text that she reached in the pre-intervention assessment, as the more difficult levels of text read in

the second NARA brought her average reading rate down. These improvements in her achievement are represented graphically in Figure 5.21.

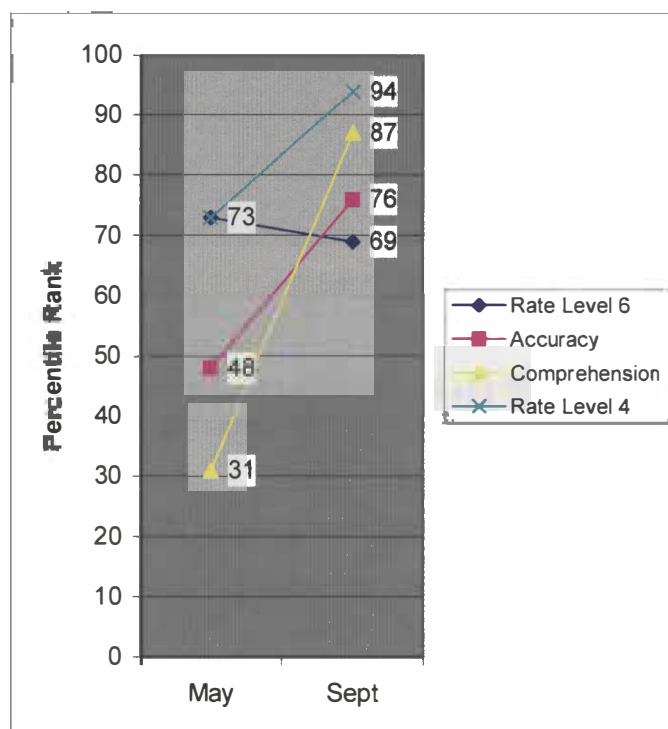


Figure 5.21. Pre- and post-intervention results of the NARA: Claudia

Brianna

Brianna's oral reading fluency improved according to both the NARA and the Multidimensional fluency scale. The teacher, Nicole, noted that her confidence and self-esteem also seemed to have improved. On the level 3 text, Brianna improved her score by 3 points (up from 4 points to 7). She improved her performance on each of the three dimensions, achieving the maximum score of 3 for phrasing (Figure 5.22.).

With reference to the level 4 text, Brianna also improved her performance, this time by a single point. Here, she improved her phrasing but not her smoothness and pace.

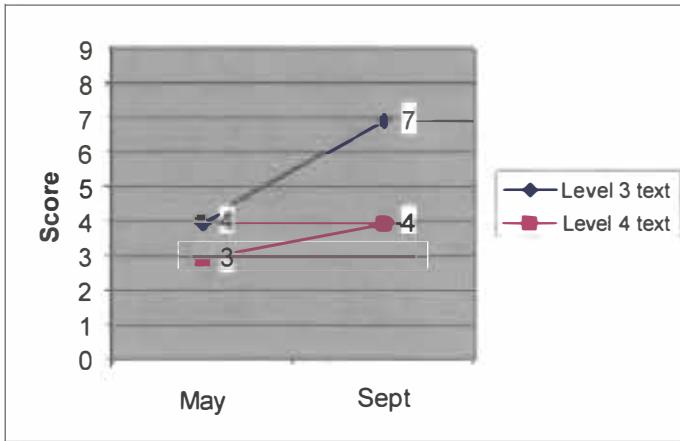


Figure 5.22. Pre- and post-intervention results of the Multidimensional Fluency Scale: Brianna

According to the NARA, Brianna's comprehension increased from the 54th percentile to the 84th, whilst her oral reading rate increased from the 28th percentile to the 42nd. This increased to the 56th percentile when calculated for level 4 texts and below, as in her pre-intervention assessment. Her accuracy also improved, from the 37th percentile to the 52nd. The NARA scores are represented in Figure 5.23.

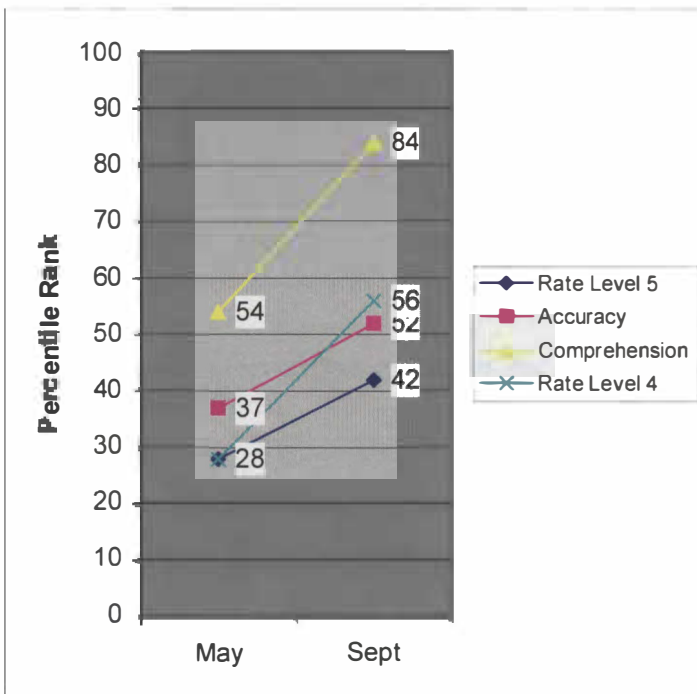


Figure 5.23. Pre- and post-intervention results of the NARA: Brianna

Becki

Becki's oral reading fluency did not improve significantly according to the NARA or the Multidimensional Fluency Scale, although Nicole had noted that she was trying harder to read with expression. Indeed, she sometimes tended to be 'over-expressive' in her oral reading, stretching words and syllables and altering her pitch in a dramatic, exaggerated fashion. This may partially account for her substantially slower rate of reading.

According to the Multidimensional Fluency Scale, Becki's oral reading fluency did not improve when reading a level 3 (NARA) text, and her performance slightly declined when reading a level 4 text in that her smoothness was broken by more 'rough spots'. This is represented below, in Figure 5.24.

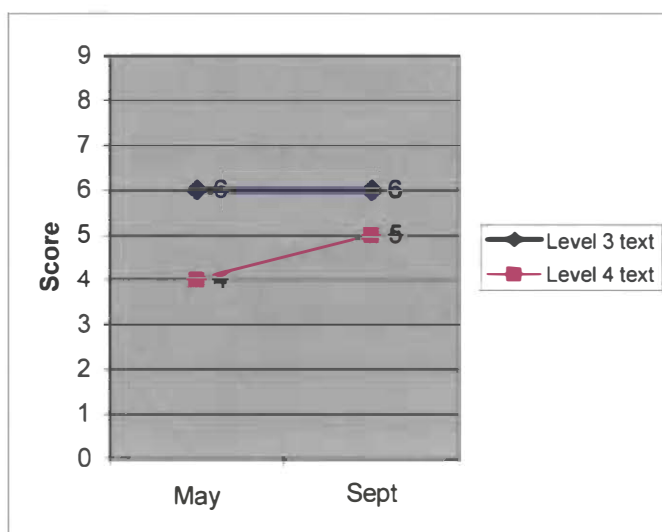


Figure 5.24. Pre- and post-intervention results of the Multidimensional Fluency Scale: Becki

The NARA indicated that Becki's comprehension had increased from the 49th to the 62nd percentile, and her accuracy had decreased slightly from the 26th to the 21st percentile, whilst her rate had decreased from the 72nd to the 50th percentile (see Figure 5.25.) However, it must be noted that she seemed to be attempting to read with more expression in the post-test NARA, and was stretching words and syllables for effect. Also, she was not 'racing' through the texts as she previously had, and seemed to be taking more time to make meaning, as shown by the increase in her comprehension score.

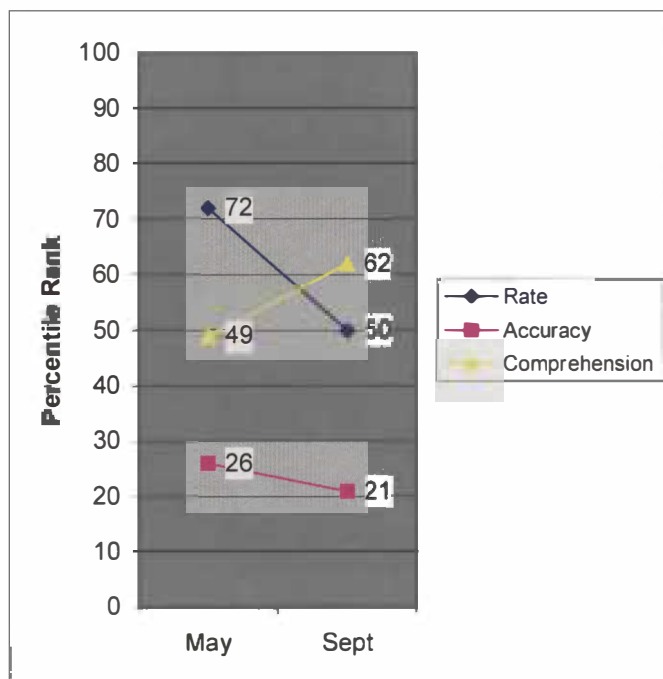


Figure 5.25. Pre- and post-intervention results of the NARA: Becki

Overall, Claudia and Brianna performed well in their post-intervention assessments, although caution must be exercised when attributing outcomes to interventions, especially in a complex classroom situation. Becki, however, did not perform as well on the post-tests, although according to Nicole, her awareness about fluency and her expressiveness seemed to have improved. Table 5.9 summarises the Multidimensional Fluency Scale results and allows comparisons of the three participants' scores. Figure 5.1 can also be referred to for pre- and post-intervention NARA results for the three students.

Table 5.9. Table showing improvements in oral reading fluency according to the Multidimensional Fluency Scale: St Clair's Year 5

	Pace/Rate	Smoothness	Phrasing
Claudia	Consistently conversational.	Generally smooth reading with some breaks, but word and structure difficulties are resolved quickly, usually through self-correction.	Generally well phrased, mostly in clause and sentence units, with adequate attention to expression.
Brianna	Uneven mixture of fast and slow reading.	Occasional breaks in smoothness caused by difficulties with specific words and/or structures.	Generally well phrased, mostly in clause and sentence units, with adequate attention to expression.
Becki	Uneven mixture of fast and slow reading.	Occasional breaks in smoothness caused by difficulties with specific words and/or structures.	Mixture of run-ons, mid-sentence pauses for breath, and possibly choppiness, reasonable stress/intonation.

 = Shaded area indicates improvement in performance

From the results shown above, it would appear that creating multimedia storybooks as a context for improving oral reading fluency may be a beneficial and practicable strategy, although it must be remembered that the results achieved by the three students reflect both of the strategies implemented (i.e. IMMARR and the creation of electronic storybooks).

Facilitative and Inhibitive Factors

Throughout the planning, implementation and evaluation of this activity, several facilitative and inhibitive factors were identified. These are summarised in Table 5.8. The factors are marked for each student. Each cell is marked 'Y' if the factor was observed for a particular student, or is shaded if the factor was observed for a particular student to a specific degree. It can be seen that there was a high degree of commonality between the students.

Table 5.8. Facilitative and inhibitive factors associated with creating electronic storybooks as a means of improving oral reading fluency

Facilitative Factors				Inhibitive Factors													
	Claudia	Brianna	Becki		Claudia	Brianna	Becki										
The student was competent in using computers.				The student was not permitted to install software on her laptop.	Y	Y	Y										
The student was motivated to engage in the activity.				The student engaged in 'mouse wars' and 'keyboard envy' (overall category: 'battles for control').													
The student referred to recordings of sound (visual 'waveforms' and audio-recordings) on the computer to help her monitor her oral reading fluency.				The student did not want to write a paper-based storyboard.	Y	Y	Y										
The teacher was committed to the activity and put aside time during school hours for the student to work on it.				The student had previously used electronic storybooks.	Y	Y	Y										
The student used electronic story starter.	Y	Y	Y	The student wanted to spend more time than the teacher deemed necessary on creating IMM 'effects'.													
The student helped her peers identify spelling and punctuation errors (editing).				The student had difficulty doing collaborative writing.	Y	Y	Y										
The student saved time by using the digital camera to create pictures for the talking book (instead of drawing them).	Y	Y	Y	It was difficult to access a digital camera (not enough cameras in the school).													
The student soon learnt to use the software (which had an interface similar to MS Word).	Y	Y	Y	The classroom teacher found it difficult to find time to assist/supervise.													
Deciding where to place text highlighting encouraged the student to discuss phrasing.	Y	Y	Y	Aspects of the activity, such as linking the text to the narrations, were time-consuming.	Y	Y	Y										
<table border="1"> <thead> <tr> <th colspan="2">KEY</th> </tr> </thead> <tbody> <tr> <td>Never observed</td> <td></td> </tr> <tr> <td>Sometimes observed (1 to 5 times)</td> <td></td> </tr> <tr> <td>Often observed (6 or more times)</td> <td></td> </tr> <tr> <td>Observed</td> <td>Y</td> </tr> </tbody> </table>				KEY		Never observed		Sometimes observed (1 to 5 times)		Often observed (6 or more times)		Observed	Y	There were occasional 'technical hitches'	Y	Y	Y
KEY																	
Never observed																	
Sometimes observed (1 to 5 times)																	
Often observed (6 or more times)																	
Observed	Y																

Unplanned Outcomes

Reinking and Watkins (2000) have stated that, in formative experiments, it is important that unplanned outcomes be identified. This is one means of finding new ways of using IMM in the classroom.

However, the identification of unplanned outcomes is not a simple process because evaluations used in educational contexts normally relate to the specific pedagogical goal(s) being targeted, thus unplanned outcomes may go unnoticed, especially in IMM contexts where 'new' outcomes may result. Nevertheless, several unplanned outcomes were identified in Nicole Nielsen's Year 5 class during and after the interventions:

- higher increases in comprehension scores were recorded than anticipated;
- all participating students had increased confidence and self-esteem;
- the teacher noted improvement in the students' ICT skills and confidence;
- the participating students demonstrated increased audience awareness;
- the participating students demonstrated increased metalinguistic awareness.

Establishing Preferability

As will be explained further in Chapter Nine, there are several difficulties inherent in establishing preferability, not least problems associated with assessing specific interventions and attributing particular outcomes to them. Also, the notion of preferability can be somewhat imprecise unless strategies being compared are clearly delineated (and this is often extremely difficult in complex IMM-based contexts). The notion of 'preferability' should thus be used primarily to refer to specific contexts and may not be amenable to generalisation. Indeed, it has been suggested by Salomon (2002) that it is not possible to compare ICT-based and traditional learning activities, unless ICT-based activities are being used as mere imitations of traditional ones.

Reigeluth and Frith (1999) suggest that it is possible to establish preferability by using the dimensions of efficiency (the degree to which the activity is time and

cost effective), effectiveness (the degree to which the activity addresses a specified pedagogical goal) and appeal (the degree to which the activity is enjoyed by students and teachers). Table 5.9 summarises aspects of the intervention in terms of these three dimensions.

Table 5.9. Preferability of the strategy (creation of electronic storybooks) for oral reading fluency

Efficiency	This was a relatively time-consuming and resource-hungry means of teaching fluency. However, it may have been more effective than other strategies.
Effectiveness	This approach was effective for teaching phrasing in an authentic context, encouraging students to monitor one another and to self-monitor for fluency, getting students to practise oral reading, and facilitating peer discussions about fluency.
Appeal	The project provided an opportunity for students to use their existing ICT skills in an authentic way. The students were highly motivated throughout the project, and the final project was appealing to student and teachers.

With reference to the strategy's preferability, Nicole stated:

I think the motivation is definitely there. I think in terms of ... particularly in our school which has an IT focus ... anything that's going to increase their skills, and lets them practise their IT skills, as well as ... I mean, that's our whole purpose, to integrate computers into every curriculum area, in whatever way's the best way. I mean, it's definitely an advantage to us that we do something on the computer, as well as doing it the old-fashioned way. So, in our circumstances I think it is preferable, especially at this level where they all have their own laptops.

And also understanding that you don't just focus on your reading or your fluency or whatever it is you're targeting when you're reading a book; you also read off the screen, you also read printed out pieces of work, you read other people's work, and it's important in all of those areas. It's not just when you open up a book that you're going to need expression in your voice, and read fluently.

To summarise the preferability of the creation of electronic storybooks over other, traditional methods of teaching reading fluency. It:

- was motivational;
- encouraged multiple outcomes such as ICT, writing, problem solving and reasoning outcomes, 'multiliteracies', and comprehension;

- provided an authentic purpose for students to discuss phrasing, expression and fluency;
- provided tools and resources (such as wave forms, sound files, and the ability to highlight text) that could not easily be provided by other means.

Conclusion of Chapter

As noted above, the IMM-based interventions used in this case were seen by the teacher and the students as being highly appealing. In terms of effectiveness, it does appear that they were successful in helping participating students improve their oral reading fluency, especially in terms of phrasing and expressiveness. The interventions also seemed to help two of them improve their comprehension, although this assertion must be treated with a degree of caution. A likely explanation for the gains in comprehension scores is that the students increased their ability to read in meaningful units.

The participating teacher, Nicole Nielsen, was satisfied that the IMM-based interventions were instrumental in the improvements in the students' achievements, as she had previously tried other interventions without much success. It must be stressed once again that, in formative experiments, authentic classroom-based assessments are used as well as standardised tests, thus although the students' gains may not be deemed to be admissible (due to reliability and validity issues) in quantitative research methodologies, they are acceptable in this type of research.

It must also be noted that both strategies (IMMARR and the creation of electronic storybooks) are not separable as far as the results are concerned; formal assessments were not undertaken at the end of the IMMARR sessions, as is consistent with the formative experiment methodology, which permits modifications in strategies for a range of reasons, not merely on the basis of achievement.

Furthermore, the students were also engaging in the THRASS (Teaching Handwriting, Reading and Spelling) program (Davies & Ritchie, 1996), a highly structured phonics program, for the duration of the study. This may have contributed towards the improvements in decoding/accuracy, which Claudia and Brianna showed. This increased accuracy could have contributed towards these two students' increased fluency and comprehension.

In addition, it must be noted that the students were receiving some additional instructional time, not merely different instruction, because two of the weekly IMM-based sessions took place after school hours.

As described in previous sections, several facilitative and inhibitive factors were identified, all of which will be further discussed in detail in Chapter Nine. The most notable facilitative factors seemed to be the students' level of motivation and the unique capabilities of the IMM. The most notable inhibitive factor seemed to be a lack of appropriate software (IMMARR), a shortage of time for the teacher and researcher to plan, monitor and modify, and a shortage of time for the students to engage in the activities. Other inhibitive factors were related to the ways in which the students interacted with the computers. Yet others appeared to arise as a result of mismatches between the resources available and the instructional strategies that were used.

Also, it was difficult for the teacher to assess the interventions due to poor record keeping on the part of the students and the complexity, invisibility and 'knotted' nature of some outcomes.

In terms of teacher involvement, Nicole Nielsen fully participated in the planning and assessment cycles of the interventions, but was not as involved in the implementations. As a consequence, she did not learn as much as the students did about using the software, although she was able to find time to learn 'the basics'. However, because she was a confident and competent computer user, she was often able to find out what she needed to know and to help the students on the occasions when they requested it. Because the students were competent computer users, the teacher allowed them a large degree of independence in constructing their own learning.

CHAPTER SIX

HILLVIEW PRIMARY SCHOOL

Overview of Case

Students were given free choice of software. Activities were sometimes 'co-constructed' by the teacher and were often construed as 'play'.

Government/Private school:	Government/Co-educational
Number of students in class:	29
Number of students in school:	Approximately 250
Socio-Economic Status :	Low/Multicultural
Pedagogical goals:	Increase in comprehension/oral reading fluency
Other significant information:	17 'at risk' students

Table 6.1. Overview of participants: Hillview Primary School

Participating Students					
Name	Year	Age at beginning of study	Other	Estimated hours spent doing IMM-based activities	Estimated hours spent doing IMM-based activities independently
Andrew	4	9:5	-	27	22
Ryan	4	9:1	-	22	15
Nada	4	9:3	ESL (LI=Oranien)	22	15
Rosie	4	8:8	ESL (LI=Khroer)	40	33
Anita	4	9:6		30	26

Participating Teacher		
Name	Teaching experience	ICL experience
Linda Harris	12	Limited

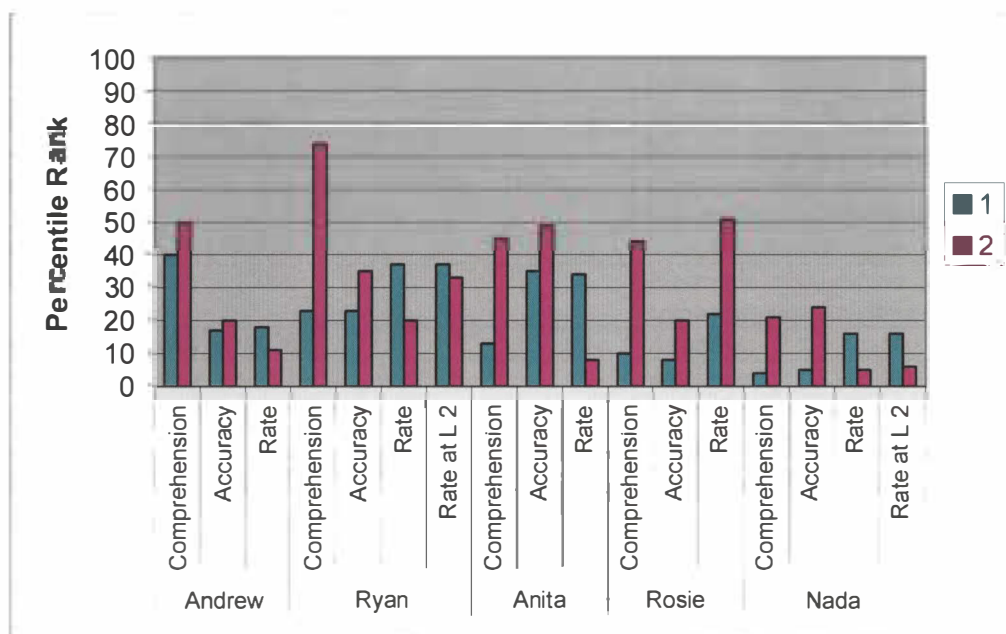


Figure 6.1. Pre-and post- intervention NARA results: Hillview Primary School

Table 6.2. Hardware available

Classroom Computers	Specifications
Computer # 1	Window 95 OS Pentium II processor 64 MB RAM 36x CD-ROM Soundcard (speakers) Microphone acquired during study
Computer # 2	Windows 95 OS 486 processor 16MB RAM No soundcard at beginning of study
Computer # 3	Windows 95 OS 486 processor 16MB RAM Soundcard (speakers)
Computer Laboratory	No laboratory at this school

Table 6.3. Software used during the study: Hillview Primary School

Software Used	Description
Arthur's Birthday. (1994).	Electronic storybook.
Carmen Sandiego Word Detective. (1997).	Word and spelling games.
Computer Classroom Reading at Home 3. (2000).	Electronic texts (several genres) with comprehension activities.
Dr Seuss Reading Games. (2000).	Electronic storybooks and reading games for young children.
Harry and the Haunted House. (1994).	Electronic storybook.
My First Incredible Amazing Dictionary. (1994)	Multimedia dictionary.
Phonics Alive! 2 The Blender. (1998).	Phonics tuition and games.

Phonics Alive! J The Soeller. (1999).	Phonics tuition and games.
Microsoft PowerPoint. (1997).	Multimedia authoring (presentations) software.
Reading Blaster 7-9. (2000).	Reading and spelling games.
Reading Blaster 9-12. (2000).	Reading and spelling games.
Reader Rabbit 2 Reading Development Library(1997).	Electronic storybooks and comprehension activities.
Microsoft Publisher. (1997).	A desktop publishing program.
Reading for Literacy 3. (2000).	Electronic texts (several genres) with comprehension activities.
Reading for Literacy 4. (2000).	As above.
Reading for Literacy 5. (2001).	As above.
Storybook Weaver Deluxe. (1998).	A simple multimedia authoring program for children.
Superspell - A Day at the Beach. (1997).	Spelling games.

The School Context

Hillview Primary School was built in 1912 and at the time of the study had approximately 338 students from Year 1 to Year 7. It had 16 permanent classrooms and 3 temporary classrooms.

According to school documents, Hillview Primary had 22 teaching staff, including one Education Support teacher and one part-time Education Support teaching assistant. Most of the staff members had between 5 and 30 years of teaching experience. The school comprised students from many different linguistic and cultural backgrounds and therefore had a part-time (0.4 FTE)²⁹ English as a Second Language (ESL) teacher catering for the needs of students who had, according to school documents, 'recently arrived with residential status from an overseas country'.

Hillview Primary School emphasised self-esteem and health as important issues in addressing the academic needs of each child. Students were expected to 'be responsible and to respect themselves, each other, and the school itself', according to school documents. The school also reinforced the concept of 'empowering' the students to take greater responsibility for their own learning. One means used to achieve this was the use of Information Technology as a tool in the classroom, underpinned by the concept of 'Multiple Intelligences' (Gardner, 1993).

²⁹ FTE (Full time equivalent, or percentage of full time). 0.4 is thus 40% of full time.

ICT at Hillview Primary School

Hillview Primary School was a Technology Focus³⁰ school and had in 1998 received a grant of approximately AUD \$30,000 from the Western Australian government to purchase ICT equipment and professional development. Despite this, it did not have a computer laboratory, although it was hoped that one would be ready for the following year³¹. The computer to student ratio was 1:10. Two of the three desktop computers in the classroom involved in the study were old and frustratingly slow. These were connected to the school network but only one was connected to the Internet. According to the participating teacher, the students used computers mainly in 'Technology and Enterprise'³², and the teachers seldom used computers in other curriculum areas, such as English, even though according to the school's 'Beliefs About IT' document (see Figure 6.2.), the central purpose of IT was stated as: 'to locate information ... and then process and present that information'.

The school was due to commence a 'Learning Technologies Project' which would entail an allocation of over AUD \$20,000 from the Western Australian government. The teachers were to receive professional development to help them better use various technologies in the curriculum to improve learning outcomes for students. It was expected that teachers would continue to improve the skills of their students in Information Technology throughout the school during the year in which this study took place and beyond, and staff had devised a set of simple 'competency checklists' for students across the primary school years as a means of monitoring progress.

The school's beliefs about Information Technology and its role in education are listed in Figure 6.2.

Beliefs About Information Technology

³⁰ 'Technology Focus Schools' were set up by the government of Western Australia in 1997 as 'lighthouse' schools, intended to provide models of how to use ICT as a resource for teaching and learning. The TF schools were given extra financial support (between AU\$12,000 and AU\$74,000 each) in order to set up the infrastructure needed and to train teachers. Information was then disseminated by way of practicum runs by the TF schools, Listservs and school websites.

³¹ This was later deferred for one more year.

³² Technology and Enterprise is a learning area in the Australian curriculum in which 'students apply knowledge, skills, experience and resources to the development of technological solutions that are designed to meet the changing needs of individuals, societies and environments. Students become innovative, adaptable and reflective as they select and use appropriate materials, information systems and processes to create solutions that consider the short- and long term impact of societies and environments.' (Education Department of Western Australia, 1988)

- | | |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1) | Information Technology should have significance for all students; they should understand the purpose of research. |
| 2) | Information Technology development is a continuous process and requires skills and strategies, which need to be learnt and applied. |
| 3) | The central purpose of Information Technology is to locate information using a range of texts, audio visual and electronic equipment, and then to process and present that information. |
| 4) | Teaching/Learning strategies need to be consistent with and support individualised learning programs. |
| 5) | Information Technology is an interactive medium, which needs to be considered in the teaching and learning process. |
| Source: School documents | |

Figure 6.2. Hillview's beliefs about technology

In addition to the above measures, the teachers had developed an 'Information Technology Plan' approximately 3 years prior to the commencement of this study (see Appendix 6.1). At the time of the study, the school was still working towards the objectives stated in the plan.

Andy Travis, a classroom teacher at the school, also had the role of the school's computer technician. He was allocated some time to help the other teachers with hardware and software problems and to keep the school local area network running.

Hillview's Literacy Policy

Hillview Primary School did not have a wide range of literacy resources. It was therefore necessary for the teachers to use what was available. Some of the texts were almost 20 years old and of questionable interest and relevance to today's students. However, some books termed as 'high interest, low ability' (in terms of vocabulary and readability) books were available for the reluctant readers. To counteract the shortage of resources, the participating teacher (Linda Harris) created many herself, including both teacher-made and student-made texts. No literacy policy was available.

The school had for several years been running a 'Parent Reading Tutor Volunteer Program' for Year 1, 2 and 3 students; a group of school-trained parents went to the school four mornings a week to read with students who had been identified as 'at risk'. These students had been chosen up through early identification strategies in Year 1 and referred to the program for Year 2. The program focussed on

reading, comprehension, and word recognition. The Year 4 students participating in this study were no longer eligible to be included in this program. However, the classroom teacher had arranged for a (grandparent) tutor to visit the school each week. This untrained tutor took students into a quiet space, where she read aloud texts of their choice.

Students at Educational Risk (SAER) policy

The school identified Students at Educational Risk by utilising the information obtained by teachers' individual testing, the Western Australian Literacy and Numeracy Assessment (WALNA) and school-based assessment as listed in the Schools Managing Information System. In the year after the study, the school was to receive Commonwealth Literacy and Numeracy funding of over AUD \$15,000, which would contribute to the school's funding resources to assist students identified as at educational risk.

Linda Harris's Class

The Classroom Environment

There were 29 students in Linda Harris's Year 4/5 class, 17 of whom she described as 'at risk'. The classroom was fairly spacious with the desks arranged in groups. The walls were decorated with the students' artwork and writing, as well as several charts. These included a months of the year chart, a days of the week chart, a THRASS word chart, a chart showing the structure of the 'procedure' genre, and a chart describing 'Look, Cover, Write and Check', for learning spellings.

The Classroom Teacher (Linda Harris)³³

Linda Harris was in her forties at the time of this study and had been teaching for approximately 12 years. She had started teaching at Hillview Primary School at the beginning of the academic year, approximately six months prior to the commencement of this study. Before that, she had spent 11 years working at many schools on a temporary basis (on fixed-term contracts), usually for one school year per school. Linda had a three-year Diploma in Teaching.

³³ It must be noted that, at Linda's request, some data pertaining to this case has been omitted.

Whilst Linda was concerned about the lack of resources available to help her cater for the students in her class, she was nevertheless energetic and creative in helping them progress. Several nights a week, she stayed after school to provide free tuition to students who were experiencing difficulties. Small groups of two to four children stayed behind for approximately one hour so that Linda could hear them read, carry out guided reading, and help them practise their grapho-phonics skills through the use of the THRASS method (Davies & Ritchie, 1996). She also tried to help them develop their comprehension skills through questioning and discussion.

Although Hillview Primary School was a Technology Focus School, Linda had not received any formal professional development in using ICT for her own purposes or to promote learning. At the beginning of this study, Linda's knowledge about computers could be described as rudimentary. From an 'instructional evolution' perspective, she was at the 'entry' stage (Dwyer et al., 1990), or at the 'survival' stage of the continuum described by Holland (2001) with reference to use of technology in her classroom. This continuum is described in more detail in the literature review (Chapter Three).

In general, Linda found her lack of knowledge about ICT frustrating and had attempted to learn from her peers on an informal basis, but had virtually stopped seeking such assistance because she was uncomfortable about imposing on their time. Also, as is consistent with the research findings on the professional development of teachers described in Chapter Three, Linda found that she needed ongoing training and support, as opposed to one-off demonstrations.

How Was Reading Usually Taught in Linda's Classroom?

Linda did not consider many of the students in her class to have mastered 'the basics' of literacy, such as common letter-sound correspondences, the spelling and sight recognition of high frequency words, or comprehension of grade level texts, even at a literal level. For this reason, she provided them with explicit instruction through the THRASS approach (Davies & Ritchie, 1996), spelling lists, dictation, and the use of basal reading books. She often divided the students into ability groupings for reading and she provided each student with as much one-to-one direct instruction as she had time to provide. A support teacher assisted four times a week for 40 minutes each time, although Linda did not consider this to be especially

beneficial because the support teacher had not been adequately trained in the area of assisting students who experienced literacy difficulties.

Because there was a high proportion of 'at risk' students in Linda's class, it was difficult for her to give them as much one-to-one attention as she would have liked. In order to minimise this problem, she stayed behind after school most days to tutor small groups of students for one to one and a half hours per session. In these sessions, she often used the NIM method (Heckelman, 1969), requiring students to read aloud on an individual basis but reading along with them through parts of the text they struggled with. She prompted them to use the three cue systems (grapho-phonetic, syntactic and semantic) and she used the THRASS program to help them consolidate their grapho-phonetic knowledge, as many of these students had difficulties in word recognition. In addition, Linda used direct instruction (Carnine, Silbert, & Kameenui, 1997), which involved her demonstrating pronunciations and decoding strategies, modelling reading, giving students turns to read individually, motivating and pacing them, correcting their errors after prompting them to self-correct, monitoring their learning and discussing text meanings with them, as well as discussing their learning.

How Was ICT Usually Used in Linda's Classroom?

In Linda's classroom there were three computers, each running the Microsoft *Windows 95* operating system. One of these was relatively new at the time of the study, with a Pentium II processor, 64MB of RAM and a 36x CD-ROM drive. The older ones had 486 processors, only 16MB of RAM and 24x CD-ROM drives. These were frustratingly slow. Furthermore, one of them had no sound card or speakers. At the beginning of the study, there were no headphones in the classroom, but some were found in the library. There was one printer between the three computers, and paper for it was kept in a cupboard a distance away from the computer to prevent wastage.

Before the commencement of this study, the students in Linda's class used computers mainly to learn *about* ICT, rather than to learn *through* ICT. They had recently started to learn to use *Microsoft Word* (1997), and had learnt to create and save documents, and then reopen them. They also knew how to create text boxes and add clipart, as well as how to create borders. However, because there were only three

computers in the classroom and no computer laboratory, this was a slow and frustrating process. Furthermore, the students were unable to regularly use a word processor to facilitate the drafting, revising and editing stages of the writing process, although they sometimes used a one to publish their work. Although one of the computers was connected to the Internet, this was not often used. Indeed, Linda did not know how to access websites, use a search engine, or use an email application.

Linda occasionally borrowed software from the school library, and students who were confident and knowledgeable in the use of computers would usually install this on the computers. At the beginning of the study, *Reading Blaster 9-12* (2000) was installed on one of the classroom computers, as were *Encarta* (1995) and *Reading at Home 3* (2000).

Although Linda had not taught the students how to use any of this software, many had worked it out for themselves and would use it independently before school and during recess³⁴. Linda was disappointed when the librarian informed her that, due to licensing restrictions, she was only permitted to install each CD-ROM on a single machine.

The students had minimal keyboarding skills and were not in the process of learning touch-typing, although Linda stated that they would be able to do this when the promised laboratory was ready. Although there was a typing tutorial CD-ROM in the classroom, it was not often used.

On one of my visits to her classroom, Linda was calling out words from the students' spelling lists, many of which had the vowel digraph 'ir' in them. Three students were typing these words into the word-processor and the spellchecker was alerting them if they had made an error. The students would then correct any spelling errors, referring to the THRASS chart³⁵ to help them if necessary. Linda was also checking over their shoulder.

Linda had heard of *Accelerated Reader*³⁶ and was interested in "giving it a go" but stated that it was prohibitively expensive at AUD \$16,000 for only the

³⁴ As is standard procedure, students were not allowed in the classroom unless a teacher was present.

³⁵ The THRASS chart is a wall chart that shows the different ways of representing phonemes with combinations of letters.

³⁶ *Accelerated Reader* is a system that claims to facilitate the teaching of reading by motivating students to read books. Students read books at their own pace, then do a computer-based quiz about the text, which helps teachers assess comprehension. Immediate feedback is generated, which may

middle school. However, she had a sample CD-ROM, which she planned to evaluate at home. I informed her about Scholastic's web-based 'Lexile' system³⁷, which I thought was similar to *Accelerated Reader* and a more affordable alternative. Linda considered that a web-based program would be preferable to the CD-ROM based *Accelerated Reader* because several students would be able to work on it simultaneously, it would be regularly up-dated, and there would be no disks to get lost or damaged. Unfortunately, after more research, it transpired that Scholastic's Lexile Framework was quite different from the incentive scheme she had heard about. This is an example of a 'dead end' we encountered during this study.

In the context of using ICT in the classroom, it appeared that Linda had a 'low structure' (Biggs & Moore, 1993) decision-making style and did not wear the mantle of the 'expert', but rather that of a helper, co-learner or facilitator. She stated that she gave the students as much free choice and autonomy as she could in order to keep them motivated.

In summary, computers were used in Linda's class in a somewhat unsystematic way. Although she was interested in using them to support learning in curriculum areas, Linda had neither the hardware, the software nor the knowledge necessary to do this in any coherent way. Furthermore, in the school's 'Beliefs About Information Technology' document, it was stated that the central purpose of IT was to 'locate information' and then to 'process and present that information'. Thus, the school did not consider ICT to be a tool for assisting students with reading difficulties. Because of this, teachers at the school were not encouraged or trained to use ICT for this purpose.

The Participants

Linda had a large pool of potential participants for this study, but the choice ultimately depended on which students were available for after school tuition at the times that I was able to visit the school. We decided to select pedagogical goals after assessing the needs of the students who stayed behind on Mondays and Tuesdays,

help teachers ensure that students are provided with instructional level texts, which are challenging but not frustrating.

³⁷ Scholastic's Lexile Framework for Reading is an assessment system that places students and texts on a common scale, and is intended to assist teachers in selecting appropriate texts, assessing reading comprehension, and planning interventions.

although Linda noted that it would be difficult to select specific goals because many of the students had 'multiple difficulties'¹⁴. Two of those who stayed behind on Tuesday afternoons were students for whom English was a second language (ESL), and Linda wanted them to participate in the study, even though I had not planned to include ESL students.

The Students

Andrew

Linda informed me that although Andrew had good general knowledge, his abilities in the literacy area were of concern. In particular, his ability to use grapho-phonetic correspondences in decoding and spelling was weak (for example, he spelled 'cut' as 'cete' and 'to' as 'ot'), as was his reading fluency. Linda had spent six months teaching him letter sounds as he seemed to know letter names only. Although she had tried a variety of strategies to assist him, she had recently started to mainly use the THRASS program.

According to the NARA, Andrew's accuracy and reading rate were at the 17th and 18th percentiles, whilst his comprehension was at the 40th percentile (see Figure 6.5.). According to the PPVT-R, his receptive vocabulary was low average, at the 39th percentile (see Figure 6.6.). Andrew indicated that he found spelling 'boring and difficult'.

The ERAS indicated that Andrew's attitude towards reading was negative, with his attitude towards recreational reading at the 11th percentile and at the 29th percentile for academic reading (see Figure 6.7.). Andrew came from an English-only speaking background and had a computer at home, which he liked to play games on. He reported that *Dungeon Keeper* was his favourite game because it had 'lots of little creatures in it'. He did not read at home for pleasure.

Ryan

Ryan tended not to persevere with learning experiences or find much enjoyment in them. For example, after going on a school excursion to an adventure playground, he described the experience as 'boring'. In the classroom, he tended to

¹⁴ This is typical of many students who experience reading difficulties. (Peters-Laird, Deane, & Garvis II, 1999)

fidget. English was Ryan's first and only language. He liked computers and had a computer at home, which he used to play games.

Linda stated that Ryan needed fluency training as well as improved word recognition abilities and self-monitoring of comprehension. He had not mastered literal comprehension at the beginning of this study, much less inferential or evaluative comprehension (Barrett, 1972). His spelling was mostly phonetic, although on some occasions he misrepresented sounds. For example, he wrote 'spoke' instead of 'smoke' and 'chorek' instead of circus. Below are some examples of his spellings from Terms 1 and 2, 2001:

wil	(will)	fuod	(found)
ball	(bell)	wek	(week)
spokc	(smoke)	leter	(letter)
becors	(because)	liva	(lives)
owns	(once)	chorek	(circus)

However, according to Ryan's self-assessment of his reading (see Figure 6.3.), he did not perceive himself as a reader with difficulties. This could perhaps be explained by the fact that there were 17 'at risk' students in his class, some of whom had more severe difficulties than Ryan.

Reading Self-Assessment

1)	I can work out hard words by using sounds I know and other clues in the word and on the page	Y
2)	I go back and reread if I lose the meaning of the sentences.	Y
3)	I go back and have another go at the words I don't know	S
4)	I can read common words that I know and see all the time	Y
5)	I can use punctuation properly so that the text has meaning.	S
6)	I can work out the order of main events in a narrative or a recount.	Y
7)	I can think about the events that happen in a story - ie have a picture in my imagination.	Y
8)	I can understand how illustrations including diagrams, tables, maps, captions etc add to the meaning of the text.	'Depends'
9)	I can tell when an author is trying to make me think about something his other way.	Y
10)	I can find the key words in a question to be able to locate the answer in the text.	S
11)	I enjoy reading to myself ie silent reading	N
12)	I enjoy reading to someone else.	'Depends'
13)	I read regularly at home ie home reading.	N
14)	Reading helps me learn things that are useful in everyday living	N
15)	I am good at reading - on a scale of 1 - 10 (10 is high)	S

Y=yes; S=sometimes; N=no.

Figure 6.3. Ryan's self-assessment (reading)

When reading for the NARA, Ryan read in a staccato, word-by-word fashion. His accuracy and reading rate were at the 23rd and 37th percentiles respectively, whilst his comprehension was at the 23rd percentile (see Figure 7.5.). His receptive vocabulary was at the 42nd (see Figure 6.6.). These results seemed to indicate that Ryan's poor decoding skills were the major source of his reading difficulties.

His attitude towards academic reading was high average, at the 58th percentile, but he strongly disliked recreational reading and scored at the 2nd percentile (see Figure 7.7.).

Nada

Although Nada was born in Australia, her parents were Bosnian and did not speak English fluently. English was Nada's second language. However, Linda had not been told much about Nada's literacy abilities in her first language, for example, whether she could read and write in Bosnian. Nada received 40 minutes a week of English language instruction from a specialist ESL teacher.

Although she had a computer at home and 'lots' of computer games on CD-ROM, Nada reported that her mother had 'hidden' them because they were being damaged. Nada's favourite subject was art and she disliked maths.

The NARA indicated that Nada's comprehension was at the 4th percentile. Her accuracy was at the 5th percentile, whilst her oral reading rate was at the 16th (see Figure 7.5.). According to the PPVT-R, Nada's receptive vocabulary was at the 25th percentile (see Figure 6.6.), and the ERAS indicated that her attitude towards reading was negative, with academic reading at the 2nd percentile and recreational reading at the 23rd (see Figure 6.7.).

Rosie

Rosie was born in Australia to Cambodian parents, usually spoke Kluener at home and had not learnt to speak English until starting school. Linda described her as 'very bright' and cooperative. Like Nada, she received 40 minutes of English Language instruction each week from a specialist ESL teacher.

Rosie had been attending Hillview Primary School for two and a half years and prior to that had attended a government school in another Perth suburb. Her favourite subject was mathematics. She had no computer at home.

Rosie's spelling was particularly problematic. Below are some examples of her spelling from the school term preceding the commencement of this study:

Scnd (spend)	Fing (thing)
Wot (what)	Samk (something)
Mysef (myself)	Sore (saw)
Gavv (gave)	Feds, fiend, fend, fent (friends)
Ukst (asked)	Uthn (other)

It can be seen that Rosie usually did not represent all sounds in words, and sometimes she represented extra sounds, such as in 'supr' for 'soap' (see Figure 6.4.). She spoke with a Standard Australian accent.

Own a puon a time thirty misu were in virt to a ten a magic cricus.
 They clened drtd shirt with supr and water. They aet a mall ou rice
 con and graps with a fook. It was going to bey quite a happy day for
 revey own . Off they went.

(Once upoo a time thirty ouce were invited to aend a magic circus. They cleaned their dirty
 shirts with soap and water. They ate a small meal out of rice corn and grapes with a fork. It
 was going to be quite a happy day for everyone. Off they went.)

Figure 6.4. An example of Rosie's writing (dictation, April 2001).

The NARA indicated that Rosie's reading accuracy was at the 8th percentile, with 70% of her errors being refusals or appeals for help. Her comprehension was at the 10th percentile and her rate was at the 22nd (see Figure 6.5.). Linda expressed surprise that Rosie's results were so low.

According to the PPVT-R, Rosie's receptive vocabulary was at the 2nd percentile (see Figure 6.6.), and according to Linda, she also experienced problems with grammatical aspects of English, such as tense.

Rosie's attitude towards reading was mixed. Although her ERAS score for recreational reading indicated that she was at the 58th percentile, she was only at the 16th percentile for academic reading (see Figure 6.7.).

Anita

Anita's parents, who were born in Germany and sometimes spoke German at home, spoke English with German accents. Anita spoke a little German but mainly used English. She stated that her favourite subject was writing, although Linda was of the opinion that she had problems sequencing events and ideas in her writing.

According to Linda, Anita had problems comprehending at each of the 'three levels of comprehension', literal, inferential and evaluative (Barrett, 1972), and had difficulties in finding 'the main idea'. Anita's parents were concerned about her slow progress in literacy and planned to seek private tuition for her

The NARA indicated that Anita’s comprehension was at the 13th percentile, whilst her accuracy and rate were at the 35th and 34th percentiles respectively (see Figure 6.5.). She read with poor intonation and phrasing, paying scant attention to punctuation. Many of her errors were mispronunciations or ‘non-words’.

Although English was Anita’s first language, her receptive vocabulary was low, at the 9th percentile (see Figure 6.6.). However, her attitude towards reading was within the average range, with recreational reading at the 60th percentile and academic reading at the 35th (see Figure 6.7.).

Summary of Pre-Intervention Assessments

In the following three graphs, the pre-intervention assessment results for the five participating students are summarised.

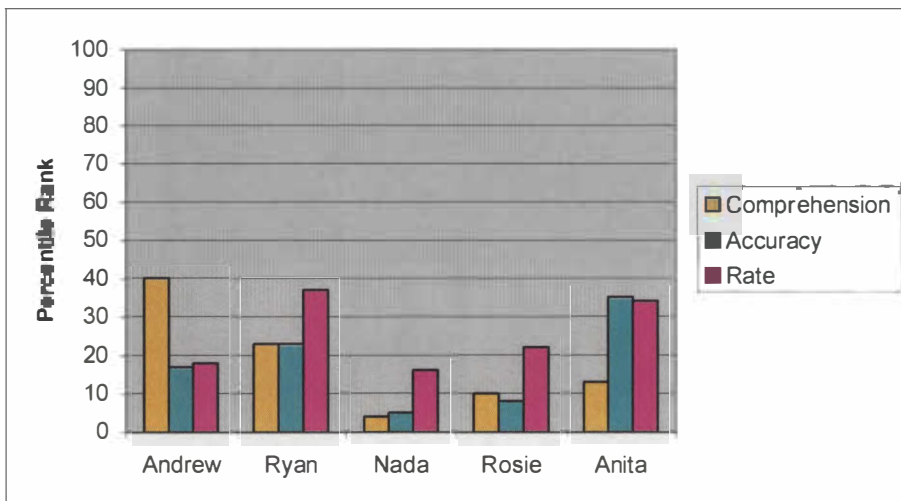


Figure 6.5. Pre-intervention results of the NARA: Hillview Primary School.

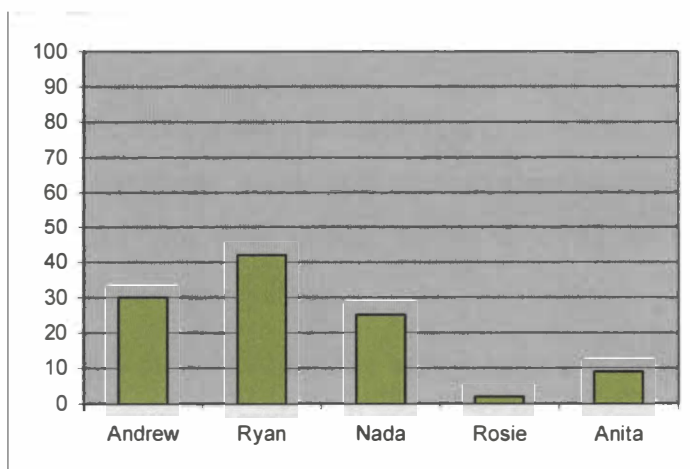


Figure 6.6. Pre-intervention results of the PPVT-R: Hillview Primary School.

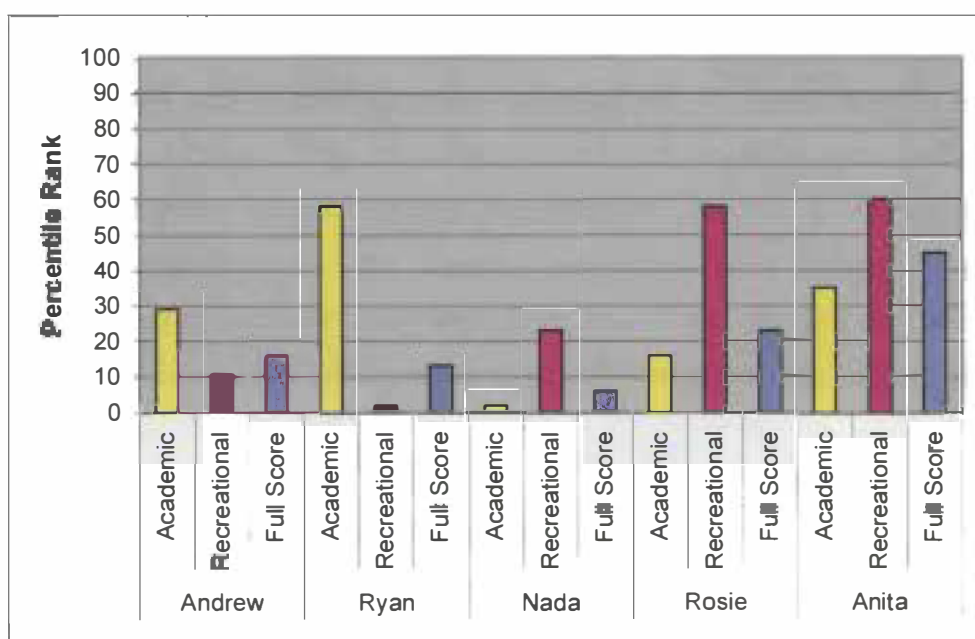


Figure 6.7. Pre-intervention results of the ERAS: Hillview Primary School.

Conceptualisation of the Problem and Selection of Pedagogical Goals

After being presented with the assessment results, Linda hypothesised that increased engagement in reading through using IMM software might be a means of improving the students' overall reading skills, and ultimately their comprehension³⁹.

³⁹ Linda believed that, although explicit reading instruction is important, especially for students with literacy difficulties, reading practice is also crucial to help students improve. This is a view shared by

Conceptualisation and Selection of Possible Strategies

Linda was flexible in her approach to teaching and stated that she preferred to "go with the flow" of the students' needs and interests than be restricted by rigid planning. She declared that she was willing to try anything to help the five participating students improve their reading.

However, as an extremely busy teacher with a large proportion of 'at risk' students, she had insufficient time to review all of the CD-ROMs (see Table 6.3) that I had supplied. Linda suggested investigating the students' preferences regarding the software before making any firm instructional plans. In this way, she could explore the software alongside the students and be a partner in learning as opposed to an authority. A disadvantage of this approach proved to be that she was initially unable to answer the students' questions about the software and provide guidance.

Linda did not want to make firm plans regarding how the students would use the software, at least initially. For the duration of the study, students were given a high degree of autonomy in choosing and using software⁴⁰ because Linda did not want them to lose motivation in the voluntary after-school class through having software and activities imposed upon them. She was of the opinion that these students would not have stayed after school if the IMM-based activities offered had not been enjoyable.

Formulation of Evaluation Techniques

Evaluation techniques were not fully formulated prior to the implementation, although we agreed that Linda would watch for improvements in the normal classroom context. Signs that the students were engaging with the electronic texts would also be monitored. It was not possible to specify evaluation techniques at this point as we had not decided upon the strategies to be used or, indeed, the software.

many theorists, such as Allington (1977). Also, it has been shown that 'situational interest' or motivation to read in certain contexts (for example, on the computer) may lead to 'personal interest', or intrinsic motivation to read (Reinking & Walkins, 2000).

⁴⁰ As the teacher, Linda had ultimate control over whether or not a CD-ROM remained in the classroom library. She did not choose to remove any items, although she did at one point suggest colour coding or 'levelling' them. Because of the complexity of the software, this was not done and the students continued to self select.

As is permissible in the formative experiment, it was decided to select evaluation techniques at a later time (Reinking & Watkins, 2000).

The Implementation

Because the implementation was somewhat open and unstructured, it was not possible for Linda or me to observe, note and analyse all of the interactions that participating students and their classmates had with software. The following descriptions are therefore not exhaustive. However, they do reveal many facilitative and inhibitive factors, which were major foci of this study.

Andrew

For the first few sessions⁴¹, Andrew used *Reading Blaster 9-12* (2000) (see Figures 6.9 and 6.10), always with headphones. This software was extremely popular with most of the students in the classroom. It had a games-like interface and featured somewhat 'spooky' activities, featuring ghosts, graveyards and little green men.

Andrew flitted around from one game to another, never seeming to be engaged in what he was doing. Not surprisingly, Linda did not think this software was targeting his needs sufficiently. She stated that a priority for Andrew was to improve his knowledge of grapho-phonetic relationships, namely his THRASS sounds.

Although THRASS software was available, we did not have access to it. I therefore suggested that Andrew could use *PowerPoint* (1997) to first type in each 'THRASS sound', such as 'air', then a word containing the sound, such as 'hair', and finally a sentence containing the word. He could then animate these objects and add his own narrations and sound effects (see Figure 6.8.).

I showed Linda and Andrew how to use *PowerPoint* (1997), although Andrew did not want to discontinue using *Reading Blaster 9-12* (2000). Before we could commence *PowerPoint*, it was necessary for Linda to search the school for a microphone.

Although Andrew quickly learnt how to use *PowerPoint* (1997), he was not particularly interested in the activity, and was embarrassed to hear his recorded

⁴¹ The duration of each session was 1 to 1 ½ hours. The sessions were held in the classroom after school, after the students had taken a short break.

voice. Also, background noises sometimes made it difficult to record. Andrew asserted that he never wanted to do this activity again, even though Linda and his mother, who occasionally came in to watch, thought that it was “a brilliant activity”. Andrew’s attitude was disappointing to Linda, as she had hoped that his presentation would be useful to other class members as a learning resource. However, she did not try to persuade him to continue with it.



Figure 6.8. *PowerPoint (1997). Andrew’s presentation.*

The following week when I arrived at the school, Linda informed me that she had been unable to find Andrew’s *PowerPoint (1997)* presentation on the computer’s hard drive. I showed her how to search the hard drive for particular types of file, in this case a .ppt (PowerPoint) file. This is one example of how Linda’s limited IT skills inhibited her teaching plans.

Andrew was using *Reading Blaster 7-8 (2000)* and did not want to change to another program. He played several games and complained that the computer was too slow. One of the games, *Ski Bum Mumbler* (see Figure 6.9.), required him to read a story (no narrated support was given by the computer) and then answer some literal questions about the text in a multiple-choice format. Andrew did this successfully. Between answering text-related questions, the user steered a skier down a hill, avoiding obstacles, using the mouse. However, there seemed to be a lot of skiing compared to answering questions. Also, because of the multiple-choice format, it was possible to guess the answers. If Andrew selected the wrong answer, he was merely told to try again, although the narrator reminded him that he could reread the text if he thought it necessary. He was never observed rereading a text.

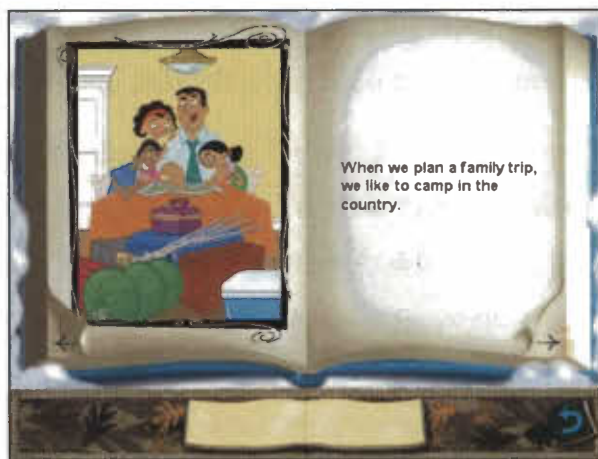


Figure 6.9. *Reading Blaster 7-8 (2000). Ski Bum Mumbler.*

The other reading game he played on this occasion was a spelling game, Bridge Puzzle (see Figure 6.10). In this game, a word appeared and the computer pronounced it. Andrew was then required to type the word correctly, although the original word was still there for him to refer to. Next, some of the letters disappeared and he had to type the word again. Finally, all of the letters disappeared and he had to type the entire word independently.



Figure 6.10. *Reading Blaster 7-8 (2000). Bridge Puzzle.*

In one session, Andrew selected *Reading for Literacy 4 (2000)*. However, as soon as he saw the texts he stated that they were ‘too hard’ for him, and Linda confirmed this. This illustrates that self-selection of CD-ROMs can be successful. In addition, Andrew did not like the interface of this program, so he decided to try *Superspell – A Day at the Beach (1997)* instead. This Australian software consisted

of seven different games, with 60 spelling lists ranging from very simple consonant-vowel-consonant words to more difficult words such as ‘incoherence’.

Games included The Beach Game, in which students were shown a written sentence that was narrated by the computer. After studying it, students clicked on the highlighted word to make it disappear. They then had to type in the correct spelling. The computer pronounced each letter name as it was typed in. The Diving Game was a variation of ‘hangman’, except the penalty for being unable to insert the correct letters was being eaten by a shark rather than being hanged. In The Fairground Game, students were required to make up compound words out of pairs of shorter words. However, some of the compound words used seemed to be beyond many students’ experience - for example ‘overpay’. The Fishing Game was a word sleuth (see Figure 6.11) and The Pier Game involved inserting missing letters from words. For example, ‘te— —is’ was displayed and the user was required to choose either ‘nn’, ‘tt’ or ‘dd’.



Figure 6.11. *Superspell – A Day At The Beach* (1997). Fishing Game.

In The Sandcastle Game, a word appeared for a short time before it was washed away by a wave. Students then had to type the word correctly. The computer narrated letter names as the student typed them. Finally, in The Windsurfing Game, two spellings of a word were presented and the user had to click on the correct one.

Superspell – A Day At The Beach (1997) also allowed users to enter customised spelling lists and context sentences, with narrations. As well, it was possible for the teachers or students to record their own narrations, although the procedure for doing this was not simple.

Andrew began playing The Beach Game at level 5, which was too easy, so I suggested that he try level 10, which featured words like ‘strand’. The context

sentence was, 'A single strand of hair was used to convict him.' However, Andrew did not know what 'convict' meant. After he had completed some of the other level 10 games, such as the word sleuth, which contained many words beginning with the letter cluster 'spr', he was asked to spell some of the words orally and he did this without difficulty

Nevertheless, Linda and I were concerned that Andrew and the other students were not getting the opportunity to consolidate what they had learnt on the computer, so we designed an 'Interesting Words Book'. In this, students were required to write new words, draw illustrations and write definitions. Linda decided to use this book with the whole class to help them improve their spelling and vocabulary. However, participants did not use this book often.

A positive feature of *Superspell - A Day at the Beach* (1997) was that it was possible to make customised word and sentence lists, including pronunciations. When I told Linda about this feature, she wanted to know if it was a quick and simple procedure. When I responded that it involved naming sound files in a specified format, she decided against this option, stating that *Superspell* lists were 'mostly suitable' in any case.

Over the duration of the study, it was difficult to motivate Andrew. He only seemed interested in playing, and even this was half-hearted. On one occasion he stated that he didn't like any of the software that was available to him at school. I asked him what sorts of games he preferred and he responded that he liked the games where he got 'to kill', such as the games available in arcades and on Playstations.

Ryan

Linda had tentatively chosen *Superspell - A Day at the Beach* (1997) for Ryan because the NARA had shown his reading accuracy to be at the 23rd percentile and she hoped that this software might help him improve in this area.

Ryan 'flitted' through the games and played with each of them for a few minutes. He sat for a short while then stood up and used the software in the posture people often adopt when playing arcade games such as Pinball. Although I was sitting with him, urging him to slow down and listen to my instructions, he did not do so. There were no oral instructions available in this software and the written instructions were fairly complex (see Appendix 6.2.). Because he did not know what

he was required to do, or because the software violated his expectations, Ryan quickly became bored. When Linda asked him what he didn't like about the software, he responded that he didn't 'get it'.

The Diving Game (which was a variation of the game, 'hangman') frustrated Ryan because no clues were given about the word and he relied largely on guessing. Linda suggested that he try the vowels first but this did not help him greatly. Without a clue as to the category of the word (eg 'an animal', 'a place'), this game was not beneficial to him. He did not appear to have the metacognitive skills to succeed at the game without more support.

There were many instances when Ryan did not know, or at least could not articulate, the meaning of a word. In The Sandcastle Game (see Figure 6.12), for example, where words appear in isolation, there was no way he could work out or infer the meaning of the word, 'frank'. The Beach Game, however, showed words in the context of a sentence. Even so, the meanings were on some occasions unavailable to Ryan.



Figure 6.12. *Superspell – A Day At The Beach. Sandcastle Game.*

Linda perused the manual that came with the software and said that she would like Ryan to practise words containing long vowel sounds. We could not find a way to change the word list from within a game. Eventually we discovered that it was necessary to go back to the main menu, change the word list, and then re-enter the game.

Overall, both Linda and Ryan said they found *Superspell* rather slow and unexciting, although the relatively old computer they were using might have been

partially to blame for this. They also considered the male Australian narrator's voice to be monotonous. Ryan enjoyed *The Fishing Game* the most, possibly because this was basically a word sleuth, something he understood.

I noted in my journal that, although he was impatient to explore some new software, it might be beneficial for Ryan to return to *Superspell* at a later date, to use it at a 'deeper' level.

The quality of Ryan's written feedback was not good, as illustrated In Figure 6.13. In response to this, Linda indicated that she would design a response sheet, but as she was not able to do this because of time restrictions, I designed it instead. An example of this is shown in Appendix 6.3. This succeeded in eliciting a greater quantity of more useful feedback.

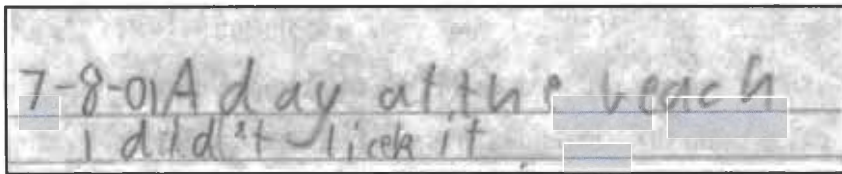


Figure 6.13. Ryan's journal (1)

When I asked Ryan if he would prefer to use software with talking stories (storybooks) or games type software he decisively chose games. Because there was a limited range of software available, I suggested *Carmen Sandiego's Word Detective* (1997), even though I suspected that the interface might be too complicated for Ryan.

He engaged in some word activities such as unscrambling letters to make words, a 3D word sleuth, a cloze activity, and adding suffixes and prefixes to words. He was excited when he collected three passwords and was able to release a fellow spy, a stereotypical muscular American with dark glasses, who thanked Ryan for releasing him. This reward definitely seemed to motivate him to keep going. He also said he preferred the look of the program to that of *Superspell – A Day at the Beach* (1997). The interface of *Carmen Sandiego* (1997) was 'high-tech' and may be perceived by some as rather 'masculine' (see Figure 6.14).



Figure 6.14. *Carmen San Diego's Word Detective (1997).*

There were some words Ryan didn't know the meaning of, such as 'cello'. As in *Superspell (1997)*, definitions were not available. There was much complex connected text in *Carmen Sandiego (1997)*, such as instructions, which were difficult to understand in both spoken and written language. Although Ryan said that he understood the instructions, sometimes his interactions with the computer seemed a little aimless. In his journal, he wrote:

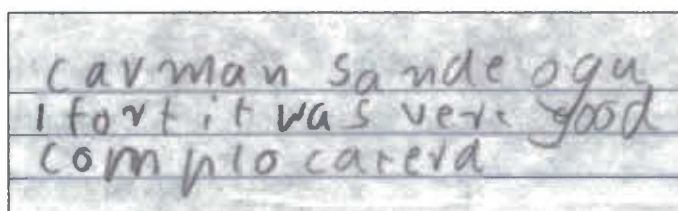


Figure 6.15. Ryan's journal (1)

Ryan took a break from *Carmen Sandiego (1997)* and explored *Dr Seuss Reading Games (2000)*. However, he soon decided that this software was 'too easy' and returned to *Carmen Sandiego*. Although this 'flitting' from one program to another might seem to be time wasting, it at least allowed him to satisfy his curiosity.

The next time we met, Ryan selected *Reading Blaster 9-12 (2000)*, which he had been using throughout the week whenever he could get access to the computers⁴². I asked him what he thought he had learnt from the software through

⁴² It must be noted that if the computer with a particular program installed was occupied by another student, students would solve this problem by installing the software on a vacant computer. I spent

the week and he responded that he had, "Just played." He did not appear to perceive using this software as a learning activity. Yet on a later occasion, when I asked him the same question, he responded, "I'm learning a couple of things and it's also fun!"

Ryan accessed an activity where he had to find antonyms and shoot them down. The software did not pronounce them, but he assured me he could read them. Being able to decode and know the meanings of words were not the only criteria for success in this game. Mouse control and speed of reflexes were also important. This could prove to be demoralising for students who do not have well-developed skills in this area. Another class member, Terry, was helping Ryan, and kept grabbing the mouse. I reminded Terry to help Ryan by explaining things to him, not by doing things for him. Ryan returned to *Reading Blaster* several times throughout the period of the study.

At one point during this session, Linda changed her mind about *Reading Blaster* (2000), declaring it was "quite good", although at the beginning of the study, she had not been able to see how this software could be beneficial.

Three weeks into the study, Linda was delighted to tell me that Ryan had written a one page story in approximately 20 minutes, a feat he'd never before accomplished. However, it was difficult to attribute this to his engagement in the IMM-based activities, although Linda thought that this had played a significant part.

In a later session, I showed Ryan how to use the desktop publishing program, *Microsoft Publisher* (1997), as he wanted to make a birthday card for his mother. Although this had been installed on the computers in the classroom all along, none of the students or Linda knew how to use it. In fact, Linda had not been aware that the software had been installed nor what its purpose was. She observed when I taught Ryan to use it and pronounced that it looked "terrific".

Several weeks into the study, Linda showed Ryan how to use *Storybook Weaver Deluxe* (1998); she was familiar with this software from her previous school and was quite impressed with its capabilities. I asked her if she thought there was a tendency for students to spend too long on the graphics and she explained that she

always asked students to articulate what they were doing and why, so that at least they were talking and thinking when they were choosing graphics.

When Ryan first saw the software he said, "Oh, cool!" He learnt to use it quickly and particularly liked the fantasy characters, which included dragons and monsters (see Figure 6.16). He typed the words first and then read them into the microphone, although it might have been preferable to create the story orally, record it, and then write it down. In this way, his narrations would not have been so stilted and he may have been encouraged to use a wider vocabulary. The process may also have been quicker.

Ryan had problems with his spelling and appeared to find the spellchecker in *Storybook Weaver Deluxe* (1998) useful. The software required him to choose the correct spelling from a list of options, memorise it (or write it on paper) and then type it. The spellchecker list did not remain on display when the user returned to the main program, perhaps forcing users to take a close look at the spelling. Also, it was not possible to copy and paste the correct spellings into the story. Although the clumsiness of this spellchecker could be seen as a limitation of the program, in this case it seemed to be beneficial.

The following week, Ryan wanted to try *My First Incredible Amazing Dictionary* (1994), even though he had enjoyed using *Storybook Weaver Deluxe* (1998) the previous week. However, after five minutes he returned to his multimedia story. He worked on this for 45 minutes before stopping work because he was hungry (he said he'd had no breakfast or lunch that day). His friend, Theresa, arrived and collaborated with him in creating more of the story. Ryan corrected some of her spelling errors and taught her how to select backgrounds, characters and sound effects. After 25 minutes, they had selected a setting and some characters and talked about the story, but had not actually written anything.



Figure 6.16. *Storybook Weaver Deluxe* (1998). Ryan's story.

Ryan claimed that he had tried to show *Superspell – A Day at the Beach* (1997) and *Phonics Alive! 2* (1998) to some of his classmates but that they had been reluctant to listen to him. They had claimed that they already knew how to use the software and did not want to him to teach them. However, I heard of and witnessed many occasions when Ryan did, in fact, help his peers learn to use software. In this sense, he became a classroom 'expert', although it would appear that some of his peers resented his superior expertise and more frequent engagement with the IMM-based activities.

Ryan used a wide range of software during this study, not all of which is described above. Although he seemed to 'flit' from one thing to another, his confidence and enthusiasm for reading and other literacy tasks, such as writing, appeared to have increased.

Nada

In her first session, Nada chose the CD-ROM *Phonics Alive 3! The Speller* (1999) by examining the covers. However, after only a few minutes of using this program, she declared, "I don't like it!" and asked if she could choose another. The only part of the program she had used concerned short and long vowels (see Figure 6.17).



Figure 6.17. *Phonics Alive! 3 The Speller* (1999).

Nada stated that she needed something “easy” and finally decided to try *Reader Rabbit Reading Development Library 2* (1997), which had a bright cover featuring a cartoon rabbit and a cheerful red font. She informed me that she had some *Reader Rabbit* CD-ROMs at home but was not permitted by her parents to use them.

She chose to read the story, *King Midas*, and, even though the animated characters in the software gave oral instructions, Nada repeatedly asked, “What do I do here?” She read along with the narrator in a soft voice, laughing out loud frequently. She mumbled where she was unable to read the words. Linda commented that Nada was engaged with the software. After reading the story, Nada completed the sequencing activity, which involved putting pictures and words from the story into the correct order by dragging and dropping with the mouse. Nada informed me that she had used the pictures and guessing to complete this activity without reading the words. She had not realised that she could have clicked on the text to access a computer narration.

When I arrived at the school for the next session, Nada was already at the computer, using *Superspell – A Day at the Beach* (1997). Ryan had shown her how to use it. She was working at ‘easy’, level 1, which contained simple consonant-vowel-consonant words such as ‘cat’. I suggested she go up to level 10. Nada hadn’t the confidence to jump up so many levels, so we agreed on level 5. She selected *The Pier Game*, which involved putting missing letters in words. If she typed in incorrect letters, the bridge collapsed and a lady with a pushchair fell into the water. Some words, such as ‘coffin’, were unfamiliar to Nada. The lack of definition or pictorial illustration of such words was a disadvantage.

Nada quickly lost interest in this software and asked if she could change to *Reading Blaster 9-12* (2000). I suggested that *Reading Blaster 7-8* (2000) might be better for her, to which she declared, "But I'm nine!"

Although I suggested that *Reading Blaster 7-8* (2000) might be more suitable, Nada insisted on *Reading Blaster 9-12* (2000), saying that it was "better fun" than the one intended for younger students. She spent some time playing with the menu page, looking for an activity. *Reading Blaster* can be rather difficult to navigate: it has unclear menus, often in graphical form, with somewhat obscure icons such as 'e'. When I asked Nada what she was looking for, she replied that she knew and that she did not require help. She eventually found a word sequencing activity. The target sentence was, 'Black ravens soar above us', which was completely beyond her capabilities. Thus, the time spent using this software seemed ill spent.

In her next session, Nada selected *The Computer Classroom Reading at Home 3-4* (2000) which Linda Harris had borrowed from the school library. With the help of Linda, Nada engaged in a sentence making activity, where she selected words and phrases to create sentences that made sense. Linda noted that a disadvantage of this program was the inability to 'undo' entries. If Nada made a mistake, she had to go back and begin the sentence from scratch, which she found frustrating. Because there were mathematics activities as well as literacy on this CD-ROM, Nada occasionally strayed to these. Linda commented that the computer narration which kept interrupting to give instructions sounded somewhat "condescending".

At one point, Nada complained, "I don't want to do this ...", to which Linda responded, "OK, I'll do it!" She modelled how to do it and elicited responses from Nada, which constituted a form of scaffolding.

Throughout the period of the study, Nada seemed to enjoy most of the software, especially if it was humorous (she would laugh out loud), but she did not seem motivated to complete the tasks set and did not seem to fully engage with the software. She often gazed around the room or rocked in her chair. Further, she was absent for three of the ten sessions.

On one occasion when I asked Nada if she thought she'd learnt much through using the computers to help her reading she replied, "No."

Rosie

At the beginning of Rosie's first session, I demonstrated and Linda observed the CD-ROM, *Dr Seuss Reading Games* (2000) to Rosie and Anita, using my laptop computer. This software, which was intended for 3 to 7-year-olds⁴³, featured 2 electronic storybooks, Dr Seuss's ABC and *The Cat in the Hat*, as well as a song and several reading games.

Almost immediately, a 'fatal error' occurred, wasting approximately five minutes. Anita and Rosie became fidgety during this technical hitch. However, when I got the program running and the students heard the Dr Seuss song, they soon regained interest. Linda asked Rosie if she would like to "try" the software.

Linda asked if I would show her how to install the software on one of the classroom computers (computer number 3). I did this after uninstalling it from my laptop, as it was not licensed to be installed on more than one computer. Although the classroom computer ran the CD-ROM, it was very slow.

As Rosie explored the software she was supervised and assisted most of the time by Linda. She wore headphones so as not to disturb everyone else, making it slightly difficult for Linda to communicate with her. At the end of the session, Linda expressed concern that Rosie might quickly find this software boring, as there wasn't "much to it". We therefore asked her to read the story several times along with the narrator (repeated readings) until she was confident enough to read it independently, without the narration. Thus, she was directed to engage with the software for a longer period and in a more purposeful way than she might otherwise have done.

In Rosie's next session, the following day⁴⁴, she used the same software for approximately 15 minutes before asking if she could try something else. Before selecting new software for her, I asked her to read *The Cat in the Hat* aloud without the computer narration (by turning the volume down), but she was unable to keep up with the pace of the computer highlighting and the page turning. Linda asked if it was possible to decrease the rate of the narration but, because the software was new to me, I was not familiar enough with it to know if it was possible to pause the

⁴³ Judging by what was written on the CD-ROM cover, Linda had assured me that this software would not be too easy or 'babyish' for Rosie.

⁴⁴ Rosie attended after-school reading sessions twice a week, whereas the other students attended once a week. This was entirely Rosie's choice.

screens or progress through them at the student’s own pace, or if it was possible to disable the highlighting. Also, there seemed to be no facility to print out the story. Consequently, Rosie’s ability to read this story (at her own pace) was not satisfactorily assessed.

Rosie asked if she could use *Reading Blaster 9-12* (2000) next. However, as she had the reading age of a 6-year-old (according to the NARA), Linda and I decided that *Reading Blaster 7-8* (2000) would be more appropriate for her.

This program featured several reading and spelling games (see Figure 6.8.). Rosie first chose the game Volcano Drop, in which the user was required to press arrow keys to help a female character collect words. The character’s aim was to drop further into the volcano with minimal confrontations with a pursuer. Within each of two categories, ‘easy’ and ‘hard’, there were five levels of the game (1-5). Rosie began at the easiest level, possibly because she was not aware that by clicking the ‘Ⓟ’ symbol it was possible to change levels. The computer narrated the instructions, which the user could hear repeatedly by clicking the ‘?’ icon. Written instructions were not available.



Figure 6.18. *Reading Blaster 7-8* (2000). Main menu.

For Rosie’s first game, the computer narration instructed, ‘Collect all of the words that have the same beginning sounds as ‘clock’’. Because Rosie was wearing headphones when these instructions were narrated, Linda, who was sitting alongside her, did not know what she was supposed to be doing. Rosie also appeared to have little idea about what she was meant to be doing. Evidently, she had either not heard or failed to understand the oral instructions, and did not know how to access them

again. Ryan, who was familiar with *Reading Blaster 9-12* (2000), volunteered his help. Rosie was then able to play the game. However, her response times were not quick. That is, she had to keep moving her eyes from the arrow keys on the keyboard to the screen. This made it difficult for her to progress through the game.

Linda commented that she was not sure that this game would be beneficial to Rosie, as there seemed to be insufficient support and feedback. For example, the software did not pronounce words as the character collected them. Rosie successfully collected many words that started with 'cl', but seemed to have little idea about how the words were pronounced and what they meant. Indeed, Linda began asking her to read them out as she collected them, but she was often unable to do so. Despite being unsure about the pedagogical benefits of this game, Linda permitted Rosie to continue using it.

The *Reading Blaster* software, like many of the other CD-ROMs available to assist students improve their levels of literacy, was designed in North America and featured North American accents. When I asked Linda if she saw this as being a disadvantage for Australian students she stated that the students would "just ignore it." She pointed out that these students watched a lot of television and were thoroughly familiar and comfortable with North American accents.

At the beginning of her third session, Rosie began to use the *Volcano Drop* game again. Linda commented that she was not happy with *Reading Blaster 7-8* (2000), even though *Reading Blaster 9-12* (2000) had been in use in her classroom for several weeks and was popular with the students. I agreed that the game *Volcano Drop* seemed unlikely to meet Rosie's current needs, but noted that the other games on the CD-ROM had not been explored and evaluated. I wrote in my journal:

I'm worried that there might be a tendency to 'write off' software too quickly, without fully exploring its potential first. *Reading Blaster 7-8* may have many good points that were not discovered by the student or the teacher. This indicates (again) that teachers need to be extremely familiar with each software item to prevent students repeatedly going back to the bits they know (comfort zone?) as Rosie did today.

I later suggested that *My First Incredible Amazing Dictionary* (1994) might be helpful to Rosie in that it could help increase her vocabulary. For example, the word 'jaguar' was pronounced by the computer narrator as well as illustrated

pictorially (see Figure 6.19.). A definition was also available in writing and as a narration. Dynamic concepts such as ‘jump’, ‘run’ and ‘race’ were accompanied by animated illustrations.



Figure 6.19. *My First Incredible Amazing Dictionary* (1994).

Linda sat with Rosie to try the software and concluded that it was “very good” and that it had the sort of interaction that students liked. She gave Rosie one-to-one attention as she explored the software. Linda asked her to attempt to read the words and definitions independently, before clicking to hear the computer narrations. In this way, Rosie used her own reading strategies, but support was available if required. Nevertheless, she appeared to find this process somewhat demanding.

She then went on to play the spelling game, *Spell It*, which was part of *My First Incredible Amazing Dictionary* (1994). This activity first showed a picture and simultaneously pronounced a word, and the user was then required to type in the missing letters of the partly written word. Rosie had never encountered some of the words presented before, for example ‘king’ and ‘raccoon’. I suggested that she could print out some of these new words and put them in a personal word bank to take home in order to practise reading and spelling, and to use in her writing. However, she seldom did this.

Rosie did not work independently with the software during this particular session. Linda explored the software with her, providing help and support. In many ways, Linda seemed to use the software as a context for discussion about language, vocabulary, and spellings. It was used as a resource rather than as a tool, tutor or tutee (Taylor, 1980).

At the beginning of the next session, Rosie chose *My First Incredible Amazing Dictionary* (1994) again. She voluntarily revisited some of the words she had accessed previously, such as 'raccoon'. She read the definitions aloud independently and then clicked on the speaker icon to hear the computer narration. She engaged in this software for 30 minutes and then asked if she could use the software another student was using; *Reading For Literacy 3* (2000). Curiosity about the software other students were using seemed to be a distraction for Rosie, as well as for Andrew, Ryan and Nada, although Anita was usually not distracted by what others were doing.

The next time we met, Rosie requested to use *Phonics Alive! 2* (1998) again, although she could not recall the name of the software; she had to point to the icon on the computer screen. She quickly became engaged in the program, but we were unable to pause the software when she had to leave the computer for a short time. Rosie thus lost points in the game, as the computer calculated that she had responded extremely slowly.

When I asked Rosie what she thought of this software, she responded:

"It's good. It helps you spell and you can learn more words from it ... and it's a lot of fun!"

Another advantage of this software was that it logged what the student had done (see Appendix 6.4.), although Linda did not find it necessary to use this feature because she was able to personally supervise the students in the small group most of the time.

The following week, I took in a selection of *Living Books* CD-ROMs to the classroom and Rosie chose to read *Arthur's Birthday* (1993). I asked her to first listen to it in 'Read To Me' mode, then read it silently in 'Play' mode, before clicking the text to check her reading. In Read To Me mode the computer narrated and highlighted the text and also turned the pages. In Play mode, the computer narration was activated only if the user requested it. Users also turned the pages at their own pace. In addition, there were many hotspots. Rosie clicked on one or two of these but did not appear to be greatly interested in them.

Rosie was highly engaged in the story the first time it was read to her, and voluntarily followed the text with her eyes. I asked her to read it silently the second

time through in Play mode, clicking only on unknown words, before having the whole screen narrated to her. In fact she read it aloud. Without having to worry as much about decoding, she read reasonably fluently. She clicked on several unknown words, such as 'course'.

When I asked her if she liked the story she responded, "Yes!" Within 45 minutes she had read the story three times. I asked her to practise reading it throughout the week, if she got the opportunity. She also read *Horry and the Haunted House* (1994). She listened to it in Read To Me mode. Again, she appeared to be fully engaged.

Throughout the study, Rosie tried a range of software, but did not spend a lot of time 'surfing' or 'flitting' through it. She seemed to find it intrinsically interesting. Her favourite was *Phonics Alive! 2* (1998), which she returned to repeatedly. Each time she finished a unit and was able to print out a new certificate, she expressed great satisfaction.

Anita

Linda and I had decided to ask Anita to read *Reading for Literacy 3* (2000) because this software featured texts of genres as well as several comprehension activities at the end of each text; we thought that the different genres might be useful in helping Anita recognise the different structural and language features of different text types, thus helping her identify key words and main ideas.

We installed the program on computer number 2 before realising that this computer had no sound card or speakers⁴⁵. Within 24 hours, Linda had asked the computer technician, Andy Travis, to fit the computer with a sound card and speakers. He agreed that he would do it in the next day or so as he had a spare sound card on his desk. However, three weeks passed before the computer was fitted with the necessary hardware.

On the laptop, I quickly⁴⁶ demonstrated how to use the program and left Anita to work independently, reassured by the fact that the program had oral instructions all the way through to guide her. However, when I checked on her

⁴⁵ Linda had not, at this point, heard of a soundcard.

⁴⁶ Because of the fact that several students were using new software, it was necessary for demonstrations to be quick due to teacher time constraints. These could be termed 'mini-demonstrations'.

progress a few minutes later, Anita had commenced a comprehension activity without having read the story first; she had not listened to the oral instructions properly and did not know how to command the computer to repeat them. The written instructions were minimal in this software.

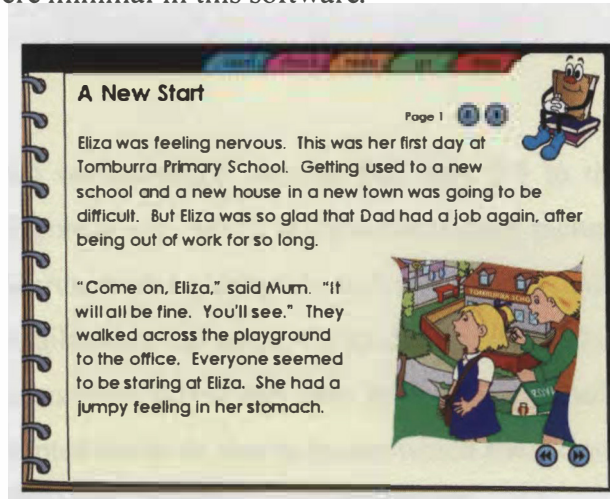


Figure 6.20. *Reading for Literacy 3* (2000). A New Start

Linda sat with Anita, who read a text aloud along with the narration. At one point, Linda remarked to her, "I'm not sure how to turn the page over. It's not doing anything!" They had reached the end of the story and had not realised that they had to click the button that said 'stop' to navigate to the comprehension activities.

Anita moved onto a poem about food and read it aloud without listening to the computer narrative first. Her reading was interrupted by the computer's verbal instructions, which twice instructed her to click on 'Read' to access the computer narration. This proved to be a distraction for Anita, who wanted to read independently. She read the text through slowly and dysfluently, although she didn't make any errors and managed to decode all of the words. I asked her to read the text again, faster, saying, "Read it as you would read a poem!" She read it again, much more quickly and smoothly. I wrote in my journal:

All this without the computer narration - superfluous in this instance.

Anita carried out the associated activities. In the cloze activity she was instructed to insert rhyming words. Although she was able to do this, she didn't know the meaning of the word 'frown' and, as word definitions were not available in this software, she asked me what it meant. I proposed that perhaps a way of

overcoming this problem would be to use the software in conjunction with *My First Incredible Amazing Dictionary* (1994). However, there was no free computer on which to run the other CD-ROM and, in any case, it did not include all the words Anita needed to look up, including the word ‘frown’. Anita was told to access a conventional students’ dictionary in future. However, she did not appear to follow this advice.

Anita scored 4/4 on the cloze exercise but only 2/5 in the Locating The Answer activity (see Figure 6.21), which involved matching pictures and labels of food with descriptive words, such as ‘salty’, ‘juicy’ and ‘plump’. Although all of the answers were clearly available in the poem, Anita did not switch back to the text to check before inserting answers, which was easy to do in the *Reading For Literacy* (2000) program. I prompted her to do this in future, which she did sometimes.

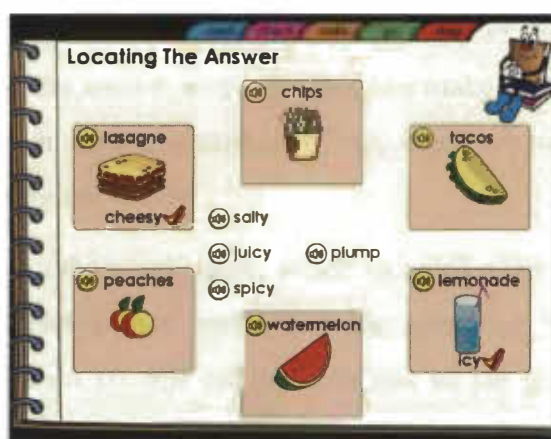


Figure 6.21. *Reading for Literacy 3. Yum! Locating The Answer.*

In general, Anita tended not to use all of the computer support available to her, even when she needed it. This is a relatively common tendency in multimedia contexts, which has been referred to as ‘under-accessing’ (Collins et al., 1997). This tendency could be a result of poor metacognitive skills, or not knowing when support is needed. To overcome this, the teacher may model metacognitive skills, for example by saying, “I’m not sure about that answer. Is there a way I can check? Yes, I can read the text again. I’ll just flick back to it.” Over the course of the study, Linda and I tried to do this with Anita, and she did appear to improve with regards to accessing support when she was unsure about something.

Alternatively, under-accessing could be a result of embarrassment, or not wanting others to know that one needs assistance. The use of headphones may afford

more privacy and help overcome this. However, some students, including Anita, seemed to find headphones uncomfortable.

After three sessions, Anita asked if she could try *Superspell – A Day at the Beach* (1997). She had a quick browse through it, declining any help, and quickly decided not to use it. When I asked her why she had made this decision, she did not reply. Next she loaded *Dr Sexs Reading Games* (2000), which I warned would probably be too easy for her and after a few minutes of 'flitting' through the software, she agreed. She then went back to *Superspell – A Day at the Beach* (1997) and into The Fishing Game activity (word sleuths), which another participant, Nada, had recommended to her. I suggested that she begin at level 8, which consisted of simple four letter words. It transpired that, although Anita could decode these low-frequency words easily, she did not know their meanings. Examples of these words are, 'awig', 'smug', 'snub', 'smog', 'prim' and 'swot'. I explained the meanings to her (twice) throughout the session and suggested she make up definitions in her own words, an activity which she found difficult. I also asked her to write both the words and sentences containing the words.

Anita printed out the word sleuth, which included a list of all the words used, thus enabling her to practise them away from the computer. She then accessed the Sand Castle Game at level 10. She did not complete all the games at level 8 before moving on, and consequently the repetition of words that is built into this software was not fully realised.

At the end of this session, Linda commented that a problem with this group of students was that they would use strategies if prompted, but did not know how to choose and use strategies independently. This seemed to demand the continuation of strategy modelling by teachers.

Throughout the following sessions, Anita progressed through *Superspell – A Day at the Beach* (1997) until she declared it was "too easy". Instead of selecting a more difficult level in the same software, she chose to switch to *Reading for Literacy 4* (2000), and systematically read most of the texts. She usually read the texts independently first, then used the computer narration to check her reading. When she later accessed *Reading for Literacy 5* (2001), it was immediately apparent that her comprehension of the texts had broken down, even with the support of computer narrations. This was most likely largely because of her limited vocabulary. For

example, she did not know the meanings of the words 'resistance' and 'accelerate' and was unable to infer the meanings from the text she was reading, titled Parachutes.

When Anita was first asked to complete a response sheet that I had devised (see Appendix 6.3.) in response to the question, 'Name of software?' she asked, "What's software?" indicating that students may need to be given the language to talk about ICT, if they are to provide meaningful feedback.

Although Anita briefly explored some of the other programs described above, she usually preferred *Reading for Literacy* (2000) and concentrated on the activities in this software. This was despite the fact that in her normal classroom context she found it difficult to concentrate on traditional literacy tasks. Anita appeared to find the one-to-one interaction with the computer satisfying, and she often clapped to herself when she got something right, showing an appreciation for the immediate feedback. Indeed, on one of her response sheets, Anita wrote of *Reading For Literacy* (2000):

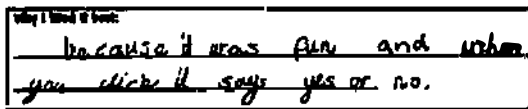


Figure 6.22. Anita's response form (1).

Anita was generally extremely positive about the software she used and her mother informed Linda and me that Anita loved Monday afternoons because of the IMM-based activities.

Evaluation of the Implementation

Two weeks after the intervention had commenced, Linda stated that she knew it was working because the students were engaged in reading, something that was usually difficult to achieve.

Thus, this particular formative experiment seemed by default to become focussed on the question: 'What are the facilitative and inhibitive factors when using 'free choice' of reading software with an aim of increasing engagement in reading?'

It has been strenuously argued over the years that free choice in a traditional context can be very powerful. As Eanes (1997) has pointed out, free choice, or control, can be an extremely effective motivator:

'One of the most effective ways to motivate students is to give them more control over their learning. You can empower them by showing them you trust them enough to make the selection most appropriate for them. When students can make their own choices, they become more active participants in the learning process.' (Eanes, 1997)

Through increased motivation and engagement, it was hoped that other outcomes, such as increased accuracy and comprehension, would result. In the next section, the post-intervention assessments are outlined, although it is emphasised that Linda was also carrying out informal assessments for the duration of the study, both within and outside the context of DMM-based activities.

The Assessment Results

As shown in Table 6.1, the students' reading in terms of comprehension, accuracy and rate improved substantially during the four months of the study, with Ryan's NARA comprehension score increasing from the 23rd to the 74th percentile. These results will be discussed in more detail below.

Despite positive test results for all of the students, Linda reported that she had not noticed much of an improvement in Andrew and Ryan's classroom literacy performances, indicating that any positive effects may not have transferred to the classroom context. A discussion of the results of the individual students in greater detail follows.

Andrew

Andrew's comprehension increased from the 40th percentile to the 50th, his accuracy increased marginally from the 17th to the 20th percentile and his rate of reading decreased slightly (see Figure 6.23). The decrease in rate could be explained by the fact that he was far more likely to risk 'having a go' at decoding during the post-intervention test, where he did not refuse any words or appeal for help. In the pre-intervention test a high percentage of his errors (72%) were refusals or appeals. In short, he appeared to be thinking more in the post-intervention test.

Despite these results, Linda was disappointed with Andrew's progress and stated that she did not see any improvements in his reading ability or in his attitude towards reading in the normal classroom context.

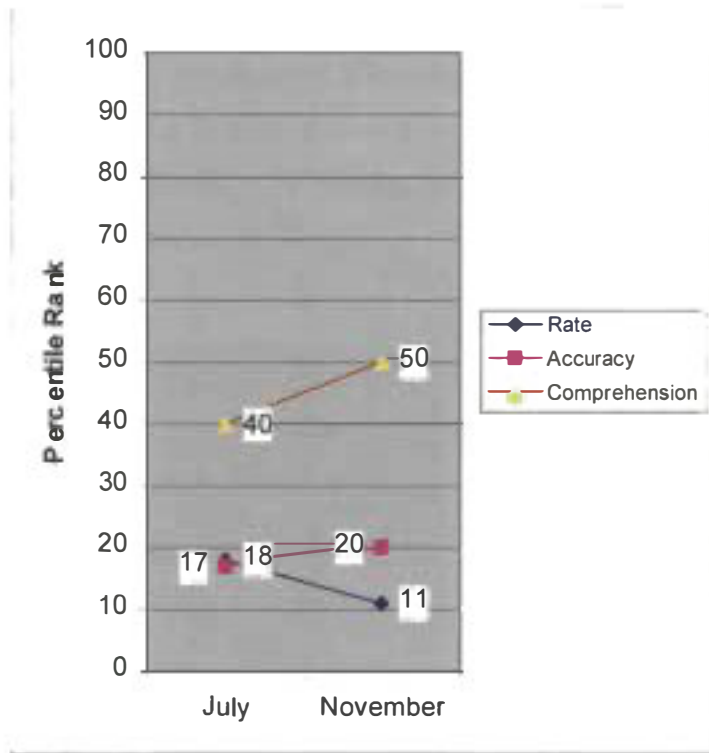


Figure 6.23. Pre- and post-intervention NARA results: Andrew

Ryan

Ryan's comprehension increased from the 23rd to the 74th percentile and his accuracy increased from the 23rd to the 35th percentile (see Figure 6.24.). He made fewer mispronunciations and non-words in the post-intervention test (26%, as opposed to 46% in the pre-intervention test). Instead, he was more likely to appeal for help. This could indicate that he had become more aware of what made sense and what did not. Because he appeared to be reading for meaning, he was unwilling to articulate non-words and mispronunciations.

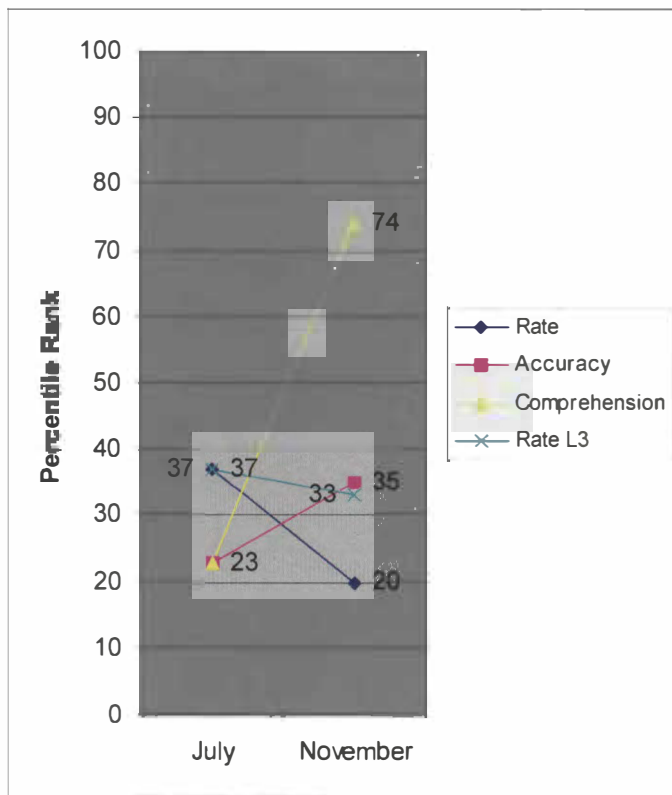


Figure 6.24. Pre- and post-intervention NARA results: Ryan

Linda, although pleased that Ryan had been asking to stay behind after school almost every day to take part in the IMM-based activities, reported that she had not noticed much of an improvement in his reading performance in the classroom context. This could have been an artefact of the types of assessment Linda was using in class (Fehring, 2003). Linda was concerned that Ryan still had a negative attitude

towards reading traditional printed texts. She was also concerned about his eyesight, which she saw as a possible cause of his reading problems.⁴⁷

Nada

Nada's comprehension rose from the 4th to the 21st percentile and her accuracy from the 5th to the 24th (see Figure 6.25.). However, her rate of reading decreased from the 16th to (less than) the 5th percentile. It must be noted that in the second test, she read up to level 3, whereas in the pre-intervention test she read up to level 2. If measured only up to level 2, her post-intervention rate went down to the 6th percentile. The slower rate could be accounted for by the fact that she was taking more care with accuracy and was making more meaning.

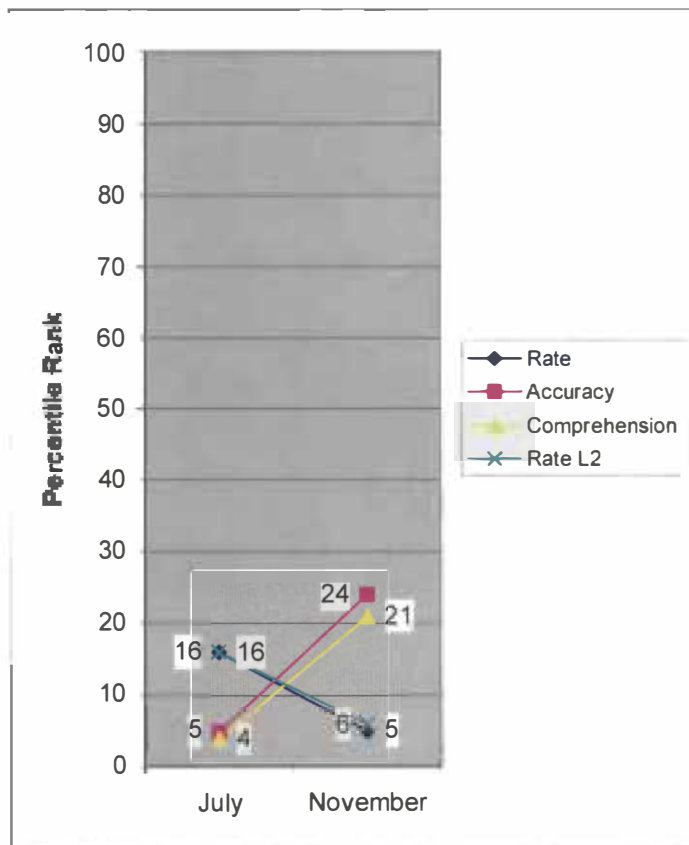


Figure 6.25. Pre- and post- intervention NARA results: Nada

Although it may seem that Nada's abilities were still weak at the end of the study, it must be remembered that the starting point for her, and her confidence level,

⁴⁷ Ryan now wears spectacles.

were extremely low. This may explain why she often appeared not to be interested in the software. There may have been a fear of failure, even in this context.

Rosie⁴⁸

Rosie's comprehension increased from the 10th to the 44th percentile and her accuracy increased from the 8th to the 20th (see Figure 6.26.) However, 72% of her errors were still refusals/appeals for help. Her rate increased from the 22nd to the 51st percentile and if measured up to level 1, as it had been previously, it increased to the 82nd percentile.

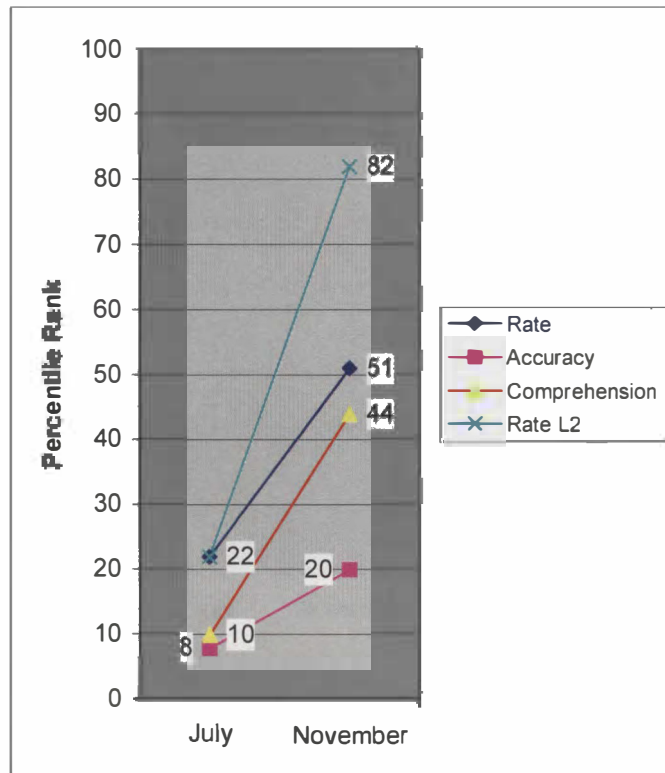


Figure 6.26. Pre- and post-intervention NARA results: Rosie

Linda stated that, although she had noticed a slight improvement in Rosie's literacy skills in the classroom context, it had not been dramatic.

⁴⁸ It must be noted that Rosie participated in almost twice as many sessions as did the other participants.

Anita

Anita's comprehension rose from the 13th percentile to the 45th, her accuracy from the 35th to the 49th percentile, and her rate decreased from the 34th to the 8th percentile (see Figure 6.27.). However, in the pre-intervention NARA test she read to level 3, whereas she read to level 4 in the post-intervention test. Her rate decreased only to the 22nd percentile if calculated up to level 3.

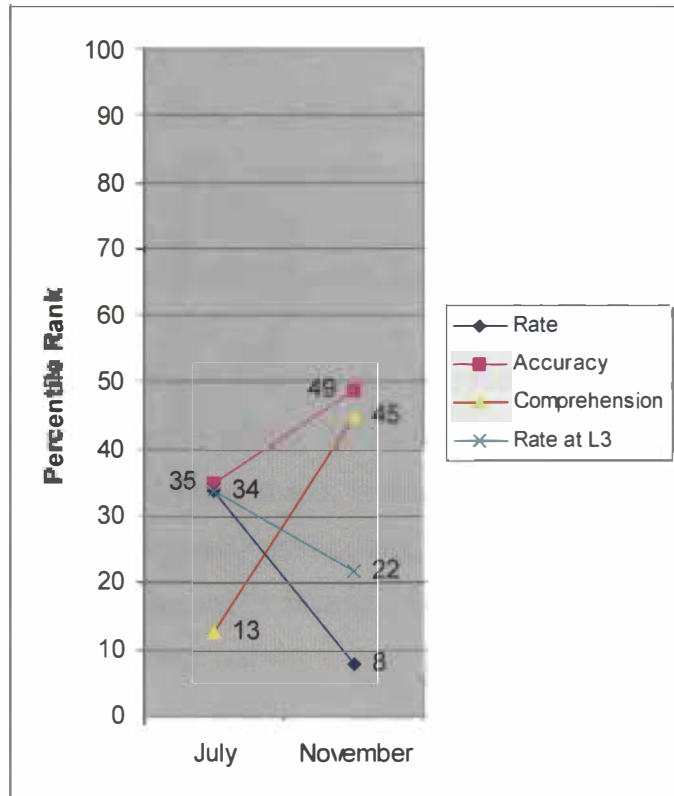


Figure 6.27. Pre- and post-intervention NARA results: Anita

Of Anita, Linda said:

I have found that Anita's interest in reading has improved, especially in silent reading. She'll select her couple of books and she'll stay and read them - she won't go wandering. It's really pleasing on here [the results sheet] and I have noticed it in her general interest as well.

Discussion of the Assessment Results

Because of the nature of the study, it is not possible to make direct causal links between the interventions and the test results. However, when I asked Linda

how far she attributed the test results to the fact that the students had been involved in the IMM-based activities, she responded:

“With Anita I would, definitely. Without the computers to motivate her and to have that repetition, I don't think she'd be there. Nada and Rosie, their interest in the class has improved and their conversation level has improved - Rosie so much so that she's getting her name on the board now! She's coming out of her shell and it's vocab[ulary], it's talking, it's expressing. At the beginning of the year, I was very worried because she said nothing, she would not ask for help, would not ask to go to the toilet, would not say who she'd like to sit next to.”

However, with reference to Andrew and Ryan, Linda claimed to have seen little improvement and thus saw no need to make attributions.

Facilitative and Inhibitive Factors

Many factors facilitated and impeded the interventions, although it seemed much easier to detect the inhibitive factors. In this section, the most salient of these will be listed. The cells of the table are shaded according to how often that factor was observed with reference to a particular participant. In this case, many of the factors directly involved the teacher, so she is included in the table. All factors will be discussed in more depth in Chapter Ten.

Table 6.4. Inhibitive and facilitative factors: Hillview Primary School

Facilitative Factors	Andrew	Ryan	Anita	Rosie	Nada	Teacher	Inhibitive Factors	Andrew	Ryan	Anita	Rosie	Nada	Teacher
The student engaged in collaborative learning.						N A	The teacher felt she had insufficient access to professional development	N A	N A	N A	N A	N A	
The teacher had a positive attitude towards the IMM-based activities.	N A	N A	N A	N A	N A		The teacher/student had limited knowledge about hardware						
Student was willing to learn how to use new software.						N A	The teacher/student had limited knowledge about software						
The design of software helped the student (for example, built in repetition).						N A	There was insufficient time.						
The student was motivated and engaged in the activities.						N A	Technical hitches were experienced.						

student showed appreciation for humour in software.						N A	The student provided insufficient quality feedback.								N A
Comments that might have seemed 'babyish' in additional contexts were accepted by the student in IMM format.						N A	Licensing and copyright issues were experienced.								
Resources supplied by software, such as certificates or thanks/praise in an animated character, motivated the student.						N A	There was insufficient space in the classroom to set up a satisfactory computer station.								
Student was motivated by software recommended or used by others.						N A	There was a shortage of suitable hardware.								
							The student had poor keyboarding/mouse skills.								N A
							Software design issues were experienced. For example, not enough word identification/spelling support for Ryan in some programs; ambiguous navigational systems, intrusive narrations; inflexibility; poor instructions.								
							Students did not always use software in ways intended by producers. For example, they engaged in 'flitting' from one IMM-based activity to another and 'skipping' through sequenced activities.								N A
							Participating students were distracted by what others were doing on adjacent computers.								N A
							The teacher had inadequate support in identification of nature of reading difficulties.	N A	N A	N A	N A	N A	N A		
							Pedagogical 'dead ends' were experienced.	N A	N A	N A	N A	N A	N A		
							Multimedia sounds appeared to cause embarrassment or irritation.								N A
							The student did not access multimedia support available (even when they knew it was there and how to access it).								N A
							The cost and inaccessibility of some software (eg <i>THRASS</i> , <i>Accelerated Reader</i>) was inhibitive.	N A	N A	N A	N A	N A	N A		

KEY	
Never observed	
Sometimes observed (1 to 5 times)	
Often observed (6 or more times)	
Not applicable	N A

The student did not want to change IMM-based activities at the teacher's suggestion.	Orange	Yellow	Yellow	Yellow	Yellow	N/A
The teacher experienced difficulties in the assessment of outcomes.	White	White	White	White	White	Yellow

Unplanned outcomes

- Possible deterioration of writing skills. Linda reported that, since the introduction of IMM-based activities, some of the students in her class appeared to have “regressed” in terms of their paper-based writing abilities. That is, they were writing less and their writing was of poorer quality. However, Ryan, one of the participants, had started to write a larger quantity of text since the introduction of the IMM-based activities.
- Other class members (not participating in the study) benefited from using the software. Linda informed me that a girl who stayed after school on another night had “skyrocketed”.
- Loss of interest in “old” software. Linda noted that students no longer showed enthusiasm for software such as the word-processor, as it was not as exciting as IMM. However, this may have constituted a ‘novelty effect’, which would likely decrease with time. As a possible response to this problem, I suggested that the students could use *Microsoft Publisher* (2000) instead of *Microsoft Word* (1997) so that they could make flyers, booklets and greetings cards, and write for authentic purposes.
- Use of resources developed for participants’ use (such as ‘The Interesting Word Book’) by the whole class.
- Students’ self-esteem and risk-taking behaviour increased.
- The oral language capabilities and confidence of some of the participating students improved.

Establishing Preferability

As noted in previous chapters, there are several difficulties inherent in establishing preferability, such as difficulties in detecting and assessing outcomes

and attributing gains to particular activities. As in previous chapters, Reigeluth and Frick's dimensions of efficiency, effectiveness and appeal (1999) are used as a framework to make use of data relating to inhibitive and facilitative factors, as well as to assessment data (see Table 6.5).

Table 6.5. Preferability of the strategy ('free choice' of a wide range of IMM literacy software) over 'traditional' literacy strategies.

Efficiency	There was a perception that students may have 'wasted time' by flitting from one activity to another. The teaching strategy required a large (initial) investment of teacher time. The cost of a wide range of software was high.
Effectiveness	In the case of the five participating students, gains were made. The teaching strategy appeared to be very effective for Ryan, Anis, Rosie and Nada.
Appeal	The strategy was appealing to the students (although Andrew only liked one of the CD-ROMs), the teacher and other classroom members. The students and the teacher often referred to the IMM-based activities as 'play'.

Overall, because students who had been making minimal progress and who did little independent reading in traditional contexts were able to improve their literacy performances, the strategy could be said to be preferable for these particular students at this particular time. The students had diverse literacy needs, which the diversity of software and activities available seemed able to address. In order to contain the 'flitting' from one activity to another, Labbo's (2000) recommendations concerning the importance of 'modelling' and 'mentoring' seem to be valuable (see Chapter 3).

In terms of appeal, the IMM-based activities were often seen by the students and the teacher as 'play'. In this case, engaging and motivating the students was seen by the teacher as being of paramount importance because they were normally not highly motivated to read in classroom contexts. The fact that the students saw the activities as 'fun' and 'play' encouraged them to read, which was something they usually avoided.

As pointed out by Beecher and Arthur (2001, p. 28.), play is voluntary, episodic, symbolic, has its own momentum and focus, demands children's participation and is pleasurable for the players. Table 6.6. lists how the IMM-based activities used during this formative study included various qualities of play.

Table 6.6. Qualities of play inherent in IMM-based literacy activities

Qualities of Play	Description of Qualities	Examples of Qualities of Play in IMM-Based Literacy Activities
Voluntary	Children play voluntarily, for their own reasons, for example to interact with peers or out of curiosity. When they play they are often deeply engaged.	In the case of Hillview Primary School, the five participating students stayed behind after school to use the computers on a voluntary basis. They were free to engage in other literacy activities (such as reading a book) or to go home if they wished. Indeed, the students often used the term 'play' with reference to the IMM-based activities and were usually eager to participate.
Episodic	Children play according to their own goals, which may emerge from spontaneous sequences of play.	When the students 'fitted' through software, they acted according to their own goals and purposes, which they often changed. They spontaneously changed activities when they were not gaining satisfaction from them.
Symbolic	Children enter into the 'reality' of play and follow roles and rules.	In many of the IMM-based activities, especially those with a games interface, students stepped into roles and followed rules of the game, often drawing on real-life experiences.
Momentum and focus	Children can make up their own rules without outside direction.	In the context of IMM-based activities, students were often 'drawn into' the activities by the interactivity and the dynamic nature of the activities. They often created their own 'paths' through the activities without outside intervention.
Demands children's participation	Children participate in a number of different types of activities when they play, such as observation, listening and acting.	Because IMM-based activities usually require users to interact with the software, for example by clicking on the mouse or using the keyboard, participation is demanded.
Pleasurable	Play is pleasurable, even when a degree of challenge is involved.	IMM-based activities are often pleasurable. Hillview Primary students often referred to the activities as "fun".

As with using play to teach literacy in a traditional context, there are several issues related to using IMM as a context for children to learn literacy through play. One is that teachers may fear that play can take away their control of children's learning (Beecher & Arthur, 2001), although this concern was not shown by Linda Harris. Beecher and Arthur have also pointed out that it is important for educators to join in and guide children's literacy-enriched play, as this can help them focus and reflect on their learning.

Conclusion of Chapter

At the end of the study period, Linda displayed a positive attitude about the DMM based activities and stated that she "wouldn't be without them". In terms of appeal and effectiveness, she was satisfied that the interventions had worked for the participating children. I donated several CD-ROMs to the school, which Linda stated she would continue to use⁴⁹. She was also enthusiastic about continuing to improve her own skills in the ICT area.

Linda had intended that the activities should be enjoyable and motivational for the students, and there were many aspects of the DMM-based activities in which the students engaged that could be likened to play, which, as explained in the previous section, can be a very effective means of learning.

Even though coherent strategies were not always implemented, and the students were often allowed to explore software freely, the student outcomes appeared to be positive. Furthermore, several students in Linda's class (including students who were not participants of this study) appeared to have benefited from the DMM-based approach, as shown by Figure 6.1.

The fact that this particular formative experiment was somewhat unstructured and did not fully conform to all of the requirements set out by Reinking and Watkins (2000) may be seen by some as a concern. Nevertheless, various inhibitive and facilitative factors emerged which may form the basis of further study.

Despite the fact that Hillview Primary School was a Technology Focus school, a majority of the inhibitive factors that emerged stemmed from a shortage of resources in terms of software, hardware and professional development. Nevertheless, Linda was flexible and eager to overcome these barriers and seemed to have begun her journey towards becoming an 'inventive' (Dwyer et al., 1990) teacher in terms of her use of DMM to facilitate reading in students who experienced reading difficulties, despite the difficulties inherent in doing so.

One means by which Linda minimised inhibitive factors was by co-constructing activities with the students. That is, she sat with them and learnt

⁴⁹ At a meeting with Linda one year after the end of the study, she reported that she still used the software in her classroom but it was increasingly difficult to do so because there was only one functional computer in the classroom. The promised school computer laboratory still was not ready

alongside them. She often mediated the students' interactions with software by explaining concepts to them, exploring options and navigational structures, 'wondering' out loud about aspects of the software (a type of strategic modelling) and becoming engaged in discussions with students in order to focus their attention and thinking. Beecher and Arthur (2001, p. 66.) describe a co-construct or as follows:

'Co-construction occurs when the educator and a child or group of children are jointly involved in an activity or project. Both the educator and the children are actively engaged in the teaching and learning process.'

During this co-construction, Linda was also able to provide direct instruction, where needed. She also provided direct instruction in the normal classroom context.

This particular case seems to add credence to Burns' (2002) notion that teachers do not necessarily need to be 'experts'³⁰ in ICT in order to use IMM to assist students who experience literacy difficulties; they need 'just enough'. Furthermore, they do not necessarily need to follow rigid strategies. It appears that, in some circumstances, the ability to skilfully co-construct IMM-based activities with students may be 'just enough'.

³⁰ Linda had the support of myself (the researcher), however.

CHAPTER SEVEN

MORLAND PRIMARY SCHOOL

Overview of Case

IMM-based reading and repeated readings of electronic text and IMM-based comprehension activities, using commercial software.

Government/Private:

Government/Co-educational

Number of students in class:

25

Number of students in school:

Approximately 240

Socio-economic status:

Middle

Pedagogical goal:

Increase in comprehension

Table 7.1. Participants: Morland Primary School

Participating Students				
Name	Year	Age at beginning of study	Estimated hours spent doing IMM-based activities	Estimated hours spent doing IMM-based activities independently
Mitchell	5	9:8	30	27
Luke	4	9:7	22	19
Kerri	5	10:6	22	19
Zara	5	10:1	22	19
Participating Teacher				
Name	Teaching Experience	ICT Experience		
Sarah Fox	3 years	Some		

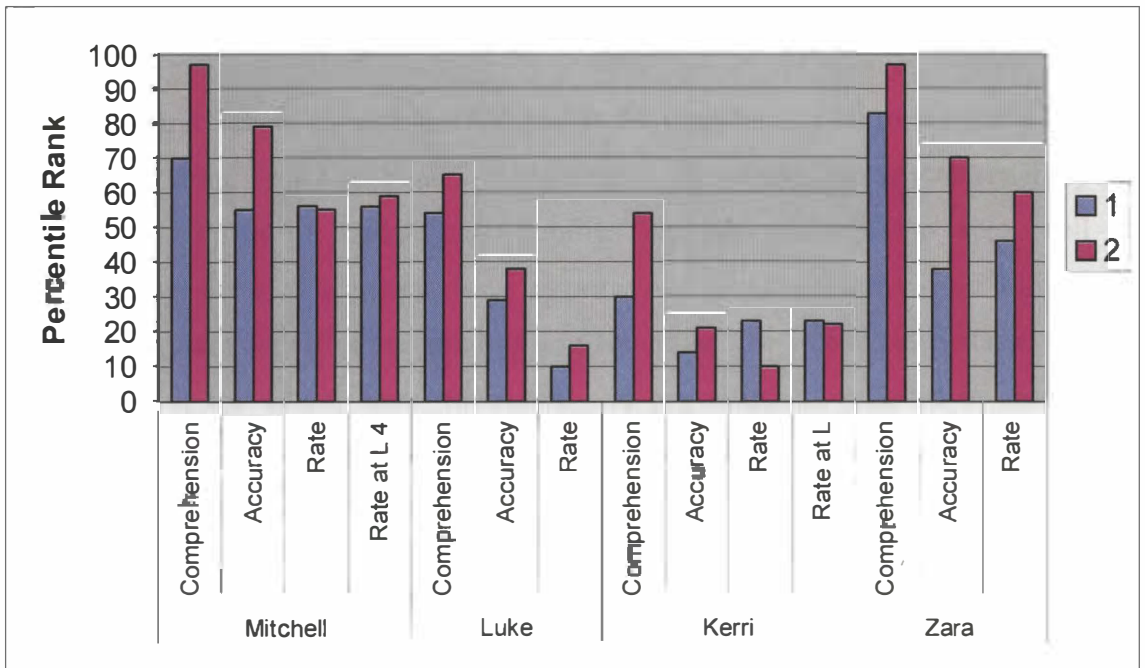


Figure 7.1. Pre- and post-intervention results of the NARA: Morland (Year 4/5)

Table 7.2. Hardware available

Computers	Specifications
Laptop computers	None available.
Classroom computers	3 x Pentium III computers. Speakers. Microphones. 17 inch monitors. Headphones.
Computer Laboratory	Not used for this study.

Table 7.3. Software used during the study: Morland Primary School

Software Used	Description
Reading for literacy 3 (2000).	Electronic texts (several genres) with comprehension activities.
Reading for literacy 4 (2000).	As above.
Reading for literacy 5 (2001).	As above.
PM Storybook Silver (2000).	Electronic texts (mainly narrative) with comprehension activities.
Computer Classroom Reading at Home 3 (2000)	Electronic texts (several genres) with comprehension activities.

The School Context

Morland School opened in 1966 and at the commencement of the study had 240 students from Year 1 to Year 7. According to its website, the school generally drew on a catchment of 'middle class families' and had students who were 'well behaved and positive'. The parents were supportive of the school and were willing to contribute to class activities and fund-raising activities. The website also stated that the teachers at the school were 'motivated and experienced', believed in student centred learning approaches, and worked collaboratively, using technology to enhance learning outcomes.

ICT at Morland Primary School

Morland School was a Technology Focus school⁵¹. The school's purpose was to 'develop the cognitive, social, physical and creative abilities of all students and the use of technology was seen as a necessary part of this. The school's Technology Plan stated:

'We believe that we can no longer teach today's students with yesterday's tools and expect them to be successful. It is important that we increase the use of technology to engage students and facilitate learning.

Our students need to be able to utilise global information and manipulate this information using computers as a tool. Technology allows students to join the global culture.

Students need to be able to use learning technologies and other technologies to solve problems efficiently and effectively and in so doing develop skills which are required by the workforce both now and in the future.

We view technology as a tool to improve the learning/teaching environment with integration into the eight learning areas using EDWA's [Education Department of Western Australia] eight student outcome statements.⁵²

The school had a computer laboratory, some staff computers and an automated library, as well as a part-time technology coordinator (0.4 FTE or 40% of

⁵¹ Technology Focus Schools are described in Chapter Seven

⁵² The Education Department of Western Australia (EDWA) states eight learning areas, which are: The Arts, English, Health and Physical Education, Languages Other Than English, Mathematics, Science, Society and Environment, and Technology and Enterprise (Education Department of Western Australia, 1998).

full time), whose role it was to 'implement the school's technology plan, follow action plans, manage school technology and support students and staff with knowledge of software and the implementation of technology as a tool for learning'.

When students went into the school laboratory, lessons were not taken entirely by specialist teachers but also by the classroom teacher, who was expected to use ICT to enhance class-based activities. Using computers was therefore not seen as a peripheral activity, but as an integral part of the curriculum.

The school considered its hardware to be 'state of the art' and, indeed, the computers were at the time of the study almost new. In the participating teacher's classroom, there were two computers with Pentium III processors and 17-inch monitors. They had large (10 gigabyte) hard drives and were networked via Novell. There was one printer connected to the two computers, but this was extremely slow. The students had access to a wide range of software on the network, including those listed in Table 7.4.

Table 7.4. Software available on Morland Primary School network

Software	Description
Hyperstudio 4 (2000)	A multimedia authoring program for students
Authorware (n.d.)	A professional multimedia authoring program
Inspiration (2000)	A concept-mapping program
Kidpix Deluxe (1998)	A multimedia art program
Land of Um (n.d.)	Problem-solving software
Magic School Bus (1994)	Virtual field trip (the ocean)
MS Office (1997)	Word, Access, PowerPoint, Excel, Publisher
Phonics Alive! 1 (2000)	A phonics program
Phonics Alive! 2 (2000)	A phonics program with a focus on 'blending'
Printmaster 8 (n.d.)	A desktop publishing program
Reading Blaster 9-12 (2000)	A games-based reading and spelling program

Because software was available on the school's network, students did not use CD-ROMs in the classroom on a regular basis. Indeed, the teacher had experienced difficulties installing CD-ROMs onto the computers since the introduction of the Novell network, six months prior to the commencement of this study.

Morland Primary School occasionally ran workshops/practicums for teachers from other schools, in which the IT coordinator gave lessons on how to use such applications as *PowerPoint* (1997), *Inspiration* (2000) and *Kidspiration* (2001), and how to integrate these into the curriculum. It was not compulsory for teachers at the

school to attend these workshops and the participating teacher, Sarah Fox, had not attended many due to time constraints.

Morland's Literacy Policy

Reading

Morland had separate writing, reading and spelling policies. The school's reading policy (1997) defined reading as follows:

Reading is the process of getting meaning from print. It is not a passive, receptive activity, but requires the reader to be active and thinking. Reading cannot be seen in isolation from listening, speaking and writing.

This policy defined reading as a purposeful process of gaining meaning from print using the cueing systems of language (grapho-phonetic, syntactic, and semantic), as 'an active process of meaning construction, to which readers bring a range of experiences, background knowledge and feelings'. The policy stated that students should be taught a range of strategies and when to apply them, and that these strategies should be taught by modelling, in the context of whole language activities.

Further, the policy stated that teachers should provide a language-rich environment where print is presented in 'natural and meaningful' contexts, and should read to students on a daily basis from a range of genres. It claimed that students should have the opportunity to read independently each day and to conference with the teacher and peers to discuss aspects of their reading. In addition, it stated that teachers should help students monitor the effectiveness of their reading and encourage them to respond to and reflect on texts critically, as well as encourage students to take risks while making meaning, emphasising strengths rather than weaknesses.

Students at Educational Risk (SAER) Policy

Students deemed to be at 'educational risk' were referred to the school's 'At Risk Coordinator', who carried out standardised tests and analysed the child's achievements and difficulties within the classroom, in collaboration with the classroom teacher. The two teachers then completed an Individual Learning Plan (ILP) for the student that was implemented mainly by the classroom teacher but sometimes also involved support teachers, aides and parents. Parents were

interviewed and their suggestions and feedback requested. The plan was then put into place and constantly monitored, using various techniques such as rating scales and anecdotal records.

The Classroom Environment

The Year 4/5 classroom was bright, colourful and full of activity. There was often quiet background music playing, contributing to a relaxed atmosphere. A large aquarium was positioned near the front of the classroom and the students' artwork and writing were displayed on the windows and walls. There was also a variety of wall charts concerning literacy, such as:

- How to create a story map;
- Punctuation;
- How to write a report;
- Word endings;
- The writing process;
- Forms of poetry;
- Parts of speech;
- De Bono's 'The thinking wheel' (de Bono, 1999).

The students sat in large groups and worked collaboratively much of the time; they discussed many of their activities and provided support for each other. The classroom teacher, Sarah Fox, declared that she was a great believer in 'scaffolding' (Vygotsky, 1978). The desks were rearranged often, almost weekly, so that the students got opportunities to participate in a variety of groups.

Moreover, Sarah Fox believed that the pace of classroom life was often too fast, inhibiting learning. She thus endeavoured to allow students to work at their own pace in order that they might "enjoy" their learning and make it meaningful, instead of rushing through it and learning on a "superficial" level. Sarah had a flexible approach and was by no means a slave to the timetable. For example, at one point she implemented a 'maths week' because she thought the students needed to consolidate and use their maths learning in meaningful ways.

The Classroom Teacher (Sarah Fox)

Sarah Fox was in her early thirties at the commencement of the study and had a Bachelor of Education in Primary School teaching from a Western Australian university. She had commenced an Honours degree in Education but had put it "on hold" as she found life as a classroom teacher too busy to allow further study.

Sarah had been teaching for approximately three years at the commencement of the study and had a one-year contract to work at Morland Primary School.³³ Sarah had received some professional development in using ICT in the classroom through participating in a few of the practicums run at the school. She used technology for word-processing and accessing the WWW, but did not use email frequently. Indeed, she had forgotten her email address.

How Was Reading Usually Taught in Sarah's Classroom?

Sarah believed that reading should be "purposeful and enjoyable", and mainly used strategies that were in accord with the school's literacy policy, such as guided reading (Fountas & Pinnell, 1999) and directed silent reading (DSR) (Education Department of Western Australia, 1997b). She used a range of basal and trade books, as well as electronic texts from the WWW. In addition to reading aloud to the students on a daily basis, Sarah ensured that they had time to read independently and time to talk with peers about their reading. Morland Primary School emphasised the importance of collaborative learning and Sarah encouraged the students to collaborate in all aspects of learning, including reading. Occasionally she used worksheets, which comprised a short text and a set of comprehension questions, but this was done mainly to provide something "tangible" for the students' assessment portfolios. Students with reading difficulties participated in the normal classroom routines but were given texts at their own level and received more intensive one-to-one support from Sarah, as the need arose, than did students who were not perceived to be experiencing such difficulties.

How Was ICT Usually Used in Sarah's Classroom?

According to the students in the class, they used the computer for various purposes, using the software listed in Table 7.4. In addition, they often emailed

³³ Towards the end of the study she applied for a permanent position at the school and her application was successful.

students in other classrooms and used the WWW to conduct research. According to one student, they also used it to visit "fun" sites such as *Disney* (www.disney.com).

With reference to using the WWW to conduct research, for the entire term prior to the commencement of this study, Sarah's class had worked collaboratively with a Year 2 class on a project about endangered species. The students had worked in asymmetrical pairs, one Year 5 student with one Year 2 student, to research and write a presentation on endangered species, using *Hyperstudio* (2000). Twice a week for the whole afternoon, the students went to the computer laboratory to work on the project. Sarah commented that it had taken a while for the students to adjust to each other. For example, the older students had found it necessary to "slow down" and the younger ones had needed to learn to participate in discussion with more confidence. The pairs were of mixed genders, although some of the younger girls had been "all shy" when working with older boys. Sarah and her colleague, the Year 2 teacher, reported that they had initially found it difficult to "let go" and become facilitators rather than instructors, and that they had found the levels of noise made by the children difficult to accept. However, they had been highly satisfied with the learning outcomes.

As has been illustrated, Sarah used ICT in her classroom for a range of language activities. However, she had not used it specifically to assist learners who experienced reading difficulties.

Identification of Learning Needs and Selection of Pedagogical Goals

Sarah considered that comprehension was a common difficulty for the four students she had identified for participation in the study, but requested that the NARA was administered and analysed before she made further comments regarding the pedagogical goal. Because of time constraints, she had not had time to carry out any standardised tests, although she felt that this would have been beneficial for diagnostic purposes. The pedagogical goal will be discussed in further detail after the following descriptions of the students and their assessment results.

The Students

Sarah identified four students who were experiencing difficulties in reading to participate in the study. Although these were not the only individuals in the class with such difficulties, Sarah thought that they might particularly benefit from using IMM because of its possible motivational benefits and because she thought it could provide 'one-to-one' support, to which these students usually responded positively.

Mitchell

According to Sarah, Mitchell was not motivated and engaged in the classroom; thus his reading comprehension suffered. His mother was of Maori descent and English was Mitchell's first and only language. Mitchell enjoyed using computers and had access to one at home, which he used mainly to play computer games such as those bundled with Microsoft Windows, for example *Solitaire* and *Minesweeper*.

In his school portfolio self-assessment, Mitchell recorded that his only weakness was that he needed to 'work faster'. In response to a question about 'a piece of work I found hard to do', he recorded, 'nothing'. This seemed to indicate that he did not perceive himself as a student with reading difficulties nor, indeed, any difficulties. According to school reports, he achieved at 'satisfactory' or 'highly satisfactory' levels in mathematics, art, music, viewing, speaking and listening.

The NARA indicated that Mitchell's comprehension was at the 70th percentile and his rate and accuracy were at the 56th and 55th percentiles respectively (see Figure 7.2.). His attitude to reading, according to the ERAS, was at the 94th percentile (see Figure 7.3.). According to the PPVT-R, Mitchell's receptive vocabulary was at the 25th percentile (see Figure 7.4.). His relatively low receptive vocabulary seems incongruous with his high comprehension score, however in the PPVT-R words were presented in isolation, whereas it is probable that Mitchell was able to infer word meanings when they were presented in context.

Even though Mitchell's NARA comprehension score was at the 70th percentile and his attitude towards reading was positive, Sarah wanted him to participate in this study as she thought it might help him improve his confidence and his ability to comprehend classroom texts. Furthermore, as the conversation below

illustrates, Sarah was not convinced that the NARA reflected Mitchell's true abilities:

Researcher: Look at the comprehension – 70th percentile! I wonder why he doesn't perform well in class, then?

Sarah Fox: Well, I think ... I *thought* it was a problem with comprehension.

Researcher: Maybe it's a different sort of comprehension? That is, [with the NARA] you ask them questions and they answer them verbally. There are different ways of measuring comprehension, so maybe if we'd used retells or something else, the results wouldn't have been so good?

Sarah Fox: Yep, that's what I've found.

Luke

Sarah stated that Luke found it difficult to concentrate and focus and that he tended to lapse into daydreams. Although his reading was weak, Luke had the confidence to take risks and Sarah reported: "He's got his own strategies for putting bits and pieces together to make meaning. He's trying really hard."

Luke's favourite subject was sports and he excelled in this area. In fact, Sarah was of the opinion that this was the only curriculum area in which Luke was motivated. Luke was also very sociable and popular.

According to the NARA, Luke's comprehension was at the 54th percentile, his accuracy was at the 29th and his reading rate was slow, at the 10th percentile (see Figure 7.2.). According to the ERAS, his reading attitude was at the 20th percentile (see Figure 7.3.). The PPVT-R indicated that his receptive vocabulary was at the 63rd percentile (see Figure 7.4.).

Kerri

Sarah stated that Kerri had extremely weak spelling and decoding abilities, which led to poor comprehension. Kerri also had poor self-esteem and low confidence. Indeed, during the administration of the NARA, she was unwilling to take risks and asked me several times to supply unknown words. After the test, I

enquired how she would normally attack an unknown word and she responded that she would simply "ask someone". I probed further and asked what other things she could do and she replied that sometimes she would "break words into parts". She felt that she was very poor at spelling. Below are some examples of her spellings at the beginning of this study:

pout	(put)
pour	(poor)
who	(how)
pad	(paid)
aner	(answer)
teef	(teeth)

According to Sarah, Kerri's main difficulties in reading were decoding and making inferences. She also had difficulties finding the main idea and supporting details in texts, as well as making comments on the author's intended message. She was achieving at a satisfactory level in other subjects, such as mathematics and music.

Kerri's favourite subject was art. Indeed, she was deemed to be talented in this area and was in the TAGS⁵⁴ program, which meant that she spent extra time in the art room, taking her away from normal classroom activities for approximately one hour a week. Kerri had access to a computer at home and had a copy of *Reading Blaster 9-12* (2000), which she said she used occasionally.

Sarah expressed concern about Kerri's lack of confidence. However, she said that Kerri would often "blossom" if in a roleplay situation and would "virtually change personality". Kerri was slowly gaining confidence in reading, as Sarah was giving her extra support in spelling and writing.

According to the NARA, Kerri's comprehension was at the 30th percentile. Her accuracy was at the 14th percentile, and her reading rate was at the 23rd (see Figure 7.2.). Despite her difficulties, the ERAS showed that her attitude towards reading was at the 91st percentile (see Figure 7.3.). Her receptive vocabulary, according to the PPVT-R, was at the 39th percentile (see Figure 7.4.). Fifty percent of her errors were refusals, indicating that she was not prepared to take risks in her

⁵⁴ TAGS is a program for 'talented and gifted' students in Western Australia, whereby they receive additional instruction in areas in which they excel.

reading. The other errors were substitutions (37.5%) and additions or insertions (12.5%).

Zara

Zara was a hard-working, well-mannered girl. According to her school portfolio, she thought of school as ‘fun’. However, she was often absent from school and, according to Sarah, had extremely low self-esteem and was distractible. Indeed, she was “out of her seat every three seconds.”

Zara’s low self-esteem was illustrated when I asked her which of the self-portraits on the classroom wall was hers, and she replied “the ugly one.” In her self-assessment [portfolio], she wrote: ‘I wish I could do better and be smatter (sic).’ She informed me that she liked Harry Potter, horse books and adventure stories, and that she read a lot at home.

Sarah considered that Zara needed to improve her inferential comprehension, and that she was very weak in her understanding of grammar, such as parts of speech. According to the NARA, however, Zara’s comprehension was at the 83rd percentile (she read level 6). However, her accuracy was at the 38th percentile and her reading rate was at the 46th (see Figure 7.2.) She had a positive attitude towards reading, at the 96th percentile (see Figure 7.3.) and the PPVT-R showed that she had a receptive vocabulary at the 84th percentile (see Figure 7.4.). It seemed, therefore, that her classroom reading difficulties might have had a basis in behavioural factors rather than in attitudinal or intellectual factors.

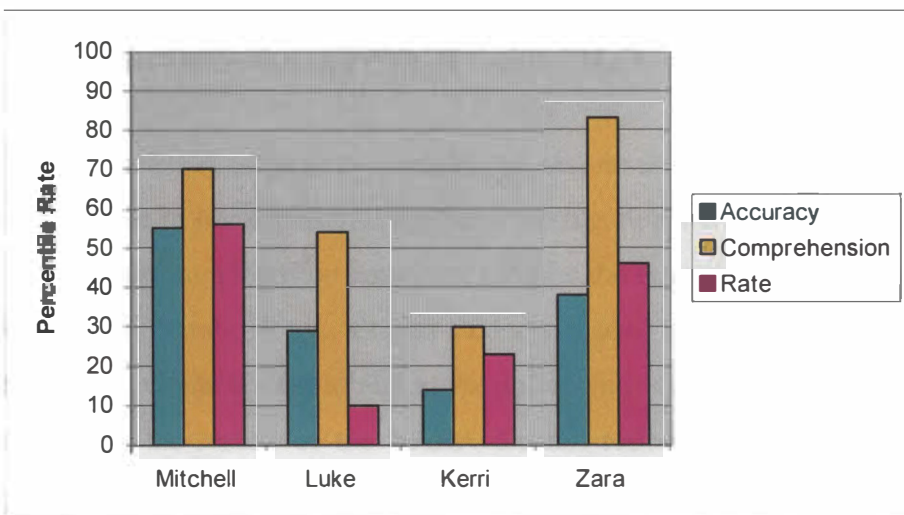


Figure 7.2. Pre-intervention NARA results: Morland Primary School

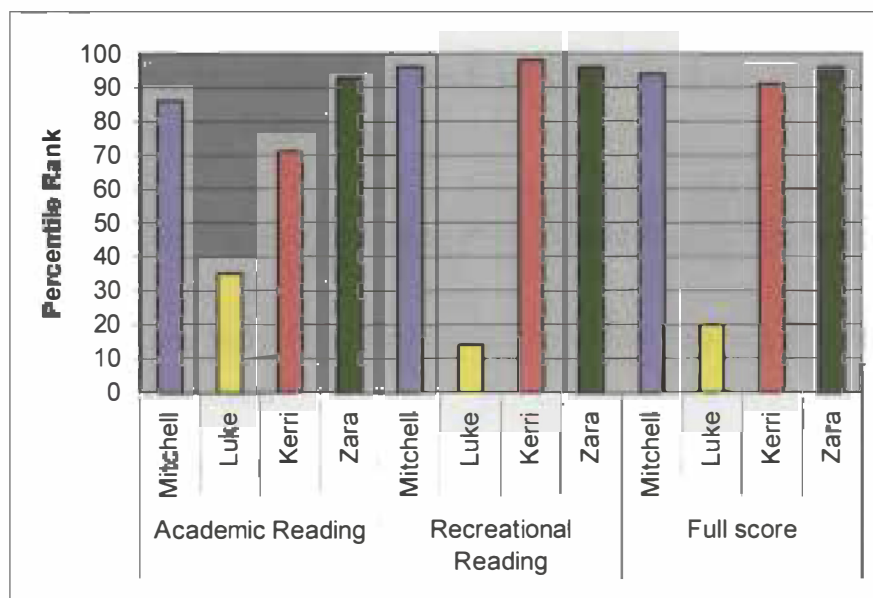


Figure 7.3. Pre-intervention ERAS results: Morland Primary School

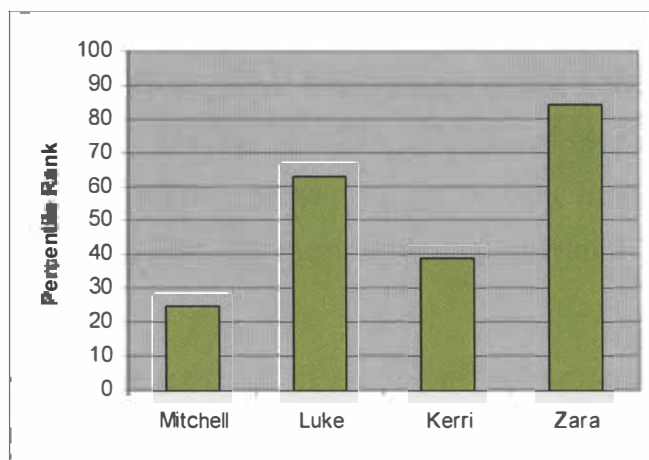


Figure 7.4. Pre-intervention PPVT-R results: Morland Primary School

Sarah expressed surprise at some of the test results and seemed reluctant to trust them because in her experience the participating students had failed to perform well in classroom comprehension activities. Despite the relatively positive results for Zara and Mitchell, Sarah felt that all four students needed to improve their reading in the area of comprehension, especially at the inferential level. With respect to Zara, Sarah noted that the results of the NARA did not reflect her performance in the classroom, as Zara simply didn't do any of the work set unless it was on a one-to-one basis. Sarah added that, in contexts where they could not get help with their

decoding, Zara and Mitchell's comprehension suffered. As noted in Chapter Four, assistance with decoding was available in the NARA as the test administrator was permitted to supply unknown words.

The Conceptualisation and Selection of the IMM-Based Strategies

How Did Sarah Typically Help Students Who Experienced Reading Difficulties Improve Their Comprehension?

Sarah usually assisted students who experienced difficulties in comprehension by giving them additional one-to-one attention. That is, she would sit with them individually or in small groups and ask them to provide oral retells, answer comprehension questions and help them provide written responses. Because she had not had time to administer tests, she had not been able to hypothesise about reasons for the students' comprehension difficulties and had thus not been able to gear her teaching towards the underlying difficulties. For example, the NARA indicated that Mitchell and Zara might not have comprehension difficulties as such, although for some reason, they were not providing evidence of their comprehension of texts in the classroom context. Sarah had not thought that their apparent difficulties might actually stem from, for example, writing, attitudinal or behavioural factors.

Sarah reported that the provision of one-to-one assistance and supervision was the only way she had been able to assist the participating students. Without this support and encouragement, they were often unable to meet her expectations.

Availability of Software and Hardware

The software listed in Table 7.3. was available for Sarah and me to choose from, in addition to the software that I had chosen and purchased. (See Chapter 5 for details of the selection process). As described above, two classroom computers with multimedia capability were available, as was a school computer laboratory. All computers had CD-ROM drives and speakers.

Selection of the IMM-based Strategy

Sarah decided that, in order to improve their participation and comprehension, the students would benefit from support such as in the pronunciation

of words and the fluent narration of texts. Mitchell and Zara, who had demonstrated good comprehension abilities in the NARA, but who usually did not do this in the classroom context, seemed to need to learn how to read texts more purposefully, with the knowledge that they would be required to respond to them and to demonstrate their comprehension. Sarah hypothesised that giving them the opportunity to do this in the one-to-one, yet private and 'fiat' context of IMM-based activities should be advantageous. Luke also seemed to need a new approach, as his attitudes towards reading were generally negative. Sarah hoped that the CD-ROMs she had initially selected would be able to address all of these learning needs.

Planning the Administration of the Implementation

We decided that the implementation would be carried out during classroom time and that both Sarah Fox and I would participate in the implementation and the monitoring of it. Sarah thought that the students should use the software for one or two hours each for the duration of the term, and didn't mind what other lessons they missed, as she considered their literacy difficulties needed to be addressed as a priority.

Formulation of Evaluation Techniques

It was decided that Sarah Fox would evaluate students' literacy progress in the normal classroom context, as it was hoped that there would be transfer of learning from the IMM-based context to the classroom context. Thus, Sarah would only be assessing traditional outcomes.

In addition to this, both Sarah and I would observe the students as they carried out IMM-based tasks, as well as assess any products or related work. Feedback about the IMM-based activities would also be sought from participating students.

Finally, we planned to implement the NARA post-intervention, although this was not something Sarah would normally have done. Indeed, she reported that she did not know how to administer the NARA, although there was a copy of the test in the teachers' resource room.

The Implementation

Sarah decided that the implementation would take place in the classroom context, in school time, and allocated one to two hours per week for each of the students for this. It was decided that she and I would collaborate in planning, implementing and evaluating the programs.

She chose two CD-ROMs from a selection I demonstrated on my laptop in the staffroom during Sarah's DOTT (Duties Other Than Teaching) time and she seemed to find this decision unproblematic. Both of the CD-ROMs she selected featured short texts as opposed to words in isolation, and were not games-based.

PM Storybooks Silver Level (2000) (see Figure 7.5.) featured ten short stories, each of approximately 850 words. Whether or not the computer narrated the story was optional. Narrations were available on whole text or page-by-page basis, although text highlighting was not available. There were seven different post-reading activities to complete, which focussed on comprehension, vocabulary and spelling. Through the teacher options, particular stories and activities could be enabled or disabled. Further, the software could track students' activities. Sarah also selected *Reading for Literacy 3, 4 and 5* (2000; 2001), which have been described in Chapter Seven.

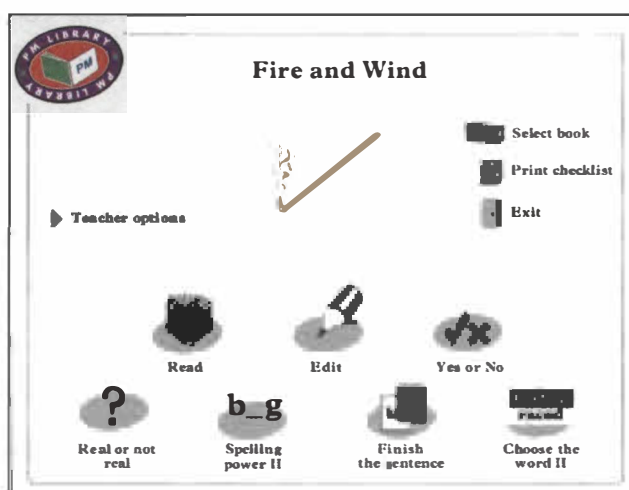


Figure 7.5. *PM Storybooks Silver Level* (2000). Menu.

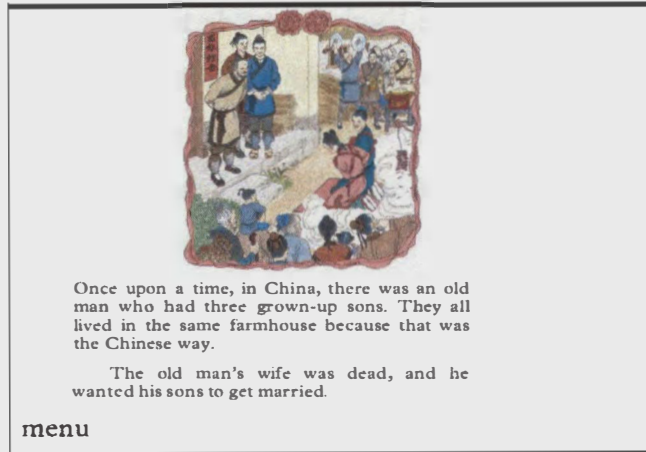


Figure 7.6. *PM Storybooks Silver Level. (2000). Fire and Wind.*

As illustrated by my journal entry below, Sarah and I had difficulty installing the CD-ROMs onto the classroom computers:

I installed *PM Silver* on one of the computers without any trouble but was unable to put a shortcut on the desktop – it just wouldn't do it. I was not successful in installing *Reading for Literacy* on the other computer, either. It said that it had installed properly but I couldn't find it anywhere on the hard drive!

I asked Sarah about it and she went for another teacher to help. The other teacher spent about 15 minutes with me and the school's manual on how to install software but we ended up not installing *Reading For Literacy*. Nobody knew how to do it! She also said that it was not possible to search the hard drive.

After spending half an hour of 'trial and error' I succeeded in installing the software but was unable to create shortcut icons onto the computer desktops, despite following the instructions Sarah had on her desk about how to do this. I consequently had to write instructions for the students so that they would be able to launch the CD-ROMs in my absence. It transpired that, without the desktop shortcuts, the students initially found it difficult to launch the software without my help, although they were able to do so after several sessions.

Mitchell

Mitchell was going to use *Reading for Literacy* (2000) but could not do so because of the installation problem, so he used *Reading At Home 4-5* (2000) on his

first session. He began with a text about droving⁵⁵ and firstly read it silently, then listened to the narration and read along to check for accuracy. When he progressed to the reading exercises, at least three times he either did not hear or did not understand the narrated instructions. In addition, he was extremely slow on the keyboard. Despite this, when it was time for recess, Mitchell asked if he could stay behind and continue using the software. He progressed to a text and associated activities about the human heart and answered all of the questions correctly, even though complex labelling of parts of the heart and the description of blood circulation were involved.

When later listening to the text about Alexander the Great, Mitchell turned the volume of the computer down, as he seemed to have realised that it may have been distracting his classmates. Again, he succeeded in all of the post-reading activities, apart from the cloze, where he typed in the correct word several times but with incorrect spelling. The computer gave him insufficient feedback, in that it only informed him that the answer was incorrect, not incorrectly spelt. This caused Mitchell some confusion as he then tried a variety of other words, some of which made little sense.

The fact that the software did not provide word definitions was a shortcoming. For example, Mitchell did not know the meaning of the word 'social', and was unable to determine its meaning from the sentence and whole text context. Although he could have used a conventional dictionary, and was advised to do this in future, the provision of definitions by the software would have saved time and may have been more accessible to Mitchell, if it had been delivered by multimedia with pronunciations and illustrations.

Mitchell next asked if he could try *PM Storybooks Silver* (2000), as he had seen one of his peers using it. He selected a story about a dog and a wolf, titled *Silver and Prince*. The selection of a story had to be made by looking at the pictures and reading the title, or sampling a few of the pages. When later asked if he preferred the shorter texts in *Reading At Home* (2000) or longer ones such as those featured in *PM Storybooks Silver* (2000). Mitchell responded that he liked both. It is noted that, as no text highlighting was available in the *PM Storybook* (2000), Mitchell tracked the text using his mouse.

⁵⁵ 'Droving' is a word used in Australia to refer to the herding of cattle and sheep.

In the next session, Mitchell first used *Reading for Literacy 4* (2000), the software that Sarah had initially selected for him, and which I had finally managed to install. Initially, he chose to read the texts independently, and then listened to the computer narration to check for accuracy. This time he wore headphones, which he continued to wear for most of the remainder of the study period. This appeared to afford him a degree of privacy and also blocked out distractions.

Mitchell again stayed in the classroom during recess to continue reading. He began to skip through the texts and activities very quickly, looking for those he liked. Because of this, the software tracking/student achievement recording system did not acknowledge any of his work, because for this to happen it was necessary to correctly complete all of the activities related to any given text.

In the next session, Mitchell chose the Chinese tale, *Fire and Wind*, from *PM Storybooks Silver* (2000). I asked him to predict what the story might be about, using the title and the pictures, but he was unable to do this. However, the pictures throughout the story were all very similar and did not fully illustrate the story's events.

Mitchell put on his headphones and listened to the computer narration, reading along silently. This time, he did not attempt to read independently first. Afterwards, he provided a brief oral retell, which was confusing and omitted main events and facts. Furthermore, it was told in the incorrect sequence.

In the next session, Sarah suggested that Mitchell pair up with a male classmate who was very well respected by his peers; she thought that Mitchell would not be happy working with girls or "weaker" class members, as that would be "uncool". However, because the male classmate had to leave the classroom for another lesson, Mitchell did not get the opportunity to work with him on the computer on this occasion, and thus completed a paper 'think sheet' (see Appendix 7.1.) with my help. He commented that he did not like writing and, indeed, his handwriting was laboured and untidy.

After four weeks, Sarah told me that Mitchell was "coming on in leaps and bounds". We decided to extend him even further by asking him to create questions about the text to ask a partner, which is a well-researched means of improving comprehension (Duke & Pearson, 2002). However, he had never made up questions

before, even in traditional paper-based text activities. Furthermore, none of the participating students knew about the ‘levels of comprehension’, or the terms ‘literal’, ‘inferential’ and ‘evaluative’ (Barrett, 1972) nor ‘right there’, ‘between the lines’ and ‘on your own’ questions (Raphael, 1984). I therefore asked them to make up three questions of any kind, in the first instance. Later, I modelled the different types of questions and scaffolded them as they posed questions for themselves.

Mitchell was asked to work with Kerri (even though Sarah had initially said that he did not like working with girls). They both read the narrative text, *Tosca*, from *Reading for Literacy 4* (2000) then created several questions, mainly literal. Kerri did not write hers in a question format but in a cloze format and Mitchell seemed embarrassed about his writing and spelling. This particular attempt to combine a traditional strategy with electronic texts was not enjoyed by the students and they found it difficult. However, due to time constraints the attempt can be criticised on many fronts. Firstly, the students were not given the chance to analyse and identify models of the different types of questions. Furthermore, they were not given sufficient time to become comfortable with the process, nor enough time to create the questions. If time had permitted, some of these shortcomings could have been ‘ironed out’.

Over the course of the study, Mitchell seemed to develop his own strategies for working with the software. For example, he spontaneously developed a strategy of entering answers he knew first, leaving more difficult ones for later. Also, he often sought feedback after each answer instead of each page, which removed the risk of getting a whole page wrong at once (see Figure 7.7.).



Figure 7.7. *Reading for Literacy 4* (2000). The Incas. Locating the Answer.

In the final two weeks of the study, Mitchell stopped regularly using headphones. This could have been an indication of increasing confidence. However, when asked why he was not wearing them as much, he responded with a shrug.

After he had read all of the texts in *Reading for Literacy 4* (2000), Mitchell progressed to *Reading for Literacy 5* (2001), which he found much more difficult. However, he seemed to be accessing support less frequently since removing the headphones. Also, there were several words in the text that he did not know the meaning of, for example, 'atom', 'hologram', 'emission' and 'extremely', and which the software did not define. A peer came forward and defined these words for him.

He soon decided that *Reading for Literacy 5* (2001) was too difficult for him, so I installed *Reading for Literacy 3* (2000), which was approximately the same level as *Reading For Literacy 4* (2000), at the beginning of the next session. During this session, he read six different texts and completed all of the associated activities, which amounted to a considerable amount of reading and thinking. He was very proud of this and told Sarah Fox about his success.

When I asked him, "Would you say this CD-ROM was a bit too easy for you, or did you still get something out of it?" he replied, "Got something out of it, because there's new words."

Luke

On his first session, Luke used *PM Storybooks Silver* (2000). He selected the story about an elephant, Nelson, which was the first on the list. Luke read through the story silently, taking 15 minutes. He listened to the entire computer narration, seeming to be fully engaged and reading the text along with the computer narration.

He selected the Yes/No activity after he had read the text but the feedback from the computer was ambiguous⁵⁶ and he was unsure whether he had responded correctly. In the next activity he selected, Spelling Power, Luke spontaneously attempted to solve the cloze himself before accessing the missing word, which was hidden behind a sliding door. This contrasts with the way in which Mitchell used this software, by accessing the word behind the door straight away.

⁵⁶ The feedback for a correct response was a series of firework explosions, but Luke was not sure whether this animation indicated success or failure.

After finishing the activities, Luke swapped places with Mitchell and started to use *Reading At Home 5-6* (2000). This time, he made no attempt to independently read the text before listening to the computer narration. However, he did seem to be reading along with the narration.

Luke was methodical in his approach to the activities. For example, in the *Yes/No* activity, he was instructed to declare the following statement either 'true' or 'false': 'Nat had a few cows and a sheep.' Luke returned to the text to check for the answer and did not attempt to guess. He did not know what a 'drover' was and had not been able to infer the meaning from the text. Again, word definitions would have been useful.

In the following session, Luke returned to *PM Storybooks Silver* (2000) and selected the folk tale, *Wind and Fire*. As his reading rate was slow, I asked him to read along with the computer narration in a 'soft voice' as I thought this might help him in this area. He was reluctant to do this initially, perhaps because he was in a classroom setting where his peers could hear him.

I realised that it was possible to put a user name into *PM Storybooks Silver* (2000) and track the students' performance, and also that it was possible to print out worksheets that supplemented the stories. This illustrated that, even if the teacher did review software prior to using it in the classroom, it was easy to fail to notice all of its attributes, whether positive or negative.

Luke tried the headphones for the first time but quickly took them off again, saying that they were uncomfortable. He read the text independently and then listened to the narration on a page-by-page basis. Although he claimed to be reading along with the computer narration, I observed him gazing around the classroom a few times. Once again, the absence of word definitions in the software was a disadvantage, as Luke did not seem to understand all of the vocabulary. For example, when asked what 'way' meant, he replied, "Like, standing back and stuff"

In the next session, Sarah and I decided to ask Luke to work with a female classmate in order to encourage discussion. However, there was very little discussion between the two, unless prompted by myself. They read a text from *PM Storybooks Silver* (2000) silently and then listened to the narrations, page-by-page. They completed the think sheet I had given them, but the partner did most of the work. The

think sheet comprised before, during and after reading activities (see Appendix 7.1.). It took the pair an hour to read the text and complete the associated activities. They both stayed motivated and focussed throughout.

In the next session, the *PM Storybooks Silver* (2000) CD-ROM could not be found, although it was usually kept on Sarah's desk. Luke selected a comic strip text from *Reading for Literacy 4* (2000). I gave him a think sheet and he wrote a brief prediction, based on the title and the pictures. Later, I wrote in my journal:

It transpired that it's impossible to do 'during reading' activities, such as rereading if meaning is lost and jotting down unknown words, as the computer narration cannot be paused; the only 'during reading' activities possible [with this software] are 'in the head' activities.

Luke was inconsistent in his use of the support features available. Sometimes he listened to every narration and pronunciation, and sometimes he used none. For example, he did not know how to pronounce/decode the words 'planet', 'exploration' and 'geologist' but did not click on the speaker icon for pronunciations.

In a later session, Luke worked with Zara in reading a text from *Reading for Literacy 4* (2000). After reading the text, each student constructed a set of comprehension questions. I modelled how to construct literal and inferential questions by thinking aloud. However, Luke appeared to find this activity very difficult: "I don't know what to ask," he said. He was slow at writing the questions and not confident about asking them. It seemed that this may not have been the best use of his time. He may have preferred to write using a word-processor or to record his questions onto a tape recorder.

I ended the session by asking him more inferential questions from the electronic texts he had read. For example:

Researcher: Why did the king laugh?

Luke: Because he [the suitor] was a frog and he wanted to marry the [king's] daughter.

Researcher: How did the young man get into the girl's room?

Luke: Actually, the sound didn't really work on that bit so I don't really know.

His response to the latter question seemed to indicate that he was relying on the computer narrations quite heavily to help him make meaning from the text.

However, this may have helped him improve his comprehension of spoken language, which is closely related to the comprehension of written language (Heller, 1991).

Kerri

At the beginning of her first session, Kerri chose a story from *PM Storybooks Silver* (2000) about an elephant, Nelson. This was the first story in a list of ten. I told Kerri that she could either read along with the computer narration or read it silently and then go back and listen to the computer narration to check for accuracy. She decided to read it silently, which took a considerable time. A facility to click on individual words for pronunciations may have been helpful at this stage, as Kerri asked me several times what particular words said. After her silent reading, she listened to the entire narration, although it was difficult to tell whether she was consistently following the text with her eyes during the computer narration. yet sometimes she followed it with her mouse pointer.

It occurred to me that it might have been preferable for Kerri to read (and then listen to the computer narration) on a page-by-page instead of a whole text basis, as this may have improved comprehension, although it may have interrupted 'flow'. Kerri completed all of the activities after the reading, except the editing activity, which involved correcting spelling and punctuation errors. Kerri's keyboarding skills were very poor, which may have made it difficult for her to type in correct spellings.

In her next session, she chose a narrative from *Reading for Literacy 4* (2000) and read it through independently before accessing the computer narration. When carrying out the activities after reading the text, she seemed to resort to guessing. After being reminded to think before clicking, she made fewer errors. Indeed, she went back and read the text three times in order to complete the activities. Her progress was hindered slightly because the software performed an illegal operation and it was necessary to restart the computer. At the end of the session, I attempted to print out a record of her reading but was not successful.

Because it all seemed 'too easy', I discussed with Sarah whether she thought we had implemented the software in an appropriate way. We were unsure as to whether we were using the software in the optimal way to help the participating students. After all, the students were mostly using the software in an isolated

fashion, withdrawn from their peers and disconnected from the wider classroom curriculum. This was contrary to many of our beliefs about using technology in the classroom and about teaching students with learning difficulties.

However, Sarah informed me that, like Mitchell, Kerri was “coming on in leaps and bounds”; even her spelling was improving. In short, Sarah was satisfied with the implementation and saw no reason for change.

During the next session, it was necessary to reinstall *Reading for Literacy 4* (2000), as it was not running correctly. Kerri then chose a narrative to read. I gave her the ‘think sheet’ and she wrote down a brief prediction about the text. Tosca, listened to the computer narration and read along. She did not write down any words ‘during’ the reading, but as it was not possible to pause the narration, this is perhaps unsurprising. She then completed the comprehension activities, but did not access any computer narrations or pronunciations to assist her with this. However, she was succeeding in getting the answers correct first time and she commented that the texts were “easy”. She had no trouble following the computer’s oral instructions. At the end of the session I asked her to read the text aloud, which she did relatively fluently, with only a few ‘rough spots’ (Zutell & Rasinski, 1991). She commented that being able to listen to the text first helped her read it.

When I asked if she would like me to print out a paper copy of the text for her to read away from the computer, she declined. However, it must be noted that the printouts of texts from this software were fairly unattractive, in black and white and somewhat fuzzy.

Zara

Sarah and I had planned to use *Reading for Literacy 5-6* (2000) with Zara, but in our first session together this was not possible because of difficulties in installing the software. We therefore used some similar software, *Reading at Home 5-6* (2000) (see Figure 7.8.). This Australian software comprises 24 short texts of approximately 250 words each. Comprehension exercises such as cloze and questions are available for each text as ‘after reading’ activities. As in most reading software, there are no ‘before reading’ activities and the only ‘during reading’ support available was the computer narration of the text.

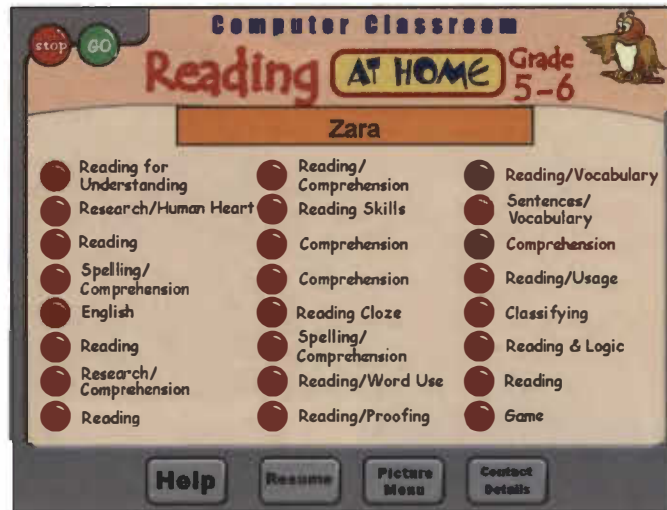


Figure 7.8. *Reading at Home Grade 5-6. Main menu.*

Zara read the first text silently and listened to the computer narration. Her eyes seemed to be following the text highlighting, which appeared sentence by sentence. After reading the text, it was not clear to Zara how to find the comprehension activities, although the computer narrator had explained this. Written instructions were not available on the screen and it was not obvious how to re-access the oral instructions. By trial and error, Zara found that by clicking on 'GO', she could navigate to the activities.

She first completed some 'true' or 'false' questions and it took her several minutes to work out that she was required to type in a 'T' or an 'F' as, once again, she had either not listened to or not comprehended the computer's oral instructions. She commented that the "game" was too slow. It seemed that she'd had expectations of what the computer program was going to be like, and appeared to be somewhat disappointed initially.

When engaged in the next activity, a cloze, Zara asked me what a 'drover' was (see Figure 7.9.), as she had not deduced this from the text⁵⁷. As the software did not provide word definitions, she was advised to have a dictionary at her side when using it in the future. However, it was possible to complete the activities without comprehending the text, as the program beeped and would not accept incorrect responses. Only correct responses were accepted, thus allowing the student to guess or even 'blindly click' until a response was accepted.

⁵⁷ A 'drover' is person, often on horseback, who drives cattle or sheep, usually over long distances.



Figure 7.9. Cloze Activity from *Reading at Home Grade 5-6*. Cloze activity.

The first three texts in this software were unrelated on the topic of droving, Roman armies, and the heart. As a teacher, I had assumed that these topics would not be especially interesting to students. However, Zara reported that she enjoyed them, with the exception of the text about the heart, which made her “feel sick”. However, she commented that the texts were too short. She read four of them in the first session and completed all of the associated activities.

In the following session, I managed to launch *Reading for Literacy 4* (2000) and Zara selected a narrative and a procedural text to read. She turned the volume down as she said she “didn’t need it”. As the instructions were oral, this made it impossible for her to access them. She said that she found this software “too easy”, so I assured her I would bring *Reading for Literacy 5* (2001) for her to use next time. Meanwhile, she switched to *PM Storybooks Silver Level* (2000), which featured considerably longer stories. She selected Nelson, a story about an elephant. She read it silently prior to listening to the computer narration, although she had not listened to the narrations when using the previous ‘easy’ software.

She encountered several difficulties with this software. For example, an activity, Real or Not Real, where it was necessary to sort words and non-words into separate groups, the software prompted her to ‘try again’, even though she had sorted them correctly. On another occasion, when she was carrying out the editing activity, she went back to the text to check some spellings and punctuation, only to find she had lost the editing she had already done when she navigated back to the editing

activity. This would probably be a disincentive to go back and check the text in future.

Sarah and I decided to create some away-from-the-computer activities to complement and consolidate what Zara and the other three participants had been doing. Consequently, in her next session, Zara worked with a female student who was not part of the study Sarah had selected a student of "average ability" to work with her in order that she would receive assistance yet would not be made to feel "inferior". As a pair, they were asked to fill in the think sheet (see Appendix 7.1), which involved 'before', 'during' and 'after' reading activities. Before reading, they made predictions about the story Zara then read the story aloud, with the other girl correcting her occasionally and asking her to define words. After reading, the pair drew a story map. Zara's partner, however, did most of the writing.

I also gave Zara a 'New Words Book' in which she was asked to write new vocabulary, along with definitions in her own words. However, during this session, she only entered one word, 'impressed'. During the course of the study, she entered very few words.

Towards the end of the session under discussion, I informed the partner that she could return to her set class activity. She replied that she would prefer to continue helping Zara on the computer, as it was "fun". In a later session, Zara worked with Luke. She wrote some questions about the text, which she subsequently asked Luke. She appeared to experience no difficulties with this, although she had no previous experience.

Throughout the rest of the study, Zara continued to use a combination of the three CD-ROMs mentioned above. Some weeks she used them for an hour and other weeks, two hours. However, on several occasions she was absent from school.

Zara seemed to use the software for feedback rather than for support in that she usually did not access pronunciations and narrations during reading, but appeared to appreciate the immediate feedback she received when completing the comprehension activities. On one occasion when she did access the computer narrations (during reading a text about bats), she said: "I usually don't [access narrations], but I am today I don't know why."

Sarah said of the IMM-based activities: "This is the only thing I've ever seen her look forward to!"

The Teacher's Role

During the first session, Sarah Fox continued teaching the class and came over to the computer corner several times to check what the students were doing. However, she did not directly participate. At the end of the session, I left the CD-ROMs with her and she said that she would familiarise herself with them. However, when I next visited the school one week later, she had not been able to find time to look at them. Furthermore, the four participating students had not had time to use the software in my absence. However, the time that they did spend using the software (see Table 7.1.) was perhaps sufficient. Sarah had wanted them to work as independently as possible, or to collaborate in pairs or a small group. She did not encourage her students to be dependent on her, seeing herself as a facilitator rather than an instructor. She therefore did not intervene in their interactions with the IMM-based activities.

Although Sarah did not feel the need to supervise the students closely when they were using the computer (she always allowed them to work relatively independently), she was interested in hearing about my observations and was fully engaged in planning the sessions and suggesting possible modifications. However, these were relatively few as Sarah was satisfied that the students were engaged in reading the electronic texts and that this in itself was sufficient at the time. If the study had continued for a longer period, this may not have been the case.

The Assessment Results

When I presented the results of the second NARA to Sarah, she commented, "Isn't it exciting?" and seemed delighted to see the students' improved scores, although she was quick to point out that, in the case of Zara and Luke, she had observed few improvements in terms of their normal classroom literacy activities.

Mitchell

Mitchell successfully read up to level 6 (the highest level) in the NARA, whereas he had previously reached his ceiling at level 5. The distribution of types of errors remained similar. It must be noted that he occasionally looked at the text to find/verify his answer. However, this was something that Sarah actively encouraged.

Mitchell's comprehension increased from the 70th to the 97th percentile for his age, whereas his accuracy increased from the 55th percentile to the 79th (see Figure 7.10.) His rate, however, remained unchanged but this may be attributable to the effects of the more difficult passage at level 6.

It is possible that Mitchell was a gifted underachiever, and the IMM-based activities helped him achieve his potential.

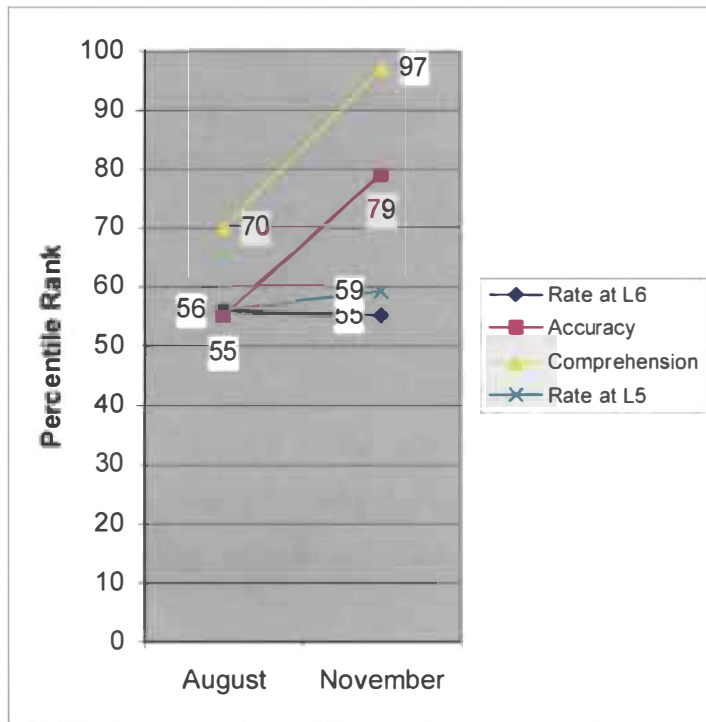


Figure 7.10. Pre and post- intervention NARA results: Mitchell

Researcher: What have you thought about the stuff you've been doing on the computer?

Mitchell: It's great.

Researcher: What do you like best about it?

Mitchell: I like new words - learning new words.

Researcher: You like it because it gives you the opportunity to learn? And you have learnt a lot?

- Mitchell:** Yes.
- Researcher:** What didn't you like about it?
- Mitchell:** Nothing.

Luke

According to the NARA, Luke's comprehension increased from the 54th to the 65th percentile, and his accuracy improved from the 30th percentile to the 38th and his reading rate increased slightly, from the 10th to the 16th percentile (see Figure 7.11.). Whereas in the first administration of the NARA, 16.6% of Luke's errors were refusals, in the second he made no such errors, indicating that Luke was, perhaps, more likely to take risks in his reading. Also, as opposed to 41.6% in the first test, in the second test only 30% of his errors were mispronunciations and non-words. However, more of his errors (60% as opposed to 33.3%) were substitutions and these were not meaningful substitutions. They were based on similarities in appearance between the written word and the word pronounced by Luke, indicating that he was over-relying on the grapho-ponic cueing system.

Sarah said she was "amazed" at Luke's progress and that he had started to make inferences; something he had never done before. However, it was difficult to attribute this to the software, as he also had additional instruction in inferential or 'between the lines' comprehension in the form of teacher modelling, as well as constructing inferential questions himself. Sarah informed me that Luke had also gained confidence in learning, and looked forward to reading electronic texts.

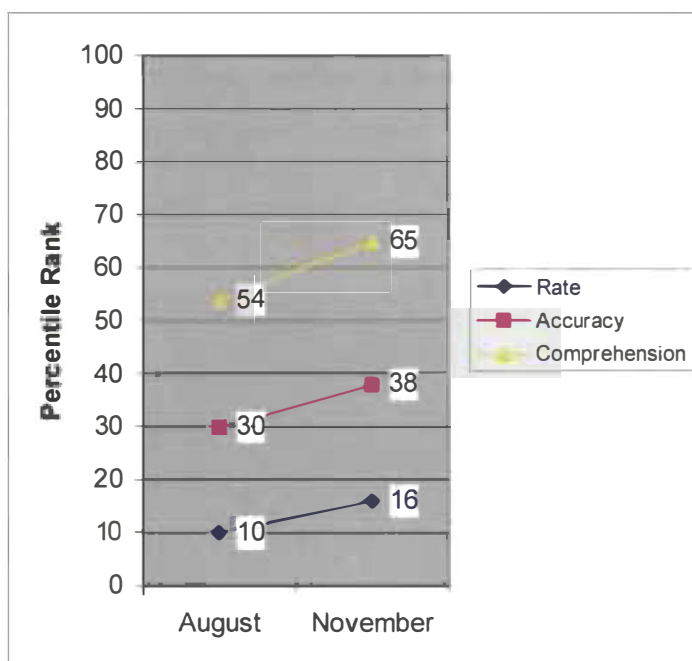


Figure 7.11. Pre- and post-intervention NARA results: Luke

Researcher: Tell me about any activities that you didn't like doing.

Luke: In the first story I did...

Researcher: The PM Silver?

Luke: Yeah ... I did a couple of times and it started to get a bit boring, but I still liked it a lot. It was a bit black and white.

Researcher: You mean the pictures?

Luke: No, they were good ... it was just the start. Most of it was good but the front bit was a bit, like, plain.

Researcher: You mean the bit where you get to click what you want to do? The menu? [main menu].

Luke: Yeah ... what you could do is bring a bit more colour into it.

Researcher: What about the voices?

Luke: Sometimes they did get a bit annoying. You'd have to wait till they'd finished to start the activities ... and he spoke quite a while.

Researcher: Do you think he spoke too slowly or quickly or just right for you?

Luke: Oh, he just went a tiny bit too slow.

Kerri

Kerri's comprehension increased from the 30th to the 54th percentile. She reached the level 4 text, whereas prior to the intervention her ceiling had been level 3

of the NARA (see Figure 7.12.). Furthermore, the distribution of her errors changed considerably, indicating a change in her risk-taking behaviour. Before the intervention, 50% of her errors were refusals, contrasting with only 10.5% afterwards.

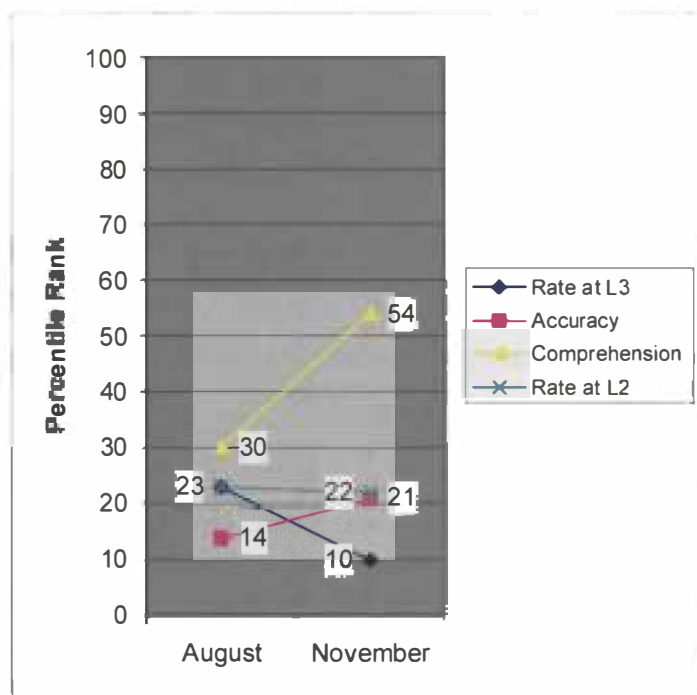


Figure 7.12. Pre- and post- intervention NARA results: Kerri

Sarah noted that Kerri's reading had improved notably, as had her attitude to classroom work in general. Sarah attributed this to the fact that she had experienced success:

It's fantastic that everybody's improved. I've noticed with Mitchell and I've noticed with Kerri, there's a marked improvement in their attitude and their confidence – their attitude to their work has changed, because of the success they've experienced.

Sarah also noted that she had previously considered Kerri to be 'at risk' but no longer considered her to be so. From Kerri's own point of view, she had experienced no difficulties or frustrations when working with the CD-ROMs and she perceived that she had improved her reading:

Kerri: I thought it was fun.

Researcher: Anything else? Do you think you learnt anything?

Kerri: Yes, some reading.

- Researcher:** Was there anything you didn't like about it?
Keri: No.
Researcher: What was difficult about it?
Keri: Nothing.
Researcher: Anything that irritated you?
Keri: No.

Zara

Zara's comprehension, according to the NARA, increased from the 83rd percentile to the 97th. This raises questions about her being identified as a student with reading difficulties, even though she had not been achieving in the classroom context. She may have been 'at risk' of not reaching her potential. Her accuracy also improved greatly, from the 38th to the 70th percentile, whilst her rate of reading increased from the 46th to the 60th percentile (see Figure 7.13.).

When asked what she thought she had gained from engaging in the IMM-based activities, Zara responded: "Well, I've learnt some new words and I read a little bit better now." She had no criticisms of any of the software, except one activity in which she had to crack a secret code, which she saw as "pointless". When asked if she would like to continue using CD-ROMs to help her reading, she replied, "Yes!"

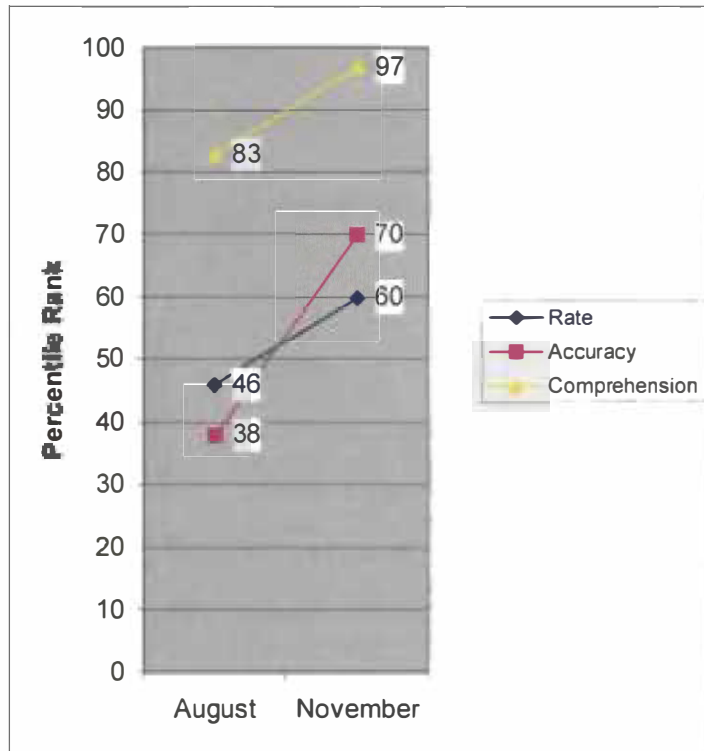


Figure 7.13. Pre- and post- intervention NARA results: Zara

When I asked Sarah if she had noticed any improvements in Zara’s reading performance in the normal classroom context, away from the computer, she responded:

Not that I’ve really noticed. I mean, she’s trying to be that little bit neater and things but that’s about the only difference that I’ve noticed with her, because I know she absolutely adores – she can’t wait for you to come in, and she’s all excited and her attitude is really different when she’s with you but she *does* like the one-on-one. She’s craving that really badly and she’s craving it from me all the time.

In the next section, I outline some of the facilitative and inhibitive factors experienced with respect to each student, as well as any unplanned outcomes and preferability issues. It can be seen from Table 7.5. that there was quite a high degree of commonality between the students. These factors will be more fully discussed and analysed in Chapter Nine.

Facilitative and Inhibitive Factors

Table 7.5. Facilitative and inhibitive factors

Facilitative Factors	Mitchell	Luke	Kern	Zara	Teacher	Inhibitive Factors	Mitchell	Luke	Kern	Zara	Teacher
	The student focussed on only a few CD-ROMs (and did not 'flit' from one activity to another).							The teacher experienced difficulties in identifying student strengths and 'needs'.			
Headphones seemed to help the student concentrate.						There was a shortage of time. (The teacher did not have time to get as involved as she would have liked. She did not have time to become familiar with the software and there was not enough time to implement all of the modifications or ideas that emerged).					
Minimal teacher input was required.						The way the student interacted with software was inhibitive. (Some of the students were compulsive clickers and didn't think before clicking. Some students, for example Zara, did not use the support offered by the computer).					
The teacher was seen as a facilitator. (As Sarah put it: "I facilitate the experience, because I know where it's supposed to go, but really when it comes to hands-on things [with ICT], they can teach me so much more. It's wonderful.")					Y	'Technical hitches' were experienced. (For example, installing the software and creating desktop icons. If there's a problem with the computers, Sarah said that it took "days and days" for the technology support people to come and rectify it).					
The student worked relatively independently and at his/her own pace.						Shortcomings of software design inhibited activities. (For example, no word definitions, no facility to pause the computer narrations).					

The student was highly motivated to engage in IMM-based activities.						The 'computer corner' was cramped and uncomfortable.											
<table border="1"> <thead> <tr> <th colspan="2">KEY</th> </tr> </thead> <tbody> <tr> <td>Never observed</td> <td></td> </tr> <tr> <td>Sometimes observed (1-5 times)</td> <td></td> </tr> <tr> <td>Often observed (6 or more times)</td> <td></td> </tr> <tr> <td>Observed</td> <td>Y</td> </tr> </tbody> </table>	KEY		Never observed		Sometimes observed (1-5 times)		Often observed (6 or more times)		Observed	Y		The teacher experienced some difficulties in evaluating effectiveness					
KEY																	
Never observed																	
Sometimes observed (1-5 times)																	
Often observed (6 or more times)																	
Observed	Y																

Effect on the Rest of the Class

The use of the CD-ROMs seemed to be distracting for several class members who couldn't keep their eyes off the computers, especially if they were sitting near them.

As there were only two computers, other class members did not get their 'fair share' of time on the computers. There were times when lots of shuffling around was necessary, because the CD-ROMs were only licensed to be installed on one computer at a time.

Unplanned Outcomes

According to Sarah, there were no unplanned outcomes. However, I noted several, including an increase in risk-taking in reading for some students, and an increase in confidence and motivation.

Establishing Preferability

When I asked Sarah whether she thought that using IMM-based activities had been in any way preferable to using traditional media and techniques for the students in question, she responded with:

Lack of distractions, to start with. They weren't distracted. Like, with a book in front of them, there are a lot of other things they tend to wander off and do. I don't know if it's something to do with the size of the print? You know, it could be something to do with it. There's colour in the background, it's lit up, it's highlighted ...it's interactive with them, it's responsive. Straight away, they get the feedback.

In addition to the points just made, the students would not have been able to access the level and immediacy of feedback that they obtained from the computer from their teacher. The preferability of this strategy over other, paper-based strategies is summarised in Table 7.6.

Table 7.6. Preferability of the IMM-based teaching strategy

Efficiency	This IMM based teaching strategy was efficient in terms of the teacher's time, students' time and monetary cost, as only a few CD-ROMs were used. The teacher allowed the students to work independently and did not need to invest a great deal of time in planning, implementing or monitoring the intervention. The students used the software for only one to two hours a week (this varied), during classroom time.
Effectiveness	All of the students increased their comprehension, which was the pedagogical goal. They also improved their accuracy, although reading rates did not always increase. The confidence and 'risk-taking' behaviour of students seemed to increase.
Appeal	The IMM-based teaching strategy appeared to be appealing to all concerned. All of the students stated that they enjoyed the activities and only Luke occasionally indicated that he would prefer to carry out the IMM-based activities at another time, rather than miss what other peers were doing. Sarah, the teacher, found the strategy appealing in that it provided one-to-one attention and instant feedback to students, something she had not enough time to do personally.

Conclusion of Chapter

Overall, the IMM-based activities that were chosen worked for the students in that they helped them move towards the pedagogical goals in an enjoyable way. The activities also fitted in with Sarah Fox's abilities, philosophies and teaching style.

Most of the inhibitive factors associated with this intervention were associated with occasional mismatches between software and the students' needs and abilities, and a shortage of time on Sarah's part to become fully involved in what the students were doing. However, as mentioned above, Sarah did not necessarily see this as a problem, as she expected the students in her class to work either independently or to collaborate with each other: she stated that she did not see herself as a purveyor of knowledge or a supervisor, but as a partner in and facilitator of learning.

CHAPTER EIGHT

ST CLAIR'S COLLEGE: YEAR 4

Overview of Case

In this intervention, IMM-assisted repeated readings (IMMARR) and the creation of electronic books were used as strategies to improve five students' oral reading fluency

Name of school:	St Clair's College
Public/Private:	Private
Number of students in class:	28
Number of students in school:	Approximately 1000
Socio-economic status:	High
Pedagogical goal:	Increase in oral reading fluency

Table 8.1. Participants: St Clair's College, Year 4

Participating Students				
Name	Year	Age at beginning of study	Estimated hours spent doing IMM-based activities	Estimated hours spent doing IMM-based activities independently
Tamara	4	9:1	30	20
Montic	4	9:3	30	20
Bridget	4	8:7	30	20
Amanda	4	8:8	30	20

Participating Teacher		
Name	Teaching Experience	ICT Experience
Catherine Williams	8 years	Substantial

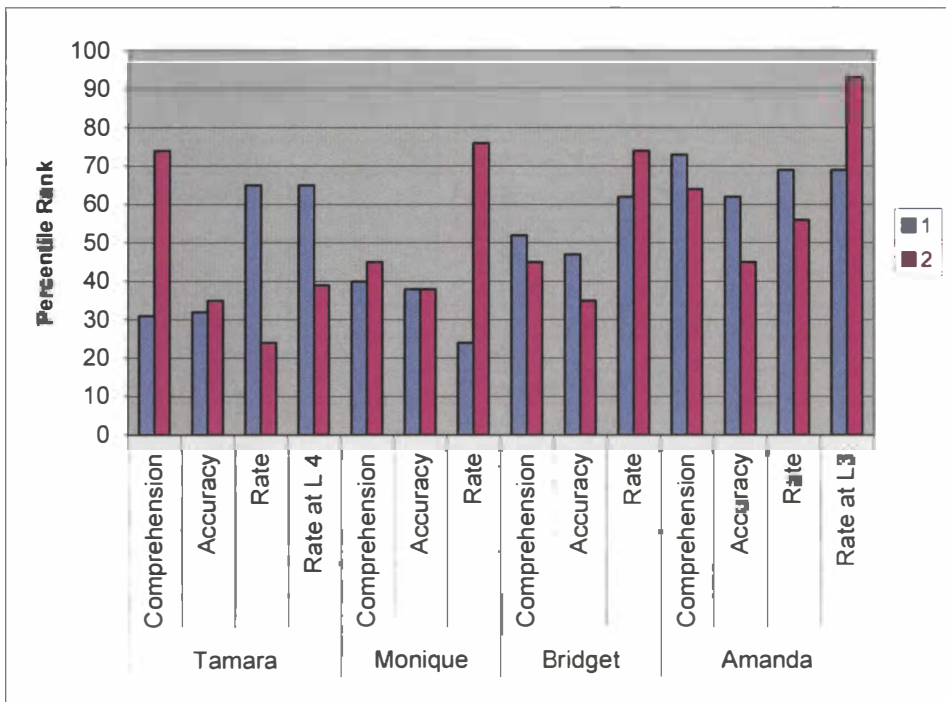


Figure 8.1. Pre- and post-intervention results of the NARA: St Clair's (Year 4)⁵⁸

Table 8.2. Hardware available

Computers	Specifications
Laptop computers	These students did not have laptops
Classroom computers 3 desktop computers	Pentium II processors 128MB RAM Soundcards and speakers Headphones No microphones Windows 98 Operating System
Computer Laboratory	'Hub room' with 12 computers. Used for approximately one hour per week.

⁵⁸ The validity of the NARA test 2 was compromised as the teacher insisted on administering it and the procedures were not strictly observed.

Table 8.3. Software used during the study: St Clair's College, Year 4

Software Used	Description
Aesop's fables (1994).	Electronic storybook. Short texts.
Arthur's birthday (1994).	Electronic storybook.
Arthur's teacher troubles (1993).	Electronic storybook.
Cinderella (1994).	Electronic storybook.
Fables (1993).	Electronic storybook.
Harry and the haunted house (1994).	Electronic storybook.
Illuminatus (1999). (Version 4.5).	Multimedia authoring program.
Illuminatus opus (2001) (version 2.6).	As above.
Just me and my dad (1997).	Electronic storybook.
Paintshop Pro 4. (1998). (Version 4.15SE).	Graphics program.
Reading for literacy 3. (2000).	Reading program containing electronic texts and comprehension activities.
Reading for literacy 4 (2000).	As above.
Reading for literacy 5 (2001).	As above.
Speech Analyser (2000). (Version 1.5).	Sound recorder and speech analysis program.
Stellaluna (1996).	Electronic talking book.

The Classroom Context

The Classroom Environment

The classroom environment of Year 4 at St Clair's College was positive, stimulating and supportive. The students seemed to be highly motivated and went about their work in a settled fashion. They often collaborated with each other and Catherine Williams, the teacher, encouraged a classroom culture of helpfulness, friendliness and acceptance, which could be described as a 'learning community' (McLaughlin, 1999).

The classroom was colourful and interesting, with a large quantity of students' written work and artwork on display. There was a small aquarium at the front of the classroom, behind which Catherine had drawn a large underwater mural on the blackboard. There were several small bookcases that contained a variety of commercial trade books, library books, magazines and scheme books.

Many of the charts on the classroom wall during the period of the study related to mathematics, although there were several charts showing the conventional structure of genres, such as the narrative, report, recount and procedure.

Collaborative learning was common in Catherine's classroom, with students often working in pairs and small groups. The desks were arranged so that the

students sat in groups of four or six. The students also collaborated with each other when using the classroom computers, often in pairs.

Unlike the Year 5 classroom described in Chapter Five, this was not a 'laptop' class. A bank of three desktop computers was positioned at the back of the classroom. These computers were relatively up to date (at the time of the study), with Pentium II processors, 16 x CD-ROM drives, speakers, and an inkjet colour printer between the three. Unlike the laptops in the 5Y classroom, these computers ran on the *Windows 98* operating system and not *Windows ME*, meaning that some older programs (that would not run on *Windows ME*) could be considered for use. Each computer was connected to the school network and allowed easy access to the Internet and the school's intranet.

Parents were involved in their daughters' education and often came into the classroom to discuss matters with Catherine, who treated them as partners. She also believed that the parents must accept a degree of responsibility for their daughters' education and did not hesitate to advise them how they could help at home, for example by regularly reading aloud.

The Classroom Teacher (Catherine Williams)

Catherine Williams was in her late twenties at the beginning of this study and had been teaching for approximately eight years. She was an extremely energetic and positive teacher who was more than willing to implement new strategies in her classroom if she considered that they would help her students. She often tutored individual students after school hours if she had concerns about their progress.

Catherine had a Bachelor of Arts (Education) from a Western Australian university. Since graduating, she had become interested in how ICT might be integrated into the classroom. Indeed, during the course of this study she and her students were also involved in piloting some commercial mathematics software. She had a very good working knowledge of computers and software such as Microsoft's *Word* (1997), *PowerPoint* (1997) and *Excel* (1997). She was also proficient in using the website building software, *Dreamweaver* (2001), and the concept-mapping software, *Inspiration* (2000). The school had provided her with a laptop, which she used daily for communications and record keeping purposes.

Another area of particular interest to Catherine was literacy; she had recently served on Western Australian and National benchmarking boards, helping to establish benchmarks for National Literacy Tests for Year 3 students. This seemed to indicate that Catherine was a teacher who was held in great esteem by her peers⁵⁹. Catherine's professional development in the area of using ICT to enhance learning had been similar to that of Nicole, the Year 4 teacher. That is, she had been involved in workshops run by St Clair's, as well as the weekly 'sharing' sessions in which staff members shared their ideas and knowledge. Catherine had in many respects been self-taught, and had actively sought involvement in projects such as the present study with the intention of furthering her professional development.

How Was Reading Usually Taught In Catherine Williams' Classroom?

Multiple strategies, including reciprocal reading (Palincsar & Brown, 1984), paired reading (Topping, 1987), shared book (Holdaway, 1979) and USSR (Uninterrupted Sustained Silent Reading) (Gambrell, 1978), were used in Catherine's classroom to teach reading. Like Nicole Nielsen (the Year 5 teacher), Catherine often modelled fluent reading and reading strategies, by reading aloud and 'thinking aloud'. Also, she would discuss reading strategies with the students and encourage self-monitoring and self-assessment.

In order to enhance their comprehension of texts, the students made story and character maps and engaged in 'read and retell'. In addition, they were regularly asked to respond to and create oral and written questions, as well as to engage in cloze, build word banks, and compare different texts. Several pre-reading strategies were taught, such as brainstorming, predicting and clarifying the purpose of reading a text.

Strategies to develop oral reading included reader's theatre (Hill, 1990), choral reading, paired reading (Topping, 1987), dramatic interpretation of texts, and teacher modelling (Clark, 1995). When asked how she taught oral reading fluency, Catherine responded:

"Well, when I listen to them read, I use the NIM⁶⁰ method, where I cast my finger underneath and slightly ahead of where they're reading

⁵⁹ Since this study concluded, Catherine has been promoted to a 'leading' teacher at St Clair's, with new responsibilities in the area of coordinating the school's curriculum.

⁶⁰ Neurological Impress Method (Heckelman, 1969)

so that they can anticipate the words with their eyes before they're actually processing it and reading it out loud. That helps them a lot with their fluency. And just to make sure they're reading correctly, I'll put my finger underneath and say 'Ah-a!', interjecting, and see if they'll self correct. If they stumble I'll just read it out for them and help them through.

I tape their reading - each of the girls has a tape - and they do an interview analysis of that, so that's good ... for them to listen to themselves. And we also listen to them orally read as much as we can, and if we haven't got direct records of them reading, we'll listen to them, giving them one-to-one. When I'm with those girls [the participants in this study], we do a lot of modelled, shared reading with books and posters and whatever, and so we just go through and break it up as much as possible. I wouldn't do that so much with the other two groups."

How Was ICT Used In Catherine's Classroom?

ICT was used in several ways in Catherine's classroom. With reference to literacy, the students used the computer for word-processing and making *PowerPoint* (1997) presentations, which they later presented to the whole class on a large television screen. They also used the Internet to research topics, and Catherine sometimes directed them to Internet texts; she would later ask them to summarise the text(s) and answer written comprehension questions. For an example of this type of activity, see *The Bungarra* (Appendix 8.1). The students also used *Phonics Alive!* 6 (2000), which combined phonics with keyboarding activities.

Some of this work took place in the computer 'hub room'⁶¹, as there were only three desktop computers in the classroom. Catherine's class was also allocated regular time (one hour a week) in the hub room and had fairly free access at other times, as long as it was not being used by another group. Only four classes (Years 1 - 4) shared the hub room, as Years 5 and 6 had personal laptops.

Although the students often used the three classroom computers to access the Internet and to create *Word* (1997) documents and *PowerPoint* (1997) presentations, they often had to wait their turn to do this. They were also free to use the computers before school and would access maths programs, *PowerPoint* (1997), or sometimes a CD-ROM that one of the students had brought in from home. The students also knew how to use the concept-mapping software *Inspiration* (2000) and *Kidspirallon*

⁶¹ The 'hub room' was a computer laboratory, which had 12 networked computers, scanners, and printers. Only students from Years 1 - 4 (i.e. four classes) regularly used it.

(2001). At the commencement of this study, Catherine had recently started to use a CD-ROM to help one of the students, Monique, improve her oral reading fluency.

Identification of Learning Needs and Selection of Pedagogical Goal

Catherine was of the opinion that several of the students in her class needed to improve their oral reading fluency. Even though the four students she selected had different needs in the literacy area, she thought that they were all dysfluent in their oral reading. In her judgment, the selected students needed to learn how to phrase or 'chunk' sentences appropriately, to attend to punctuation, and to "get away from word-by-word reading" and, after they had mastered this, they needed to improve their ability to read with expression.

The Students

Amanda

Amanda was a polite, shy girl who had been at St Clair's since starting school. Her father was from France, although English was spoken exclusively at home and Amanda knew little French. According to Catherine, Amanda tended to work somewhat quickly and did not always try to complete activities correctly or with sufficient care. She was slightly anxious socially and tended to feel nervous about some of her classroom work, most notably mathematics.

At the beginning of the study, Catherine was of the opinion that Amanda tended to read word by word, without trying to "string it together". According to Catherine, Amanda was reluctant to take risks and would often not attempt to decode unknown words. In the past, her teachers had believed that a lack of phonological awareness⁶² might be the root of Amanda's decoding difficulties and she had thus received a considerable amount of phonological awareness training. Despite this, her spelling remained extremely weak and a reluctance to use her knowledge of letter-sound correspondences to help her decode unknown words was evident as she read some of the more difficult texts from the NARA. "What's that say?" she asked repeatedly.

⁶² Phonological awareness is the ability to recognise and manipulate the sound units of language (Rohlf, 2000).

Amanda also tended to pay little attention to punctuation and her phrasing skills were weak. However, according to the NARA, her reading comprehension was satisfactory (at the 73rd percentile) as were her accuracy (62nd percentile) and rate (69th percentile). This concurs with the scores she achieved in her Year 3 Student Outcome (Reading) Test⁶³, in which her score was in atanine 6 (60th to 76th percentile).

Amanda's knowledge of vocabulary was at the 87th percentile, which may have been a contributory factor to her relatively good comprehension. Her attitude towards reading was negative, however, at the 13th percentile. Catherine rated Amanda's fluency on the most difficult text that she successfully read⁶⁴ for the NARA, a level 3⁶⁵ text. According to this rating, Amanda scored 2 out of a possible 3 points for the dimensions of phrasing, smoothness and pace (see Table 8.4). This seemed to indicate that she was not experiencing significant difficulties in reading fluency. However, Catherine was sufficiently concerned about Amanda's performance to want her to become a participant in this study. She was most concerned about her phrasing, particularly her limited attention to punctuation.

Table 8.4. Pre-intervention results of the Multidimensional Fluency Scale (Amanda)

	Pace/Rate	Smoothness	Phrasing
Text: Ali Level 3 Score: 6/9	Uneven mixture of fast and slow.	Occasional breaks in smoothness caused by difficulties with specific words and/or structures.	Mixture of run-ons, mid-sentence pauses for breath, and possibly choppieness, reasonable stress/intonation.

Tamara

Tamara was a talkative, cheerful girl who tended to rush through tasks without gaining much satisfaction from them. In most areas she achieved at an average level, although she was weak at spelling and decoding unknown words when reading. She would make up non-words and continue reading, although it was apparent that she was making little meaning from the text. According to Catherine,

⁶³ In Western Australia, all students are tested using a standardized test on a range of literacy skills, such as literal and inferential comprehension, sequencing, and personal response. These tests are currently carried out in the third Term of Years 1, 3, and 5.

⁶⁴ In The NARA, students are not required to continue reading once they have reached their 'ceiling', where 16 errors or more are made in a text (or 20 errors in the Level 6 text). The text in which they reach their 'ceiling' is not regarded as having been successfully read and is disregarded.

⁶⁵ Level 2 is aimed at readers aged 4-7, and the more difficult levels 3 and 4 are aimed at readers who are aged 5-8.

Tamara could be somewhat "headstrong", which occasionally inhibited her ability to listen and to cooperate. At the beginning of the study, Catherine said of her:

Tamara will just read it at the rate of knots and not even register that some of it doesn't make sense, so when she's having to do comprehension tasks it will take her so long because she has to go back and skim and scan and really try and nut it out, and she hasn't got that understanding.

When reading for the NARA, Tamara seemed happy and confident. She read fairly quickly (at the 65th percentile) and took frequent risks. However, her comprehension was low (31st percentile), as was her accuracy (32nd percentile). She mispronounced and substituted many words. Examples of the non-words she pronounced included: 'reeval' /ri:væl/ for 'rival', 'altings' /a:ltmɪz/ for 'alighting', 'engered' /ɛnʒəd/ for 'emerged' and /la:nʃ/ for 'launch'. The high frequency of non-words suggested that Tamara's knowledge of vocabulary might be limited. However, the PPVT-R indicated that her receptive vocabulary was at the 66th percentile.

The NARA scores achieved by Tamara were considerably higher than those achieved in her Year 3 Student Outcome (Reading) Test, in which she was in stanine 1, which means that she scored at the 4th percentile or less. This suggests that she had made significant progress in reading during the nine months prior to the commencement of this study, although it is acknowledged that the two tests may not be strictly comparable and that in the previous whole class group administered test she had not demonstrated her level of reading attainment.

Tamara's attitude towards reading was at the 20th percentile. She had a slight preference for recreational reading as opposed to academic reading. On the Multidimensional Fluency Scale, she scored 2 out of a possible 3 on each of the dimensions of phrasing, smoothness and pace (Table 8.5.). Thus, she was not considered a fluent reader but was approaching fluency.

Table 8.5. Pre-intervention results of the Multidimensional Fluency Scale (Tamara)

	Pace/Rate	Smoothness	Phrasing
Text: Ali Level:3 Score:6/9	Uneven mixture of fast and slow	Occasional breaks in smoothness caused by difficulties with specific words and/or structures.	Mixture of run-ons, mid-sentence pauses for breath, and possibly choppiness, reasonable stress/intonation.

Monique

Monique had moved to St Clair's at the beginning of the school year in which the study took place and had only been at the school a few months when this study commenced. Although Catherine described her as, like Tamara, having a fairly "domineering and headstrong" personality, she lacked confidence in reading and did not like speaking in public. Her mother had expressed concern at Monique's lack of confidence and interest in reading. Catherine explained:

Monique is learning to [take risks] more and more as her confidence is growing. I think she's had bad experiences in the past and now that she's finding her self-confidence, she's taking more risks. And I've been helping her take greater care in presenting her work and re-reading for meaning, and realising that if she has got it wrong that it's actually alright - there's no need to panic. That anxiety ... that's leaving her more and more as she's gaining confidence.

To help Monique progress, Catherine had been giving her extra homework in phonics, which her mother helped her complete. Catherine was hopeful that this would be helpful. Monique was taking part in the THRASS program (Davies & Ritchie, 1996) once a week with the support teacher. Sue had also been staying behind after school for one hour a week, when she was receiving fluency training, which entailed reading along with Catherine and the computer. She had been doing this for approximately two weeks when the study commenced.

I've been using this program since I bought it [recently] but previous to that I was spending that time [doing] repeated reading, but the repeated reading has certainly helped Monique. It really has. And now she's saying, "No, no! That doesn't make sense." And she's re-reading, which is terrific. We're really getting somewhere.

Monique had a low average receptive vocabulary (39th percentile). This could have contributed to her low accuracy, comprehension and rate. Her attitude towards reading was at the 56th percentile. However, she greatly preferred recreational

reading (78th percentile) to academic reading (35th percentile). According to the Multidimensional Fluency Scale (Table 8.6.), she scored 2 out of 3 on each of the dimensions of pace/rate, smoothness and phrasing.

Table 8.6. Pre-intervention results of the Multidimensional Fluency Scale (Monique)

	Pace/Rate	Smoothness	Phrasing
Text: Ali Level 3 Score: 6/9	Uneven mixture of fast and slow.	Occasional breaks in smoothness caused by difficulties with specific words and/or structures.	Mixture of run-ons, mid-sentence pauses for breath, and possibly choppieness, reasonable stress/intonation.

Bridget

Bridget was a hard-working, pleasant, and positive girl who had experienced learning and physical difficulties since birth, due to the congenital condition hyperthyroidism. She had experienced delayed achievement of all developmental milestones. At the time of the study, Bridget still had difficulties in gross and fine motor control, as well as some difficulties in speaking quickly and clearly. According to Catherine, Bridget was "a very kinaesthetic child" who liked "hands on activities" and was quite "visual". Because of difficulties in motor control, she preferred keyboarding to handwriting, although she still had not learnt to touch type.

Catherine said that Bridget also had difficulties sequencing and articulating thoughts and ideas. Her parents had worked extremely hard to help her progress, as had the teachers at St Clair's, where she had been since starting school. She had received a range of therapy such as speech and occupational therapy, as well as direct instruction in reading and other curricular areas. Also, her mother worked with her for 'hours each night', according to Catherine. Bridget's mother informed me that she had purchased some *Living Books* software, and also some electronic *PM Storybooks*, as well as some *Reader Rabbit* software. Bridget would read and listen to these for enjoyment at home.

Despite her difficulties, Bridget managed to achieve at an average level, probably due to the high level of support she received. Because of this, she may already have reached her highest potential. Despite her speech articulation difficulties, her reading rate was above average (62nd percentile), and her accuracy

(47th percentile) and comprehension (52nd percentile) were average. However, she often ignored punctuation.

In her Year 3 Student Outcome (Reading) Test, Bridget scored in stanine 4 (23rd to 39th percentile range). This suggests that she may have made some progress in reading during the nine months leading up to the commencement of this study, although it must be acknowledged that the two tests may not be strictly comparable.

Bridget's receptive vocabulary was below low for her age, at the 30th percentile, whilst her attitude towards reading was at the 66th percentile. She did not express a clear preference for either academic or recreational reading.

Catherine rated Bridget's performance of the NARA text, 'Ali', using the Multidimensional Fluency Scale. She scored 1 out of a possible 3 on each dimension, indicating that she needed to improve on all of these (see Table 8.7.).

Table 8.7. Pre-intervention results of the Multidimensional Fluency Scale (Cinadia)

	Pace/Rate	Smoothness	Phrasing
Text: Ali Level 3 Score: 3/9	Moderately slow	Several 'rough spots' in text where extended pauses, hesitations etc., are more frequent and disruptive	Frequent two and three word phrases giving the impression of choppy reading. Improper stress and intonation that fails to mark the end of sentences and clauses

In summary, the results of the NARA indicated that Bridget was achieving at an average level in comprehension, accuracy and rate. Results of the ERAS indicated that she had a positive attitude towards reading but results of the PPVT-R showed a low knowledge of spoken vocabulary. According to Catherine, Bridget needed to improve her phrasing and smoothness, and to pay more attention to punctuation. In Catherine's opinion, Bridget did not particularly need to improve her proficiency in reading with expression.

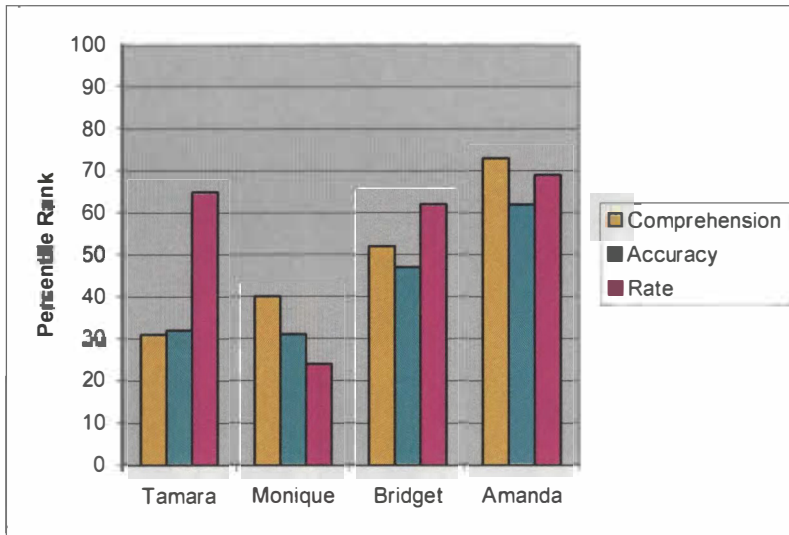


Figure 8.2. Pre-intervention results of the NARA: St Clair's, Year 4

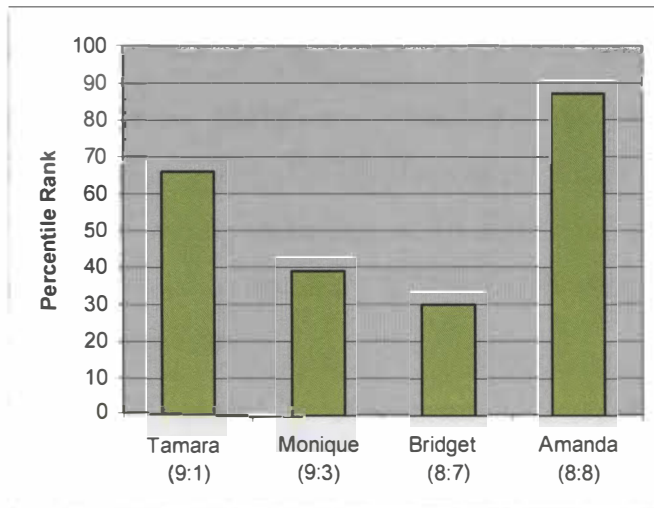


Figure 8.3. Pre-intervention results of the PPVT-R: St Clair's, Year 4

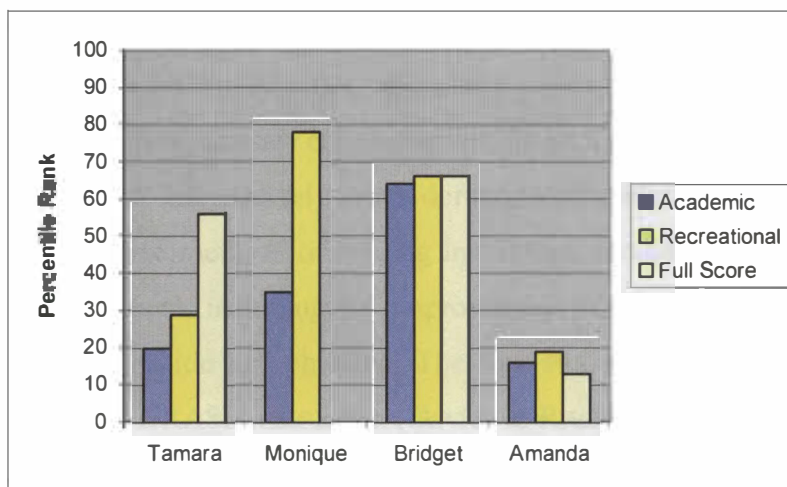


Figure 8.4. Pre-intervention results of the ERAS: St Clair's, Year 4

Verifying the Significance and Appropriateness of the Pedagogical Goal

Catherine was confident that the use of repeated readings would be helpful in developing oral reading fluency and, after considering the results of the NARA, was hopeful that the four participating students would benefit from this approach. She was of the opinion that it would be necessary to focus on phrasing first, as this would facilitate expression at a later time.

As she had already started to experiment with repeated readings in a computerised context with *Reading at Home 3* (2000) and had found it promising, she was enthusiastic about trying this approach with all four students, going through the process of identifying facilitative and inhibitive factors, modifying the technique to suit the circumstances, and ultimately judging its preferability.

Conceptualisation of Possible Learning Strategies

As was the case with Nicole Nielsen (the Year 5 teacher), Catherine was interested in trying out the IMM Assisted Repeated Reading (IMMARR) strategy and the creation of electronic storybooks to help students improve their oral reading fluency (see Chapter Five for details of these strategies). Like Nicole, she tentatively selected the pedagogical goal prior to choosing the students.

How Did Catherine Usually Help Students Who Experienced Reading Difficulties Improve Their Oral Reading Fluency?

Catherine saw reading fluency as a complex ability that was dependent on comprehension and word identification, and also a good understanding of the role of punctuation. Furthermore, she saw comprehension as both a cause and a consequence of fluency. Because of her relatively broad definition of reading fluency, she was of the opinion that diverse methods of reading instruction should make a contribution towards its improvement, including the improvement of word identification skills, vocabulary, comprehension and phrasing. The four students involved in this study were also receiving THRASS instruction (Davies & Ritchie, 1996), delivered by the support teacher, Susan Alessi, and received additional classroom support in the form of a higher degree of teacher attention. Moreover, they were grouped with students of a similar ability for reading lessons.

Despite being satisfied that general reading instruction and practice lead to improvements in fluency, Catherine also considered specific fluency instruction, such as the Neurological Impress Method (NIM) (Heckelman, 1969) and modelled reading (Clark, 1995) to be necessary for students with difficulties in fluency. She occasionally used NIM, but because of time constraints she more often used modelled reading or choral reading which did not require one to one instruction. Catherine also tried to make the students aware of the facets of oral reading fluency that they were successfully improving and those that they needed to further develop, by periodically writing comments in their 'Oral Reading Record' (see Appendix 8.2.) For example, with reference to Monique's reading, she wrote:

I was pleased to hear you attacking difficult words. Good volume and pace. I can hear you are trying to add expression when a character is speaking. Great work! (3/5/2001)

Several times a term, Catherine also asked the students to listen to tape recordings of their oral readings and engaged them in discussions about how it sounded. This was intended to increase their awareness of what fluent reading sounded like, and to encourage self-monitoring.

Additionally, as mentioned above, Catherine had recently started using the CD-ROM, *Reading at Home 3* (2000), in an attempt to help Monique improve her oral reading fluency. This Australian software consists of short texts, usually of

approximately 100 to 200 words, and offers computer narrations and text highlighting. In relation to this, Catherine said:

I actually tutor her once a week after school on reading and we use the computer program as well, and what she does to begin with is, she reads the piece of text and then there's a book icon, and when she clicks on that, it reads it out to her and she has to read it again, trying to keep up the pace ... And it's actually encouraging her fluency, and I read with her.

In summary, Catherine was already using a range of strategies to help the four students introduced earlier improve their oral reading fluency and felt that these strategies were useful and relatively successful. However, she was keen to increase the range of strategies at her disposal and to find ways to incorporate the use of ICT into her teaching. She also wanted to investigate the potential inhibitive and facilitative factors involved in using ICT for this purpose. Furthermore, she felt that the four students involved would find using computers for this purpose enjoyable and motivational.

Selection of IMM-based Learning Strategy: IMMARR

As Catherine had already started to use CD-ROMs to assist Monique, she was interested in trying IMM Assisted Repeated Readings (IMMARR) with the four participating students. She believed that the support (models of fluent reading, pronunciations) and motivational factors associated with this strategy would be beneficial.

Availability of Software and Hardware

Software

During the previous school holidays, Catherine had visited a major educational supplier and asked for suitable reading software for students in their middle primary years. Staff had offered her some CD-ROMs to review over the school holidays, from which she had selected *Reading at Home 3-4* (2000) to use with Monique.

Catherine had been somewhat disappointed at the small range of software available at the shop, although pleased that she had been permitted to take the

software away on trial. Despite the relatively small range available at the school's usual supplier, Catherine had not tried other means of accessing software, such as buying over the Internet. I provided her with 10 CD-ROMs to evaluate⁶⁶.

Several days later when we met to discuss these, Catherine reported that she had not found time to appraise all of them, although she pointed out that two of them had failed to run on her laptop (which had the *Windows ME* operating system). These were *Harry and the Haunted House* (1994) and *Arthur's Teacher Troubles* (1993). However, we later successfully launched them on one of the classroom computers (which had the *Windows 98* operating system) although it was necessary to manually change the screen settings⁶⁷. Catherine decided that *Harry and the Haunted House* (1994) would be at an appropriate level and an interesting story for the students concerned, but was concerned at its lack of flexibility and features, such as it not allowing the text highlighting to be switched off and featuring no activities such as spelling and comprehension activities at the end of the story. For repeated readings, such activities are not necessary, but Catherine nevertheless considered them to be potentially valuable because they might improve comprehension and thus help improve oral reading fluency.

During this meeting, Catherine reviewed *Stellaluna* (1996) and commented that the narration was "awfully slow", although it might be appropriate for some of the lower ability students. She expressed frustration that she could not find a way to quickly exit from or move through the story; I showed her that it was possible to use the arrow keys for this purpose. Catherine then examined the quiz at the end of the story and was dismayed that it did not relate directly to the story but to bats in general.

We finally reviewed *Reader Rabbit's Reading Development Library* levels 2, 3 and 4 (1997) and Catherine expressed a preference for these because they included options to turn off the text highlighting, to pause the story, and to engage in comprehension and writing activities (see Figure 8.5.).

⁶⁶ Refer to Chapter Five for details of how I found and chose these CD-ROMs.

⁶⁷ It is worth noting that many CD-ROMs still don't do this automatically and, although it only takes a few seconds to change the screen settings manually, the four participating students found it difficult to remember how to do it.



Figure 8.5. *Reader Rabbit's Reading Development Library 2.* A sequencing activity.

On the negative side, Catherine thought that the necessity for users to ‘sign in’ each time they used the software might prove to be somewhat frustrating. Again, it was necessary to manually change the display settings. Other frustrations included having to wait for characters to finish speaking before the book options were displayed, and the fact that it did not seem possible to exit the program quickly before reaching the end. Yet another negative factor in Catherine’s view was that this software used North American accents, which may not have provided the optimal models for Australian participants. In addition, there were lengthy animations between screens or pages, which could not be skipped.

An advantage of the software, according to Catherine, was that it permitted the user to choose from three different characters, who told and narrated the story from their own perspectives (Figure 8.6.). However, we decided that for the IMMARR it would be necessary for the students to stick with a single character. They would later be permitted to explore the other two perspectives.

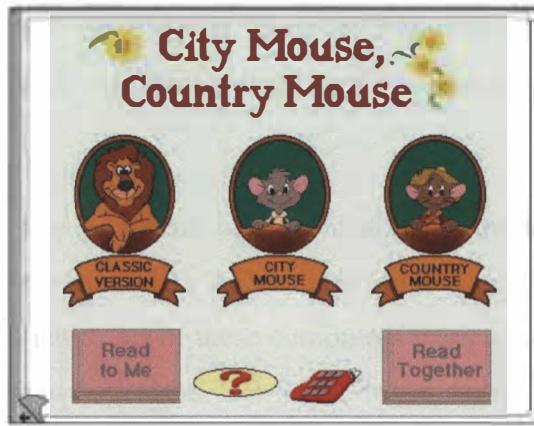


Figure 8.6. *Reader Rabbit's Reading Development Library 2. Choice of characters*

When reviewing one of the CD-ROMs and attempting to read the story, *The Princess and the Pea*, the computer repeatedly froze on page 12, even though the other story on the CD-ROM ran perfectly. We tried the CD-ROM on four different computers, some of which had different operating systems, and the same problem arose each time. I emailed technical support at The Learning Company and supplied them with the required details. Within two days they had responded with a suggestion about how the problem might be rectified. However, it is probable that many teachers would have found this advice difficult to implement because of its relatively technical nature (see Figure 8.7.).

This is a 32-bit compliant application and requires 32-bit CD-ROM drivers. To check for 32-bit CD-ROM drivers, use the following steps. The installer program is designed to run on either 16 or 32 bit operating systems. It is a separate program and is not dependent on 32-bit drivers.

- 1) Right click on My Computer and select Properties.
- 2) Click the tab labelled Device Manager. Look for CD-ROM, it should appear near the top of the list.
- 3) If CD-ROM is not listed, 32-bit CD-ROM drivers are not installed.
- 4) If CD-ROM is listed, click the tab labelled Performance. There will be a listing of system specs. File System should be 32-bit. If it refers to MS-DOS compatibility, it is not utilizing 32-bit drivers.

Figure 8.7. *Technical support from The Learning Company.*

When this solution was not effective, I was advised by technical support to apply to my supplier for a refund or a replacement CD-ROM. However, when I tried

the replacement CD-ROM, exactly the same problem arose on a variety of computers. Needless to say, this technical hitch was time-consuming and frustrating.

Hardware

As described previously, a bank of three desktop computers was located at the rear of Catherine's classroom. Also, the computer 'hub room', which contained a dozen computers, was available. All of these computers were less than two years old at the time of the study and had speakers, CD-ROM drives, headphones and all of the specifications we were likely to need. Unlike some other teachers who participated in this study (see Chapters Seven and Eight), Catherine was aware of the specifications and capabilities of the computers in her classroom.

Planning the Administration of the Implementation

It was essential to decide when and where the IMMARR sessions would take place and who would teach/supervise them. It was agreed that Catherine and I would conduct the sessions jointly for approximately one hour after school, once weekly. The students would also be given opportunities to use the software in the classroom before school or during classroom time. Although the students all had access to computers at home, we did not plan to allow them to take CD-ROMs home because of licensing restrictions. The CD-ROMs were licensed to be installed on a single computer and the frequent installing and uninstalling that would have been necessary to comply with the licensing requirements would have been impracticable.

Formulation of Evaluation Techniques

Catherine and I discussed how we might assess the students' progress in oral reading fluency:

Catherine: [That can be achieved by] going through an interview, an analysis, and their speed, I suppose – just comparing over a time period the rate at which they're reading. Also to measure how well they've understood the text.

Researcher: What about the intonation, the prosody side of things?"

Catherine: Well, there it comes through on the tape. And let them compare their own performances and talk about the reading. I do a lot of modelling of reading, especially

when I have my three groups. I think also the parents need to be able to see the results, as a consequence of all this extra support that they've been getting ... so even with the Neale [NARA] test, if we re-do them at the end, then that gives them true, hard data.

I proposed the possibility of carrying out intonation analyses, but we decided that this process was too complex and was not something that 'real' teachers in 'real' situations would be able to accomplish. Catherine also wanted to continue to encourage the students to use self-assessment, in that they would listen to recorded episodes of their reading and reflect upon on factors such as pace, expression and smoothness. In addition, she decided to use the Multidimensional Analysis of Reading Fluency throughout the study (Zutell & Rasinski, 1991) because of its ease of use.

The Implementation

IMM Assisted Repeated Readings (IMMARR)

Catherine considered that, in order to enhance motivation, the girls should be given the opportunity to choose their own texts. Monique and Amanda were asked to choose a story from *Reader Rabbit Reading Development* (1997) levels 3 and 4, whereas Tamara and Bridget, who were the less proficient readers, were asked to choose from level 2.

In order to gauge their oral reading fluency with reference to their chosen texts before they engaged in IMMARR, the participating students were asked to read a section of it from screen dumps, printed on A4 paper in colour. These were exact copies of the screen versions, and included pictures⁶⁸. The students also read a section from the computer screen, with the sound and highlighting switched off. Reading from the screen was not ideal because it took a few seconds to 'turn the page' after each screen had been read, disrupting fluent reading.

Catherine regretted the fact that printed books were not available to use in conjunction with these CD-ROMs, as they are with some others. Even though the students reported that they enjoyed reading from the computer screen (see Figures

⁶⁸ It must be noted that, because of the complexity of copyright rules, I was somewhat concerned that printing out 'screen dumps' might constitute a copyright infringement.

8.8. and 8.9.) we concluded that in future implementations of IMMARR with this software it would be preferable for students to read from printouts, if an initial assessment of fluency with reference to the particular text was required. This was due to animated disruptions in the computer version, as well as the slow page turning. It had, however, taken me several hours to capture and print the paper versions. Classroom teachers would not normally be able to devote this amount of time.

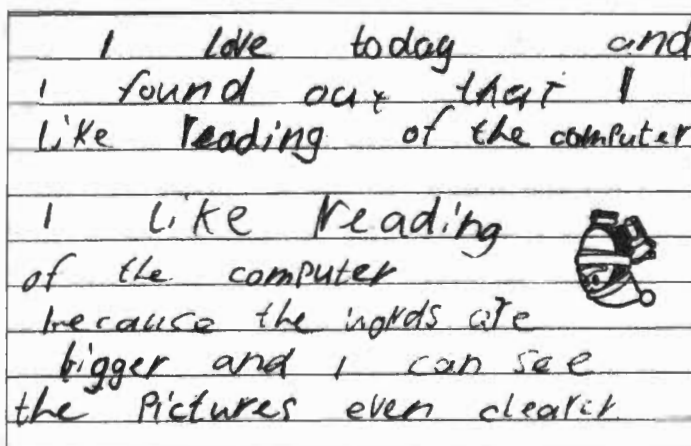


Figure 8.8. Amanda's journal (1)

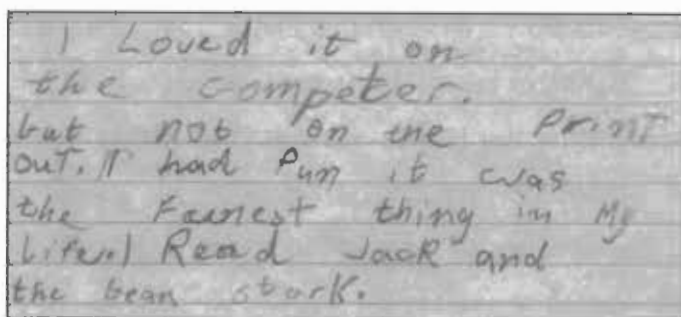


Figure 8.9. Bridget's journal (1)

The students read their sections of text from the printout at the rates (in words per minute - WPM) and percentage accuracy displayed in Figure 8.10. We concluded that in future implementations of IMMARR with this software, it would be preferable for students to read from printouts if an initial assessment of fluency with reference to the particular text was required. This was due to animated disruptions in the computer version, as well as slow page turning.

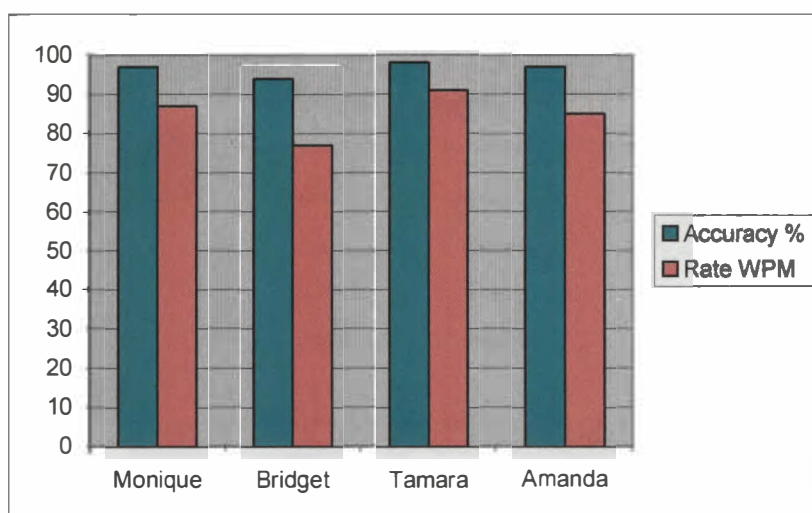


Figure 8.10. Rate and accuracy of students' reading before IMMARR, using *Reader Rabbit's Reading Development Library* (1997).

From the above information, Catherine and I concluded that the texts seemed to be of an appropriate ('easy') difficulty level for the students. That is, they would have been at an appropriate difficulty level for repeated readings in a traditional context. For more detailed discussion about 'readability' and electronic storybooks, see Appendix 1.1.

We had discussed whether it would be beneficial for the students to engage in any 'pre-reading' activities before they embarked on the IMMARR. Catherine had stated that the main pre-reading activities she carried out with her students were prediction activities, which she saw as largely motivational in purpose. She hypothesized that, as electronic storybooks should be motivational 'intrinsically', there would perhaps be no need for further pre-reading activities. Also, she was interested to investigate whether the various supports offered by the CD-ROMs would negate or reduce the need for pre-reading activities, which, in addition to heightening motivation, can prime the reader to better understand the concepts, themes and vocabulary in texts, thereby increasing accuracy and comprehension. In any case, the *Reader Rabbit's Reading Development* (1997) software provided an optional pre-reading activity in the form of a word list. This allowed users to practise words that they would encounter in the text by clicking on them and hearing pronunciations. An example of a word list can be seen in Figure 8.11.



Figure 8.11. *Reader Rabbit's Reading Development Library 3 (1997). A word list*

At the beginning of the next session, Catherine used the first few pages of *The Princess and the Pea* to demonstrate to the students how the software worked. They were shown the two modes, 'Read To Me' and 'Read Together'. See Table 8.8. for descriptions of these two modes.

Table 8.8. *Description of the 'Read To Me' and 'Read Together' modes in Reader Rabbit's Reading Development Library.*

Read to Me	Read Together
The computer narrates the story all the way through.	The user has the option of listening to the computer narration on a page-by-page basis or reading independently.
The story is interrupted occasionally by animated conversations between characters.	The story is interrupted occasionally by animated conversations between characters.
There is a pause button so that users can stop the narration in order to practise words or phrases on their own.	
	Users can click on individual words to hear pronunciations.
	Users can click on pictures to view content-related animations.

It is noted that the highlighting in this software appears word by word, or 'grows', until an entire sentence is highlighted. Highlighting of this nature seems unlikely to assist students in improving their ability to phrase.

The students were also shown how to turn off highlighting and sound, how to navigate through the pages and how to click on individual words for pronunciations. In addition, they were shown how to carry out the activities at the end of the program, which comprised:

- a sequencing activity, where the user must drag and drop a sentence onto a corresponding illustration;
- a letter writing activity, where the user must create a letter to one of the characters by filling in missing words;
- a picture-word matching activity, where the user must drag and drop a word onto its matching picture. (Figure 8.12.).

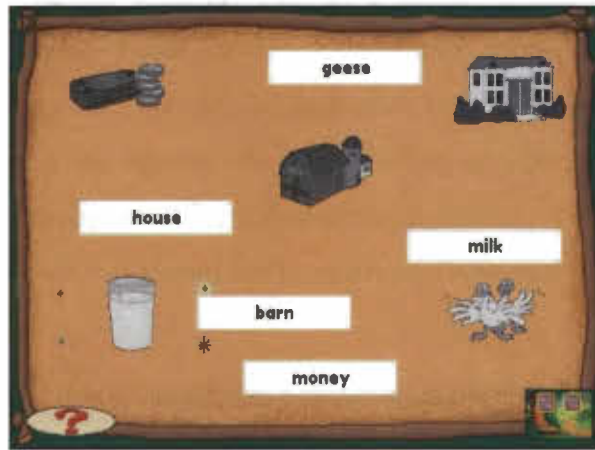


Figure 8.12. *Reader Rabbit's Reading Development Library 3* (1997). Picture-word matching activity.

The students carried out a choral reading of *The Princess and the Pea* with the teacher and the computer narration until it 'froze'. They were somewhat disappointed about this, despite being warned that the story would not run all the way through. Catherine later said that she had found the animated scenes frustrating, as they seemed to interrupt the girls' fluency. We could not find a way to skip the animations and there was nothing in the electronic manual about this. The students also appeared to find this frustrating, as they had on several occasions tried to skip the animations by pressing the arrow keys.

At the beginning of the next session, I revised with the four students how to navigate around the *Reader Rabbit's Reading Development Library* (1997) software on my laptop. I then installed each of the three CD-ROMs on a classroom computer. The four students were given headphones and were instructed to read along with the computer in a 'soft voice' or a whisper, and I demonstrated how to do this. In addition, they were requested to remember what the story was about, as Catherine and I would be asking them to retell the story and answer some questions at the end.

To facilitate comprehension of the small selection of text that they were to repeatedly read, they were asked on this occasion to read their chosen story all the way through, although they would not be reading it in its entirety each time. They were asked to select the 'classic' version of the text⁶⁹ as this was the version they had read from the paper printout. They expressed disappointment about not being allowed to choose other characters at this time.

Using the laptop, Amanda read King Midas. Using the classroom desktop machines, Tamara read Town Mouse, City Mouse, Monique read The Goose that Laid the Golden Egg and Bridget read Jack and the Beanstalk. The students launched the program, signed in, selected the correct story and narrator and began to read along, wearing headphones. After a few minutes, however, the sound on Monique's computer disappeared so I closed the program and restarted it. There were no further technical problems.

Bridget read aloud without any embarrassment but was so loud that Monique and Tamara asked her to speak more quietly. Monique didn't seem to mind reading aloud, although she did sometimes read silently. However, she'd been doing NIM (Heckelman, 1969) reading with Catherine and *Reading At Home 3-4* (2000) and was thus somewhat used to it. Tamara said she was 'reading in her head' and hardly read aloud at all. Amanda, who was sitting nearer the front of the classroom, using my laptop, was reminded several times by Catherine that she was supposed to be reading along aloud, but she did not appear to be comfortable about doing this.

The students then orally retold the story and answered several questions (see Appendix 8.3.). They all performed satisfactorily, although Monique was able to answer only the literal questions. According to Catherine, she consistently struggled with inferential and evaluative questions.

Next, the students did the letter writing and sequencing activities that appear after the stories. Indeed, Amanda read her story from all three characters' points of view and completed the letterwriting activity several times, using different words.

The following week, I asked the students how many times they had read their section of text. Unfortunately, they were not sure. Furthermore, they had not

⁶⁹ The lion was the narrator of the 'classic' version, although there were two other versions told from the point of view of other characters.

recorded their reading in their journals. In response to this, the teacher and I designed a record sheet that they could fill in each time they read their text (see Appendix 5.5.). However, their ability to use the record sheet to accurately record what they had done also proved to be weak.

Nevertheless, Catherine was able to report that each student had read her text on the computer on two consecutive days during class time. She reported that Monique had appeared to be finding the repeated readings somewhat dull, although the other three students seemed to enjoy it. It must be noted that it was not possible in this context to use a common incentive to repeatedly read a text, namely rate graphs⁷⁰. This is because narrations in electronic books do not increase in rate⁷¹, and the student must therefore read at the same rate each time, unless they at some point disable the computer narration and highlighting. Rasinski and Padak (2000) have also suggested that performing the text to peers is a good incentive to read a text repeatedly, but we decided against this in Monique's case, as, in Catherine's opinion, she had not developed sufficient confidence to enjoy reading to an audience.

During their independent repeated readings of electronic storybooks, Catherine reported that the students seemed to have experienced no problems. However, it had been necessary for her to change the screen setting for them each time they used the CD-ROMs, which she found onerous. Also, the students indicated that they did not like the music that accompanied the stories (see Figure 8.13.). Furthermore, they were disappointed that they had been instructed to choose the 'classic' version of the text with 'Sam the lion' narrating.

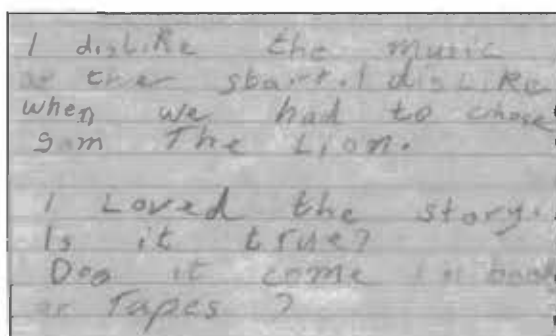


Figure 8.13. Bridget's journal (2)

⁷⁰ By graphing how many seconds it takes a student to read a text each time, a visual representation of progress is created. This can be highly motivational (Rasinski & Padak, 2000).

⁷¹ The computer narrations in the *Reader Rabbit Reading Development* Software were approximately 120 words per minute.

The students had read their respective texts along with the computer three times each, Bridget and Monique reading along in a 'soft voice' more consistently than Amanda and Tamara. In addition, they had read the paper printout once. It has been suggested that texts be re-read three to five times for optimal effect (Meyer & Felton, 1999b).

In order to make their final reading of the text more meaningful, Catherine and I had decided to transfer screen dumps of several pages of the stories into *PowerPoint* (1997). Instead of speaking into a tape recorder, the students would speak into the computer as they read from the computer screen. They would thus create their own electronic text, which they could listen to periodically. However, we found it difficult to ascertain whether this was permissible under the license, which stated:

You must treat the software like any other copyrighted material, except that you may make one copy of the software solely for backup or archival purposes.

We reasoned that it would be 'fair dealing' under the Copyright Act 1968 to copy several pages (no more than 10%) for educational use, although it was not possible to be entirely confident that this was the case, as fair dealing is often determined on the facts of each case (Commonwealth of Australia, 2001).

Bridget was hesitant about talking into the computer microphone, and said that she disliked hearing her voice on recordings. Catherine and I assured her that we would erase or change the recording if she didn't like it. However, all of the students, including Bridget, seemed pleased when they heard their voices on the electronic storybooks, despite the sound quality being relatively poor. They expressed disappointment that they couldn't turn up the volume. Also, the files turned out to be too large to fit on floppy disks, because of the large sound (WAV) files, so the electronic storybooks were not distributed to the students after all.

After repeatedly reading the texts, it was noted that the students had barely improved their performance in terms of accuracy, although Tamara and Amanda increased their rates (see Figures 8.14 and 8.15.). It must be noted that, since their accuracy rates were initially very high, it is perhaps not surprising that they did not improve.

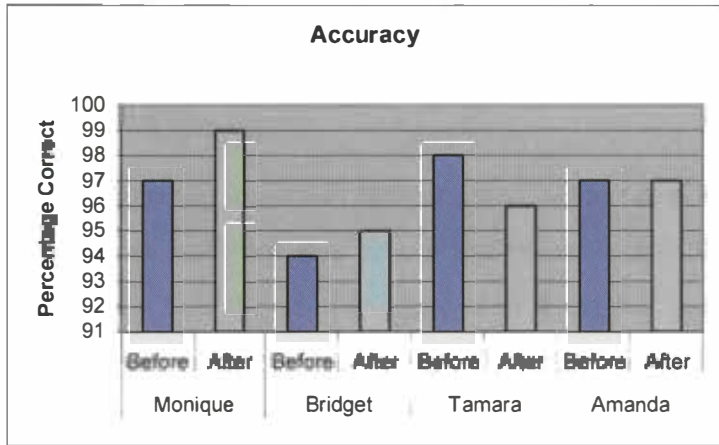


Figure 8.14. Accuracy of students' reading after IMMAAR of *Reader Rabbit's Reading Development Library*(1997)

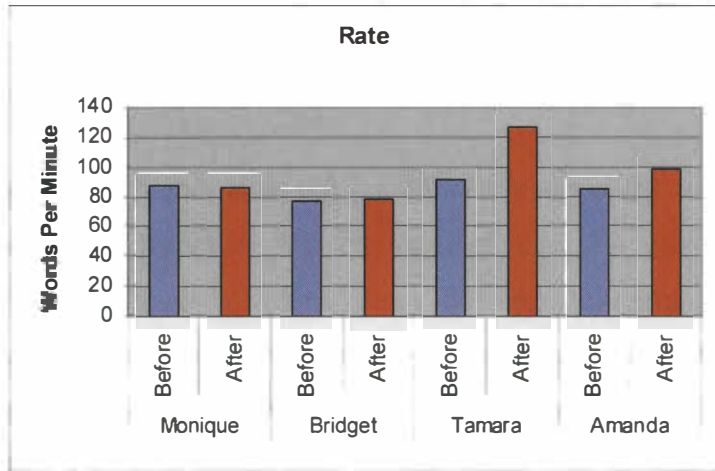


Figure 8.15. Rate of students' reading after IMMAAR of *Reader Rabbit's Reading Development Library* (1997).

Smoothness and phrasing were not formally assessed, although Catherine said she was “blown away” by the difference in Tamara’s performance. In her final reading of her selected text, Tamara read smoothly, with a good pace and generally phrased the text well, mostly in clause and sentence units, with adequate attention to expression. She achieved a pace that was similar to the pace of the computer narration. Although Bridget did not improve her rate or her accuracy, her phrasing did improve slightly, with fewer two and three word phrases. However, she still occasionally paused mid-sentence for breath. Monique did not improve her rate or her accuracy, but her phrasing improved, with fewer two and three word phrases. She read with more expression, especially for the dialogue. Amanda was able to improve

her rate slightly, although her accuracy did not improve. Her phrasing seemed to have improved, however, with fewer run-ons. Also, she paid greater attention to expression, especially with dialogue.

Only Tamara's rate had improved substantially. It was not possible to find an explanation for this as we were not sure how many times each of the students had read the texts and exactly how they had engaged with them. For example, had they read along aloud with the computer narrator? Or had they read along silently, as Tamara had? Had they read it (aloud or silently) without the computer narrator? It is possible that Tamara benefited from reading along silently, as this may have allowed her to play closer attention to the model of fluent reading, instead of dividing her attention between listening and speaking at the same time⁷². This raises the question of whether reading aloud is necessary, or whether silently reading along is just as beneficial. For Tamara, it seems that reading along silently was beneficial in this instance.

Even though the highlighting did not indicate phrases, the students' phrasing of this text seemed to improve. We hypothesised that this was because it was possible to discern the phrase boundaries from the computer narrations. In addition, increased comprehension of the text brought about by repeated readings could have facilitated improved phrasing. It was thus also necessary to raise the question of whether text highlighting in phrase units is beneficial. Due to time constraints, we were not able to pursue this question.

After considering the above results, Catherine wondered whether the strategy was, after all, going to be preferable to traditional means of improving oral reading fluency, especially for Monique, whose dysfluency seemed to be rooted in decoding difficulties. Catherine wondered if the THRASS program (Davies & Ritchie, 1996) and more writing activities might have been more beneficial for this student. However, she acknowledged that it was probably too early to abandon the strategy. After all, the students had only read one electronic storybook each. Furthermore, we weren't sure as to the nature of their engagement with the electronic text, due to their reluctance to record exactly what they had done.

⁷² Attention is thought to be available in limited quantity, and the processing demands of reading may exceed the amount of attention available (Sammels, 2002), perhaps especially in students with reading difficulties.

At the end of the session, the students swapped CD-ROMs without any disagreements⁷³, and at the beginning of the next session, I asked them how many times they had read their selected texts, whether they had read aloud, whether they had listened to the narrator and whether or not the highlighting had been switched on. Their oral responses did not correspond with their written records of what they had done. Indeed, their journal writing and response sheet were only partially completed. Catherine later suggested that tape-recorded responses and observations might be preferable to written ones:

Even if it was a tape-recorded reflection, that might have been easier, because you know what they're like, they like to ... at this level, Year 4, I know that the girls just love to hear their own voice, love to have a gimmick somehow involved in it. Their attention span ... it's so small, it's so short that umm they get over something so quickly and it's in the past. They could be saying what they think as they go along?

And writing it is incorporating yet another medium, it's processing a lot more and it's tapping into something a lot different to the main objective of the task, you know, of the project, so writing, for them ... it's a struggle for Bridget, so she wouldn't do it. Monique will just find any loophole to get out of everything. Tamara will do it, and Amanda will do it, but it'll be short, and they won't be very meaningful.

Tamara reported that she had read the text, *Harry and the Haunted House* (1994), twice throughout the week, but that she had found the hotspots⁷⁴ "boring". Despite saying this, she clicked on at least twenty of them whilst I watched her engaging with the electronic text. This indicated to me that students' reports do not always concur with their actions, raising further questions about the usefulness of such devices as journals.

As with the *Reader Rabbit* (1997) software, Tamara never read aloud along with the computer narration. When I asked her to read aloud as it might help her to sound more exciting when she read, she responded with, "I already sound exciting when I read." This indicated a need for more explicit discussion about what fluent and expressive reading sounds like. However, this aspect of teaching fluency was not focussed upon during the OMMARR phase, although it was addressed when the students later created their own electronic storybook.

⁷³ In the Year 5 group, there had occasionally been conflict over who should read what CD-ROM.

⁷⁴ See Glossary

Even though she did not read aloud with the computer, Tamara reread her story confidently and with good expression, again raising the possibility that it is not necessary to read along aloud. It must be noted that her ability to read the text on the screen was occasionally obstructed by the appearance of animated characters, which obliterated the text. Tamara stated that she found this frustrating.

Bridget reported that she had read *Ruff's Bone* (1994) four times throughout the week and had enjoyed it. She always used her headphones and read along, sometimes in an inappropriately loud voice. This was possibly because she could not clearly hear her own voice when wearing the headphones. In response to this, Catherine and I asked her to remove the headphones and to read along quietly with the computer, which was turned to a low volume. This turned out to be less distracting to the other students. Although very compliant in reading along aloud, Bridget found it difficult to keep up with the highlighting and the narration. As the highlighting could not be switched off in this software, I suggested that she might try to ignore it (if it was going faster or slower than she wanted to read). As anticipated, this was not a satisfactory solution to the problem. Bridget found it extremely difficult, if not impossible, to ignore the highlighting.

Monique had read the narrative *Master Frog* from *Reading for Literacy 4* (2000) several times. However, she had not recorded the frequency. She had also explored several of the other short texts (approximately 100-200 words) on this CD-ROM and had completed some of the comprehension activities. This particular software was capable of recording the texts students had completed, helping teachers overcome the problem of not knowing what students had done. However, it did not record how many times the student had accessed the text or the computer narration, and it only recorded the text as having been completed if the student had successfully⁷⁵ completed all of the comprehension activities.

Reading for Literacy 4 (2000) highlighted text sentence by sentence, not by phrase units, but the Australian narrator modelled fluent, expressive reading and it was relatively easy to discern the phrase boundaries as he spoke

⁷⁵ In *Reading for Literacy* (all levels), if the student did not score 100% in all of the activities, the text was not deemed to have been completed and was not recorded as such on the computerised record sheet. Furthermore, the record sheet did not indicate whether a particular text had been accessed and that activities had been attempted. The student was, however, given the opportunity to repeat the activities until 100% was achieved.



Figure 8.16. *Reading for Literacy 4.* (2000). A reading comprehension activity.

The students continued to select electronic storybooks and either read them in their entirety or in short sections until the end of term. The main impediments involved the four participants getting sufficient time and access to the classroom computers to enable them to complete the repeated readings, the shortcomings of the software, and the difficulties the teacher had in monitoring what the students were doing, which made it difficult to ascertain effectiveness and preferability. In addition to this, Catherine reported that the students were not highly motivated to repeatedly read electronic texts, but wanted to quickly move on to other electronic texts. As mentioned in the previous chapter, it has been suggested that multimedia texts can encourage readers to read ‘extensively’ rather than ‘intensively’ (Leu, 1996a). That is, readers tend to want to read many texts in a somewhat superficial manner rather than reading a few texts ‘deeply’. With regard to repeatedly reading the same electronic text, Catherine reflected:

Also, when you're repeating the same story over and over, over the course of a couple of weeks, or even over the course of a week, it gets dull. And even though the outcomes are so beneficial from our point of view, they're looking at the same story over and over again, and it's, 'Urrrr!'

Also, Catherine found that, because the screen settings needed to be changed so often, the students could not easily work independently; they always had to wait until she was available to change them. She did not appear to consider the students capable of changing the screen settings themselves, although it is possible that they could have learnt how to do this with practice and an instruction sheet.

Below (Table 8.9.) is a list of facilitative and inhibitive factors associated with using IMMARR as a means of improving oral reading fluency with respect to the four students. It can be seen that, with a few exceptions, these were common to all four.

Table 8.9. Facilitative and inhibitive factors associated with using IMMARR as a means of improving oral reading fluency

Facilitative Factors	Amanda	Tamara	Monique	Bridget	Inhibitive Factors	Amanda	Tamara	Monique	Bridget										
	The student was competent in using computers.						'Technical hitches' occurred.												
The student found the CD-ROM electronic talking books motivational and 'fun'.					There was insufficient time to engage in activities adequately (to repeatedly read the texts).														
The teacher actively encouraged the student to comply with the requirements of the strategy.					There was a shortage of suitable electronic texts.	Y	Y	Y	Y										
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">KEY</th> </tr> </thead> <tbody> <tr> <td>Never observed</td> <td></td> </tr> <tr> <td>Sometimes observed (1 to 5 times)</td> <td style="background-color: #d9ead3;"></td> </tr> <tr> <td>Often observed (6 or more times)</td> <td style="background-color: #f4cccc;"></td> </tr> <tr> <td>Observed</td> <td>Y</td> </tr> </tbody> </table>	KEY		Never observed		Sometimes observed (1 to 5 times)		Often observed (6 or more times)		Observed	Y					Features of software, (such as inability to pause, change speed of narration, or switch off text highlighting and/or animation).				
	KEY																		
	Never observed																		
	Sometimes observed (1 to 5 times)																		
	Often observed (6 or more times)																		
	Observed	Y																	
						It was difficult to for the teacher to monitor and assist the student due to time constraints.													
						The student did not enjoy repeatedly reading electronic texts (she wanted to explore more texts.)													
					The student had insufficient access to computer hardware.														
					The student did not record her engagements with electronic talking books accurately.														
					The student did not like reading aloud with the narration.														
					The student reading aloud with electronic talking book was distracting to other students (read too loud).														

	The student found it difficult to synchronise her reading with that of the computer narrator.				
	The student was impatient to use software being used by other participants.				

Selection of IMM-based Learning Strategy: The Creation of Electronic Storybooks

At the beginning of the third school term, Catherine and I decided to engage the four participants in making an electronic storybook. This decision was made, in part, because we were running out of commercial electronic texts to use; there was not a wide range easily available in Australia for this age and ability group. Also, the four students were extremely eager to make their own electronic storybooks, as they had heard that this might be a possibility.

Catherine was of the opinion that the activity would be enjoyable and highly purposeful, although she was worried that the cost of the software could be prohibitive. I therefore gave her a CD-ROM that contained a free version (*Illuminatus* version 4.1.) of the software, which I had acquired free of charge from a computing magazine. She was able to install this on one of the computers.

I showed the four students the first page or two of *The Magic Elephant*⁷⁶ so that they had an idea of what to aim for. Whereas the Year 5 students had composed a new text especially for the electronic storybook, the Year 4s did not, as Catherine thought that it would be expeditious to use picture books that the students had already written. Thus, instead of creating electronic storybooks, the Year 4s *converted* existing texts into electronic storybooks (see Figure 8.17.). This may not be an ideal way to write multimedia texts, as multimedia texts can be, and perhaps should be, inherently different from traditional texts in that they can be non-sequential (Nielsen, 1995) and use media other than written text to convey messages. However, for the purpose of trying to improve fluency through practising, talking about oral reading, and deciding upon phrase boundaries, it seemed appropriate to

⁷⁶ *The Magic Elephant* is the electronic storybook made by the Year 5 students at the same school (see Chapter Five).

use a linear text that had already been composed for another purpose. This approach proved to save a considerable amount of time.



Figure 8.17. *Just Me and Cherie.* An electronic storybook made by Year 4 students at St Clair's College.

We started by typing in the text of a picture book Bridget had written, called *Cherie and Me*. The students and the teachers sat around a single computer to do this, which was somewhat cramped, and the students took turns to type. They were extremely eager to type, even though their keyboarding skills were slow; they had only recently commenced keyboarding lessons. Catherine and I were able to model expressive reading as the students typed in the text, for example by saying to the scribe, “Now type in, ‘Doctor, is it a boy?’”

As with the Year 5 group, the students wanted to spend a lot of time choosing fonts and background colours. However, Catherine urged them not to do this, as “the story’s the main thing”.

The students learnt how to use *Illuminatus* (1999) quickly, although they were not familiar with some of the terminology used. For example, when I asked them to make a ‘text box’ with the mouse, they said they did not know what this was. It transpired that they did know how to create text boxes, and regularly did so when using Microsoft *PowerPoint* (1997) and *Word* (1997), although they were not aware of the terminology. Also, they did not know what ‘animation’ meant, although when shown animation on the screen they recognised it.

A dilemma that arose from converting an existing text into an electronic format was deciding whether or not to faithfully transfer the layout, or to change it so

that fewer words per page appeared in the electronic version. Catherine suggested that it should be the same in the electronic as in the traditional version because the pictures had been created to "match the text exactly" and it would change the meaning of the text if the layout were altered.

Not having to create new illustrations was one advantage of using an existing text in that it saved time. Catherine offered to scan the pictures from Bridget's picture book. However, she came back from the computer laboratory after almost half an hour, frustrated, saying, "I can only get one picture on that disk." Instead of scanning the picture in at a 75 dpi (dots per inch)⁷⁷, she had scanned it in at 700 dpi, which took up a large amount of disk space. The pictures were later successfully scanned at a lower dpi.

After typing a few pages, the students were asked to practise and record some narrations. Monique asked, "Can we have, like, equal?" As in the case of the Year 5s, the students were concerned that they may not get the opportunity to talk into the computer as much as they would like; they competed over the microphone.

During recording, there was some peer discussion about reading with expression and how it might be achieved. However, the students lacked the metalinguage necessary to gain optimal benefit from these discussions. For example, they tended to say, "It sounds good," or "That's OK," or "That sounds silly" They also talked about the speed, the volume and whether or not someone's voice should go 'up' or 'down', (intonation) and where there ought to be pauses (juncture). However, they did not use terminology such as 'pitch', 'intonation', 'volume', and 'pace'. Although this terminology could have been too complex for them, it did seem that they needed additional language to enable them to think and talk about oral reading fluency more precisely. Catherine and I missed the opportunity to provide them with this metalinguage, although it is possible that we did this implicitly to some extent.

The students usually worked cooperatively but there was much saying, "It's my turn to speak next!" In general, the Years 4s collaborated better than the Year 5s had done (see Chapter Five), but this may have been because the nature of the

⁷⁷ See Glossary

process was different; there was much less for the Year 4s to discuss as the story had already been written.

After practising, the students recorded the narrations, listened to them, then discussed them further and decided if they were satisfactory. As with the Year 5s, this group of students was intrigued by the visual representation of their recordings on the waveforms. "Look at that!" they said on more than one occasion.

At one point, we lost a WAV or sound file; it was not in the folder on the hard drive that we thought we had saved it in and the students expressed some concern about this. It was necessary for me to search the hard drive for it, which was not something these students could have done independently, although the Catherine Williams could easily have accomplished this.

In the following session, the students, Catherine and I had a discussion about where we might place the highlighting. Instead of drawing slashes on printouts of the text, the students read the story aloud and clapped their hands to indicate phrase boundaries. Monique and Tamara, particularly, became highly engaged in this activity and the students quickly came to an agreement about where the highlighting should be placed. Although I did show the students how to synchronise the narrations with text highlighting using an *Illuminatus Opus* (2001) feature called 'auto-narrate', it would have been too time-consuming for them to complete this task independently.

Evaluating the IMM-Based Strategy (Creation of Electronic Storybooks)

Catherine stated that she did not think the creation of electronic storybooks as a context for improving oral reading fluency was the best approach for these students at this time because it did not seem to provide sustained practice but the practice of "fragments" of text, or "a sentence here and a sentence there". She did not see this as the best use of the students' time. In addition, she was concerned that the text might not have been challenging enough for the students because Bridget, who was not a highly skilled writer, had written it.

Despite this, the teacher, Catherine Williams, stressed that the girls had enjoyed the activity enormously and had gained confidence and learnt "many

things”⁷⁸ from making the electronic storybook. Nevertheless, she felt that it did not target fluency directly enough⁷⁹ and wanted to return to IMMARR.

Reading for Literacy (2000) was considered by Catherine to be the best for this purpose, as it featured short texts and did not have much animation, which was deemed to be distracting. We discussed whether reading along with many different texts, instead of repeated readings of the same texts, might be beneficial to fluency, as this would be a solution to students’ reluctance to read a text more than once or twice⁸⁰. Also, Catherine wondered if the students should all use the same text in order to minimise distraction, but this was not possible because we did not have multiple copies of the CD-ROMs or site licences.

The students were somewhat disappointed when informed that we were not going to continue with the creation of the electronic storybooks. Monique and Tamara had been eager to have their picture books translated into electronic form so I agreed to scan and type in the stories myself (see Figure 8.18.). Instead of the time consuming task of having them speak into the computer microphone screen by screen, I asked them to read the whole text into a tape recorder, after two practice runs. I then transferred this into separate sound or WAV files for their electronic storybooks. This was relatively time-consuming for me, but could perhaps have been done by older students to help them improve their ICT skills.

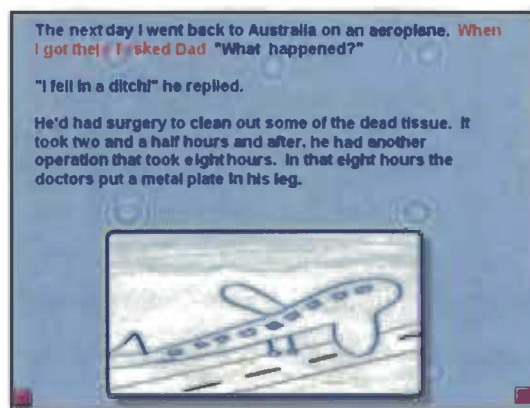


Figure 8.18. *Ice Arena*. Tamara’s electronic storybook.

⁷⁸ It is not always possible to ascertain what unplanned outcomes in terms of student learning have resulted from a complex activity such as this.

⁷⁹ This clearly illustrates how a teacher’s theory about what ‘fluency’ is and how it should be taught can determine the intervention. In this case, the intervention was discontinued because of the teacher’s assumption that sustained repeated reading is more efficacious than the development of concepts about fluency, self-monitoring, and the ability to break texts into ‘chunks’ or phrases.

⁸⁰ Although this was discussed, we did not follow it up during the formative experiment. Numerous possibilities emerged; it was impossible to follow all potential paths.

A possible solution to Catherine's concerns about the preferability of the creation of electronic storybooks as a context for improving oral reading fluency would be to encourage students to discuss teacher-made electronic books⁸¹, focussing on meaning, punctuation and phrase boundaries. Students could then practise reading the whole text, using discussion, listening to recordings and the viewing of waveforms as a basis for improvement. There is no reason to focus on 'fragments' of text at this stage. Finally, after sustained practice and discussion have taken place, narrations could be recorded in the appropriate segments. However, these possibilities were not explored during the study due to time restrictions.

The students were asked in interviews and during casual interactions for their assessments of the activity. Their comments, some of which are transcribed in Table 8.10., were overwhelmingly positive.

Table 8.10. Student comments about creating electronic books to improve fluency

Positive	Negative
<u>Bridget</u> [I like it] because you get to type in your own thing and you're allowed to tell it forever,	<u>Amanda</u> I found it hard to try to look at the screen and talk into it [the microphone] at the same time.
<u>Bridget</u> [Recording my voice helps] with the expression, because sometimes I think, 'I don't like that!'	
<u>Monique</u> [I learnt that] you've got to be fluent or it won't sound that nice.	
<u>Monique</u> [Learning to 'phrase' helps] because you just read some, then you get a little time to take your breath - because sometimes sentences are too long.	
<u>Tamara</u> It was fun.	

Table 8.11. shows the facilitative and inhibitive factors observed when the students created electronic storybooks as a means of improving oral reading fluency. Once again, it can be seen that these are similar for each of the students.

⁸¹ These could be made without narration and highlighting, which the students would construct.

Table 8.11. Facilitative and inhibitive factors associated with creating electronic storybooks as a means of improving oral reading fluency

Facilitative Factors					Inhibitive Factors														
	Amanda	Tamara	Monique	Bridget		Amanda	Tamara	Monique	Bridget										
The student was competent in using computers.					There was insufficient time for the student to work on the electronic talking book.														
The student was motivated to engage in the activity.					The student did not like hearing her own recorded voice.														
The student referred to recorded representations of her oral reading (visual 'waveforms' and sound recording on the computer) to help her monitor her oral reading fluency.					The student engaged in mouse, keyboard and microphone 'battles' ('battles for control').														
Using a pre-written story and illustrations saved time.	Y	Y	Y	Y	The student had limited access to computers.														
The student quickly learnt how to use the software.	Y	Y	Y	Y	The student spent 'too much' time (according to the teacher) experimenting with effects														
Deciding where to place text highlighting encouraged the student to discuss phrasing and expression.					The student found it difficult to read from the computer screen and record her narration simultaneously.														
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">KEY</th> </tr> </thead> <tbody> <tr> <td>Never observed</td> <td></td> </tr> <tr> <td>Sometimes observed (1 to 5 times)</td> <td></td> </tr> <tr> <td>Often observed (6 or more times)</td> <td></td> </tr> <tr> <td>Observed</td> <td>Y</td> </tr> </tbody> </table>	KEY		Never observed		Sometimes observed (1 to 5 times)		Often observed (6 or more times)		Observed	Y					The student did not know the 'language' of computers or fluency.				
	KEY																		
	Never observed																		
Sometimes observed (1 to 5 times)																			
Often observed (6 or more times)																			
Observed	Y																		
					The student's keyboarding skills were limited.	Y	Y	Y	Y										
					There were occasional 'technical hitches'.	Y	Y	Y	Y										

Returning to IMMARR

Upon returning to IMMARR, we decided to use *Reading for Literacy* (2000; 2001) and *PM Storybooks Silver* (1998), as these programs featured a relatively small amount of animation and used Australian narrators¹². Catherine Williams, the teacher, approved of the activities in these programs, such as the cloze activity and the punctuation activity in *PM Storybooks Silver* (1998), as she thought these would benefit the students' reading generally and therefore their fluency. Despite our earlier doubts about the value of reading aloud, the students were asked to 'soft read' along with the computer narration, as Catherine was of the opinion that these particular students needed to practise reading aloud.

Similar types of problems arose as in the earlier implementation of IMMARR, with the main difficulties being the fixed speed of the narrations and getting sufficient access to the computers. Other features of the software also proved to be frustrating. For example, at one point, Amanda started doing the letter writing and story-mapping activities before reading the text, as she thought they were stand-alone activities. This may be partially explained by the fact that many of the instructions in *Reading For Literacy* (2000) are given orally and are not reinforced in writing. Some students do not seem to attend to and comprehend oral instructions. Also, only one narrator was used in the CD-ROM, which the students found somewhat dull. Despite these limitations, Catherine preferred this software to *Reader Rabbit's Reading Development* (1997) software and the *Living Books* software and reported that she wished we had started with this software at the beginning of the study. Some of her comments about using IMMARR to help improve students' oral reading fluency are displayed below (Table 8.12.).

Table 8.12. Catherine's comments about IMMARR

Positive	Negative
The software was fantastic.	(They prefer repeated readings of traditional texts). We do that within one afternoon and there's a goal - simple as it might be. It's within the one session and I suppose that they can see the feedback straight away.
I think repeated reading is fantastic - I'm in love with it. I mean - you've reintroduced me to it. I've	The girls were always interested in the other ones the electronic storybooks other students were

¹² It seemed to us that Australian accents and intonation patterns might be slightly easier for these Australian students to understand and replicate.

used it before but it just really benefits the students that really struggle and I think that's fantastic.	reading).
Putting them in front of the computer, we're actually testing them but they don't know. I know that they'll do it twenty million times and then when they get to a test and they can't do it.	

In addition, comments from the students were sought. In Table 8.13, are some of their thoughts about using JMMAAR for improving their oral reading fluency.

Table 8.13. Student comments about JMMAAR

Positive	Negative
Tamara I like it because you get to go at your own speed with some of the books, like you can turn the page whenever you want.	Bridget [I didn't like it] when you had to turn the page and it wouldn't go to the next page.
Monique Umm...the reading on the computer is, I think, fun because you get [pause] because when it gets, when you do the highlighting, you know where they're reading with you. Like, sometimes when you read off a piece of paper [you lose your place].	Monique I wish you could turn the page easier, like just click, instead of clicking on that little thing ...
Amanda [I like the highlighting] because when you're reading, like, I always read where I'm reading ... if I've got a big paragraph to read or something, and so with the highlighting, it's better because you know where you're reading ... you know where you're up to.	Amanda Err ... I don't really like the voice because sometimes when I'm having trouble it keeps on going.
Bridget I liked doing it really, really fast without anybody know wise	

The Assessment Results

In this section of the chapter the results the students achieved in the NARA and the Multidimensional Fluency Scale after the interventions are discussed, even though the main foci of this study were the facilitative and inhibitive factors, and the unexpected outcomes that emerged. These will be discussed further in Chapter Nine.

It must be noted that the postintervention NARA was administered under less than ideal conditions at the end of the school day when the students were relatively tired and the surrounding rooms were not as quiet as was desirable. Also, the teacher, Catherine Williams insisted on administering the test in order to enhance her ability to assess students' reading ability. When listening to the tape recording, I observed that she had not usually supplied unknown words to students after a five second silence (as she preferred them to work words out for themselves). Because of

this, the NARA results may not be valid. As the end of the school term was approaching, there was no opportunity to administer this test at a different time, under better conditions. The poor conditions and failure of the teacher to supply the unknown words could have influenced the students' performances. About the results in general, Catherine said:

I was disappointed with Bridget and Amanda's results - I don't think they really reflect the actual progression that I've seen. The Neale [NARA] might not reflect actual improvements in expression, and they might have been nervous. Even so, they're still coming within the acceptable age range - both of them.

I think the Neale ... was not necessarily a comprehension test but it was also a memory test.

Amanda

According to the NARA⁸³, Amanda's accuracy, rate and comprehension had decreased (see Figure 8.19.), however, according to the Multidimensional Fluency Scale her phrasing had improved, although it is possible that her scores could have decreased further without the intervention, as it is common for the reading performance of students who experience reading difficulties to decrease over time, relative to students without such difficulties (Stanovich, 1986). However, her rate had increased, if calculated only to the reading level she had reached for her previous test.

⁸³ The validity of the NARA assessment was compromised by the way in which the teacher carried out the assessment.

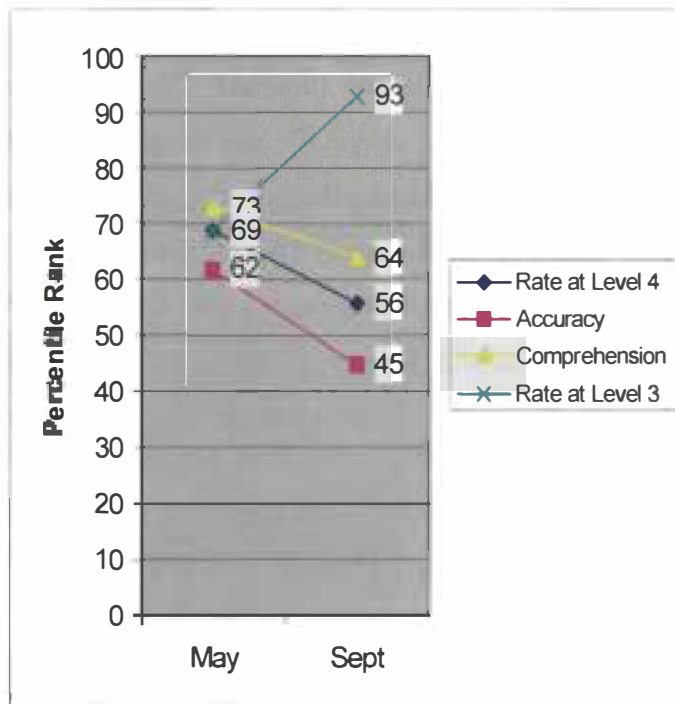


Figure 8.19. Pre- and post-intervention results of the NARA: Amanda

Tamara

According to the NARA⁸⁴, Tamara's comprehension improved considerably and her accuracy improved slightly (see Figure 8.20.), although her rate decreased. This could be explained by the fact that she appeared to have begun to read for meaning instead of merely racing through texts, decoding words. According to the Multidimensional Fluency Scale, her phrasing had improved substantially, although her smoothness had not changed. Also the teacher, Catherine Williams, stated that Tamara's reading confidence had increased greatly.

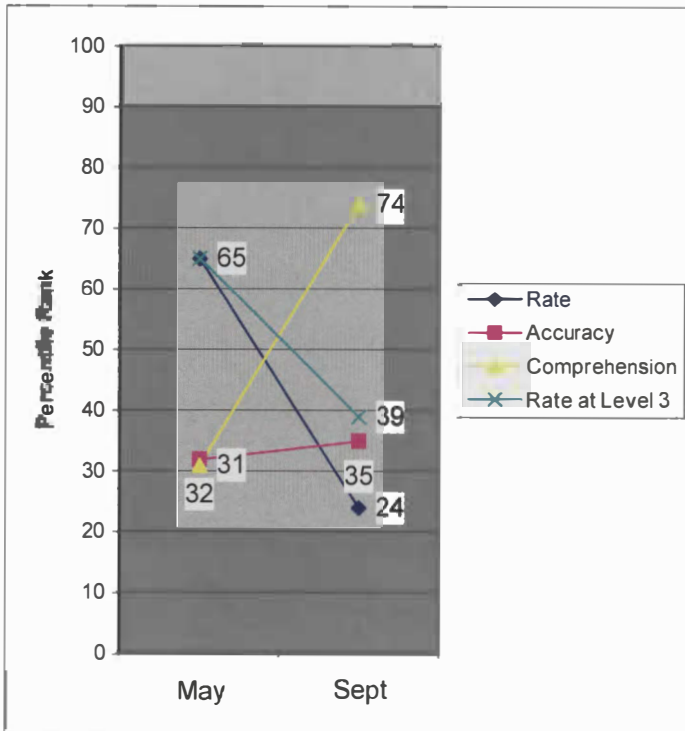


Figure 8.20. Pre- and post-intervention results of the NARA: Tamara

⁸⁴ The validity of the NARA assessment was compromised by the way in which the teacher carried out the assessment

Monique

According to the NARA⁸⁵, Monique's rate had improved considerably and her comprehension had improved slightly (see Figure 8.21.). Her accuracy had decreased slightly. According to the Multidimensional Fluency Scale, her phrasing had improved, as had her smoothness.

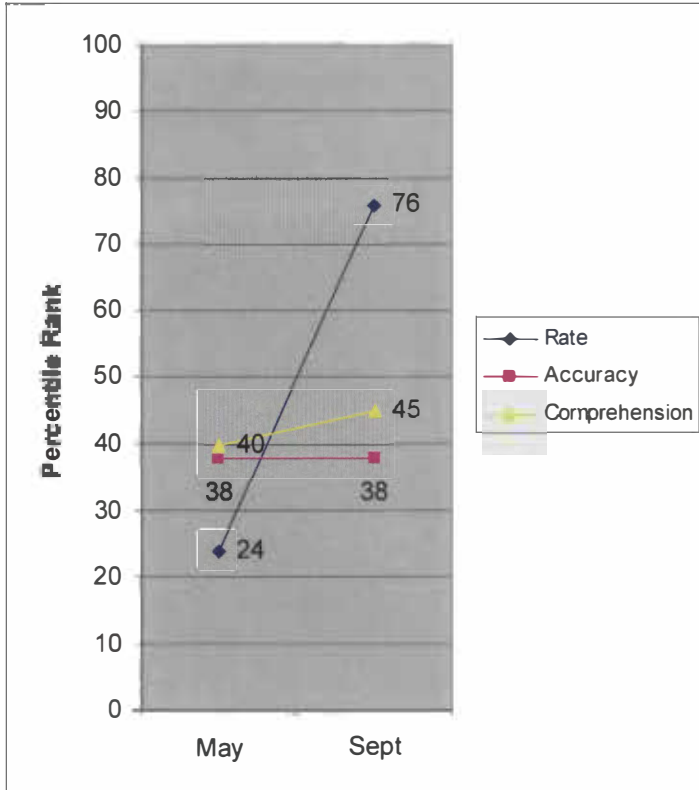


Figure 8.21. Pre- and post-intervention Results of the NARA: Monique

⁸⁵ The validity of the NARA assessment was compromised by the way in which the teacher carried out the assessment.

Bridget

According to the NARA⁸⁶, Bridget's rate had improved slightly, although her comprehension and accuracy had decreased (see Figure 8.22.). The Multidimensional Fluency Scale showed that her pace had improved, although her smoothness and phrasing had not changed. Catherine commented:

Bridget's a bit of a tricky case, I think, because her actual oral speaking is slow and lacks phrasing itself, so it's difficult, and she'll need a lot of this phrasing.

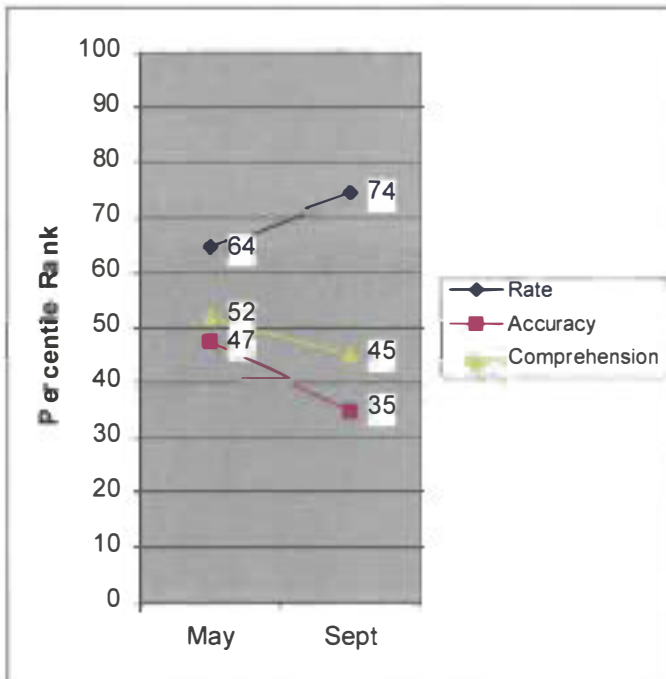


Figure 8.22. Pre- and post –intervention results of the NARA: Bridget

Table 8.15. constitutes an overview of the students' results on the Multidimensional Fluency Scale. Shading in the appropriate cell marks improvements in a particular dimension.

⁸⁶ The validity of the NARA assessment was compromised by the way in which the teacher carried out the assessment.

Table 8.15. Post intervention results on the Multidimensional Fluency Scale (St Clair's Year 4)

	Text	Pace/Rate	Smoothness	Phrasing	Teacher Comments
manda	Text: Circus Level 3 Score: 7/9	Uneven mixture of fast and slow.	Occasional breaks in smoothness caused by difficulties with specific words and/or structures	Generally well phrased, mostly in clause and sentence units, with adequate attention to expression.	Still occasional run-ons. Generally better pace, fluency and slight improvement in expression.
mara	Text: Circus Level 3 Score: 7/9	Uneven mixture of fast and slow.	Occasional breaks in smoothness caused by difficulties with specific words and/or structures	Generally well phrased, mostly in clause and sentence units, with adequate attention to expression	Decoding slows the smoothness/pace down. However, after repeated reading there is a noticeable improvement due to her awareness of the text.
onique	Text: Circus Level 3 Score: 7.5/12	Uneven mixture of fast and slow.	Between the two categories: Occasional breaks in smoothness caused by difficulties with specific words and/or structures, and: Generally smooth reading with some breaks, but word and structure difficulties are resolved quickly, usually through self-correction	Generally well phrased, mostly in clause and sentence units, with adequate attention to expression	Expression lapses mid-way to end of reading text. Certainly an initial attempt at expression.
idget	Text: Circus Level 3 Score: 7/12	Uneven mixture of fast and slow.	Several 'rough spots' in text where extended pauses, hesitations, etc., are more frequent and disruptive.	Frequent two and three word phrases giving the impression of choppy reading; improper stress and intonation that fails to mark the ends of sentences and clauses.	Still occasional run-ons. Generally better pace, fluency and slight improvement in expression.

 = Indicates improvement in this dimension

Catherine concluded that:

The girls have benefited enormously from participating in this project, namely in their enthusiasm to read more. Due to their increased fluency in reading, their comprehension has developed - particularly at the inferential level.

Table 8.16. outlines the inhibitive and facilitative factors overall, as Catherine saw them. These will be further discussed in Chapter Nine.

Facilitative and Inhibitive Factors

Table 8.16. Facilitative and Inhibitive factors: St Clair's (Year 4) as Identified by the classroom teacher.

Facilitative factors	Inhibitive factors
The software is fantastic, I think it's great but the girls were always interested in the other ones.	I suppose the inhibitive would be just setting it up on the computers, just installing it, just the basic practicalities of installing it. With some of them you had to change the properties. And perhaps also that they had different stories and they were always interested in the others ... it was always the grass is greener on the other side. Perhaps if they'd had the same stories it might have been different - it might not have been pitched at their level, but ...
It was certainly motivating. It was just great, and the speaking element was terrific and the activities at the end were great - just reinforcing their understanding of it all.	We've only got three computers in the classroom, although we have used your laptop whenever possible, which always leaves one of the 4 on the outer.
The variety that was going on kept them interested, they looked forward to it ... and certainly making 'Me and Cherie', they loved that.	Although it [fluency] was being modelled, they weren't actually reflecting on their own performance.

Unplanned Outcomes

No unplanned outcomes were detected, apart from the four students beginning to see themselves as 'experts', and an increase in their self-esteem.

Catherine noted:

The girls [other girls in the class] saw the CDs over there and they said, "Can we give this a go?" and I said, "Oh, yes, of course you can!" and I would say to the girls [participants], "Oh, you're the experts, you show the others how to use it," and they liked that because they got the chance to kind of shine and in the reading area they're not the shining ones, so it was nice for them. In an indirect way they became tutors, so that was the peer tutors there and I thought that was really good. And their enthusiasm to read, when it comes to silent reading time after lunch, they just jump on a book or jump on the computer to read a story - but again as I said they didn't do that every day, which is a shame, and as you say it really needs to happen for half an hour every day

Establishing Preferability

As noted in the previous chapter, there are several difficulties inherent in establishing preferability, not least the problems associated with assessment and the attribution of any gains to the intervention. Also, personal values, beliefs and preferences come into play, which make it difficult to make generalisations. However, using the dimensions of efficiency, effectiveness and appeal (Reigeluth & Frick, 1999), it is possible to summarise the preferability of the IMM-based strategies compared to 'traditional' strategies for enhancing oral reading fluency. Nevertheless, caution must be exercised as evaluating what may be essentially incomparable strategies could yield spurious conclusions.

Table 8.17. Preferability

Efficiency	Catherine did not think that the creation of electronic storybooks was time-efficient, although she thought that IMMARR was time-efficient because it provided students with 'individual' attention that she personally would not have had time to provide.
Effectiveness	It was difficult to judge the relative effectiveness of the two strategies because they were combined in the intervention and separate assessments were not undertaken. Post-intervention assessments were administered not strictly according to standardised instructions. However, Catherine stated that, according to classroom assessments and observations, she had noted improvements.
Appeal	The creation of electronic storybooks seemed to be the most appealing of the two strategies for the students, whilst the IMMARR was the most appealing to Catherine, the teacher.

Conclusion of Chapter

The teacher clearly saw IMMARR as preferable to traditional repeated readings in its efficiency, effectiveness and appeal, whereas the students themselves found the creation of electronic talking books more appealing than IMMARR. This illustrates that the notion of 'appeal' is highly subjective.

In terms of effectiveness, the teacher thought that the IMM-based interventions had resulted in increased achievement levels for all of the students, although the standardised tests did not necessarily show this. This importance of classroom-based assessments should not be ignored in formative experiments, as these can often measure dimensions that are 'missed' by standardised tests.

The formative experiment in Catherine Williams' Year 4 class raised many facilitative and inhibitive factors, as described throughout this chapter. These related primarily to shortages of appropriate software and hardware and also to the students' interactions with the software. Although it was possible to respond to some of these factors, it would have taken much longer than two school terms to satisfactorily resolve the issues that arose and to modify interventions until they seemed to achieve the required outcomes. It must be noted that, even then, many of the issues could not have been resolved within the classroom context as they were to do with software limitations, technology limitations and time limitations.

The teacher, Catherine Williams, claimed to have learnt a lot throughout the study, both in terms of technology and its applications to help children who have literacy difficulties, and in the processes of identifying student strengths and needs and in thinking about appropriate instructional strategies to further their learning. She also went through a valuable process of reviewing her existing practices and their underlying rationales.

Catherine tended to plan carefully what kinds of understandings she wanted her students to construct and what processes she wanted them to go through in order to do this. She tended to feel uncomfortable in circumstances where she was not aware of what, why and how the students were learning. She was also extremely conscious of 'efficiency' and preferred to find the most time-effective ways of meeting her pre-defined objectives.

CHAPTER NINE

ADDRESSING THE RESEARCH QUESTIONS

In the previous four chapters, what happened in each of the participating classrooms when the teachers started to use IMM to assist students who experienced reading difficulties was described and discussed. As is required by the formative experiment design (Reinking & Watkins, 2000), we followed a cycle of planning, implementation and evaluation of IMM-based innovations. Inhibitive factors, facilitative factors, planned and unplanned outcomes were identified and analysed throughout the cycle, and some modifications to innovations were made, based upon these factors. The research questions of this study address these issues.

The four cases were complex and differed in several important ways. Variations included the teachers' prior experience with and attitudes towards ICT and IMM, the resources available, the selected pedagogical goals, and the innovations and characteristics of the participating students. It is therefore hardly surprising that some of the facilitative and inhibitive factors that emerged also varied, although many factors were common to all four cases.

In this chapter, the research questions are addressed with reference to the four participating classrooms, focusing on the facilitative and inhibitive factors as well as the unplanned outcomes that emerged. These are discussed with reference to existing perspectives and explained in terms of an emerging theoretical framework in Chapter Ten. Finally, how the preferability of IMM-based strategies over traditional strategies for students with reading difficulties might be determined is considered.

Research Question 1

How do the participating educators typically assist students who experience reading difficulties, and what role does Interactive Multimedia (IMM) play in this?

Prior to the commencement of the study, the four participating teachers used a range of techniques to help students who experienced reading difficulties. The following factors seemed to influence the teaching strategies they selected:

1. **The perceived reading difficulties of the students.** Linda Harris, for example, saw her students as lacking in "basic skills", such as grapho-phonetic knowledge and a bank of high frequency sight words, and consequently relied mainly on a teacher-centred instructional approach to teach them such skills. Sarah Fox saw the participating students in her class as lacking in comprehension skills and motivation, so responded by giving them as much one-to-one support as she could in completing reading tasks set on a whole class basis. She also encouraged peer support. The two classroom teachers at St Clair's, Nicole Nielsen and Catherine Williams, saw oral reading fluency as an area of need for the participating students, so had been requiring them to read aloud together on a regular basis. This was a highly valued outcome at St Clair's and tape recordings of children's oral reading were sent home regularly for parents to listen to.
2. **The perceived personal characteristics of the students.** Student characteristics such as personality, motivation and interests also seemed to influence the choices teachers made when catering for students with reading difficulties, for example, Sarah Fox observed that Zara was "lacking in self-esteem" and was "unmotivated". She therefore designed activities that were authentic, holistic and appealing. Zara would participate in extra conferencing with Sarah to help her successfully complete the activities. Linda Harris saw Andrew as somewhat "lazy" and unmotivated, so tried hard to find reading topics that might interest him.
3. **Teacher's repertoire of strategies.** Teacher knowledge of strategies and when to apply them, as well as the availability of necessary instructional resources, seemed to be a determining factor in the way teachers catered for students with learning difficulties in reading. For example, Catherine

Williams and Nicole Nielsen had larger stores of resources at their disposal than did Linda Hanis, who often resorted to making her own. Teachers seemed to use a 'repertoire' of strategies that was somewhat restricted. For example, Catherine Williams had used the repeated readings strategy in her early teaching days but had since "forgotten" about it. Neither of the teachers at St Clair's College, or Sarah Fox at Morland Primary School, had heard of the strategy of teaching students 'chunking' to promote fluency and comprehension.

4. **Teacher beliefs, styles, habits and 'intuition'** (Atkinson & Claxton, 2000; Farstrup, 2002). It became apparent that the participating teachers sometimes selected instructional activities according to their personal beliefs about and definitions of literacy, what they had become accustomed to, and in response to their 'hunches' about what might work for students, as well as what the students might enjoy. This will be discussed further throughout this chapter.
5. **School-wide factors.** Factors such as the availability of support and/or whole school programs had an impact upon the kinds of programs teachers were able to offer. In some schools, programs such as the structured phonics program, THRASS (Teaching Handwriting, Reading and Spelling skills) (Davies & Ritchie, 1996) were available on a whole-school basis, whereas in other schools responsibility for assisting students with difficulties rested to a greater degree with individual classroom teachers. For example, Linda Fox at Hillview Primary School had access to a support teacher for a short period each week, but the support teacher was, in Linda's opinion, ill-equipped to assist students who experienced reading difficulties.

In the following section, how each of the four participating teachers typically helped students who experienced reading difficulties and the role IMM played in their teaching, is summarized.

Catherine Williams

Catherine Williams at St Clair's College utilised a fairly wide range of strategies to assist Year 4 students who experienced literacy difficulties, depending on the particular area she was targeting. With reference to fluency, for example, she used repeated readings, Neurological Impress Method (NIM), and student self-

monitoring using tape-recorded oral readings, as well as encouraging students to practise oral reading. In addition, students were divided into small groups for reading lessons, in which such strategies as guided reading and shared book were used. A support teacher was available to teach some of the groups. She was able to send selected students for THRASS sessions with another teacher.

Although the students in Catherine's class used computers for a range of literacy purposes, Catherine had only recently begun to use IMM to assist a student with difficulties; the student was asked to read aloud along with computer narrations of short texts. This was a variation of the NIM method.

Nichole Nielsen

Like Catherine Williams, Nichole Nielsen, also of St Clair's College, used a range of strategies for helping Year 5 students who experienced reading difficulties. THRASS was used to help students improve their knowledge of grapho-phonetic relationships, and students were grouped according to ability in order that they could receive appropriate teacher support and instruction. However, her teaching strategies for students with reading difficulties did not differ from her standard classroom strategies; it was the degree of support offered that differed.

IMM was not used specifically to assist students with reading difficulties, although all students often used the Internet, *Inspiration*, *Word* and *PowerPoint*.

Linda Harris

Because a large proportion of the students in her Year 4 class were experiencing literacy difficulties, Linda Harris at Hillview Primary School primarily used structured whole-class instruction of "basic facts", such as grapho-phonetic relations, as a means of assisting such students. Linda was of the opinion that it was necessary to teach the students a degree of decontextualised 'code-breaking' (Luke & Freebody, 1997), as she saw this as a prerequisite for reading with comprehension, purpose and fluency.

In addition to this, students with difficulties read to Linda on a one-to-one basis as often as possible. In this context, she would use the 'pause-prompt-praise' strategy (McNaughton, Parry, & Robinson, 1987) and teach grapho-phonetic relationships and comprehension strategies according to individual needs. However,

time limitations impeded the efficacy of this approach. Furthermore, as previously mentioned, the support teacher allocated to assist Linda teach the students with literacy difficulties was not, in Linda's opinion, sufficiently qualified nor experienced to be of maximum assistance.

Prior to this study, IMM had not been used at all by Linda to help the students with literacy difficulties. Indeed, as described in Chapter Seven, Linda stated that she was in need of professional development to help her use computers; she had minimal knowledge of the hardware and software in her classroom and how to use it.

Sarah Fox

Sarah Fox at Morland Primary School carried out minimal structured instruction with her Year 4/5 class, but instead favoured conferencing with individual students and providing instruction when the need arose, during the context of holistic, meaningful literacy activities. Students with reading difficulties received a higher degree of teacher support in the form of over-the-shoulder assistance.

Although students used computers for various literacy purposes, IMM was not used in any distinct way to assist students with literacy difficulties in Sarah's classroom.

Issues

From the above descriptions, it is apparent that the four participating teachers had diverse philosophies, students, and strategies for teaching students with literacy difficulties. Moreover, they had different means of identifying students with literacy difficulties and different conceptions of what constituted a learning difficulty in the literacy area, which often stemmed from their personal definitions of literacy. Some of the participating students would not have been defined as experiencing literacy difficulties outside their particular school/classroom context. Indeed, as previously mentioned, two of the students in Sarah Fox's class (Mitchell and Zara), achieved high scores on the NARA reading test, particularly in the area of comprehension. Yet they were identified by Sarah as not achieving in classroom activities. Further, some of the students at St Clair's would not have been identified as experiencing reading difficulties in a classroom such as that of Linda Harris, which contained

many students who were achieving well below levels expected for their age and year level.

In Western Australian primary schools there are apparently no reliable, standardised means of identifying students with literacy difficulties and many students may be misidentified, as there is no consistency or quality of the identification process in many instances. The issue of definition of literacy difficulties/disabilities and the identification of students suffering from such difficulties is complex and confused. The Australian situation differs from that of the United States, where funding and exclusinn from state testing are dependent on a child being officially diagnosed as suffering from a reading 'disability' (Rnhl & Rivalland, 2002). In Australia, learning 'disabilities' tend to be seen as restricted to a small group of students with *persistent* problems, whereas the term 'difficulties' describes the experience of a wider group of students who 'do not respond well to their classroom programs' (Elkins, 2002, p.1).

A second insight that may be gathered from the way the teachers identified students in their classes as experiencing difficulties is that they often tended to 'compartmentalise' literacy and identify students as experiencing difficulties in certain *aspects* of literacy. They perceived that literacy ability could be 'situational', or that there were different 'literacies' for different purposes (Luke & Freebody, 1997). However, this tendency may have been amplified by the requirement in formative experiments to focus on pedagogical goals.

Having outlined the ways in which the four teachers used IMM to assist students they had identified as experiencing reading difficulties, it seems necessary to discuss the four teachers in terms of the 'evolution' of their instructional beliefs and practices in an ICT context (Dwyer et al., 1990). This 'evolutionary scale', showing the locations of the four participating teachers, can be illustrated diagrammatically and is shown in Figure 9.1. This scale, and other conceptions of teacher evolution or development, is discussed fully in Chapter Three.

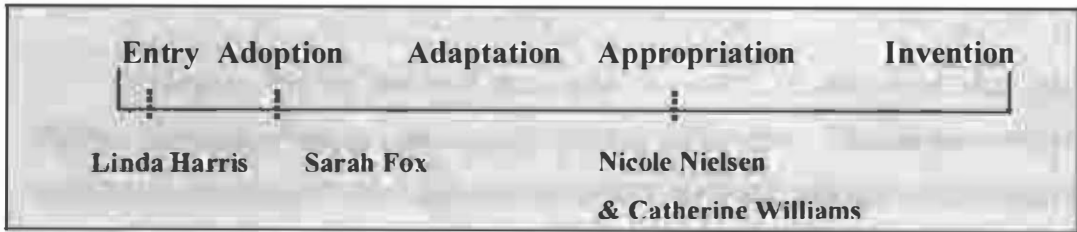


Figure 9.1. Scale showing evolution of teachers' beliefs and practices in relation to using ICT in the classroom to facilitate reading (Dwyer et al., 1990)

Catherine Williams and Nicole Nielsen used ICT for a broad range of purposes and were highly competent and confident in the use of computers. Nevertheless, they had barely begun using IMM to assist participating students who had reading difficulties, although many of the strategies used on a whole class basis, such as using *Inspiration* (2000) to construct story maps, were possibly as beneficial to these students as they were to students without such difficulties. Catherine and Nicole could be said to be in the 'appropriation' stage (Dwyer et al., 1990) of the scale in terms of using ICT in their classrooms to facilitate student learning. That is, they were extremely comfortable with using software for a range of purposes and felt a sense of 'ownership' of it, but had not become 'inventive' to the extent that they used it in novel ways for novel purposes, for example to help such students with reading difficulties.

Sarah Fox could be said to be at the 'adoption' stage in terms of using ICT in her classroom. That is, she used technology in a range of ways but had not reached the 'adaptation' stage, in which the teacher adapts the use of software and teaching strategies to suit her purposes. Sarah had not adapted the use of software to facilitate the learning of students with difficulties in reading.

Linda Harris was at the 'entry' stage of development. That is, she was not knowledgeable enough about the hardware and the software available in order to be able to adapt its use to assist students with reading difficulties. None of the four teachers had reached the 'invention' stage of teacher development with reference to using ICT in this context.

Summary of Research Question 1

The participating teachers employed a variety of techniques for helping children they perceived as experiencing reading difficulties. Factors that influenced their teaching included: their perceptions of the students' reading difficulties; their perceptions of the students' personal characteristics; their access to reading strategies and resources; their beliefs, habits, styles and intuitions as well as school wide factors. Because the teachers had some difficulties diagnosing the reading needs of their students, and appeared to have limited knowledge about what strategies might be applicable to each student's needs, their methods of assisting such students often appeared to be somewhat unfocused.

With reference to the use of ICT (and more specifically, IMM) to assist children who experienced reading difficulties, prior to the study the four participating teachers used such technology to varying extents, with Linda Harris using it rarely, Sarah Fox using it fairly often for a limited range of activities, such as searching the WWW, word-processing and desktop publishing, and Nicole Nielsen and Catherine Williams using it extensively in a range of curriculum areas.

Only Catherine Williams had started to use IMM to facilitate the reading of students with difficulties in this area; she had commenced using short electronic texts as a context for paired readings with Monique, one of the students who participated in this study. However, this had commenced as a result of an initial meeting between Catherine and myself to discuss this study and had thus only recently been added to Catherine's repertoire.

Research Question 2

How could the participating educators use a 'formative approach' to plan, implement, evaluate and modify IMM-based activities and programs to help students who experience reading difficulties achieve particular pedagogical goals?

Sub-question to guide the main question:

- a) What inhibitive and facilitative factors might educators encounter when planning, implementing and evaluating IMM-based innovations for students with reading difficulties?

The Identification of Facilitative and Inhibitive Factors

In order to answer this question precisely, the inhibitive and facilitative factors that emerged during the formative experiments have been categorised according to where they occurred on the 'planning-evaluation cycle' (modification of Trochim, 2002) . See Figure 9.2. for a diagram of this process and also Chapter Four, where its use in this study is justified.

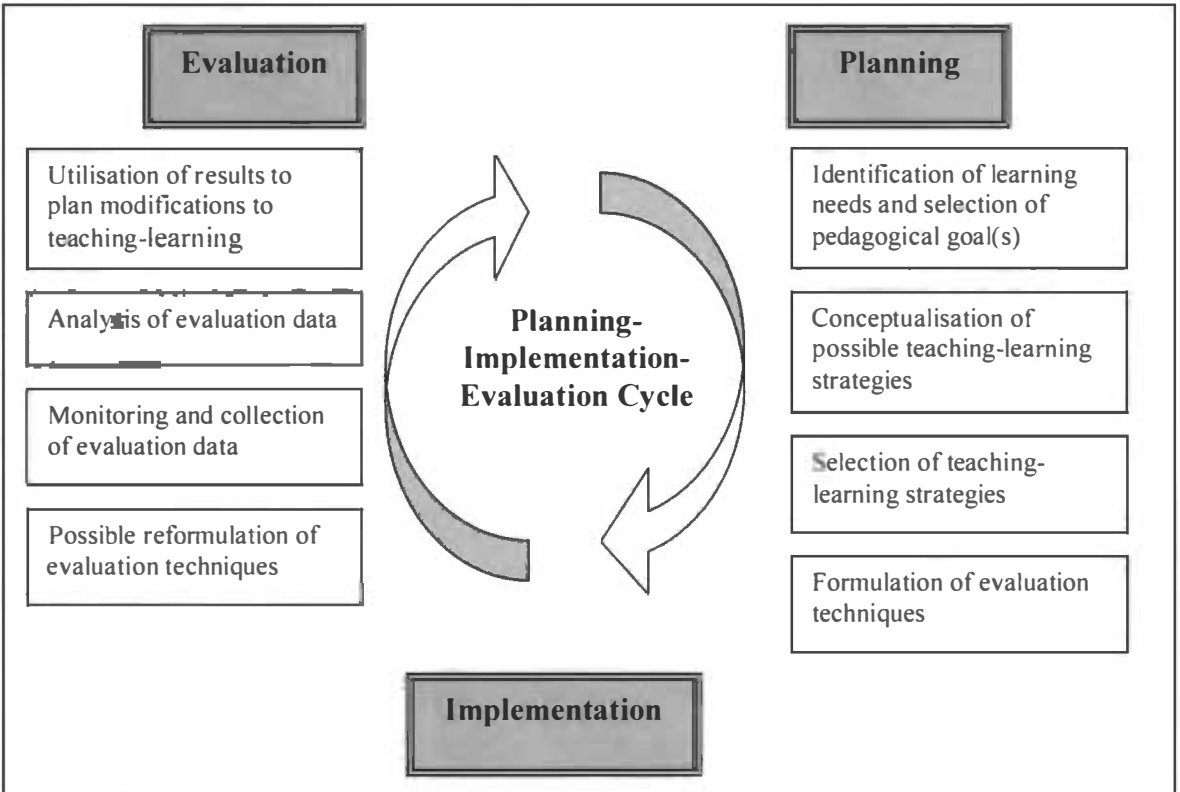


Figure 9.2. Diagram of the Planning-Implementation-Evaluation (PIE) Cycle (modification of Trochim, 2002).

It is acknowledged that this cycle as illustrated is a simplification of the process, and not able to represent the numerous recursions and confusions. Figure 9.3. shows a metaphor of the complexity of the processes, which indicates that they are often iterative and intermingled. Nevertheless, the cycle as illustrated in Figure 9.2. is used here in order to bring clarity to the identification of facilitative and inhibitive factors.

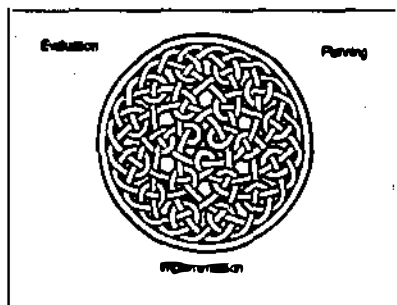


Figure 9.3. Planning-evaluation cycle. Adapted from Smith and Ragan (1999, p.8)

Several general observations can be made about the discovery of facilitative and inhibitive factors. These are outlined below.

Five Observations about Facilitative and Inhibitive Factors

1. Inhibitive factors were far easier to identify than were facilitative factors, as they constituted highly visible 'spanners in the works', whereas the facilitative factors often invisibly 'oiled the works'.
2. A facilitative factor can often be conceived of as the *absence* of an inhibitive factor. For example, the lack of time was a major inhibitive factor in many situations during the study. Having plenty of time would have been a facilitative factor.
3. On some occasions, the relationship between facilitative and inhibitive factors can best be expressed by a facilitative-inhibitive continuum. For example, the amount of prior experience teachers and students had in using computers could be either an inhibitive or a facilitative factor, depending on whether the amount of experience.
4. In some circumstances a particular factor may be facilitative and in others it may be inhibitive. For example, the students' eagerness to use the computer was facilitative in many respects, but it was inhibitive at other times when they were reluctant to carry out related paper-based activities.

5. To some extent, allocation of factors as facilitative or inhibitive is a subjective and personal process. For example, Nichole Nielson at St Clair's College saw computer narrations in non-Australian accents as an inhibitive factor, whereas Linda Harris saw this as a neutral factor.

In the next section of this chapter, I describe the facilitative and inhibitive factors that were apparent in each phase of the formative experiments.

The Planning Phase

Identification of Reading Needs



The four participating teachers experienced some problems in identifying students' learning needs. Further, structures were not always in place to assist them in identifying students who experienced difficulties. Consequently, identification often seemed to be an idiosyncratic process, which depended to some degree on the teachers' and schools' priorities and standards. For example, at St Clair's, oral reading fluency was deemed to be highly important, whereas at Morland, comprehension was seen as being the defining factor of a 'good reader' and fluency was seen as an aesthetic aspect of reading. If Claudia had been a student at Morland Primary School instead of St Clair's, it is unlikely that she would have been categorised as experiencing difficulties in reading. Indeed, at the government school she had previously attended she was not deemed to be a student who experienced reading difficulties.

Table 9.1. Facilitative factors in the identification of reading needs

		Nicole Nielson	Catherine Williams	Linda Harris	Sarah Fox
1)	The teacher possessed relevant background/theoretical knowledge about reading.	Yes	Yes	No	No
2)	Access to standardised test results.	No	No	No	No
3)	Access to previous school records.	Yes	Yes	No	No
4)	The use of informal assessment measures.	Yes	Yes	Yes	Yes

KEY:

	Never observed
	Sometimes observed (1-5 times)
	Often observed (6 or more times)

In cases where the teacher had a theory-informed hypothesis about the nature of the students' difficulties, the 'problem' was much more clearly defined and articulated. For example, Catherine Williams had a clear conception of her students' difficulties and had formulated theoretically based hypotheses about what strategies might help them. This gave the innovations in her classroom an unambiguous, rational direction, which in later stages of the cycle was beneficial in that implementation and evaluation were clearly focused.

The availability of standardised test results often appeared to help teachers confirm or disconfirm their prior conceptions of the problem through the provision of additional, normed information. For example, the results of benchmarking tests carried out in Years 3 and 5 in Western Australia were helpful to Nichole Nielsen, Catherine Williams and Linda Harris in that they supplemented these teachers' informal assessments. Results of other standardised test results carried out by the researcher, such as the NARA (Neale, 1988) and the ERAS (McKenna & Kear, 1990) also gave the teachers confidence in their informal assessments or prompted them to rethink them, and helped them theorise about the nature of the problem. However, these tests were not routinely administered in any of the schools due to lack of time in some cases and, in all cases, lack of expertise.

Nevertheless, Catherine Williams and Nicole Nielsen regularly administered other standardised tests, such as the TORCH test of reading comprehension (Mossenson et al., 1987), the St Lucia Graded Word Reading Test (Andrews, 1973) and the Holborn Reading Scale (Pumfrey, 1985).

Access to school records, such as school reports, psychologist's reports, parent-teacher interviews and test results, assisted some of the teachers in the conceptualisation of the problem. For example, at St Clair's comprehensive records were passed to teachers when students entered their class. This did not appear to be the case at Hillview or Morland Primary School.

At my suggestion, Catherine Williams and Nicole Nielsen used the Multidimensional Fluency Scale (Zutell & Rasinski, 1991), which they had not previously encountered, to help them assess the oral reading fluency of their students. After becoming familiar with it, they found it highly useful and recommended it to the other teachers in the school, who also began to use it as a tool for assessing oral reading fluency.

Table 9.2. Inhibitive factors in the identification of learning needs

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
1)	Insufficient time for teacher to carry out assessments.				
2)	Inadequate school records.				
3)	The teacher did not appear to have a clear conception about students' expected level of achievement.				
4)	The teacher did not possess/apply relevant theoretical knowledge of reading processes.				
5)	The teacher did not possess comprehensive knowledge of assessment measures and knowledge about diagnosis of reading difficulties.				
6)	Absence of a 'resource person' to assist in assessment process.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

In each of the four cases, the teachers stated that they did not have sufficient time in which to carry out standardised tests, particularly those that required individual administration. Thus, they did not have access to data that would accurately identify and diagnose students with reading difficulties. Furthermore, it seemed that records passed on to teachers when students came to them from other teachers (within or outside the school) were not always comprehensive and valuable. Also, as was the case of the teachers from St Clair's school, school reports from

other schools were not always helpful as they reflected the previous school's standards and expectations. For example, reports from her previous school stated that Monique had performed satisfactorily in the literacy area. Catherine Williams at St Clair's, who had a different set of expectations and standards, did not agree with this assessment.

As Walker (2000) has shown, it is difficult to design programs that effectively assist students who experience reading difficulties if the nature of their difficulties are inadequately identified and analysed.

As already mentioned, in several instances teachers were not certain that their informal assessments of the students' difficulties were accurate, and had no clear conception about what the child was or *could be* capable of. They were not sure whether the students were 'underachieving' in the sense that they were capable of achieving at substantially higher levels and merely needed an approach that would help them 'catch up', or if they were students who would always have literacy difficulties and would need ongoing support. They had little conception of whether the students had 'disabilities' or 'difficulties' in the reading area. This is, perhaps, not surprising because in the Australian educational context, a distinction is not generally made between these two types of reading problems (Elkins, 2002). The lack of this distinction made the teachers' task of evaluating and planning programs problematic. However, it was apparent that in some cases, records passed on to teachers when a student came to them from another teacher or school were not always comprehensive or valuable. For example, Linda Harris had received little information from previous teachers about the abilities of her students.

In some instances, teachers were not in possession of or not using appropriate theoretical knowledge about the reading process, and this impeded accurate identification and appropriate planning. For example, at Morland and Hillview, where all of the participating students were identified by their teachers as having difficulties in comprehension, the teachers concerned seemed to have limited hypotheses about why this may be so. As shown by several researchers, there are many different reasons for the breakdown of comprehension and, if possible, these reasons need to be identified and analysed (Pressley, 2000). Indeed, it is possible that two of the students (Zara and Mitchell) at Morland were experiencing both reading difficulties and giftedness and were thus 'twice exceptional' (Blacher, 2002).

Zara's poor self-concept and poor self-efficacy are classic characteristics of such students. However, neither the teacher nor the school system had investigated the possibility of Zara and Mitchell being 'twice-exceptional'.

The fact that the teachers who participated in this study did not have a variety of assessment measures (such as the NARA, the ERAS and the Multidimensional Fluency Scale) at their disposal prior to the study seemed to have led to inexact conceptions of what the students might be capable of. However, they did have comprehensive information about how the students were actually performing in the classroom context. Zara at Morland Primary School had been nominated as a student who had comprehension difficulties although, according to the NARA, she scored at the 83rd percentile for comprehension. Her score for accuracy was lower, however, at the 38th percentile, and her reading rate was at the 46th. She had a positive attitude towards reading, at the 90th percentile, and a high average receptive vocabulary, at the 84th percentile. Zara had not been performing well in the classroom context and, when presented with the standardised test results, her teacher Sarah Fox was surprised, as she had not considered Zara to be capable of such a high level of comprehension⁸⁷.

Linda Harris had never heard of the NARA (Neale, 1988), a standardised test widely used in Australia, whilst the other participating teachers, although they had heard of it, had never used it. Catherine Williams was keen to learn to use it and, indeed, used it to assist in the assessment of several of her students during the course of this study.

The teachers lamented the fact that they did not have access to a knowledgeable 'resource person' who knew what tests were available, how to judge their appropriateness and applicability, and how to administer them and analyse the results. Indeed, a survey of Australian Primary school principals (Rohl & Rivalland, 2002) showed that there were proportionally fewer trained specialist literacy teachers in Western Australia than in any other Australian state.

⁸⁷ As noted in Chapter 4, the NARA's comprehension questions are composed of approximately 50% literal questions and 50% inferential, apart from the level one text, which has only literal questions.

Issues

The four teachers who participated in this study, even Catherine Williams and Nicole Nielsen who had been using ICT in the classroom for a range of literacy purposes for several years, selected 'traditional' pedagogical goals. This may reflect the fact that their definitions of literacy had not sufficiently changed to accommodate new literacies or, if they had, such definitions may have been difficult to articulate and translate into practice. A second possibility is that the students with 'difficulties' were seen by the four teachers as needing to overcome difficulties in 'traditional' literacies prior to addressing difficulties in 'new' literacies. Also, and most importantly, the literacy-related curriculum documents usually referred to traditional pedagogical goals.

Conceptualisation of Possible Teaching-Learning Strategies



This appeared to be another area of difficulty for the four participating teachers. Because literacy is a large, complex field, it was often difficult to arrive at measurable, achievable pedagogical goals, especially as the teachers did not often seem to aim for discrete 'end states' or 'outcomes' but instead endeavoured to move students along complex, interrelated developmental continua⁸⁸, where discrete outcomes were not as apparent. Also, as mentioned in the previous section, teachers were not always certain about what difficulties the students were experiencing and why this was so.

Furthermore, when choosing pedagogical goals, it was necessary for the teachers to select those that seemed amenable to being accomplished through the use of IMM. This was necessarily problematic because of the teachers' limited knowledge of IMM and the software available.

Because it was difficult to arrive at pedagogical goals that seemed significant, appropriate and achievable, it was difficult to arrive at suitable strategies (even traditional strategies) that followed on from these. Choosing new strategies or choosing to present existing strategies through new media was thus bound to be problematic. Indeed, at St Clair's, IMM-based strategies were chosen first and then students were found who 'fitted' the strategy.

⁸⁸ In recent years, teachers in Western Australia have been asked to plan literacy programs in terms of pedagogical 'outcomes'.

Following are the facilitative and inhibitive factors identified that related to the conceptualisation of possible traditional strategies. It seemed necessary to conceptualise traditional strategies in order to determine whether they had been tried with the participating students, and to estimate their effectiveness. Furthermore, it was necessary to conceptualise these strategies because there was a possibility of presenting them using IMM. Also, it was important to be cognisant of these strategies in order to be able to modify them/diverge from them.

Here, the debate as to whether IMM is capable of merely presenting old strategies using new media (Clark, 1983) or capable of presenting entirely new strategies (Kozma, 1991) became relevant. The participating teachers, who were only just beginning to use IMM to assist students with reading difficulties, tended to prefer to use IMM to present old, tried and trusted traditional strategies. Because they were accountable to principals and parents, they preferred to minimise any actions they perceived as risk-taking.

In cases where the teacher had the time and inclination to re-examine and re-evaluate their existing strategies, it was easier to hypothesise about which IMM-based strategies might work for the individual students. For example, Catherine Williams discussed and reflected upon repeated readings (Samuels, 1979) and NIM (Heckelman, 1969) and decided that these strategies could be facilitated and enhanced if used in conjunction with electronic texts.

Table 9.3. Inhibitive factors associated with the conceptualisation of possible traditional teaching-learning strategies

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
1)	The teacher had limited knowledge of relevant traditional strategies.				
2)	The teacher had difficulties theorising about the students and linking theories with teaching-learning strategies.				
3)	The teacher used a restricted range of strategies to teach reading, particularly to students with reading difficulties.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

In some cases, teachers did not conceptualise a wide range of traditional strategies because they had not encountered them or because they had forgotten about them. For example, Catherine Williams at St Clair's College had learnt about repeated readings during her initial teacher training, but had not been accustomed to using the strategy and had not considered using it as a remedy for poor oral reading fluency. Indeed, she claimed to have 'forgotten' about it. Likewise, Sarah Fox and Nichole Nielsen had not been aware of the strategy of teaching students to 'chunk' words into larger units of meaning as a means of facilitating both fluency and comprehension.

The four teachers sometimes found it difficult to hypothesise about why students were experiencing difficulties and what strategies might assist them. For example, Sarah Fox had not fully conceptualised which aspects of comprehension her students were having difficulty in, and what the basis of this might be. This made it difficult to theorise about possible remedies.

The participating teachers often seemed to select strategies from their 'tool box' of strategies and did not apply these to novel situations or attempt to design, or even seek out, new strategies, even in traditional non-computerised contexts. This may have been because of the importance to them of classroom routines and rituals for classroom management (Maloney, 1997), and a shortage of time to reflect. Also, it may be explained by the necessity for teachers to be accountable to parents and school principals; it may have seemed safer to stick with tried and trusted strategies.

If teachers are not particularly inventive or risk-taking with reference to traditional strategies, it follows that they will probably have difficulties becoming inventive and risk-taking in computerised contexts. Indeed, teachers seem to build up a repertoire of practices, which can be defined as 'routine action' (Louden, 1991). Because of factors such as classroom pressures, and fear of failure, 'reflective action' and innovation are less frequent than 'routine action'.

Table 9.4. Facilitative factors associated with the conceptualisation of possible IMM-based teaching-learning strategies

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fole
1)	The teacher had good knowledge and understanding of traditional teaching-learning strategies and when to apply them.				
2)	The teacher had knowledge of students' educational needs.				
3)	The teacher demonstrated knowledge of pedagogical theories underlying software and the teaching-learning strategies they were based upon.				
4)	The teacher had a sense of autonomy.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

In order to conceptualise possible strategies in an IMM-based context, it seems that teachers need to have a thorough understanding of a range of traditional strategies and how/when to apply them. This knowledge was not always present. Participating teachers did not always have access to full knowledge about the child's abilities, needs and interests.

Knowledge of pedagogical theory underlying the software and its associated strategies was difficult to ascertain because teachers did not have time to fully explore the software and reflect upon it. Also, software producers did not usually supply comprehensive rationales with their products. As teachers were not always able to link theory to traditional strategies, it would perhaps have been unreasonable to expect them to be able to do this in far more complex IMM contexts.

Because IMM often incorporates multiple strategies, with an array of underlying theories, a single product can contain drill and practice and tuition as well as open-ended creative activities such as writing. These types of activities are all underpinned by different theoretical positions. The way a teacher decides to use

software can also affect the types of learning processes the students engage in, and thus the underlying theoretical positions.

At St Clair's college, there was a system of collegiality, which helped teachers in all areas of teaching, including the use of ICT in literacy. Teachers had formal 'sharing sessions' on a weekly basis, where they discussed strategies, resources, and students. Apart from this, there was a genuine collaborative culture, where teachers assisted each other in their practice. This was not the case in the other two schools.

It has been shown that where teachers do not feel a sense of autonomy to change their practices, but feel constrained by forces beyond their control, they are less likely to plan and implement major changes (Placier & Hamilton, 1994). The four teachers who participated in the study all mentioned constraints such as curriculum requirements, as well as parent, school and principal expectations, which reduced their sense of autonomy.

Table 9.5. Inhibitive factors associated with the conceptualisation of possible IMM-based teaching-learning interventions/strategies

		Nicole Nindlson	Catherine Williams	Linda Harris	Sarah Finn
1)	Finding and 'getting to know' software.				
2)	School funding limitations.				
3)	Identifying underlying theories and strategies in software and linking/comparing these to traditional strategies.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

Finding and getting to know appropriate technology can be 'overwhelming' (Bergen, 2000, p.1) and time-consuming, and this was certainly the case in this study. Perhaps the most significant inhibitive factor with reference to finding and getting to know software was the teachers' limited knowledge about available software.

They had limited knowledge about what software existed. This resulted from the fact that there seemed to be few comprehensive catalogues of existing educational software. For commercial reasons, suppliers and distributors often seem to 'push' particular software and leave other titles relatively unadvertised. In addition, commercial catalogue descriptions of software are often very brief and can be misleading (e.g. Ashton, 2000).

Various educational bodies, such as The Education Department of Western Australia, maintain software review websites, which teachers contribute to (see Appendix 5.2). These sites are relatively useful sources of information but are not comprehensive. Many useful titles are not included, perhaps due to the fact that participating teachers have not heard of them or do not know where to buy them. Furthermore, much software listed on international sites is not available from Australian suppliers. Although it can often be purchased online, this is not something any of the participating teachers had ever done.

The four teachers in this study engaged in various processes to source software. Catherine Williams, for example, tended to visit the state's major educational supplier and browse the shelves. She and Nicole Nielsen also relied on the school librarian and the ICT coordinator to find software. They both made frequent use of software available on the school intranet. Sarah Fox used some of the software that had been placed on the school's intranet by the principal and the IT coordinator. However, she had not found it necessary to seek out additional software for use in her classroom. Linda Hanis also used some of the software available on the school's intranet, but only a small proportion of it. In addition, she occasionally borrowed software from the school library.

During this study, the teachers largely relied on me to source potentially appropriate software. I used multiple strategies, such as browsing through computer magazines, attending conferences, reading educational journals, browsing around shops and educational suppliers, accessing software review websites, searching the WWW and 'asking around' (see Chapter Five).

Another difficulty in sourcing and getting to know software was the fact that it was often difficult to obtain software on a trial basis. Trial versions were often only available for 30 days, which was not always sufficient time in the context of a busy classroom. In other instances, trial software was not available at all.

Determining criteria to be used in evaluating software was also problematic during the study. The selection of criteria depended on many situational factors, such as characteristics of the users and desired outcomes, as well as the teacher's philosophies. Although there are many checklists, review forms and matrices available to help teachers evaluate software (Forgan, 2001; Geisert & Futrell, 2000; Hall & Martin, 1999; Inglis, Ling, & Joosten, 1999; Johnson, 2001; Jones & Paolucci, 1999), these have limitations (Squires & McDougall, 1994), such as limited validity across situations and the absence of important criteria (Downes & Fatouros, 1995). Teachers may thus have difficulty in choosing appropriate checklists and may need to tailor them to their particular needs and the particular situation. The participants of this study, due to a lack of time and teacher interest in this approach, did not use checklists.

Despite the above difficulties, there were some criteria that all of the participating teachers seemed to take into account when selecting software for students with reading difficulties:

1. The software needed to be 'fun' or enjoyable for the students. This was usually an important consideration from the students' perspective also (Goodison, 2002).
2. The software needed to be at an appropriate level of difficulty. However, the issues of difficulty and readability in an EMM context are complicated by the type and amount of the support offered by the software (McKenna, Reinking, & Labbo, 1997). Assessing the level of difficulty is not necessarily a straightforward process. To some extent it depends on the match between the software's features and the child's needs (see Appendix 1.1 for a discussion of readability in an EMM context).
3. The teachers usually preferred Australian software, as they thought that it would be more likely to address Australian curriculum requirements. They also thought that Australian accents and spellings would be beneficial to Australian students, especially in software with a phonics or spelling focus.
4. The participating teachers also preferred software that offered a degree of choice or flexibility or control by the students. For example, Catherine liked the *Reader Rabbit Reading Development Library* (1997) electronic stories

because they allowed the students to 'pause' narrations, allowing them to go back and reread a portion of text and to think about what they were reading.

5. All of the teachers tried to avoid software with a large amount of animation as they saw this as distracting and not educationally valuable. As has been pointed out by other authors, animation is often only loosely related to the text and adds little to the reader's comprehension (Collins et al., 1997).
6. The teachers were conscious of the price of the software and the breadth of its applicability. Whether or not it would be useful to a range of students was often a consideration.

With reference to trialling software, Catherine Williams and Nichole Nielsen were hesitant about installing it on their computers for this purpose because they did not want residual junk left on their system after uninstalling. Furthermore, it was at times technically difficult to install and uninstall such software, which deterred teachers, for example Sarah Fox and Linda Harris, from trialling it. In addition, technology coordinators occasionally disallowed the installation of certain software. At St Clair's, for example, students were not allowed to install multimedia authoring software on their laptops because of the hard drive space multimedia texts would occupy.

The schools involved in the study had limited funds available and were extremely careful about the software they invested in, although St Clair's College was slightly better resourced than the two government schools. In most instances, the schools had invested in open⁸⁹ software, which could be used as a tool in many different ways. They had purchased relatively little closed software, which was perceived to have fewer applications and less flexibility.

All four teachers had relatively little free time in which to analyse available software. This, coupled with their restricted knowledge of reading theories and strategies, particularly with reference to students with reading difficulties, made it difficult for them to ascertain the underlying theories and strategies inherent in

⁸⁹ Open software, such as word processing, multimedia authoring and desktop publishing programs can be used as 'tools' to carry out many different kinds of learning activities, often engaging higher order thinking. 'Closed' software, such as drill and practice software, has a more limited range of applications and often relates only to the lower levels of Bloom's Taxonomy, such as the acquisition of facts.

software, or to use the software to facilitate the implementation of traditional strategies. This, in turn, made informed planning unachievable.

Evaluation of Alternatives and Selection of IMM-Based Teaching-Learning Strategy



In order to evaluate the alternative IMM-based strategies and select the most suitable⁹⁰, it was necessary for the teachers to analyse and synthesise information about software, traditional strategies, and their students. As they did not have complete information about any of these areas, the task was relatively demanding.

Furthermore, it must be asked whether IMM-based strategies *can* be satisfactorily evaluated before being used by the students involved for the stated purpose; it has been asserted that software cannot and should not be evaluated by adults alone, and that the target population must always be involved (Higgins, Boone, & Williams, 2000). To some extent, Linda Harris and her students tried this approach, but it was not entirely satisfactory in this context because many of the students took on the role of what could be termed ‘perpetual evaluator’ and flitted through software without deeply engaging with it.

Table 9.6. Facilitative factors associated with the evaluation of alternatives and the selection of an IMM-based strategy

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
1)	Suggestions from other educators.				
2)	Reflecting on the effectiveness of traditional teaching-learning strategies.				
3)	Knowledge of students’ abilities and interests.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

⁹⁰ The teachers and I were of the opinion there is no ‘one best way’ to teach literacy or anything else, with or without the use of software. The term ‘the most preferable’ is therefore used instead of ‘the best’.

The fact that I had done some preliminary screening and evaluation of software, and suggested some strategies that might be used, seemed to help the participating teachers select strategies. Also, reflecting on traditional strategies that had previously worked or not worked for the individuals concerned helped teachers in the decision-making process.

Additionally, because of a relative lack of software, there were not a lot of IMM-based strategies to choose from, which simplified the matter.

Table 9.7. Inhibitive factors associated with the evaluation of alternatives and selection of an IMM-based teaching-learning strategy

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
1)	Teacher did not have enough time to evaluate software.				
2)	Teacher had difficulty deciding how to match software to students' learning needs.				
3)	Teacher had difficulty accessing trial copies of software.				
4)	Teacher had difficulty predicting which software students would enjoy.				
5)	Teacher had difficulty judging 'readability' of software.				
6)	Technical problems in running software to be evaluated were experienced.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

It was difficult to adequately evaluate software and to identify underlying theories and strategies. This, together with inadequate data about the students' strengths and needs, made the decision making process somewhat imprecise. Perhaps because of a shortage of hard data on which to base the decision, teachers often tended to resort to choosing strategies according to whether they thought the students would enjoy them and find them motivational.

However, sometimes teachers' beliefs about what the students would enjoy were erroneous. For example, Nicole Nielsen was surprised when Becki disliked the electronic book, *Aesop's Fables* (1994). Likewise, Linda Harris was surprised that her students did not like *Storybook Weaver Deluxe* (1998).

Another factor that inhibited the selection of IMM-based strategies was the question as to whether or not the software would run on the available computer systems. Software always has certain system requirements, yet some of the teachers did not know the specifications of their hardware. For example, Linda Harris had no idea that two of the computers in her room had only 4MB of RAM⁹¹ and the implications of this in terms of running multimedia software. Also, it was found that some software packaging states 'For Windows 95 and later', but will not run satisfactorily on *Windows ME* or *Windows XP*.

Because the participating teachers were not deeply familiar with the software or its capabilities, they often tended to employ modified traditional strategies, such as computer-assisted repeated readings. It has been suggested that ICT has the potential to transform pedagogy and not just slavishly reproduce existing strategies (Leu, 2000), but the participating teachers were seldom in a position to try fundamentally new, previously untried strategies (that were not possible outside the IMM-based context) because of their lack of experience in this milieu.

Sometimes the teachers did not appear to distinguish between the IMM-based strategy and the software itself. For example, Linda Harris seemed to see the software as what could be termed 'software as strategy', whereas Catherine Williams saw software as 'software for strategy'. This occasionally led to confusion.

After choosing an IMM-based strategy, teachers were sometimes uncertain about their decision, although they had high hopes that it would be beneficial to the students. It was necessary for them to take risks, which, in an environment where accountability was emphasised, could be somewhat stressful. It has been suggested that teachers and students should be actively encouraged to engage in risk-taking behaviour and experimentation with ICT (Bailey et al., 1995), but during this study the organisational environment and curriculum requirements often acted to proscribe this.

⁹¹ See Glossary

Summary of the Planning Phase

There were frequent difficulties in planning to use IMM to help students with reading difficulties. However, many of these difficulties were not simply ‘technology’ factors, but were related to the teacher’s knowledge of the students’ strengths and areas of need and of learning theories and strategies.

Although the process was complex, this complexity was not always visible and the planning phase did not always *seem* difficult. Teachers often used expressions such as, “Let’s give this a try,” or, “Let’s see how it goes”, without constructing a clear rationale. In exploratory contexts such as the classrooms concerned, this tendency to trust intuition and to launch into the unknown is, perhaps, predictable and even useful. However, such actions should be reflected upon and the reflections should be used in further planning (Atkinson, 2000).



The Implementation Phase

Implementation of Selected Alternatives

Table 9.8. Facilitative factors in the implementation of the IMM-based teaching-learning strategy

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
1)	Teacher had good knowledge of ICT.	Often observed (6 or more times)	Often observed (6 or more times)	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)
2)	Teacher had a positive attitude towards IMM-based activities.	Often observed (6 or more times)	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)	Often observed (6 or more times)
3)	Teacher had good knowledge of software being used.	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)
4)	Students had good knowledge of computers.	Often observed (6 or more times)	Often observed (6 or more times)	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)
5)	Software had a predictable interface.	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)
6)	Students had positive attitudes towards IMM-based activity.	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)	Sometimes observed (1 to 5 times)	Often observed (6 or more times)

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

Several facilitative factors were apparent in the implementation phase of the innovations. As mentioned above, a lack of inhibitive factors such as 'technical hitches' and time restrictions could be construed as facilitative factors. Also, the teachers' and students' prior knowledge about hardware and software was important. For example, Catherine Williams, who had extensive knowledge about ICT, found the process far less demanding than did Linda Harris, who was a computer novice.

Students usually found that software that had a predictable interface was easy to learn. For example, the students at St Clair's quickly learnt how to use *Illuminatus* (1999; 2001) as it had an interface similar to *Microsoft Word* (1997), with which they were highly familiar. They were thus able to focus on the content rather than the technology.

Students' positive attitudes towards working with IMM was another facilitative factor. Most of the students expressed positive feelings about the activities, were highly engaged throughout, and many of them wanted to stay and work at the computers after school and during school breaks.

An additional aspect of the IMM-based context that seemed to be facilitative in that it extended positive attitudes was humour in software; it has been pointed out that humour in literature can be motivational (Mailan, 1993). During the study, it also seemed to help relieve student anxiety. For example, Nada at Hillview often laughed out loud when using the software and appeared very relaxed, as did the majority of the other participants, including the teachers. Students with difficulties often feel anxious in learning situations and humour may help alleviate this. Indeed, computer-based learning has many features (such as patience and privacy) that render them less threatening than many other learning situations (e.g. Hasselbring et al., 1997).

Table 9.9. Inhibitive factors in the implementation of the IMM-based strategy

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
1)	Lack of time.				
2)	Legal issues (licensing/copyright).				
3)	Inadequate technical support.				
4)	Teacher role and classroom management.				
5)	Inadequate knowledge about ICT and 'language' of ICT.				
6)	Software design.				
7)	Distractions.				
8)	Unrealistic expectations.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

There were many inhibitive factors in the implementation of the IMM-based strategies during this study, and it was tempting to categorise them into three groups: student-factors, teacher-factors and technology-factors. However, this has not been done because most of the factors relate to interactions between students, teachers, technologies and context. It therefore seems imprudent to categorise them in this way. Also, it must be borne in mind that many of these inhibitive factors can be conceived of as 'teething troubles' that eased somewhat as the implementations progressed.

The over-riding inhibitive factor seemed to be a lack of time for everyone concerned. Teachers often did not have enough time to learn the capacities of the software, to teach the students how to use it, nor to monitor its use. Furthermore, largely because of heavy curriculum demands, students did not have a lot of time to engage with the software. This, combined with the fact that some of the IMM-based strategies were relatively time-consuming, presented problems.

Licensing issues were also important inhibitive factors. There were many instances where teachers would have liked to install software on more than one machine, as this would have meant that only CD-ROMs, not students, had to be

moved from one computer to another. There were many instances where students had to swap computers because software was only installed on a single machine. This could, perhaps, be termed 'digital musical chairs' and was disruptive and frustrating for the students.

Further, in some instances teachers would have liked to install CD-ROMs on their own computers in order to evaluate them at home when they had free time. However, it is usually only permissible to install software on a single machine, unless site licences are purchased, even though it is possible for only one person at a time to use a CD-ROM disk. Suppliers and producers should recognise that teachers are unlikely to purchase site licences if they have been unable to properly evaluate and use the CD-ROMs.

Copyright issues were a further inhibitive factor. For example, the Year 4 students at St Clair's would have liked to make their own versions of some of the electronic storybooks ('text innovation') using *Microsoft PowerPoint* (1997). However, there was a degree of uncertainty on the part of the teachers as to whether copying screens from the storybook was permitted. Teachers' lack of understanding of copyright requirements in this constantly changing domain seem to be a problem internationally also (Shane, 2001).

Teachers' relative lack of technical knowledge and confidence, as well as their limited knowledge about how students learn in IMM contexts, inhibited the innovations. For example, Sarah Fox was not sure how to install CD-ROMs on the computers in her classroom. Linda Harris was unsure how to install software, find files, use an Internet browser, and many other basic computer operations. This made it difficult for her to support and monitor the students.

Inadequate technical support in the schools and from software companies was an adjunct inhibitive factor. On many occasions, especially for Linda Harris and Sarah Fox in the government school system, it was not possible to access prompt technical support.

It seemed relatively difficult for teachers to construct a role for themselves in the context of IMM-based learning. Sarah Fox said that it was so *sometimes* difficult to 'let go' of control, even though she claimed to see herself as a 'facilitator' rather than an 'instructor' in all areas of her teaching. She intervened minimally in what the

students did on the computers, whereas Linda Harris and Catherine Williams often sat with students and acted as though they were engaging with a traditional book. Nicole Nielsen's role varied according to what the students were doing on the computer. Teacher role changes are inevitable in IMM-based contexts (Wepner & Tao, 2002), and it is suggested that educators in an ICT context should adopt a 'power with' rather than a 'power over' (Baner, 1998) stance when working with students in this context.

Classroom management issues were sometimes a concern for the teachers, the main ones being the minimisation of distraction, as well as timetabling so that students using the computer did not miss too many of their other lessons. Headphones were used successfully on many occasions to minimise noise distractions, although other class members were often curious about what the participants were doing on the computer. Linda Harris addressed this by allowing all class members to 'have a go', which succeeded to some extent in satisfying their curiosity. Also, the teachers were often frustrated by the fact that they could not teach the whole class and help/monitor the students using computers simultaneously. It is suggested that the setting up of a series of small-group workstations, through which students rotate, may help alleviate this dilemma.

Another inhibitive factor was the fact that, in some instances, students lost their motivation to use software after a relatively short period. However, the students were still at this stage evaluating the software, perhaps in the way that they would evaluate a book, by flicking through it. Particularly at Hillview Primary School, where the students were given access to a wide variety of software, they tended to 'flit' from one computer program to another. This made it extremely difficult if not impossible for the teacher to plan, implement and evaluate each computer program's use in a systematic way. This 'flitting' behaviour may also be attributed in part to the fact that it is more difficult for students to choose software than it is to choose a paper-based book, as there is often not the same amount and quality of information on the cover, and it is not possible to flick through software quickly as it is in the case of printed books. Teachers could, perhaps, write blurbs, print out screenshots and catalogue additional information to help students select software.

Participants, both teachers and students, frequently used the term 'play' instead of 'use' or 'work' with reference to computers. This undoubtedly reflected

their perception of computer use as 'fun', but it also seemed to perpetuate the myth that working on computers should *always* be fun, and that learning should be unconscious or incidental. The use of the term 'play' seemed to be a reflection, as well as a perpetuator of unrealistic expectations about IMM-based learning, although it is acknowledged that learning through play is a valuable technique (Beecher & Arthur, 2001).

The ways in which students used software seemed to a large extent to be determined by the teacher's style and expectations. For example, Linda Harris was relatively 'laissez-faire' in her teaching in an IMM-based context (although she was not as laissez-faire in other areas of her teaching). As a consequence of this teacher style, students were able to choose what they did with the software, and this sometimes appeared to result in aimlessness. On the other hand, Catherine Williams had clear expectations about what the students would do with the software, and thus they were highly focussed, although they occasionally expressed frustration that they were not allowed to 'explore' and 'play with' it.

The St Clair's students had used computers for some time and consequently seemed to be less distracted by their novelty than were the students in the two other schools. The so-called 'novelty effect' (Tergan, 1997) is often taken to be a facilitative factor because it can temporarily boost motivation. However, in this study, students appeared to see IMM-based activities as 'work' and not 'play' once the novelty had worn off. For example, the students at St Clair's, where computers were widely used, were less distracted by the 'gimmicks' in software than were participants from other schools. Furthermore, students and teachers at St Clair's did not use the term 'play' with reference to computer use as much as other participants.

Students often showed a great curiosity about what others were doing that did not usually occur as markedly in traditional printed text contexts in these classrooms. This proved to be an inhibitive factor in that students (non-participants as well as participants of this study) tended to be distracted by their peers' IMM-based activities. Linda Harris attempted to contain this by erecting some screens, but was forced to dismantle them after a few days due to students misbehaving behind them. Catherine Williams suggested that all students should use the same software at any one time, but this seemed to defeat the object of using IMM to address individual needs.

Because the IMM-based contexts were relatively complex, and students had different styles and preferences, even with same software and strategy, it was relatively difficult to predict student behaviour. This complicated evaluation of the innovations and thus further planning.

A further inhibitive factor was the fact that students and teachers did not always possess the 'language' of ICT. For example, the Year 4 students at St Clair's appeared puzzled when I referred to a 'text box'⁹². However, when I asked, 'Can you do a little box and then stretch it?' they knew what I meant and were able to create and resize a text box. Another instance of a participant not knowing the language of ICT was when Linda Harris was not sure whether 'installing' software meant merely putting the disk in the drive and running it, or setting it up on the system.

An inhibitive factor related to software design was the fact that many participants were inattentive to instructions that were narrated orally by the computer. There is an argument that the mode of delivery, whether oral or written, is irrelevant as both delivery methods have the same informational value. This view does not take into account the fact that students with reading difficulties may not be able to read complex written instructions. Also, according to the cognitive theory of multimedia learning, the delivery modality does matter (Mayer, 2001), and students will benefit from the use of dual modalities, such as written words and pictures, as this reduces the cognitive load in any one modality.

A possible explanation for the students in this study failing to listen to or comprehend narrated instructions is that they were profoundly engaged in the visual aspects of the activities. In one instance, Anita was working her way through a series of IMM-based comprehension questions and finding them very difficult because she had not attended to the oral instructions to click on a certain icon in order to read/listen to the story first. Luke was also more likely to pay attention to the visual information and to ignore the oral.

Other software related inhibitors, apart from the technical problems noted above, were to do with lack of student control over the software. For example, many electronic storybooks do not allow the user to pause in order to reread a section, or to

⁹² Refer to Glossary

reflect or write notes. At other times, students had to sit through laborious **animated** sections or introductions without having the option to 'skip' through screens.

Although some of the students in this study engaged with the software on an individual basis, as is consistent with the design of the software used, there were occasions when they were required to co-operate around the computer. There was a degree of dispute about who should have control.

Finally, in many instances the students had limited keyboarding skills, especially at Morland and Hillview. This is a common problem in primary schools (Goodison, 2002) and has been minimised at St Clair's by the provision of daily keyboarding lessons.

Summary of the Implementation Phase

In summary, the implementation was facilitated by the prior knowledge of teachers and students, by positive attitudes and by the absence of major inhibitive factors such as lack of time and 'technical hitches' and by effective classroom management, such as 'rules and roles' for the students.

The Evaluation Phase

Formulation of evaluation techniques



In formative experiments, student outcomes and strategies/innovations are seen as being intertwined, because one affects the progress of the other, and both affect decisions relating to possible modifications. However, during this study it was necessary, for the sake of clarity, to distinguish between two parallel and interwoven sets of data for evaluation: Data about the IMM-based strategy (which included the software itself and the strategy/strategies it incorporated or facilitated); and data about student outcomes. It must also be noted that a lot of the formulation of evaluation processes was carried out much earlier, during the planning stage.

Assessing student outcomes

Overall, the four participating teachers tended to choose traditional techniques to assess student outcomes, even though 'alternative approaches to

assessment are emerging' in the context of ICT and learning (Vogel & Klassen, 2001, p.108). It has been suggested that assessing and evaluating learning by students in ICT contexts, in which learning is often active, constructive, intentional, authentic and cooperative, cannot meaningfully be achieved by the use of traditional tests. In these contexts, formative assessment of learning is preferable (Jonassen, Peck, & Wilson, 1999).

As the pedagogical goals were essentially traditional, it was decided that traditional means of assessment were appropriate. Hence, the standardised tests described in Chapter Four were used, as were routine classroom-based informal assessments.

Evaluating IMM-based strategies

It was decided to evaluate implementations by observation, by discussing them with students and by using assessment information relating to student outcomes. Formative assessment was necessary in order to permit the generation of possible modifications.

Table 9.10. Facilitative factors in the formulation of evaluation techniques

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fort
1)	The teacher was clear about how the IMM-based strategy should ideally progress and the nature of the learning activities the students would engage in.				
2)	The teacher was highly proficient in formulating evaluation techniques in 'traditional' contexts.				
3)	It was permissible to formulate tentative evaluation techniques and modify them when the need to do so became apparent.				
4)	Many of the techniques chosen were the same as those used in 'traditional' contexts, as the pedagogical goals were largely traditional.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

Because we were not sure how the innovations were going to progress, and because the nature of the study was formative, it was essential to carry out formative as well as summative evaluations. As mentioned above, this meant that it was permissible to design evaluation techniques as we went along, ensuring that they were relevant and workable.

Table 9.11. Inhibitive factors in the formulation of evaluation techniques

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
1)	Because of the formative nature of the implementation, the teacher was unclear about how IMM-based implementation would progress, and had insufficient knowledge of the IMM-based learning activities students would engage in.				
2)	Teachers often did not know the capabilities of the software used well enough to facilitate the formulation of evaluative techniques.				
3)	Teachers' usual evaluation techniques were not always closely related to specific outcomes and teaching strategies, but were more general.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

It was difficult to formulate evaluation techniques in advance because teachers did not know what *might* happen, and did not know the full capabilities of the software, how the students would react, or possible unplanned outcomes. Further, they did not know how long the innovations would be in place before they were modified. As previously noted, the four participating classroom teachers tended to say things such as, 'Let's see how it goes,' and were reluctant to commit themselves to prescribed evaluation techniques.

Table 9.12. Facilitative factors in the implementation of the evaluation

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fink
1)	Many techniques were traditional and thus familiar to the teacher.				
2)	Feedback from students.				
3)	Record-keeping by computer.				
4)	Evidence of transfer of learning to normal classroom context.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

Evaluation by students is recommended in ICT-based contexts (Higgins et al., 2000) and this was a facilitative factor in the evaluation of outcomes and strategies in this study. Not only were students often able to make comments about their own learning⁹³ but they were also able to provide valuable feedback to teachers about the strategies and software. For example, Nichole Nielsen's students stated that it was difficult to read from the screen and talk into the microphone simultaneously. In an attempt to encourage this feedback, students were given journals and encouraged to talk about the implementation with teachers and other students. They were also given feedback sheets. At the end of the implementations, interviews were conducted to gather additional feedback. However, although valuable, student feedback was not usually easy to obtain.

The fact that teachers had relatively few pre-conceived ideas about the way the implementations should be evaluated encouraged an 'open-mindedness' that meant that they were, perhaps, less likely to 'screen out' certain types of data or certain possibilities.

⁹³ It must be noted that the students' opinions about whether they had learnt anything were sometimes inaccurate and did not concur with assessment results.

Table 9.13. Inhibitive factors in the implementation of the evaluation

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
1)	The teacher had insufficient time (to observe implementations, to talk to students about them, and to gather data).				
2)	Insufficient accurate records were available.				
3)	'Hidden' data or issues not identified.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

The most prominent inhibitive factor in the implementation of the evaluation was teacher lack of time to monitor and evaluate student performance. All four participating teachers mentioned this factor many times.

Another major inhibitive factor was the students' inability or reluctance to keep accurate records about what they had done on the computer. Although they were given journals and checklists and were asked to keep logs of the software they had used, for how long, and what activities they had done, students' records were minimal. Bearing in mind that these students experienced literacy difficulties, this reluctance to write might have been anticipated by the teachers and myself. To overcome the problem, Catherine Williams suggested that students could use tape recorders to record their activities, but this was not done because of a shortage of tape recorders.

Many computer programs keep records of students' activities and scores. However, the teachers did not make use of these facilities for various reasons, including a lack of time to locate them and print them out, a lack of awareness that they were available, and a 'distrust' of their accuracy. Indeed, there are many limitations inherent in such student tracking systems, such as the fact that *Reading For Literacy* (2000) did not record attempts at an activity, but only *completed* activities. Also, if students forgot to log in or out, or used the same software on more than one machine, the integrity of their records could be compromised. That is, their

records could become entangled with those other students, or could be partially recorded on more than one computer.

Another inhibitive factor in this study was the fact that it seemed relatively easy to ‘miss’ data. Because of a lack of time on the teachers’ part and because the IMM-based learning was often process-based and did not lead to a tangible ‘product’ that the teacher could collect and judge, much data was elusive. There may have been ‘unmeasurable’ and unplanned learning that the teachers did not take into account. There may also have been facilitative factors that were not noticed.



The Analysis of Evaluation Data Phase

Table 9.14. Facilitative factor in the analysis of evaluation data

	Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
Intuition/professional judgement				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

Teacher’s intuition or professional judgement seemed to be a facilitative factor in the analysis of evaluation data. Indeed, without this, it would have been difficult to make any decisions at all, as the evaluation data was incomplete and sometimes contradictory and the situations often ill-defined. The teachers would use expressions such as, ‘I feel’, or ‘I have a feeling’, rather than, ‘I think’, or, ‘I know’, indicating that they were using intuition. It has been suggested that in circumstances where information is incomplete and the situation is ill-defined, the use of intuition or professional judgement is appropriate, if it and its results are reflected upon and learnt from (Atkinson, 2000). However, teachers are accountable to parents and principals, who often require what has been referred to as ‘articulate/rational/explicit’ information as opposed to ‘inarticulate/intuitive/implicit’ information, which is based on knowledge in action (Atkinson & Claxton, 2000, p.1).

Table 9.15. Inhibitive factors in the analysis of evaluation data

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
1)	The teacher had insufficient time to analyse data.				
2)	The teacher did not 'trust' data collected.				
3)	The teacher had difficulties attributing outcomes to specific learning activities.				
4)	Confounding factors.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

A lack of time to engage in analysis was a significant inhibitive factor. Teachers did not usually have time to sit down and concentrate on the analysis. Instead, they typically performed this 'on the run'.

Furthermore, analysis is an essentially rational process and it has been suggested that many people do not routinely analyse situations or make decisions on a rational basis (Solso, 1995). The teachers involved in this study often made decisions using only partial data, such as affective factors. Moreover, partial and contradictory data were often all that was available.

In some instances, teachers did not trust the data collected. For example, Linda Harris was sceptical about the value of the post-intervention Neale Analysis of Reading Ability (NARA) results with reference to Luke, and Sarah Fox was sceptical about the pre- and post-intervention test results relating to Zara. These teachers thought that the tests inflated the students' abilities. Catherine Williams, on the other hand, thought that the post-intervention NARA results relating to all four of her participating students did not reflect their progress, which she judged to be much greater than that indicated by the test.

Finally, it was difficult to make attributions about the data because of the teacher's limited theoretical knowledge of reading, reading difficulties and assessment, and their lack of confidence in the data.



Utilisation of Results in Decision-Making

Facilitative Factors in the Utilisation of Results in Decision-Making

Absence/minimisation of the inhibitive factors noted below.

Table 9.16. Inhibitive factors in the utilisation of results in decision-making

		Nicole Nielsen	Catherine Williams	Linda Harris	Sarah Fox
1)	The teacher had insufficient time and other resources to utilise results in decision-making about possible modifications.				
2)	Accountability to parents and school principals inhibited some teacher decision-making.				
3)	The teacher was reluctant to 'chop and change' IMM-based activities too often.				
4)	Students did not want teachers to modify IMM-based activities.				
5)	The teacher experienced difficulties judging the importance and relevance of data collected in order to analyse it and make decisions about possible modifications to IMM-based activities.				
6)	The teacher did not consult data and made decisions based on other factors, such as personal beliefs and preferences.				
7)	The teacher did not have knowledge of how to use assessment data in planning for students with reading difficulties.				

KEY:

	Never observed
	Sometimes observed (1 to 5 times)
	Often observed (6 or more times)

After teachers had collected and analysed data relating to the intervention, there were several impediments to using this information to inform further planning. Often the information could not be used for reasons that were beyond the teachers' control, such as lack of time, lack of resources or school policy. Furthermore, there was often a reluctance to modify interventions because teachers did not want to 'chop and change'. They seemed to prefer to adhere to the decisions they had made

earlier and 'see how it goes'. In addition, it was often difficult to know *when* a strategy should be modified or abandoned because of difficulties in the formative evaluation of the pedagogical goal.

On several occasions, when modifications were made, students protested. An example of this was when Catherine Williams decided to discontinue creating electronic storybooks and return to OMMARR. After the move back to this strategy, the students did not seem to be as motivated as they had been previously. Students' involvement in such decision-making seems to be desirable, where possible.

Perhaps one of the greatest impediments to using the information gathered was the fact that there was a large quantity of information and numerous possible modifications, the potential outcomes of which were uncertain. It could be said that the teachers involved suffered from a 'decision-making overload'.

On other occasions, the four teachers did not seem to use the data collected to help them make decisions, but made them according to their philosophies or beliefs. For example, Catherine Williams chose to discontinue the strategy of making and chunking electronic texts to help the students in her class improve their oral reading fluency because she believed that sustained practice of oral reading of whole texts was necessary to increase fluency. She did not believe that the metalinguistic, self-monitoring and 'phrasing' benefits of creating electronic storybooks were a time-efficient and beneficial method for her students with reading difficulties.

Summary of Research Question 2a

Numerous inhibitive and facilitative factors were identified in the various phases of planning, implementing, evaluating and modifying OMM-based activities that were intended to assist students who experienced reading difficulties. These pertained to issues other than the use of ICT, such as the assessment of reading needs and the construction of pedagogical goals.

Overall, it was much easier to identify inhibitive factors, as they were highly visible 'spanners in the works' that often hindered implementations. However, it was more difficult to identify facilitative factors, as many may have been invisibly 'oiling the works'. Furthermore, facilitative and inhibitive factors were often located at opposite ends of the same continuum and were not discrete factors.

Many of the facilitative and inhibitive factors identified were common to the four different contexts, despite the fact that these varied greatly in many ways, such as teacher experience in using computers, resources available, and the socio-economic status of the students. This suggests that these factors may, with caution, be generalised to some other contexts.

Factors can be grouped into three broad categories (Oakley, 2003b), namely people, activities and resources (see Figure 9.4).

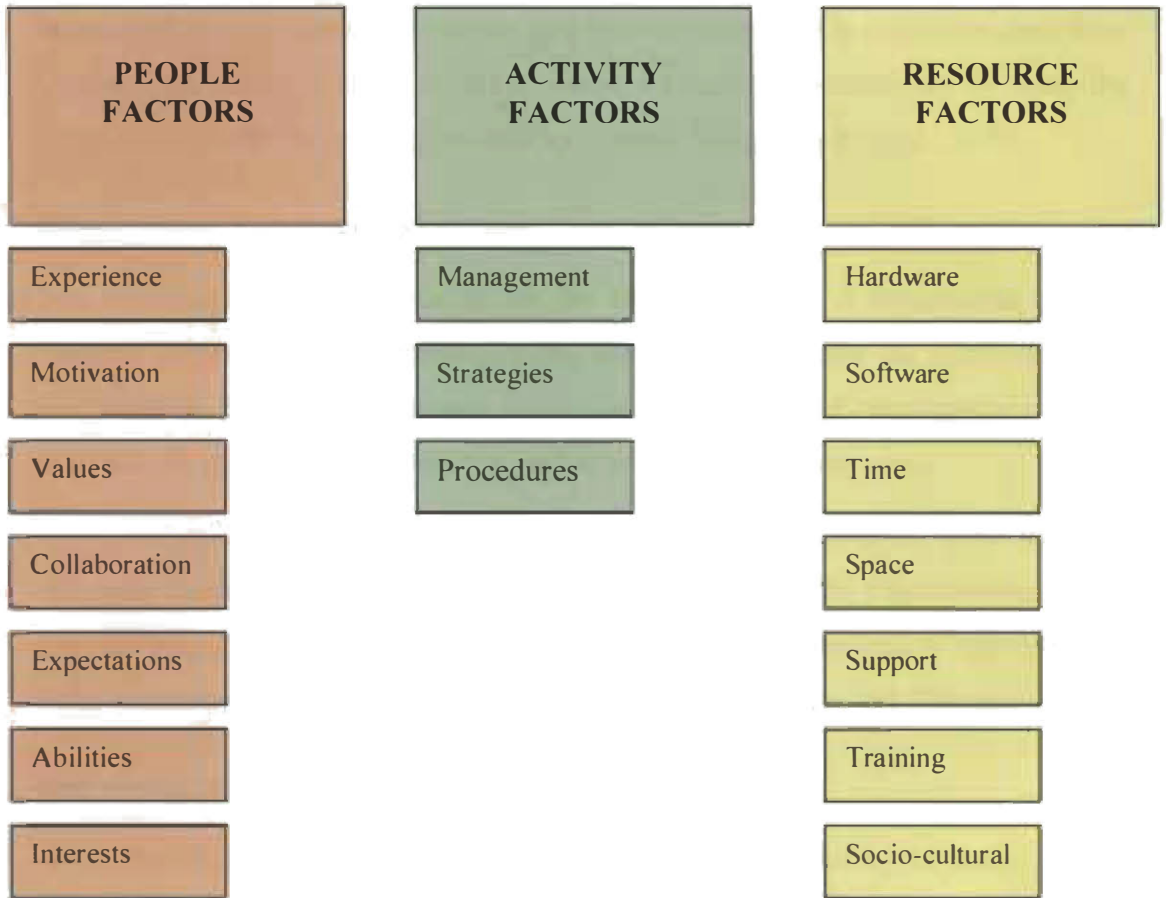


Figure 9.4. Categories of facilitative and inhibitive factors

If it had been possible to continue the study for a longer period of time, many of the facilitative and inhibitive factors identified might have changed. For example, many of the facilitative factors may have been mere ‘teething’ problems. The purpose of a formative experiment is to capitalize on facilitative factors and to endeavour to either remove or at least minimise the effects of inhibitive factors. However, in the cases described, it was not always possible to do this due to restrictions in time, resources and teacher autonomy.

Research Question 2b

- 2b) How can educators establish 'preferability' of DMM-based strategies over 'traditional' activities?

Establishing preferability

It has been suggested (Reinking & Walkins, 2000) that a formative experiment should consider the extent to which an innovation is preferable over other instructional methods. It is possible to assess a strategy's preferability by using the dimensions of efficiency, effectiveness and appeal (Reigeluth & Frick, 1999).

Effectiveness, Efficiency and Appeal

Effectiveness largely concerns the extent to which a pedagogical goal is reached. Effectiveness is increased if the innovation facilitates the achievement of the pedagogical goal over repeated trials. Also, the breadth of situations or contexts in which the innovation achieves the goal is an aspect of effectiveness.

Efficiency, which refers to the costs of the innovation in terms of time, resources needed, effort and energy, is weighed against the effectiveness of the intervention. Appeal refers to the degree to which the innovation is enjoyable for those concerned. This dimension is separate from effectiveness and efficiency.

Difficulties in establishing preferability

Establishing preferability was not a simple process during the study. Firstly, the concepts of effectiveness, efficiency and appeal were relative to the teachers' and students' philosophies, priorities and needs and cannot be seen as fixed concepts. Furthermore, teachers seemed to find it difficult to separate the three criteria; they often seemed to have a more holistic idea of preferability.

In addition, establishing preferability was problematic due to difficulties in evaluation; teachers did not always have access to the data they needed to make accurate and informed judgements, or they did not use data collected. The effectiveness dimension did not entirely allow for unplanned outcomes, or complex, 'unmeasurable' or difficult to measure outcomes. Nicole Nielsen, for example, because she taught at a school that prided itself on its ICT focus, thought that the

opportunity to use ICT in a new context made the strategies preferable, so long as the students achieved similar reading-related outcomes to those they would have achieved using traditional methods. She was also of the opinion that the multiple outcomes encouraged by IMM-based strategies augmented preferability. She found it somewhat illogical to focus on narrow, singular outcomes in IMM-based contexts. She explained:

I think the motivation is definitely there. I think in terms of ... particularly in our school which has an IT focus ... anything that's going to increase their skills, and lets them practise their IT skills, as well as ... I mean, that's our whole purpose, to integrate computers into every curriculum area, in whatever ways the best way. I mean, it's definitely an advantage to us that we do something on the computer, as well as doing it the old-fashioned way. So, in our circumstances I think it is preferable, especially at this level where they all have their own laptops.

And also understanding that you don't just focus on your reading or your fluency or whatever it is you're targeting when you're reading a book; you also read off the screen, you also read printed out pieces of work, you read other people's work, and it's important in all of those areas. It's not just when you open up a book that you're going to need expression in your voice, and read fluently.

A fourth difficulty in ascertaining preferability involved the teachers' limited knowledge about how IMM may facilitate learning. They had not encountered nor reflected upon many of the issues in the area of IMM and learning, such as IMM and multiple modalities, or the roles of the different symbol systems in IMM. It seems important to be cognisant of the theoretical principles of IMM in order to reflect with clarity.

Finally, it may be the case that IMM-based and traditional strategies are not strictly comparable (Salomon, 2002) because of their different characteristics and theoretical underpinnings.

Perhaps because it was problematic to accurately ascertain effectiveness and thus efficiency, some of the teachers established preferability primarily according to the appeal of the IMM-based innovations. For example, Linda Harris was of the opinion that the motivational features of the IMM-based strategy were sufficient justification to consider them 'preferable'. She stated, "At least they [the students] are reading!" This alone was a great improvement in her opinion.

Sarah Fox focussed on affective outcomes to establish preferability; she saw improvement in the attitudes and self-esteem of the participating students, which she attributed to their use of the IMM-based innovations. They had experienced success and become 'experts' in this domain.

Summary of Question 2b

The four participating teachers were novices in the realm of using IMM-based innovations to help students who experienced reading difficulties and, although they did ascertain preferability according to their own criteria, they were not able to make full use of those of Reigeluth and Frith's (1999).

In order to judge preferability meaningfully, it seems necessary to be able to measure effectiveness, efficiency and appeal with some accuracy and to think of these criteria with reference to the particular context and the relevant theoretical principles. The participating teachers did not usually have the resources (knowledge, data and time) to do this.

Research Question 2c

- 2c) What unplanned outcomes might result from using IMM-based activities to assist students who experience reading difficulties?

The Identification of Unplanned Outcomes

In formative experiments, it necessary to consider unplanned outcomes (Reinking & Watkins, 2000). However, this proved to be somewhat problematic in the study for two major reasons. Firstly, 'new' outcomes that were made possible by the use of IMM may have gone unnoticed and 'unmeasured', especially as the participating teachers primarily used traditional assessment measures. Secondly, teachers possibly missed even 'traditional' outcomes because they were not assessing a wide range of outcomes; they had only planned to assess those pertaining to the pedagogical goal.

Nevertheless, some unplanned outcomes were identified through the use of traditional assessment techniques and informal observation. For example, several

participating students appeared to lose interest in traditional paper-based strategies after using IMM. Linda Harris observed that, after using IMM software, the students in her class were less interested in writing on paper and furthermore were less interested in using word-processing than IMM software. At St Clair's, students did not wish to create paper-based storyboards for their electronic storybooks; they wanted to use the computer at all times during the project.

A second unplanned outcome was the fact that participating students seemed to become more confident and have increased self-esteem, according to their teachers. This was possibly a result of having achieved success and being classroom 'experts' in the new domain.

Children in Linda Harris' class who were not participants of the study, but who used the software, also appeared to benefit. Because many of them had similar difficulties to those of the participating students, this outcome was not entirely unexpected or unplanned.

Unplanned outcomes should be taken into account when considering effectiveness and efficiency, and when planning modifications to innovations.

Summary of Research Question 2

This study has demonstrated that educators can use a 'formative approach' to plan, implement, evaluate and modify IMM-based activities and programs to help students who experience reading difficulties achieve particular pedagogical goals. However, there are many difficulties and uncertainties inherent in doing this, such as difficulties in identifying reading needs, choosing, monitoring and evaluating IMM-based activities, and modifying activities in response to facilitative and inhibitive factors identified. Furthermore, deciding upon the 'preferability' of IMM-based activities over traditional activities is no easy matter, due to the factors outlined in the previous section.

Summary of Chapter

In this chapter, the research questions of the study have been addressed. Question 1 investigated the ways in which participating teachers were using IMM to

help students who experienced reading difficulties prior to the study. It was found that, although most of the teachers were using ICT, including IMM, in their classrooms, they were not using it specifically to help students with reading difficulties. Only one of the teachers had started to do this, between my initial contact with her and the commencement of the study. The four participating teachers differed greatly in their capacity to use IMM in their classrooms due to the fact that they had differential access to resources such as training, professional development, support teachers, technical support, hardware and software.

Question 2a involved uncovering the major facilitative and inhibitive factors associated with planning, implementing and evaluating IMM-based innovations to help students with reading difficulties. It was found that there were numerous facilitative and inhibitive factors, many of them unrelated to teachers' knowledge of computers and software. Teachers experienced some difficulties in identifying students with difficulties, discovering the nature of their difficulties, and linking this information with possible intervention strategies, even in a traditional context. It was therefore problematic for them to match these students with IMM-based strategies, not least because there were many barriers to identifying the strategies inherent in the software.

Further, there were difficulties in implementing innovations, some of which could possibly be 'ironed out' in later cycles. Many of these difficulties were related to software limitations, classroom management issues, teacher knowledge, and difficulties with the technology itself.

Evaluating innovations was impeded by the difficulty in gathering accurate and appropriate data and because teachers did not always have clear expectations. Using evaluation data to modify innovations was problematic because there seemed to be numerous possible options for modification. On the other hand, there were organisational and technological constraints that limited teachers' ability to modify and improve innovations.

An overriding inhibitive factor was the lack of time for all concerned. Also, limited access to diagnostic tools and theoretical and strategic knowledge proved to be difficult. As might be expected, teachers' beliefs greatly influenced their decision-making.

In Chapter Ten, the findings and their implications for teacher education and practice, as well as software design, are discussed.

CHAPTER TEN

IMPLICATIONS AND CONCLUSIONS

In chapters Five to Eight, each of four formative experiments was described and, in Chapter Nine, categories of facilitative and inhibitive factors that emerged during the study were delineated. Issues concerning how teachers might determine preferability were also discussed, as was the significance of unplanned outcomes.

Some of the issues that arose during the study were far more fundamental than anticipated. That is, issues concerning the identification and conceptualisation of students' difficulties, the linking of theory with practice and the assessment of learning proved to be almost as problematic as issues relating to educational technology and, more specifically, IMM, for helping students who experience reading difficulties. In this chapter, the implications of the findings with reference to theory, teacher education, teaching practice, software design and future research are discussed.

Implications for Theories of Reading and IMM

Whilst various pedagogical goals were targeted in the study, and 4 classrooms participated, most of the 16 participating students appeared to benefit from the interventions, as measured by standardised testing, observation, and informal classroom assessments. These findings are described in detail in previous chapters.

Most of the participating students showed gains in reading skills, such as word recognition, comprehension, and meta-cognitive knowledge of reading. Because of the naturalistic nature of the study, however, it must be emphasised that these gains cannot be attributed to the IMM-based

were not taken into account. However, it is worth noting that the teachers had previously tried a range of interventions with the students, none of which had been very successful. Participating teachers were confident in attributing gains to the IMM-based activities in which the students had engaged, because of the activities' unique configurations of motivational and instructional capabilities.

Some important benefits appeared to be affective, such as increased motivation and self-esteem⁹⁵, although it is acknowledged that the ERAS (McKenna & Kear, 1990) indicated that some participants had relatively high levels of motivation at the beginning of the study (although the teachers did not necessarily agree with the ERAS scores). There is a body of evidence indicating that technology often exerts a positive effect upon the attitudes of students with learning disabilities (Hasselbring et al., 1997; Lewis, 2000a). Because students with reading difficulties often have low self-esteem and motivation, these apparent affective benefits should be seriously considered when deciding if an intervention is preferable.

The question of how these results may be understood in terms of learning theory and, in particular, theories of learning in multimedia contexts, should be considered. Given that many different types of learning occurred in a number of different complex contexts during the study, it does not seem appropriate to attribute the results to particular characteristics of IMM, or to favour any one learning theory over others. This difficulty is amplified by the fact that in IMM-based contexts, media are confounded with instructional techniques (Clark, 1994) and it is almost impossible to extrapolate independent variables.

Indeed, Tennyson (2002) has asserted that no one theory of learning *can* accommodate all types of learning; there are qualitatively different types of learning, such as rote memorisation, concept building, and generalisation of learning to novel contexts, all of which are to some extent interlinked and interdependent. Different learning theories underlie these qualitatively different types of learning. Tennyson's assertion that no one theory of learning can accommodate all types of learning seems to be especially cogent in IMM contexts, as shown in this study.

Therefore, instead of trying to position the findings of this study in ill-fitting theoretical frameworks of learning, in this chapter it will be shown how the

⁹⁵ These gains were not formally measured but were observed by the classroom teachers.

innovations satisfied the majority of Manzo and Manzo's (1993, p. 207) 'principles of remediation' (see Chapter Three for a more thorough discussion of these principles). The titles of these principles have been modified slightly to suit the purposes of this study.

In all cases:

Build students' self-efficacy

Self-efficacy, which can be defined as a person's beliefs about his or her capability to perform a task at a specified level (Schunk & Zimmerman, 1997, p. 34), can enhance self-concept (Manzo & Manzo, 1993). The IMM-based activities engaged in during the study appeared to build self-efficacy because of the support offered and because success was often assured. Participating teachers unanimously stated that students' self-concept as readers and general self-esteem were elevated through their engagement with IMM-based activities. The teachers hypothesised that this was because the students had experienced success and a sense of control over their learning, and because they had become classroom experts in using the software.

Engage attention and motivation

This principle involves capturing students' attention and orienting them towards the learning activities offered, which can be challenging in the case of students with learning difficulties (Burgess, 2003). The IMM-based activities used in this study achieved this principle in a variety of ways, such as through the provision of advance organisers and menus and narrated objectives, as well as animated introductions. Students' involvement was often elicited at an early stage through requiring them to interact with the software, for example by typing in information such as their name or clicking on a hyperlink. Participating students and teachers commented on numerous occasions that the IMM-based contexts were motivational, and the students' increased time spent reading provided confirmation this.

Increase pace and amount of material covered

It is claimed that as the rate of learning can increase with the pace of teaching (Carline et al., 1997; Manzo & Manzo, 1993), it is advisable to cover more material in less time. Because IMM often regulates the pace of students' learning through the paced presentation of material, and because students are often motivated to access

more material, this principle is frequently satisfied in IMM-based contexts, for example when Mitchell read approximately five texts and completed all of the IMM-based comprehension activities in a one hour time-slot.

Ensure frequent and spaced practice

Manzo and Manzo (1993) propose that practice should be provided little and often, and not in large tedious blocks. Many of the IMM-based activities used during the study contained drill and practice activities, but their presentation was interspersed with other reading tasks or games. The students from Hillview Primary School, who tended to flit from one activity to another, may well have been satisfying this criterion albeit unintentionally

Provide many opportunities to read

As Allington (1977) has stated, the denial of opportunities to read will impede students' reading success. Low-achieving readers are often given far fewer opportunities to read than are their higher achieving peers, a situation that contributes to them falling further behind. IMM-based texts allow low-achieving students to access texts that are interesting and supported. Furthermore, demotivating feelings of failure are less likely in IMM-based contexts. In the present study, participating students were given many opportunities to read IMM-based texts. Because they were motivated to read and supported in their reading, students seemed to engage with these texts more readily than with traditional texts.

Make learning activities enjoyable

Evidence from observation and interviews confirmed that the IMM-based interventions were, indeed, enjoyable for the students involved in the study. Students, especially at Hillview, often referred to engaging in the activities as 'playing' and 'fun' and, according to their teachers, were always eager to participate.

Provide interesting, challenging tasks

It has been shown that students who experience difficulties in reading are often exposed to a narrower range of literacy activities than their higher achieving peers; many remedial programs focus on graphophonics and give scant attention to higher level thinking processes (Wilder & Williams, 2001). In terms of Barrett's (1972) three comprehension levels, literal questions may predominate at the expense of inferential and evaluative questions. Furthermore, authentic, purposeful texts may

be rejected in favour of highly structured 'readable' texts. Such an unbalanced approach may lead to impoverished perceptions of reading and reduced motivation on the part of students. Because of the support they offer, students may engage in a wider range of literacy activities in IMM-based contexts. For example, Mitchell and Morland was able to read texts about the human heart and Alexander the Great and answer a range of questions about them, activities he would not have undertaken in a traditional print-based context.

Provide 'safety nets'

Because Manzo and Manzo (1993) do not mention the importance of reducing stress and embarrassment for students with reading difficulties, it seems necessary to add another principle. As has been pointed out by Hasselbring et al. (1997), computerised contexts can offer students a safe place to fall, as well as privacy, encouraging them to take risks and 'have a go' without risk of ridicule and embarrassment. This is important for students with reading difficulties because many opt out of learning because of fear of failure, ridicule and further loss of self-esteem. IMM-based activities can be carried out on an individual basis, with headphones, allowing the user a degree of privacy. This privacy can save the dignity of students with reading difficulties, as demonstrated by Mitchell, who often wore headphones when he was accessing audio support from the computer.

In most cases:

Use a diagnostic teaching cycle

The formative experiment approach used was essentially a 'diagnostic teaching' approach (Kibby, 1995; Lipson & Wixson, 1997; Walker, 2000), as students' strengths and areas of need were ascertained and then activities were designed to address them. Progress was assessed formatively as well as summatively and activities were modified accordingly. However, in the case of Linda Harris at Hillview Primary School, this principle was not always adhered to, yet the students appeared to benefit from the interventions.

Ensure reading engagement

There is much evidence to suggest that engagement, which can be conceptualised as cognitive and/or affective involvement of students in learning

tasks, is a strong predictor of learning (Bangert-Drowns & Pyke, 2002; Cambourne, 2002). Engaged reading has been defined as a:

'merger of motivation and thoughtfulness. Engaged readers seek to understand; they enjoy learning and they believe in their reading abilities. They are mastery oriented, intrinsically motivated, and have self-efficacy' (Guthrie, 2002, n.p.).

Participating students often showed a higher degree of engagement than in 'traditional' contexts. For example, Zara from Morland Primary School usually found it difficult to stay in her seat, and all participating students from Hillview habitually found it difficult to engage in book-based reading. However, their teachers noted that their engagement seemed to be markedly higher in IMM-based than in traditional contexts. However, it is acknowledged that some engagement may have been the 'problematic' kind of engagement, such as clicking on 'hotspots' or 'flitting around' software (Bangert-Drowns & Pyke, 2002). It appears that the notion of engagement is highly complex and it can differ in quality as well as in degree. Bangert-Drowns and Pyke (2002, p. 3) for example, distinguish several forms of student engagement with educational software, as outlined in Chapter Three (see Figure 3.2.).

According to Bangert-Drowns and Pyke's taxonomy of student engagement, Andrew from Hillview usually fell into the category of 'disengagement' or 'unsystematic engagement'; he mainly seemed to use the software in a passive, purposeless manner and often flitted from one activity to another. Ryan from Hillview often fell into the category of 'frustrated engagement'; he attempted to achieve specific software goals but was unsuccessful, for example when he was using *Carmen Sandiego Word Detective* (1997) and *SuperSpell - A Day at the Beach* (1997). The rest of the students could usually be considered as being in the 'competent engagement' category, although there were occasions when their engagement was also problematic. Because of the relatively short duration of the study, not many personalised and sophisticated forms of engagement were noted, although Mitchell from Morland Primary School did begin to devise his own strategies for getting the most out of software in terms of helpful feedback. For example, he entered items in the *Reading for Literacy* activities individually so that he could get immediate feedback, instead of entering a whole page of answers at once.

Use teacher-directed instruction

According to Manzo and Manzo (1993), direct instruction is characterised by the fact that the teacher (or 'digital teacher' in IMM contexts) tells students what they are going to learn, how they are going to learn it, why they are going to learn it and what they have learned. The student is protected from having to make extraneous choices by the fact that the teacher (or computer) takes on a degree of control. 'Too many choices left to students seem to reduce academic engaged time and to leave students and teacher distracted and feeling frustrated' (Manzo & Manzo, 1993, p. 211). In the context of IMM-based reading, there are varying degrees of computer versus student control. For example, in *Phonics Alive! 2*, the computer is in control of the sequence of activities after the teacher has entered the level at which that child should work.

Build students' metacognitive awareness and sense of personal responsibility

The IMM environments allowed participating students a degree of control and responsibility over their own learning, which led to a sense of personal responsibility for learning.

Although metacognitive awareness was not the focus of most activities, supplementing them with self-questioning and self-monitoring activities, which are essential for reading comprehension (Pressley, 2002), could have helped build this awareness. Nevertheless, some of the comprehension activities in software such as *Reading For Literacy* (2000) may have contributed to metacognitive awareness in that they provided instant feedback to students and allowed them to try again, which may have allowed them to pose and test hypotheses.

Metacognitive and metalinguistic awareness constituted a large part of the activity involving the creation of electronic storybooks,

Apply the elements of quality instruction

Guided practice, feedback, and independent practice are all elements of quality instruction (Manzo & Manzo, 1993). The IMM-based activities engaged in during this study provided these elements, either through the computer based activities alone or through the computer and the teacher in partnership. Some of the activities included modelling, such as the modelling of fluent reading in the

computer-assisted repeated readings activities, and reciprocity was provided for because the interactive environment allowed the students to contribute to the direction of the lesson and, often, to work at their 'zone of proximal development'.

Build students' schemata and skills

Some of the software used in the study was capable of building the students' schemata as well as skills. For example, Rosie used *My First Incredible, Amazing Dictionary* (1994) to help her expand her vocabulary and her store of conceptual knowledge. Words and concepts were presented diagrammatically, orally and via animation.

Camino et al. (1997) have pointed out that many content area texts are beyond the experience of students with learning difficulties. It is thus necessary to make the ideas and concepts accessible to such children. *Reading At Home* (2000) often contributed to such concept building, for example by presenting an animated heart, which was labelled both orally and in written text. The workings of the heart were described in the text and a narration was available on demand.

Reduce distractions

Because of the physical layout of computers in all four classrooms, slightly away from the rest of the class and facing a wall or window, peers did not often distract students when they were engaging in IMM-based activities. Furthermore, headphones could be worn if required. Andrew, for example, wore headphones consistently, although it wasn't clear whether he did this to reduce distraction for himself or to stop classmates hearing the 'raspberries' the computer blew when he answered a question incorrectly. Also, the 'pull' of the computer seemed stronger than the 'pull' of the various classroom distractions. Although distractions were reduced for participating children, in some cases they seemed to be increased for other class members.

Provide scaffolding

The gradual release of responsibility to students is at the core of the notion of scaffolding (Vygotsky, 1978). The IMM-based activities the students engaged in during the study provided scaffolding in the form of narrations and feedback, which students were at liberty to disregard when they felt able. However, it seemed that a degree of student metacognitive knowledge was necessary in order to accurately

judge whether support was needed. As pointed out by Collins et al. (1997, p. 34) some students seem to 'over access', whilst others seem to 'under access' IMM support. It has also been shown that students' patterns of clicking (or accessing IMM support) changes over time, usually with a decrease in clicking (Chu, 1995; Miller et al., 1994). Thus, the relationship between the support offered in IMM environments and the support accessed by students is not straight forward.

Provide challenging but manageable learning activities

In IMM-based contexts, it is possible to provide tasks that are challenging but manageable because much needed support, such as pronunciations, definitions and explanations, can be provided in a timely fashion. This allows students to access texts that are interesting to them and close to their listening comprehension level. When he used the *PM Silver* software, Ryan at Hillview accessed texts that he would not have been able to read on his own.

Use concurrent teaching methods

Manzo and Manzo (1993) recommend using concurrent teaching methods, which are designed to target more than one pedagogical goal simultaneously; one major pedagogical goal may be targeted along with one or more collateral goals. In IMM contexts it can be somewhat injudicious to focus on only one pedagogical goal, as the use of IMM-based activities are almost always complex, multi-modal and unavoidably lead to multiple outcomes. For example, the creation of electronic talking books as a context for facilitating the teaching/learning of oral reading fluency may involve: the teaching of phrasing; students analysing recorded passages and visual representations of oral reading (waveforms); discussions about fluency; story-writing; spelling; repeated readings; and ICT skills such as keyboarding and the use of software. Where possible, it may be advisable to target and acknowledge these rather than label them as 'unplanned outcomes'.

Implications for Teacher Education

Knowledge about ICT

The four participating teachers stated that their teacher education programs had not helped them to integrate technology into literacy education, even though three had graduated from university in the past decade, so familiarity with ICT would

be expected. Further, all reported that opportunities to engage in useful professional development in this area had been limited. Many of the inhibitive factors that arose during the study could be attributed to shortcomings in teacher education and teacher professional development.

At St Clair's College, some in-house or situated professional development (Darling-Hammond, 1998; Dwyer et al., 1990) was available in the form of workshops and teacher-sharing sessions, which were helpful to Nicole Nielsen and Catherine Williams, but ultimately teachers were responsible for their own professional development in this and other curriculum areas. This aspect of their professional role they accepted without question, but acknowledged that it was at times difficult to acquire the knowledge and skills that they needed. It was difficult for them to know what type and degree of knowledge and experience they needed.

Linda Harris at Hillview reported that she had received no professional development in using ICT in her teaching, even though the school was a Technology Focus School. Furthermore, because Linda had graduated from her preservice teaching course some 12 years earlier, she had not had the opportunity to use computers during her preservice teacher education course. She thus had very little knowledge about computer hardware and software.

Sarah Fox at Morland had engaged in some professional development and had used computers to prepare her assignments at university. However, even though the school ran practicums on the use of ICT in education, which were open to all teachers in the Perth area, Sarah had not attended many of these due to lack of incentive and time.

Whilst Catherine Williams and Nicole Nielsen were familiar with technology and seemed to feel a sense of ownership and control over it, Linda Harris and Sarah Fox admitted to feeling slightly nervous when using computers. In order to feel more comfortable with computers, it seems that teachers could benefit from being able to use them for their own purposes in a range of contexts. Nevertheless, due to limited time and access for teachers, this is often difficult during school hours. It has been suggested that teachers may find it easier and more rewarding to become comfortable and familiar with computers at home (Clark, 1998). The Education Department of Western Australia's 'Notebooks For Teachers' program may go some way towards addressing this problem:

'The Notebook for Teachers Project is designed to support schools and teachers in achieving their mutual professional goals. The aim of the project is improved skills in ICT and thereby to provide opportunities for improved educational outcomes. Participation in the program is voluntary and should only be undertaken after considering how the introduction of this technology can be integrated into the school's plan' (WA Department of Education, 2002).

Under this project, teachers have access to leased notebooks for a period of three years, basic training on the use of maintenance of the notebook, Internet access, and introductory professional development. Teachers must pay a nominal fee each week out of their salary for this service.

However, in conjunction with ongoing, in-context professional development and mentoring, it would seem that the best solution would be to integrate the use of ICT into teaching at primary, secondary and tertiary levels of education because:

'When push comes to the shove, teachers will teach in the way that they have been taught in the past, as students in school. Thus, if we want teachers to change, they will have to experience as students themselves the novel learning environment' (Salomon, 1998, p. 9).

This has major implications for the way teacher education courses are structured and executed because a traditional didactic approach is often adopted, for example formal lectures.

Theoretical Knowledge about Literacy

In order for teachers to effectively use IMM or any other ICT in their teaching of students with diverse needs, including those with reading difficulties, it seems that they require enhanced capabilities and support in identifying and analysing students' needs. Indeed, this limitation in teachers' expertise also has implications for traditional contexts and may go some way towards explaining why many traditional interventions are relatively unsuccessful in assisting some students; interventions may be misapplied because of imprecision in identifying learning needs. Inhibitive factors related to teachers' limited theoretical knowledge about literacy had not been anticipated prior to this study and have not been highlighted in the literature on using ICT for literacy learning, which tends to focus on teachers' knowledge of ICT, not on other pedagogical issues such as identification of difficulties and knowledge about interventions and their theoretical bases.

Teale, I.eu, Labbo and Kinzer (2002) have suggested that preservice teachers best learn complex skills through a case study approach, whereby they learn to think like an 'expert', and this approach seems to be particularly important in the teaching of students with reading difficulties (Louden et al., in press). Through interacting and working with experts or mentors, discussions with peers, reflection, and scaffolded guidance from mentors, novices can learn to think like their more experienced counterparts. In this way, they can gain conditional knowledge, which is the ability to analyse effectively and creatively. This seems to be a necessary precursor to invention, which may even encourage teachers to engage in behaviour that they previously saw as 'risky' through giving them the ability to construct rationales for IMM-based activities. However, it appears that in Western Australian schools there is a need for more teachers who are also experts in diagnosing and addressing reading difficulties (Rohl & Milton, 2002).

As teachers become more experienced in using ICT, it may be possible to select 'new' pedagogical goals (such as creating and comprehending hypertext) that are facilitated and even necessitated by the technology (I.eu, 2002).

Praxis

Teachers in the present study had difficulties in linking theory and IMM-based practice because they had insufficient knowledge about software and its potential applications as well as some apparent gaps in their theoretical knowledge. In conjunction with access to a wide range of software and instruction in how to operate it, preservice teachers could benefit from practice in identifying learning theories and teaching strategies inherent in educational software and in how to link these to specific student needs. It would appear to be beneficial if this could be incorporated into their preservice teaching practice.

Software Knowledge

The teachers involved in the study all mentioned the fact that they had not experienced enough opportunities to access and trial a range of software, although Nicole Nielsen, Catherine Williams and Sarah Fox were all comfortable using the software available on their school's intranet, such as the *Microsoft Office* (1997) suite (*PowerPoint, Word, Access, Excel*), as well as *Inspiration* (2000). Teacher education courses could help alleviate this problem by providing a wide range of

software for student teachers to explore, either through the library or in 'hands-on' workshops.

Teacher Education and 'Designer Teachers'

Although it appears that there is much that could potentially be done through initial teacher education and professional development to better prepare teachers to use ICT in their teaching of literacy to students with difficulties in this area, including the training of 'specialist' teachers, it may be difficult to change certain personality characteristics of teachers, such as their relative proclivity to take risks and to innovate. Indeed, a distinction has been made between 'designer' and 'consumer' teachers. A designer teacher is one who feels empowered and has:

assumed the responsibility to become a *designer* of instruction and to reflect on teaching practices to improve instruction. Contrast the designer teacher to the less active, less involved *consumer* teacher, who implements someone else's philosophy, materials, and methods. (Pasch et al., 1991, p. 1)

It has recently been claimed that many teachers in Australia are too often 'consumer' teachers, who overrely on packaged instructional solutions provided by commercial bodies (Luke, 2001; Snyder, 1999). In order to avoid this tendency, both inside and outside ICT contexts, it seems that institutions of teacher education need to place yet more emphasis on the theoretical underpinnings of teaching strategies and to further emphasise the importance of reflective practice, as mentioned above. Through increased understanding and reflection, teachers may be better equipped and confident enough to create and modify their strategies for individual needs. In this way, their perceptions of what is 'risky' may be changed.

Implications for Schools

Curriculum

Difficulties arose during the study because the official Western Australian curriculum usually referred to traditional pedagogical goals, which were often somewhat fragmented and incapable of acknowledging the many (as yet) intangible benefits of using IMM to assist students with reading difficulties. Here the 'syllabus'

view of curriculum is being used, which refers to the curriculum that is set by politicians and bureaucrats. However, this curriculum or syllabus is necessarily mediated by schools and teachers to form the actual curriculum (Grundy, 2001).

Schwab (1969) goes so far as to say that the notion of curriculum means little unless it is seen as resultant from an interaction of four so-called 'commonplaces' of schooling, namely subject matter, students, teachers and the milieu. Thus, teachers interpret and act upon syllabi (official curricula) in the light of their knowledge about their students and the subject matter (reading). This is done within the perceived constraints of the particular milieu, which refers to the socio-cultural, historical and political context.

Even though the notion of curriculum is not as simple as it may at first appear, and although it is acknowledged that teachers actively interpret syllabi and construct curricula *in use*, formal curricula handed down by authorities need to be designed that take into account new outcomes, namely those enabled by ICT. Examples of these might include creating multimedia texts, writing multi-linear texts, collaborative work with students from other cultures through networked connections, designing animated illustrations to go with texts, and understanding and designing sound effects.

Culture

At St Clair's, there was a strong degree of collegiality, or a 'collaborative culture' (Hargreaves, 1989), which assisted the teachers in their professional development and sharing of ideas and problems. This culture was absent at Hillview and not highly apparent at Morland.

However, it must be noted that, although collaborative cultures can and should be encouraged, Hargreaves (1989) has warned against what he has called 'contrived collegiality'. This is enforced collaboration that is superficial and impersonal, and not based on trust and common goals. Indeed, in some instances collaboration and consensus can inhibit individual creativity.

It may be helpful to build networks of experts in schools, so that teachers have someone to turn to if they need assistance or dialogue (Fullan, 1991), but also allow teachers to 'go their own way' as far as possible, as was the case at St Clair's.

Teachers need to be given permission to take risks and explore. As Short, Miller-Wood and Johnson (1991, p. 84) have stated, 'A risk-taking environment is important for change to occur in schools', although it is acknowledged that teachers will differ in how they perceive any environment. Short et al., (1991) found that teachers in the 50 to 59 age group were the most likely to perceive the school environment as being open to, and supportive of, teacher innovation and risk-taking. This may present a problem with regards to the integration of technology into reading in schools in that teachers of this age group are less likely to be in possession of ICT knowledge and skills because such technologies were not available when they were at school and university; it may be beneficial to pair these older teachers with younger teachers who have a higher degree of ICT knowledge but may be less inclined to take risks.

In addition, according to the Short et al., study (1991), teachers who perceived that they were permitted to make changes in their classroom mostly came from decision making environments that can be described as 'advisory delegative', where their involvement in decision-making consisted of collaborative problem sharing and solving between principal and teachers, with teachers making the final decision. In schools where principals were seen as being more autocratic, teachers were less likely to risk making changes in their classrooms. This seems to indicate that the organisational structure of schools may need to change, so that principals are seen as facilitators and partners, rather than as authorities. According to Polonoli (2001, p. 35), it is principals who are 'responsible for fostering a supportive climate. Without administrative support, integrating technology into the classroom is dead before it even begins.' Informal conversations with teachers in this study confirmed that in some cases, teachers thought that principals could have done more to promote an appropriate culture as well as to coordinate the integration of technology into curriculum areas, including literacy. Principals may need training and support in the use of ICT and how to build an appropriate culture and what will be termed an 'amenable environment'.

Provision of Resources

Many of the issues that arose during the study were to do with restricted availability of resources. Teachers need access to full and complete school records and they need resource people to help them choose appropriate software and

strategies, and to clarify such issues as licensing and copyright laws. As mentioned above, they need access to software libraries so that they can investigate and evaluate software and decide if it fits in with their personal pedagogical philosophies and the needs of the students in their classes, as well as access to the latest theoretical perspectives.

Nevertheless, the overriding resource that teachers seemed to need more of was time. They needed time to assess students thoroughly, time to keep up to date with theory and instructional techniques and time to reflect, as well as time to become familiar with and 'play' or experiment with software (e.g. Watts, Lloyd & Jackson, 2001).

Professional Development

Many of the preservice teacher education issues already discussed are relevant here. However, in-service professional development differs from preservice education in that experienced teachers are likely to have more established philosophies and routines than pre-service teachers and thus be more resistant to change. King (2002) argues that transformational learning theory may be used to help educators overcome such resistance through asking teachers to engage in processes of critical reflection and the examination of their own worldviews in the light of new knowledge presented to them. In short, they are asked to restructure their existing knowledge in order to accommodate new knowledge, instead of altering or rejecting new knowledge so as to preserve their existing knowledge.

Further, teachers are not usually passive consumers of research findings and associated theory. 'The current conception of a teacher describes a person who mediates ideas and constructs meaning and knowledge, and acts on them' (Richardson & Anders, 1994, p. 202). Not only do teachers filter such knowledge through their own perspectives, they also receive knowledge from a variety of sources, some of which may be of inferior quality. They gather it from peers, non peer-reviewed articles and websites and peer-reviewed articles, and commercial books, as well as from reflections on their own experience. Much of this knowledge may remain tacit and therefore be less amenable to critical evaluation and reflection. It has been suggested that in order to overcome such problems as the above, a

collaborative decisionmaking culture, in which much discussion and reflection takes place, should be encouraged (Richardson & Anders, 1994).

The U.S. National Reading Panel (National Institute of Child Health and Human Development, 2000) is positive about the role of teacher in-service professional development and states that it can make a difference to teachers' attitudes and practices, which in turn can increase student outcomes. However, they warn that teachers need ongoing support, on a continuing basis, in order for in-service courses to have an impact:

This research suggests that there is a need, particularly at the in-service level, for extensive support (both money and time) on a continuing basis for teacher education efforts. (National Institute of Child Health and Human Development, 2000, p. 5-13)

As has been previously discussed, the skills and competencies of teachers in the area of ICT and teaching can be measured by the use of continua, such as those suggested by Dwyer et al. (1990). Such continua can help professional development providers plan and assess courses. However, in the context of using ICT for assisting students with reading difficulties, existing continua may be too simplistic and it may be more useful to evaluate teacher knowledge in terms of a multiple dimensional scale, such as the one illustrated in Table 10.1. In order to illustrate this scale's use, Nichole Nielsen's probable levels of competence have been entered. Here, ICT competency is considered, as well as proficiency in identifying learner characteristics and needs as well as the application of appropriate literacy strategies. If teachers are inexperienced in any one of these dimensions, it is proposed that their ability to use IMM (or ICT in general) to assist students who experience reading difficulties will be limited and that they will need to work with a partner or mentor who is competent or expert in these dimensions.

Table 10.1 Literacy and ICT: Three Dimensions of Expertise scale: Nicole Nielsen

Knowledge and Competence	Inexpert	Competent	Expert	Inventive
Identification of learner characteristics and needs				
Application of literacy strategies				
ICT competency				

Implications of the Study for Teachers

Identifying and Conceptualising Students' Reading Difficulties

As it seems that the choice of measure can heavily affect conclusions reached about students' abilities, Sofie and Riccio (2002) have recommended that the identification of students' reading difficulties, as well as the determination of the nature and aetiology of these difficulties, can be best carried out by multiple measures. The use of standardised tests in conjunction with curriculum-based measures is recommended where possible (Sofie & Riccio, 2002). This approach may reduce the possibility of idiosyncratic judgements about students' abilities, as shown by some teachers in this study

In order to minimise some of the difficulties associated with conceptualising learning needs, teachers may also find it helpful to follow a diagnostic flowchart, such as Kibby's Diagnostic Decision-Making Model (Kibby, 1995), which indicates steps to be taken and 'decision-making points' in diagnosing students with reading difficulties. Adopting a systematised approach such as this would undoubtedly assist teachers in assessing the nature of the students' difficulties. Another option would be Lipson and Wikson's (1997) Diagnostic Portfolio, which is a systematised, authentic, continuous, purpose-focused means of assessment, which may fit better with some teachers' philosophies because it does not rely on decontextualised testing. Discussion with other teachers may also help facilitate the identification and conceptualisation of students' difficulties, as would a whole-school approach, coordinated by literacy coordinators and specialists. It may be advantageous for preservice and practising teachers to work together in problem-solving contexts in order to develop their skills in the use of ICT to assist students who experience reading difficulties. This could help pre-service teachers to 'think like an expert' in an apprenticeship setting and help practising teachers to question their beliefs and routine practices.

Selecting Strategies

Some of the inhibitive factors that arose during the study can be attributed to the fact that the relationship between software and teaching strategies is highly complex. Not only does software incorporate teaching strategies, but teachers can

also use software in conjunction with traditional teaching strategies, or even ask students to use software in a way that incorporates a traditional teaching strategy. For example, electronic storybooks do not inherently contain the repeated readings strategy, but they can be used to implement it. Because of this, teachers need to be aware of the kinds of strategies that have the potential to be able to help address individual students' needs, but also be able to recognise when the strategies are inherent in software, and when software may be able to help implement them (as in the use of electronic storybooks for repeated readings). Manzo and Manzo's (1993) 'principles of remediation' are useful to help teachers select strategies that will help students who experience reading difficulties. These have been reworked into five principles of intervention.

1. Use a formative approach through the Planning Implementation Evaluation (PIE) cycle (which is essentially a diagnostic, reflective approach).
2. Ensure motivation, engagement, challenge and success through knowing the student, knowing the software and knowing the reading theory – termed here 'The Three Dimensions of Expertise'.
3. Provide instruction, scaffolding and practice (again, through knowing the student, knowing the software and knowing the reading theory – 'The Three Dimensions of Expertise').
4. Ensure pace and parallel methods (through a variety of learning activities. This may involve multiple outcomes).
5. Build metacognitive skills (through explicit teaching and/or discussion, which may take place away from the computer).

Teachers' personal philosophies about how learning does and should take place also affects the selection of strategies (Wray, Medwell, Poulson, & Fox, 2002), and this was clearly illustrated when teachers selected IMM-based strategies during this study. However, the use of IMM-based strategies also appeared to change some teachers' personal philosophies.

Many teachers will agree with the following statement: 'Students with learning problems do not belong alone, in the back of the classroom, seated in front of a computer' (Lewis, 2000a, p. 9), whilst others will be of the opinion that it is

acceptable for these students to spend a limited amount of time on a computer working individually. Sarah Fox, who participated in this study, usually employed teaching strategies that entailed much peer collaboration, including having students working collaboratively around computers. However, during the study she did not object to students spending a limited amount of time working on a computer on an individual basis, as this seemed to be the best way of ensuring instruction that was student controlled in terms of pace, choices of texts, and reception of feedback.

In order to select appropriate IMM-based strategies, it also seems desirable for teachers to be in possession of information about students' preferred or habitual ways of engaging with software, such as those outlined by Bangert-Drowns and Pyke (2002). It acknowledged, however, that these patterns may change over time and across contexts. The teachers in this study did not initially have access to this type of information, and this was the basis of some inhibitive factors. However, as they accumulated information on the ways in which individual students interacted with types of software, they were able to predict and circumvent problems.

Selecting Software

Evaluating the suitability of ICT applications is by its very nature a considerably more complex and time-consuming procedure than is evaluating the suitability of a book, which can often be done through a quick flick through the pages (Pachler, 1999), and all of the participating teachers reported that they had encountered difficulties in finding and choosing software. Furthermore, they were unsure how to evaluate the software they chose to use during the study.

Software needs to be evaluated in depth if its role in the curriculum is central, whereas it has been suggested that it is acceptable for teachers to more cursorily evaluate software that is to have a subsidiary role (Geisert & Futrell, 2000). When using IMM to help children who experience reading difficulties, it seems that software needs to be evaluated carefully (in depth) if it is to accurately target students' needs.

An overarching criterion is the notion of 'usability', which has been defined as follows:

Usability is the ability of a multimedia product to assist users achieve their goal without the technology 'getting in the way'. (Department of Education, State of Victoria, 1999, p. 18)

Usability is dependent on the pedagogical goal, the learner's personal characteristics and teaching-learning strategies, as well as the physical environment and social context. Ultimately, then, only the teacher can determine usability, although students can provide valuable information to help them make this decision.

It has been suggested (Bergen, 2000) that teachers should check that software will be useful and appropriate for the user by analysing the following aspects.

- Firstly, the software should use appropriate language, that is, targeted users should be able to understand vocabulary and concepts. For example, young users may understand the term 'choice' better than the term 'option'. However, it seems that students will need to be taught any language relating ICT that they are likely to encounter regularly
- Secondly, navigational features of software should be considered. As far as possible, these should be intuitive, simple and consistent.
- Thirdly, user control is a consideration that must be taken into account. The user should be given options to skip parts of the software or to turn off background music, for example.
- Fourthly, there should be variety in software, that is, the activities it contains should be varied.
- Finally, the nature of feedback offered by the software should be considered. It should be prompt and unambiguous.

It is noted, however, that many of these aspects cannot be fully analysed prior to the use of software in context. Using Bergen's suggestions as a base, this study has facilitated the construction of a 'Software Review Form' for reading purposes. This is shown in Figure 10.1 and will be further discussed below.

Software Review Form (Literacy)						
Name of software:						
Student's Name:						
Pedagogical goal:						
Main strategy:						
Suitability	Rating (5 is highest) ✓					Comments
PART A	1	2	3	4	5	
Compatible with computer system						
Underlying strategy/strategies						
Appropriate language used						
Scaffolding/support						
Ease of navigation						
Appropriate interest/content						
Attractiveness/ 'Look and Feel'						
Readability						
User control						
Lack of (irrelevant) distractions						
Facility for customisation						
Facility for keeping accurate student records						
Reasonable cost						
PART B						
Pedagogical goals achieved						
User engagement and motivation						
Ease of use/lack of technical hitches						
Time effective						
Unintended outcomes (Positive and Negative):						
POSITIVE:						
NEGATIVE:						
How to use this review form:						
1) Prior to using software, rate Part A (Use only the criteria you deem to be relevant. Add criteria in the blank spaces if you wish).						
2) After the student has used the software, rate Part A again (use different coloured pen). Also rate Part B.						
3) Keep review form for future reference, as it may help you decide what software to use for children with similar needs.						

Figure 10.1. Literacy software review form

Part A of the form involves features of the software that the teacher can to some degree assess prior to classroom use and part B, which is largely based on the 'preferability' issues of efficiency, effectiveness and appeal (Reigeluth & Frick, 1999), should be completed after classroom use.

Some of the criteria suggested by Bergen (2000) need to be addressed. The issue of readability, for example, is important in the context of selecting software to facilitate reading. Normally, measures such as Fry's Readability Index (Fry, 1968) and Reading Recovery levels for low level texts (Fountas & Pinnell, 1999) can be used to determine the readability of texts, but because of the support offered in IMM texts, such measures may not be appropriate. Oakley (2002a) has outlined some of these difficulties (see Appendix 1.1.)

Student opinion is also an important dimension when considering the appropriateness of educational software. For example, when Becki said that she hated *Aesop's Fables* (1994), there seemed little point in asking her to continue using this software and its attendant strategy, even though the teacher saw much merit in it. Also, the student's style of software use should be taken into account where possible. As Bangerl-Drowns and Pyke (2002, n.p.) have put it:

Teachers who make educational use of computer software need to distinguish different qualities of student engagement, so they can better anticipate and respond to different qualities of student learning. (Bangerl-Drowns & Pyke, 2002, n.p.)

For example, Andrew from Hillview could be said to use software mainly in an 'unsystematic engagement' mode, where he flitted from one activity to another. It may have been advantageous to select software for Andrew that did not allow such a large degree of student choice and interactivity.

Classroom Management

As noted in Chapter Nine, one of the most inhibitive factors for teachers in this study was a lack of time. In order to make the best use of limited time, teachers may find it useful to review their classroom management strategies. Indeed, technology itself can help save teachers' time in classroom management (McNally & Etchison, 2000) for example through the use of spreadsheets, Personal Information Managers (PIMs) such as *Microsoft Outlook* (1997), and desktop publishing

software. The teachers at St Clair's used ICT to help them with classroom administration tasks, such as writing school reports, rosters, and planning lessons all of which indubitably saved them time. However, these teachers possessed a high level of computer skills and worked quickly in a computerised context. For teachers with limited ICT experience, such as Linda Harris at Hillview, the use of computers for such administrative tasks would most likely be prohibitively time-consuming, at least initially.

Monitoring and supervising students on the computer were difficult for the participating teachers. It is suggested that, in order to minimise the need for supervision, teachers could ascribe clear roles and rules. This could minimise such factors as 'control envy', as it did during the study at St Clair's. Teachers could also assign class 'experts' to act as peer mentors, as observed at Hillview. In addition, teachers could set up cross age-group mentors, a strategy used at Morland.

Evaluating Teaching/Learning Activities

As Richardson and Anders (1994, p. 201) have stated:

A teacher's judgement about whether an activity is working is highly personal, and is often made quickly, during a time of complex classroom action. This judgement is often based on tacit beliefs and personal needs.

Further, the beliefs driving action are often 'deep and complex, and often contradictory' (Richardson & Anders, 1994, p. 201). Thus, teachers need to be aware of the need to constantly question their assumptions (Richardson & Anders, 1994).

During the study, it was difficult for a number of reasons to evaluate the efficacy of the IMM-based activities. As outlined in Chapter Nine, the most inhibitive of these was the fact that in IMM-based contexts there is often no tangible 'product' that the teacher can assess and the process often takes place between the computer and the student, allowing the teacher only small glimpses of what is going on. Secondly, teachers' lack of knowledge about the software has implications for assessing students' use of it. Thirdly, records kept by the computer and by the student proved in this study to be unreliable.

Despite these difficulties, the extent to which the student has attained the learning outcomes provides the most important feedback (Jones & Paolucci, 1999).

Thus, students can often be assessed using traditional means away from the computer. However, these techniques may not be able to detect many unplanned outcomes and outcomes that are ICT-bound, which may help explain why relatively few unplanned outcomes were identified.

Rubrics have been suggested as a means of assessing learning in ICT-based contexts as they are capable of measuring a wide range of outcomes and behaviours (McVee & Dickson, 2002). They may also be modified to maximise relevance as the innovation progresses. Another strength of rubrics is that they offer a way for every student to achieve at some level (McCullen, 1999) as they are scaled measures rather than discrete.

Generic rubric templates can be downloaded from the WWW⁹⁶, but these, like the innovations themselves, will probably need to be 'fine-tuned' formatively. There is a strong argument for involving students in the creation of rubrics (Skillings & Ferrell, 2000), as involving them in goal-setting and assessment processes often encourages them to critically analyse their work and ultimately become better performers through enhanced motivation and meta-cognitive skills.

In IMM-based contexts, formative assessment should be used as much as possible, despite the difficulties outlined above, because such techniques consider not only what students have learned but also the ways in which they have learned (Vogel & Klassen, 2001). Such formative assessment can provide rich diagnostic data to assist further planning.

Overcoming Software Limitations

There are many occasions when limitations of software can quite easily be overcome. For example, when using *PM Storybooks Silver* (2000), it was found that 'blubs' may have been beneficial in helping students select stories, may also have increased motivation and helped them make predictions about the text, thus increasing their comprehension. Teachers could write the 'blubs' where they are not

⁹⁶ The Teaching and Learning with Technology Website (TLT)

http://www.tlt.ab.ca/learn/overcom/rubrics_new.html

Kathy Schrock's Guide for Educators - <http://school.discovery.com/schrockguide/assess.html>

included with the software. Better still, students who have already read the texts could write them.

Teacher Decision-Making Processes

Teachers in the study often seemed to prefer to make 'safe' decisions. As mentioned above, there seem to be several reasons why teachers avoid taking risks in decision-making. Firstly, they may feel that parents and principals have not sanctioned risk-taking behaviour.

Secondly, they may feel that they do not have the knowledge with which to make a decision. It must be remembered, though, that knowledge cannot usually determine actions, and that decisions entail valid knowledge, political considerations, on-the-spot decisions and intuition. (Fullen, 1991).

Armed with as much knowledge as is available about the needs of the students and the strategies that might help them, it seems necessary for teachers to engage in some risk-taking behaviour. This could be carried out on a small scale initially, to decrease possible negative feedback from parties such as school principals and parents, should experimental approaches fail. If teachers collect data from successful innovations they will eventually amass evidence with which to convince principals and parents of their efficacy. Also, teachers may need to trust their intuition to a greater degree.

What Do Teachers Need in Order to Move Towards Being 'Inventive'?

In an attempt to integrate the issues that have been discussed in this chapter, which are derived from data collected during this study, a model that represents probable preconditions of teacher development in integrating literacy and technology to help students who experience reading difficulties has been constructed (see Figure 10.2).

It seems that, in order to become inventive⁹⁷ (Dwyer et al., 1990) in the use of ICT to facilitate reading in students with reading difficulties, teachers need to reflect upon and integrate their knowledge of ICT with theoretical knowledge of reading

⁹⁷ It seems desirable for all teachers to progress through the stages, although it is not necessary for teachers to be 'innovative' or even 'expert' in the three dimensions of expertise, as was demonstrated by Linda Harris at Hillview Primary School.

difficulties and their knowledge of the students' needs, which are the 'three dimensions of expertise', illustrated in Table 10.1. Reflection is an important part of the process because in contexts where innovation and customisation of practices to suit individual needs are targeted, 'routine' practice (Louden, 1991) is not adequate.

In addition, what will be termed an 'amenable' environment seems to be necessary. From the evidence outlined in Chapter Nine, it is proposed that an amenable environment should include a range of appropriate resources (time, professional development, software, hardware), a culture of flexibility, risk-taking, collaboration and experimentation, as well as high teacher motivation to innovate, and a sense of autonomy.

It is proposed that it is very difficult for teachers to develop through the stages of inexperienced, competent, expert and inventive without an 'amenable' environment. The environment at St Clair's College was fairly amenable to the integration of technology into reading, and thus the teachers, Catherine Williams and Nicole Nielsen had managed to progress to 'expert' levels.

The model not only accommodates teachers' knowledge and access to resources, but also gives prominence to *beliefs*, which must be accorded more importance if changes in practices are to occur. As stated by Richardson (1994, p. 90):

If beliefs are related to practices, and more particularly, if beliefs drive practices, staff development that focuses solely on teaching practices may not be successful in effecting change, unless the teachers' beliefs and theories underlying the practices are also explored.

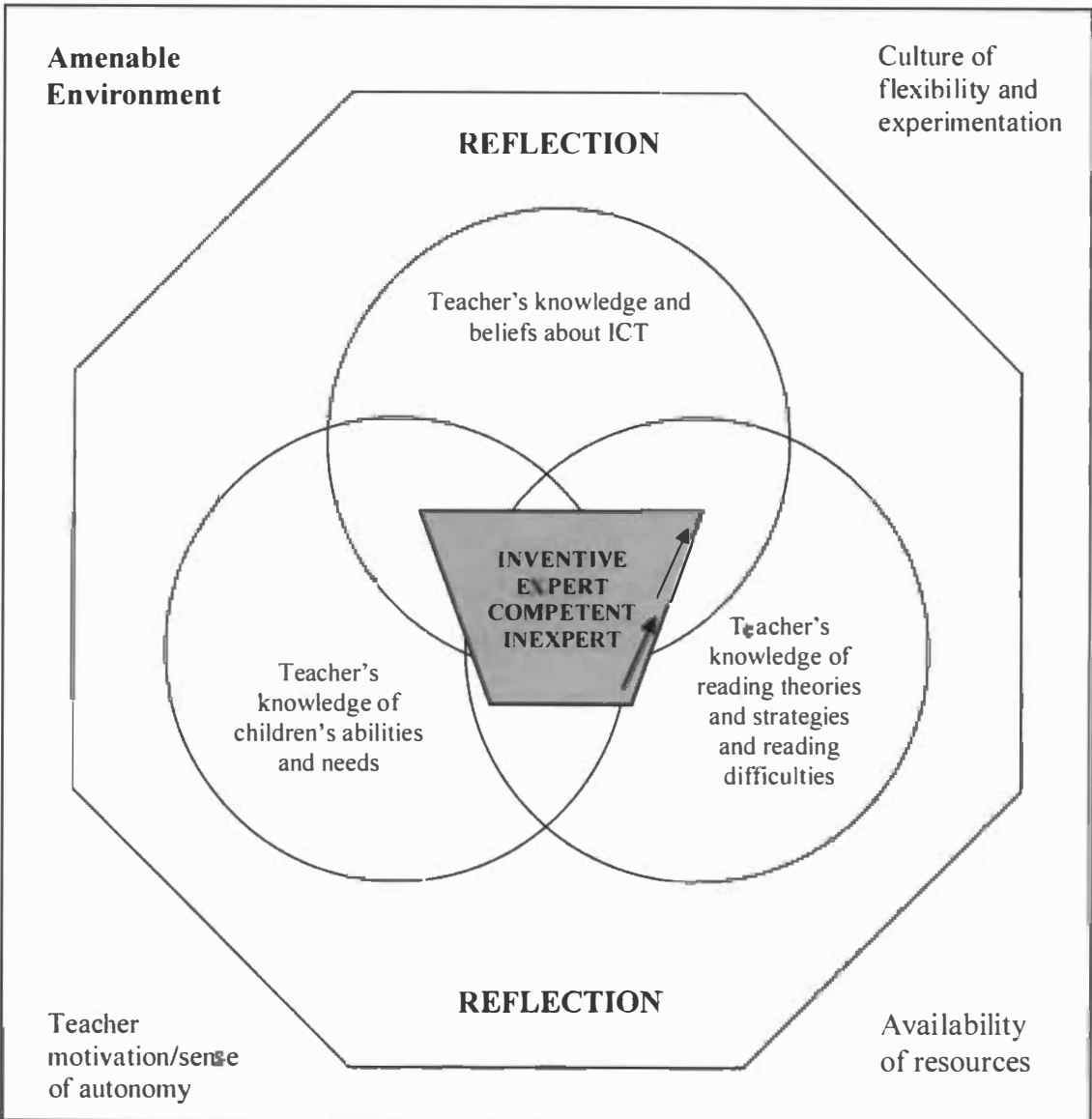


Figure 10.2. The conditions of teacher development in integrating literacy and technology to help students who experience reading difficulties.

Implications for Software Producers

Many of the issues that arose during this study were related to software limitations and the lack of availability of appropriate software. If trial copies of software (for multiple machines, not a single computer) were more freely available, teachers, especially those who are at an 'expert' level or above, would be much better able to assess its appropriateness for the learning needs of the students in their class and how its use could be managed in the classroom context. Teachers at a

lower level of development in the use of ICT for literacy learning/teaching would be able to improve their knowledge of software through the opportunity to explore a range of trial software, and may (as was the case with Linda Harris during the study) find the confidence to use more software in their teaching.

It seems that teachers need to be able to trial software on two levels. In what will be termed the 'preliminary trial', teachers should explore the software to decide whether it would worth 'trailing in context'. Secondly, software should be trialled in context for a certain period and with the intended users. Only then can software be satisfactorily evaluated. This is why the proposed software review sheet (see Figure 10.1) is composed of parts A and B, for completion before students use the software and after they have used it.

It has been argued that more teacher involvement is needed in the design of educational software, which still seems to be largely commercially driven (Naughton, 2002). Indeed, one such attempt has been made in the Australian context (Department of Education, State of Victoria, 1999), but the results do not yet seem to have changed the quality and relevance of software substantially. This situation might be improved if only teachers at the expert and inventive levels of using ICT to assist children in their literacy learning participate in such consultation. Teachers at lower levels of accomplishment in this area could also be canvassed to ascertain the difficulties they have faced in using ICT and how these difficulties might be alleviated through changes in software design.

If software producers provided more comprehensive documentation, linking software to literacy theory, teachers would indubitably find it easier to justify its use in their own minds and to justify it to stakeholders such as parents and school principals. Furthermore, more suggestions for its strategic use could be supplied. Software producers could also employ educational consultants to provide professional development for teachers on how the software might be used. Ancillary materials such as paper-based books and materials should also be made available for teachers and students, possibly through providing the capacity and permission to print texts.

Documentation, in layperson's language, provided by producers on issues such as licensing and copyright issues, would also be advantageous, as many teachers appear to avoid using software because of uncertainty regarding legal issues.

Moreover, although it is useful to consumers to have access to the age ranges of the students at whom the software is aimed, software producers could perhaps display such information more discreetly and leave it out of the title of the software, as students who experience literacy difficulties do not like using software that is advertised as being suitable for younger age-groups.

Finally, the issue of cost must be considered. Site licenses appear to be inhibitive in terms of monetary cost in many instances and thus particular software, whilst desirable to educators, may not be purchased and used at all. It may be the case that software producers could raise their revenue by reducing the cost of site licenses.

Suggestions for Further Research

There is still a large amount of research to be done in the area of IMM and literacy. The suggestions for further research that arose out of this study focus on the strategic use of IMM to help students improve their reading, especially their oral reading fluency and comprehension, which were the pedagogical goals in the four participating classrooms.

With reference to the use of IMMARR to assist in the learning of oral reading fluency, several areas need to be investigated. These are listed below:

1. How can the design of software be improved to facilitate the use of IMMARR to assist in the teaching/learning of oral reading fluency?
 - What would the benefits be of electronic talking books with varying speeds of narration?
 - Would it be advantageous to record the same story using a variety of different voices to encourage repeated readings?
 - Is text highlighting necessary to helping students detect phrase boundaries, or can they detect this from prosodic features of computer narrations?
 - What degree of animation is optimal in the use of electronic storybooks for IMMARR? Would it be better if animation were omitted completely?

- Would the ability to 'pause' or 're-read' sections of electronic storybooks benefit children's comprehension?
2. How can teachers implement the use of electronic talking books in the classroom to help students who experience oral reading fluency difficulties?
- What can be done to assist teachers in the diagnosis of reading difficulties in the area of oral reading fluency?
 - How can electronic storybooks be supplemented with other IMM-based or non-IMM-based activities to encourage self-monitoring of oral reading fluency?
 - How can teachers be encouraged to modify strategies that do not appear to be working?
 - How could waveforms be used to facilitate the teaching of oral reading fluency?

With reference to the creation of electronic talking books as a context to help children develop their oral reading fluency, the following questions could be pursued:

3. How can software design facilitate the creation (by students) of electronic talking books as a context for improving their oral reading fluency?
- Would *Microsoft PowerPoint* (1997) be a useful multimedia-authoring tool to create electronic talking books as a context for improving oral reading fluency? (Most students in Australia have access to this program at school and some already know how to use it).
 - Would composing storyboards on a computer be an attractive alternative to making paper-based storyboards? (Students in the present study disliked creating paper-based storyboards).

With reference to the use of a range of software to facilitate the improvement of reading comprehension, the following questions need to be investigated:

4. How can a 'free choice of software strategy' (FCSS) best be implemented to assist children who experience reading difficulties?

- What are the advantages and disadvantages of allowing students with reading difficulties to 'flit' through a range of IMM computer programs?
- How can the 'free choice of software' strategy be supported by the teacher to minimise frustration and wasted time for the student?

Conclusion

In this thesis, it has been shown that, even though the use of IMM to help students who experience reading difficulties is a complex and sometimes frustrating undertaking for teachers, it can be extremely beneficial to these students on several levels. Most of the students in this study went a significant way towards achieving the pedagogical goals set by their teachers, although a few students whose difficulties were not severe and who were already perhaps receiving optimal teaching (St Clair's College, Year 4) in a traditional context did not appear to achieve the pedagogical goals.⁹⁸ Also, participating students seemed to improve in terms of confidence, motivation to read and self-confidence. These affective benefits often transferred to the traditional classroom context. It seems reasonable to assume that these successes arose to some extent as a result of the diagnostic and formative approach taken by teachers, in which they diagnosed the students' needs, developed IMM-based strategies to meet these needs, and monitored the implementations to make sure they were working.

Many of the factors that prohibited or inhibited the use of IMM to assist students who experienced reading difficulties could potentially be alleviated if changes were made in initial teacher education, teacher professional development, the organisation of schools, and the production and marketing of educational software. That is, teachers need knowledge and expertise in ICT, reading theories, strategies for students with difficulties and in assessment and diagnosis of children's literacy needs. They also need an amenable school environment in which resources such as time, hardware, software and support are readily available. They also need a culture of flexibility and experimentation, where there is no sense of 'blame' if

⁹⁸ It must also be remembered that the classroom teacher and not the researcher carried out the post-intervention testing in this case and that there were some errors in its administration.

implementations do not work as expected. Furthermore, time and encouragement to reflect are necessary (see Figure 10.2).

Whilst some of these desired changes are unlikely in the short term, many seem to be achievable and, indeed, are already in place in some schools, such as St Clair's College. At this school, the most observed inhibitive factor related to insufficient time, although many other less inhibitive factors were noted. As mentioned above, St Clair's had gone some way towards providing an amenable environment, including a supportive culture, professional development, timely technical support and provision of necessary resources for teachers. Nevertheless, although the teachers were confident and supported in the use of ICT for teaching, they did sometimes show that they needed additional support in the diagnosis and remediation of reading difficulties.

At the other two schools which participated in this study, insufficient time, support and teacher education seemed to be the main inhibitors to the successful use of IMM in helping students who experienced reading difficulties. This related not only to the use of ICT in the classroom, but to the diagnosis and remediation of reading difficulties. However, many of these factors were relatively easily overcome by the provision of a temporary support person⁹⁹ who was able to help compensate for teachers' limitations in the 'three dimensions of expertise' and help them progress along these dimensions.

⁹⁹ The researcher played this role.

REFERENCES

- Adam, N., & Wild, M. (1997). Applying CD-ROM interactive storybooks to learning to read. *Journal of Computer Assisted Reading*, 13(2), 119-132.
- Aesop's fables [Computer software]. (1994). Buffalo: Disc4 Knowledge Research.
- Alderman, B., & Milne, P. (1998). Partners in learning: Educators, practitioners and students collaborate on work-based learning: A case study. *Higher Education Research and Development*, 17(2), 229-238.
- Aldrich, F., Rogers, Y., & Scaife, M. (1998). Getting to grips with 'interactivity': Helping teachers assess the educational value of CD-ROMS. *British Journal of Educational Technology*, 29(4), 321-332.
- Allington, R. (1977). If they don't read much, how they gonna get good? *Journal of Reading*, October(1977), 57-61.
- Anderson, R., & Pearson, P. D. (1984). A schema-theoretical view of basic processes in reading comprehension. In P. D. Pearson, R. Barr, M. L. Kamil & P. Mosenthal (Eds.), *Handbook of reading Research* (Vol. 1, pp. 255-291). White Plains, New York: Longman.
- Anderson-Inman, L., & Homey, M. A. (1998). Transforming text for at-risk readers. In D. Reinking, M. C. McKenna, L. D. Labbo & R. D. Kieffer (Eds.), *Handbook of Literacy and Technology: Transformations in a Post-Typographic World*. Mahwah, NJ: Lawrence Erlbaum.
- Andrews, R. J. (1973). *St Lucia Graded Word Reading Test*. Brisbane: Teaching and Testing Resources.
- Arthur's birthday [Computer software]. (1994). Novato: C A: Random House/Broderbund.
- Arthur's teacher troubles [Computer software]. (1992). Living Books/Broderbund.
- Ashton, T. M. (2000). Hypermedia-based children's phonics software: Do the features match your needs. *Special Education Technology Practice*, 2(2), 17-19.
- Atkinson, L. (2000). Trusting your own judgement (or allowing yourself to eat the pudding). In T. Atkinson & G. Claxton (Eds.), *The intuitive practitioner: on the value of not always knowing what one is doing* (pp. 53-65). Buckingham, UK: Open University Press.
- Atkinson, T., & Claxton, G. (Eds.). (2000). *The intuitive practitioner: on the value of not always knowing what one is doing*. Buckingham, UK: Open University Press.
- Authorware [Computer software]. (n.d.). Macromedia.
- Ayersman, D. J. (1995). Reviewing the research on hypermedia-based learning. *Journal of Research on Computing in Education*, 28(4), 500-525.
- Bailey, G. D., Ross, T. W., & Griffin, D. L. (1995). Barriers to curriculum-technology integration in education - are you asking the right questions? *Catalyst for Change*, 25, 16-20.
- Baker, E. L., & O'Neil, H. F. J. (Eds.). (1994). *Technology assessment in education and training*. Hillsdale, NJ: Lawrence Erlbaum Associates.

- Baker, L., Dreher, M. J., & Guthrie, J. T. (2000) Why teachers should promote reading engagement. In *Engaging young readers: Promoting achievement and motivation*. New York: The Guilford Press.
- Balajthy, E. (1994). Whole language, computers and CD-ROM technology: A kindergarten unit on "Benjamin Bunny". *ERIC Document Reproduction Service. Document Number ED364 831*, 1-10.
- Balajthy, E., Reuber, K., & Damon, C. J. (1999). *Using computers for intervention and remediation of severely reading-impaired children in a university literacy clinic*: ERIC Document Reproduction Service. Document number ED 432329.
- Bangert-Drowns, R. L., & Pyke, C. (2002). Teacher ratings of student engagement with educational software: An exploratory study. *Educational Technology*, 50(2), 23-.
- Bansel, P. (1998). Classroom relationships across the grades. In *Getting Started: Ideas for the Literacy Teacher* Newtown, NSW: PETA.
- Barrett, T. C. (1972). Taxonomy of reading comprehension. In *Reading 360 Monograph*. Lexington, MA: Ginn.
- Beavers, D. (2001). Professional development: Outside the workshop box. *Principal Leadership*, 1(9), 43-46.
- Beecher, B., & Arthur, L. (2001). *Play and literacy in children's worlds*. Newtown, NSW: PETA.
- Beginning to read [Computer program]. (n.d.). Dublin: Iona Software Ltd.
- Bennett, H. (1994). To instruct and delight: Children and young adults' literature on CD-ROM. *CD-ROM Professional*, 7(4), 84-94.
- Bergen, D. (2000). Linking technology and teaching practice. *Childhood Education*, 76(4), 252-253.
- Biggs, J. B., & Moore, P. J. (1993). *The process of learning* (3rd ed.). NY: Prentice Hall.
- Blaehcr, J. (2002). Twice-exceptional: Learning disabled and gifted. *Exceptional Parent Magazine*, 32(9), 100-103.
- Blok, H., Oosdam, M. E., Otter, M. E., & Overmaat, M. (2002). Computer-Assisted Instruction in support of beginning reading instruction: A review. *Review of Educational Research*, 72(1), 103-130.
- Bloor, M. (1997). Techniques of validation in qualitative research: A Critical commentary. In G. Miller & R. Dingwall (Eds.), *Context and Method in Qualitative Research* (pp. 37-50). London: SAGE.
- Bogdan, R. C., & Biklen, S. K. (1992). *Qualitative research for education* (2nd ed.). Boston: Allyn and Bacon.
- Bolter, J. D. (1998). Hypertext and the question of visual literacy. In D. Reinking, M. C. McKenna, L. D. Labbo & R. D. Kieffer (Eds.), *Handbook of Literacy and Technology: Transformations in a Post-Typographic World*. Mahwah, NJ: Lawrence Erlbaum.
- Boone, R., & Higgins, K. (1993). Hypennedia basal readers: Three years of school based research. *Journal of Special Education Technology*, 12(2), 86-106.
- Bowman, L. M. (1999). Curious George meets Herman: The effects of commercially produced phonics software on phonemic awareness: ERIC Document Reproduction Service.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-41.

- Bruce, B. C., & Rubin, A. (2000). *Electronic quills: A situated evaluation of using computers for writing in classrooms*. Retrieved 28/08/2000, 2000, from www.coe.uog.edu/reading/faculty/dreinking/Situated_learning.html
- Bruneau, B. J. (1992). Implementing whole language instruction for young children: Cases of teacher change and development. In C. Z. Kinzer & D. J. Leu (Eds.), *Literacy research, theory and practice: Views from many perspectives*. Chicago, Ill: National Reading Conference, Inc.
- Burgess, J. (2003). Strategies to reduce the learning difficulties experienced by children with attention and concentration problems. *Australian Journal of Learning Disabilities*, 8(3), 8-14.
- Burns, M. (2002). From black and white to color: Technology, professional developments and changing practice. *Technology Horizons In Education (T.H.E.) Journal*, 29(11), 36-42.
- Burns, M. S., Griffin, P., & Snow, C. (Eds.). (1999). *Starting out right: A guide to promoting children's reading success*. Washington, DC: National Academy Press.
- Burton, A. M. (1996). Reading with a technology twist. *ERIC Document Reproduction Service, Document Number ED396 267*, 1-10.
- Byrom, E. (1998, 2003). *Review of the professional literature on the integration of technology into educational programs*. Retrieved 3rd June, 2003, from <http://www.serve.org/technology/litrev.html>
- Cambourne, B. (2002). *Holistic, integrated approaches to reading and the language arts instruction: The constructivist framework of an instructional theory*. Newark, Delaware: International Reading Association.
- Carmen San Diego Word Detective [Computer software]. (1997). Novato, CA: Brøderbund Software.
- Carnine, D. W., Silbert, J., & Kameenui, E. K. (1997). *Direct instruction reading* (3rd ed.). Upper Saddle River, New Jersey: Prentice Hall.
- Casc, C., & Truscott, D. M. (1999). The lure of bells and whistles: Choosing the best software to support reading instruction. *Reading and Writing Quarterly*, 15, 361-369.
- Casey, C. (1996). Incorporating cognitive apprenticeship in multimedia. *Educational Technology Research and Development*, 44(1), 71-84.
- Chan, L. S. K., & Dally, K. (2000). Review of literature. In W. Louden, L. K. S. Chan, J. Elkins, D. Greaves, H. House, M. Milton, S. Nichols, M. Rohl, J. Rivalland & C. V. Krayenoord (Eds.), *Mapping the Territory. Primary Students with Learning Difficulties: Literacy & Numeracy* (Vol. 2). Canberra: DETYA.
- Chu, M.-L. L. (1995). Reader response to interactive computer books: Examining literary responses in a non-traditional reading setting. *Reading Research and Instruction*, 34(4), 352-366.
- Chun, D. M., & Plass, J. L. (1996). Facilitating reading comprehension with multimedia. *System*, 24(4), 503-519.
- Cinderella [Computer program]. (1994). Discis.
- Clark, C. H. (1995). Teaching students about reading: A fluency example. *Reading Horizons*, 35(3), 250-266.
- Clark, F. T. (1998). Integrating technology into the classroom: A teacher's perspective. *TechTrends*, 43(2), 45-46.
- Clark, R. (1983). Reconsidering research on learning from media. *Review of Educational Research*, 53(4), 445-459.

- Clark, R. (1994). Media will never influence learning. *Educational Technology Research and Development*, 42(2), 21-29.
- Clay, M. M. (1993). *Reading Recovery: A guidebook for teachers in training*. Auckland: Heinemann.
- Coffey, A., & Atkinson, P. (1996). *Making sense of qualitative data: Complementary research strategies*. Thousand Oaks: Sage.
- Cognition and Technology Group at Vanderbilt Learning Technology Centre. (1993). Examining the cognitive challenges and pedagogical opportunities of integrated media systems: Towards a research agenda. *Journal of Special Education Technology*, 12(2), 118-124.
- Collins, J., Hammond, M., & Wellington, J. (1997). *Teaching and learning with multimedia*. London: Routledge.
- Commonwealth of Australia. (2001). *Copyright in Australia: A short guide*. Retrieved 21/6/2003, from <http://www.law.gov.au/agg/Department/Publications/publications/copyrightla/waust/10.html>
- Commonwealth of Australia. (2002). *My Read: Strategies for teaching reading in the middle years*. Retrieved 3/12/03, 2002, from www.myread.org
- Ciader, J. (2003). Technology's impact on teaching and learning. *Learning and Leading with Technology*, 30(7), 54-57.
- Curry, L. (1990). A critique on the research on learning styles. *Educational Leadership*, 48, 51-55.
- Darling-Hammond, L. (1998). Teacher learning that supports student learning. *Educational Leadership*, 55, 6-11.
- Davies, A., & Ritchie, D. (1996). *THRASS: Teaching handwriting, reading and spelling skills*. London: Collins Educational.
- de Bono, E. (1999). *Six thinking hats*. London: Penguin.
- Dec-Lucas, D. (1996). Effects of overview structure on study strategies and text representations for instructional hypertext. In J. Rouet, J. J. Levonsen, A. Dillon & R. J. Spiro (Eds.), *Hypertext and Cognition* (pp. 73-107). Mahwah, NJ: Lawrence Erlbaum.
- DeJean, J., Miller, L., & Olsen, J. (1995). CD-ROM talking books: A case study of promise and practice. *ERIC Document Reproduction Service. Document Number ED385 217*
- Department of Education and Training. (2003, 2003). *Students of educational risk*. Retrieved 26 May, 2003, from <http://www.eddept.wa.edu.au/sacr/teachers/sacr/index.htm>
- Department of Education, G. o. W. A. (2002). *Notebooks for Teachers*. Retrieved 20/11/02, 2002, from <http://www.e2c.wa.edu.au/notebooks/overview/overview.html>
- Department of Education. State of Victoria. (1999). *More than a game: Exploring educational multimedia for educators and designers*. Melbourne, Vic: Department of Education. State of Victoria.
- Department of Employment Education and Training. (1991). *Australia's language: The Australian language and literacy policy*. Canberra.
- Department of Employment Education Training and Youth Affairs (DEETYA). (1998). *Literacy for all: The challenge for Australian schools*. Canberra, ACT: DEETYA.
- Derewianka, B. (1990). *Exploring how texts work*. Newtown, NSW: PETA.

- DEST. (2002). *Raising the standards: A proposal for the development of an ICT competency framework for teachers*: Commonwealth Department of Education Science and Training.
- Dias, L. B. (1999). Integrating technology. *Learning and Leading with Technology*, 27(3), 10-13.
- Dillon, A., & Gabbard, R. (1998). Hypermedia as an educational technology: A review of the quantitative research literature on learner comprehension, control, and style. *Review of Educational Research*(Fall), 322-349.
- Dolch, E. (1951). *Psychology and teaching of reading* Champaign, Ill: The Garrard Press.
- Doty, D., Popplewell, S. R., & Byers, G. O. (2001). Interactive CD-ROM storybooks and young readers' reading comprehension. *Journal of Research on Computing in Education*, 33(4), 374-384.
- Dowhower, S. L. (1987). Effects of repeated reading on second-grade transitional readers' fluency and comprehension. *Reading Research Quarterly*, 22, 389-406.
- Downes, T., & Fatouros, C. (1995). *Learning in an electronic world*. Newtown, NSW: PETA.
- Dr Seuss reading games [Computer software]. (2000). Fremont, CA: The Learning Company.
- Dreamweaver [Computer software]. (2001). (Version 4): Macromedia.
- Duchastel, P. (1991). Examining cognitive processes in hypennedia usage. *Hypermedia*, 2, 221-233.
- Duke, N. K., & Pearson, P. D. (2002). Effective practices for developing reading comprehension. In A. E. Farstrup & S. J. Samuels (Eds.), *What research has to say about reading instruction* (3rd ed., pp. 205-242). Newark, Delaware: International Reading Association.
- Dunn, L. M., & Dunn, L. (1997). *Peabody Picture Vocabulary Test III (PPVT: III)* (3rd ed.). Circle Pines, Minn: American Guidance Service.
- Dunn, R. (1990). Bias over substance: A critical analysis of Karvale and Forness' report on modality based instruction. *Exceptional Children*, 56(4), 352-356.
- Durkin, T. (1997). Using computers in strategic qualitative research. In G. Miller & R. Dingwall (Eds.), *Context and Method in Qualitative Research* (pp. 92-105). London: Sage.
- Dwyer, D. C., Ringstaff, C., & Sandholtz, J. H. (1990). *The evolution of teachers' instructional beliefs and practices in high-access-to-technology classrooms. First-Fourth year findings* (No. Report number 8). Cupertino, Ca: Apple Classrooms of Tomorrow Research.
- Eagleon, M. (2001). Making text come to life on the computer: Toward an understanding of hypermedia literacy. *Reading Online*.
- Eanes, R. (1997). *Content area literacy*. Albany, NY: Delmar Publishers.
- Easdown, G. (1995). *Encouraging teachers to explore educational computing and to integrate the use of computers and allied technology into their teaching practice: A British perspective*, from <http://www.ilt.ed.au/oltpd/docs/inv06.html>
- Education Department of Western Australia. (1988). *Curriculum Framework*. Perth: Education Department of Western Australia.
- Education Department of Western Australia. (1997a). *First Steps: Reading developmental continuum*. Port Melbourne: Rigby & Heinemann.

- Education Department of Western Australia. (1997b). *First Steps: Reading resource book*. Port Melbourne, VIC: Rigby Heinemann.
- Education Department of Western Australia. (1998). *Outcomes and standards framework overview: Student outcome statements*. Perth: EDWA.
- Education Queensland. (2002). *Literate futures report*.
- Elkins, J. (2002). Learning difficulties/disabilities in literacy *Australian Journal of Language and Literacy*, 25(3), 11-18.
- Encarta [Computer Software]. (1995). Microsoft.
- Englert, C. S., & Thomas, C. C. (1987). Sensitivity to text structure in reading and writing: A comparison between learning disabled and non-learning disabled students. *Learning Disability Quarterly*, 10(2), 93-105.
- Fables [Computer program]. (1993). Discis.
- Farstrup, A. E. (2002). There is more to effective reading instruction than research. In A. E. Farstrup & S. J. Samuels (Eds.), *What research has to say about reading instruction* (pp. 1-7). Newark, Delaware: International Reading Association.
- Fehring, H. (2003). Understanding the influences on teachers' judgements in the process of assessing and reporting students' literacy in the classroom. In H. A. Fehring (Ed.), *Literacy assessment: A collection of articles from the Australian Literacy Educators'* (pp. 9-31). Newark, Delaware: IRA.
- Flood, J., & Lapp, D. (1998). Broadening conceptualizations of literacy: The visual and communicative arts. *The Reading Teacher*, 51, 342-344.
- Ford, M. J., Poe, V., & Cox, J. (1995). *Using C.DROMs to develop automaticity and fluency in reading*. Retrieved 25/11/1998, from <http://rice.edn.deakin.edu.au/Archives/95Annual/0514.htm>
- Forgan, J. W. (2001). Selecting software for students with high incidence disabilities. *Intervention in School and Clinic*, 37(1), 40-47.
- Fountas, J. C., & Pinnell, G. (1999). *Matching books to readers: Using leveled books in guided reading, K-3*. Portsmouth, NH: Heinemann.
- Freebody, P. (1992). A socio-cultural approach: Resourcing four roles as a literacy learner. In A. J. Watson & A. M. Badenhop (Eds.), *Prevention of Reading Failure*. Sydney: Ashton Scholastic.
- Fry, E. (1968). A readability formula that saves time. *Journal of Reading*, 11, 513-516.
- Fullan, M. G. (1991). *The new meaning of educational change* (3rd ed.). London: Cassell.
- Gambrell, L. B. (1978). Getting started with Sustained Silent Reading and keeping it going. *The Reading Teacher* (1978), 328-331.
- Gardner, H. (1993). Multiple Intelligences go to school: Educational implications of the theory of Multiple Intelligences. Technical Report number 4: ERIC Document Reproduction Service. Document Number ED324366.
- Gardner, H. (2000). Can technology exploit our many ways of knowing? In D. T. Gordon (Ed.), *The digital classroom: How technology is changing the way we teach and learn* (pp. 32-35). Cambridge, MA: Harvard Education Letter.
- Gee, J. P. (1992). *The social mind: Language, ideology and social practice*. New York: Bergin & Garvey
- Geisert, P. G., & Futrell, M. K. (2000). *Teachers, computers and curriculum: Microcomputers in the classroom* (3rd ed.). Boston: Allyn and Bacon.

- Gersten, R., Fuch, L. S., Williams, J. P., & Baker, S. (2001). Teaching reading comprehension strategies to students with learning disabilities: A review of research. *Review of Educational Research, 71*(2), 279-320.
- Glasgow, J. (19967). Motivating young readers using CD-ROM storybooks. *Learning and Leading with Technology, 24*(4), 17-22.
- Gold, R. L. (1969). Roles in sociological field observation. In G. McCall & J. L. Simmons (Eds.), *Issues in participant observation*. Reading, MA: Addison-Wesley.
- Goodison, T. A. (2002). Learning with ICT at primary level: pupils' perceptions. *Journal of Computer Assisted Learning, 18*, 282-295.
- Greenlee-Moore, M. E., & Smith, L. L. (1996). Interactive computer software: The effects on young children's reading achievement. *Reading Psychology: An International Quarterly, 17*, 43-64.
- Gandy, S. (2001). The curriculum of teaching. In E. Hatton (Ed.), *Understanding teaching* (2nd ed., pp. 27-40). Marickville, NSW: Harcourt Australia Pty Ltd.
- Guba, E. G., & Lincoln, Y. S. (1982). Epistemological and methodological bases of naturalistic inquiry. *Educational Communication and Technology Journal, 30*(4), 233-252.
- Guthrie, J. T. (2002). Contexts for engagement and motivation in reading. *Reading Online, 4*(8).
- Hall, V. G., & Martin, L. E. (1999). Making decisions about software for classroom use. *Reading Research and Instruction, 38*(3), 187-196.
- Hargreaves, A. (1989). *Curriculum and assessment reform*. Milton Keynes, UK: Open University Press.
- Harris, L., & Hodges, E. (Eds.). (1995). *The literacy dictionary: the vocabulary of reading and writing*. Newark, Delaware: International Reading Association.
- Harry and the haunted house [Computer software]. (1994). Random House/Bröderbund.
- Hasbrouck, J. E., Innot, C., & Rogers, G. H. (1999). "Read Naturally": A strategy to increase oral reading fluency. *Reading Research and Instruction, 39*(1), 27-37.
- Hasselbring, T. S., Goin, L., Taylor, R., Bottge, B., & Dalton, D. (1997). The computer doesn't embarrass me. *Educational Leadership, 55*(3), 30-33.
- Heckelman, R. G. (1969). A neurological impress method of remedial reading instruction. *Academic Therapy, 4*, 277-282.
- Hede, A. (2002). An integrated model of multimedia effects on learning. *Journal of Educational Multimedia and Hypermedia, 11*(2), 177-191.
- Heller, M. (1991). *Reading-writing connections: From theory to practice*. NY: Longman.
- Hempstead, K. (2003). The three-cueing system: Trojan horse? *Australian Journal of Learning Disabilities, 8*(2), 15-23.
- Henderson, J. G. (1992). *Reflective teaching: Becoming an inquiring educator*. NY: MacMillan Publishing Company
- Higgins, K., Boone, R., & Lovitt, T. C. (1996). Hypertext support for remedial students and students with learning disabilities. *Journal of Learning Disabilities, 29*, 402-412.
- Higgins, K., Boone, R., & Williams, D. L. (2000). Evaluating educational software for special education. *Intervention in School and Clinic, 36*(2), 109-115.

- Higgins, N., & Cox, P. (1997). The effects of animation cues on third grade children's ability to learn the meanings of unfamiliar words. *Educational Research Document ED 418 686*
- Hill, S. (1990). *Readers Theatre: Performing the text*. Melbourne: Eleanor Curtain Publishing.
- Hoffman, J. V., & Crone, S. (1985). The oral recitation lesson: A research-derived strategy for reading basal texts. In J. A. Niles & R. A. Lalik (Eds.), *Issues in literacy: A research perspective. Thirty-fourth yearbook of the National Reading Conference* (pp. 76-83). Rochester, NY: National Reading Conference.
- Holdaway, D. (1979). *The foundations of literacy*. Sydney: Ashton Scholastic.
- Holland, P. (2001). Professional development in technology: Catalyst for school reform. *Journal of Technology and Teacher Education*, 9(2), 245-267.
- Homey, M. A., & Anderson-Inman, L. (1994). The ElectroText Project: Hypertext reading patterns of middle school students. *Journal of Educational Multimedia and Hypermedia*, 3(1), 71-91.
- Homey, M. A., & Anderson-Inman, L. (1999). Supported text in electronic reading environments. *Reading and Writing Quarterly*, 15, 127-168.
- Humble, A. L. (2000). A comparison study of the traditional reading strategy of reading aloud with an adult and the technology based strategy of computerized talking books. *ERIC Document Reproduction Service Document number ED450349*.
- Hyperstudio [Computer software]. (2000). (Version 4.1). London: Knowledge Adventure.
- Illuminatus [Computer software]. (1999). (Version 4.5): Digital Workshop.
- Illuminatus Opus [Computer software]. (2001). (Version 2.6): Digital Workshop.
- Inglis, A., Ling, P., & Joosten, V. (1999). *Delivering digitally*. London: Kogan Page.
- Inspiration [Computer software]. (2000). (Version 6): Inspiration Software.
- International Reading Association. (2001). *Integrating literacy and technology in the curriculum*. Retrieved 10th October, 2003, from www.reading.org/positions.html
- Ingrin, J. W. (1991). *Teaching reading comprehension processes* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.
- Jacob, E. (1992). Culture, context, and cognition. In M. D. LeCompte, W. L. Millroy & J. Preissle (Eds.), *The handbook of research in education*. San Diego: Academic Press, Inc.
- Jiménez, J. E., del Rosario Ortiz, M., Rodrigo, M., Hernández-Valle, I., Ramirez, G., Estevez, A., et al. (2003). Do the effects of computer-assisted practice differ for children with reading disabilities with and without IQ-achievement discrepancy? *Journal of Learning Disabilities*, 36(1), 34-47.
- Jiménez, R. T. (1997). The strategic reading abilities and potential of five low-literacy Latino/o readers in middle school. *Reading Research Quarterly*, 32(3), 224-243.
- Johnson, J. M. (2001). Evaluating technology resources. *Learning and Leading with Technology*, 29(2), 58-61.
- Jonassen, D. H., Peck, K. L., & Wilson, B. G. (1999). *Learning with technology: A constructivist perspective*. Upper Saddle River, New Jersey: Merrill.
- Jones, T. H., & Paolucci, R. (1999). Research framework and dimensions for evaluating the effectiveness of educational technology systems on learning outcomes. *Journal of Research on Computing in Education*, 32(1), 17-27.

- Jongsma, K. (1990). Learning styles. *The Reading Teacher*, May, 696-697.
- Just me and my dad [Computer program]. (1997). Big TimeNew Media.
- Kamil, M., & Lane, D. M. (1998). Researching the relation between technology and literacy: An agenda for the 21st century. In D. Reinking, M. C. McKenna, L. D. Labbo & R. D. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. 323-341). Mahwah, NJ: Lawrence Erlbaum.
- Kellner, D. M. (2002). Restructuring education. In I. Snyder (Ed.), *Silicon literacies: Communication, innovation and education in the electronic age* (pp. 154-169). London: Routledge.
- Kibby, M. W. (1995). *Practical steps for informing literacy instruction: A diagnostic decision-making model*. Newark, Delaware: International Reading Association.
- Kidpix Deluxe [Computer program]. (1998). Broderbund.
- King, K. P. (2002). Educational technology professional development as transformative learning opportunities. *Computers and Education*, 39(3), 283-297.
- Kinzer, C., & Leu, D. (1997). The challenge of change: Exploring literacy and learning in electronic environments. *Language Arts*, 74(2), 126-136.
- Klenk, L., & Kibby, M. W. (2000). Re-mediating reading difficulties: Appraising the past, reconciling the present, constructing the future. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson & R. Barr (Eds.), *Handbook of reading research (Volume III)*. Mahwah, NJ: Lawrence Erlbaum.
- Kolb, D. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.
- Kozma, R. B. (1991). Learning with media. *Review of Educational Research*, 61(2), 179-211.
- Kucer, S. B. (2001). *Dimensions of literacy: A conceptual base for teaching reading and writing in school settings*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Kuhn, M. R., & Stahl, S. A. (2000). *Fluency: A review of developmental and remedial practices* (CIERA Report No. 2-008): Centre for the Improvement of Early Reading Achievement.
- Labbo, L. (2000). 12 things young children can do with a talking book in a classroom learning center. *The Reading Teacher*, 53(7), 542-546.
- LaBerge, D., & Samuels, J. (1974). Towards a theory of automatic information processing in reading. *Cognitive Psychology*, 6, 293-323.
- Land of Um [CD-ROM]. (n.d.). Greym Software, Australia.
- Lankshear, C., & Gee, J. P. (1997). *Changing literacies*. Buckingham [England]; Philadelphia: Open University Press.
- Lankshear, C., & Snyder, I. (2000). *Teachers and technoliteracy: Managing literacy, technology and learning in schools*. St Leonards, NSW: Allen & Unwin.
- Latham, A. S. (1997). Technology and LD students: What is best practice? *Educational Leadership*, 55, 88-98.
- Lauillard, D. (1998). Multimedia and the learner's experience of narrative. *Computer and Education*, 31, 229-242.
- LeCompte, M. D. (2000). Analysing qualitative data. *Theory into Practice*, 39(3), 146-154.
- Lemke, J. L. (1998). Metamedia literacy: Transforming meanings and media. In D. Reinking & e. al (Eds.), *The handbook of literacy and technology: Transformations in a post-typographic world*. Mahwah, NJ: Lawrence Erlbaum Associates.

- Leu, D. J. (1996a). Exploring literacy within multimedia environments. *The Reading Teacher*, 50(2), 162-165.
- Leu, D. J. (2000). Literacy and technology: Deictic consequences for literacy education in an information age. In M. L. Kamil, P. Mosenthal, P. D. Pearson & R. Barr (Eds.), *Handbook of reading research* (Vol. III). Mahwah, NJ: Erlbaum.
- Leu, D. J. (2002). The new literacies: Research on reading instruction with the internet. In A. E. Farstrup & S. J. Samuels (Eds.), *What research has to say about reading instruction* (3rd ed., pp. 310-336). Newark, Delaware: International Reading Association.
- Leu, M. (1996b). An exploratory study of how pre-kindergarten children use the interactive multimedia technology: Implications for multimedia software design. *Journal of Computing in Childhood Education*, 7(1/2), 71-92.
- Lewin, C. (1997). "Test driving" CARS: Addressing the issues in the evaluation of computer-assisted reading software. *Journal of Computing in Childhood Education*, 8(2/3), 111-132.
- Lewin, K. (1951). *Field theory in social science*. New York: Harper & Row.
- Lewis, R. (2000a). Musings on technology and learning difficulties on the occasion of the new millennium. *Journal of Special Education Technology*, 15(2), 5-13.
- Lewis, R. B. (2000b). *Project LIT (Literacy Instruction through Technology): Enhancing the reading skills of students with learning disabilities through hypermedia-based children's literature Final report* (No. CFDA84.180G). San Diego: San Diego State University, California. Department of Special Education.
- Limbrick, L. (2001). *Becoming visually literate: With thanks to Freebody and Luke*. Paper presented at the ALEA National Conference, Hobart.
- Lipson, M. Y., & Wixson, K. K. (1997). *Assessment and instruction of reading and writing disability*. NY: Longman.
- Literacy Review for Queensland State Schools. (2000). *Literate futures: The State of Queensland* (Department of Education).
- Louden, B. (2000). Mapping the territory: Research methods and approaches. *Australian Journal of Learning Disabilities*, 5(2), 8-11.
- Louden, W. (1991). *Understanding teaching: continuity and change in teachers' knowledge*. London: Cassell.
- Louden, W., Chan, L. K. S., Elkins, J., Greaves, D., House, H., Milton, M., et al. (2000). *Mapping the territory: Primary school students with learning difficulties in literacy and numeracy*. Canberra: Department of Education, Training and Youth Affairs.
- Louden, W., Rohl, M., Gore, J., Greaves, D., McIntosh, A., Wight, R., et al. (in press). *Prepared to teach: An investigation into the preparation of teachers to teach literacy and numeracy*. Canberra: Department of Education, Science and Training.
- Lu, A. (1993-4). Jack in the text: From multimedia to hypertext: The written word finds a new home. *Et Cetera* (Winter), 496-500.
- Luke, A. (2001). *A map of possible practices: a non-reductionist approach to making state literacy policy*. Paper presented at the Leading Literate Lives Conference, Hobart, Tasmania.

- Luke, A., & Freebody, P. (1997). The social practices of reading. In A. Luke & P. Freebody (Eds.), *Constructing critical literacies: Teaching and learning textual practice*. St Leonards: Allen & Unwin.
- Luke, A., & Freebody, P. (1999). A map of possible practices: Further notes on the four resources model. *Practically Primary*, 4(2), 5-8.
- Lund, D., & Sanderson, D. (1999). *From printed page to multimedia: Evolution of a second grade class newspaper*. Retrieved 15th May 2002, from www.readingonline.org/articles/lund/index.html
- Macintyre, C. (2000). *The art of action research in the classroom*. London: David Fulton.
- Maclean, M., Bryant, P., & Bradley, L. (1987). Rhymes, nursery rhymes, and reading in early childhood. *Merit-Palmer Quarterly*, 33(3), 255-281.
- Madelaine, A., & Wheldall, K. (2003). Can teachers discriminate low-progress readers from average readers in regular classes? *Australian Journal of Learning Disabilities*, 8(3), 4-7.
- Mallan, K. (1993). *Laugh lines: Exploring humour in children's literature*. Newtown, NSW: PETA.
- Maloch, B. (2003). "I just feel like I'm ready": Exploring the influence of quality teacher preparation on beginning teachers. *The Reading Teacher*, 56(4), 348-350.
- Maloney, C. (1997). *Ritual and pedagogy: teachers' use of ritual in pre-primary settings* Unpublished Ph.D thesis, Edith Cowan University, Perth.
- Manzo, A. V., & Manzo, U. C. (1993). *Literacy disorders: Holistic diagnosis and remediation*. Harcourt Brace Jovanovich.
- Matthew, K. (1997). A comparison of the influence of interactive CD-ROM storybooks and traditional print storybooks on reading comprehension. *Journal of Research on Computing in Education*, 29(263-275).
- Matthew, K. I. (1996). The impact of CD-ROM storybooks on children's reading comprehension and reading attitude. *Journal of Educational Multimedia and Hypermedia*, 5(3/4), 379-394.
- Maxwell, J. A. (1996). *Qualitative research design: An interactive approach* (Vol. 41). Thousand Oaks: Sage.
- Mayer, R. E. (2001). *Multimedia learning*. Cambridge: Cambridge University Press.
- Mayer, R. E., & Anderson, R. B. (1992). The instructive animation: Helping students build connections between words and pictures in multimedia. *Journal of Educational Technology*, 8(4), 444-452.
- McCullen, C. (1999). Tips for evaluating students in a digital age. *Technology and Learning*, 19(7), 48-50.
- McKenna, M. C. (1998). Electronic texts and the transformation of beginning reading. In D. Reinking & c. al (Eds.), *The handbook of literacy and technology: Transformations in a post-typographic world* Mahwah, NJ: Lawrence Erlbaum Associates.
- McKenna, M. C., & Kear, D. J. (1990). Measuring attitudes towards reading: A new tool for teachers. *The Reading Teacher*, May, 626-639.
- McKenna, M. C., Reinking, D., & Labbo, L. (1997). Using talking books with reading-disabled students. *Reading and Writing Quarterly*, 13, 185-190.
- McKenna, M. C., Reinking, D., Labbo, L. L., & Kieffer, R. D. (1999). The electronic transformation of literacy and its implications for the struggling reader. *Reading and Writing Quarterly*, 15, 111-126.

- McKinney, J. D., Osborne, S. S., & Schulte, A. C. (1993). Academic consequences of learning disability: Longitudinal prediction of outcomes at 11 years of age. *Learning Disabilities Research and Practice, 8*, 19-27.
- McLaughlin, C. (1999). Culturally responsive technology use: Developing an on-line community of learners. *30*(3), 231-243.
- McNally, L., & Etchison, C. (2000). Strategies for successful technology integrators: Part I: Streamlining classroom management. *Learning and Leading with Technology, 28*(2), 6-9.
- McNaughton, S., Parry, G., & Robinson, V. (1987). Pause, Prompt and Praise: effective tutoring for remedial reading. *New Zealand Journal of Psychology, 14*.
- McNiff, J. (1988). *Action research: Principles and practice*. London: Routledge.
- McVee, M. B., & Dickson, B. A. (2002). Creating a rubric to examine literacy software for the primary grades. *The Reading Teacher, 55*(7), 635-639.
- Me and my dad [Computer software]. (1996). Big Tuna New Media.
- Medwell, J. (1996). Talking books and reading. *Reading*(April), 41-46.
- Mercer, N., & Scrimshaw, P. (1993). Researching the electronic classroom. In P. Scrimshaw (Ed.), *Language, classrooms and computers* (pp. 184-191). London: Routledge.
- Meredyth, D., Australian Key Centre for Cultural and Media Policy, & Australia. Dept. of Education Training and Youth Affairs. (1999). *Real time: computers, change and schooling : national sample study of the information technology skills of Australian school students A project funded by the Commonwealth Department of Education, Training and Youth Affairs*. [Canberra]: Dept. of Education Training and Youth Affairs.
- Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass Publishers.
- Meyer, A., & Rose, D. H. (1998). *Learning to read in the computer age*. Cambridge, MA: Brookline Books.
- Meyer, M. S., & Felton, R. H. (1999a). Repeated reading to enhance fluency: Old approaches and new directions. *Annals of Dyslexia, 49*, 283-306.
- Miles, M. B., & Huberman, A. M. (1984). *Qualitative data analysis: A sourcebook of new methods*. Beverly Hills: California.
- Miller, L., Blackstock, J., & Miller, R. (1994). An exploratory study into the use of CD-ROM storybooks. *Computers in Education, 22*, 187-204.
- Miller, L., & Olsen, J. (1998). Literacy research oriented toward features of technology and classrooms. In *Handbook of Literacy and Technology* (pp. 343-360).
- Mills, G. E. (2000). *Action research: A guide for the teacher researcher*. Upper Saddle River, New Jersey: Merrill, an imprint of Prentice Hall.
- Mixed up Mother Goose [Computer software]. (1995). Sydney: Dataflow.
- Morris, A., & Stewart-Dore, N. (1984). *Learning to learn from text: Effective reading in content areas*. North Ryde, NSW: Addison-Wesley.
- Morrow, L. M., Barnhart, S., & Rooyakkers, D. (2002). Integrating technology with the teaching of an early literacy course. *The Reading Teacher, 56*(3), 218-230.
- Mossenson, L., Hill, P., & Masters, G. (1987). *TORCH: tests of reading comprehension*. Melbourne: Australian Council for Educational Research.
- Moving gives me a stomach ache [Computer software]. (1993). Buffalo, NY: Disc.

- My first incredible amazing dictionary [Computer software]. (1994). London: Dorling Kindersley.
- Myers, J., Hammett, R., & McKillop, A. M. (1998). Opportunities for critical literacy and pedagogy in student-authored hypermedia. In D. Reinking & e. al (Eds.), *The handbook of literacy and technology: Transformations in a post-typographic world*. Mahwah, NJ: Lawrence Erlbaum Associates.
- N5 [Computer software]. (2001). Melbourne: QSR.
- National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction* (No. 00-4769). Washington, DC: Government Printing Office.
- National Reading Panel. (2000). *Teaching children to read: an evidence based assessment of the scientific research literature on reading and its implications for reading instruction*. Bethesda, MD: National Institutes of Health.
- Naughton, R. (2002). *Bridging the policy to practice gap: Using information and communication technologies to improve social and educational outcomes* (A Churchill Fellowship Study Report).
- Neale, M. D. (1988). *The Neale analysis of reading ability* (3rd ed.). Hawthorne, Victoria: ACER.
- Newman, D. (1990). Opportunities for research on the organizational impact of school computers. *Educational Researcher*, 19(3), 8-13.
- Nielsen, J. (1995). *Multimedia and hypertext*. Boston: AP Professional.
- Oakley, G. (2001a). *12 things children can do with electronic talking books ... maybe*. Paper presented at the AATE/ALEA National Conference, Hobart, TAS.
- Oakley, G. (2001b). *Using electronic storybooks to improve the oral reading fluency of children with mild reading difficulties: Issues to consider*. Paper presented at the 6th Annual Round Table of the Centre for Applied Language and Literacy Research, Perth, WA.
- Oakley, G. (2002a). Using CD-ROM 'electronic talking books' to help children with mild reading difficulties improve their reading fluency. *Australian Journal of Learning Disabilities*, 7(4), 20-27.
- Oakley, G. (2002b). Using Interactive Multimedia to help children become independent readers. *Practically Primary*, 7(3), 39-41.
- Oakley, G. (2002c). *Using Interactive Multimedia to help children with reading difficulties*. Paper presented at the TRIP Presentations: Thoughts on Research in Progress, Edith Cowan University.
- Oakley, G. (2002d). *Using Interactive Multimedia to help children with reading difficulties*. Paper presented at the 7th Annual Round Table Conference of the Centre for Applied Language and Literacy Research, Perth, WA.
- Oakley, G. (2003a). *The creation of electronic talking books to help children improve their oral reading fluency and comprehension* Paper presented at the TRLD (Technology and Reading and Learning Difficulties) International Conference, San Francisco, CA.
- Oakley, G. (2003b). Improving oral reading fluency (and comprehension) through the creation of electronic talking books. *Reading Online*, 6(7).
- Oczkus, L. D. (2003). *Reciprocal teaching at work*. Newark, DE: International Reading Association.

- Pachler, N. (1999). Theories of learning and ICT. In M. Leask & N. Pachler (Eds.), *Learning to teach using ICT in the secondary school* (pp. 3-18). London: Routledge.
- Paintshop Pro 4 [Computer software]. (1998). (Version 4.15 SE). Eden Prairie, MN: Jasc Software.
- Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1*, 117-175.
- Pany, D., & McCoy, K. M. (1988). Effects of corrective feedback on word accuracy and reading comprehension of readers with learning disabilities. *Journal of Learning Disabilities, 21*, 546-550.
- Pasch, M., Sparks-Langer, G., Gardner, T. G., Starko, A. J., & Moody, C. D. (1991). *Teaching as decision making*. New York: Longman.
- Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Newbury Park: Sage Publications.
- Pelgum, W. J. (2001). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers and Education, 37*, 163-178.
- Pereira-Laird, J., Deane, F. P., & Bunnell, J. (1999). Defining reading disability using a multifaceted approach. *Learning Disability Quarterly, 22*(1), 59-71.
- Perzyl, L., & Oliver, R. (1992). An investigation of children's use of a CD-ROM product for information retrieval. *Microcomputers for Information Management, 9*(4), 225-239.
- Phonics Alive! 2 The Blender [Computer software]. (1998). Advanced Software.
- Phonics Alive! 3 The Speller [Computer software]. (1999). Advanced Software.
- Phonics Alive! 6 Typing [Computer software]. (2000). Advanced Software.
- Pigott, T. D., & Barr, R. (1998). Designing programmatic interventions. In D. Reinking & e. al (Eds.), *The handbook of literacy and technology: Transformations in a posttypographic world* (pp. 99-108). Mahwah, NJ: Lawrence Erlbaum Associates.
- Placier, P., & Hamilton, M. L. (1994). Schools as contexts: A complex relationship. In V. Richardson (Ed.), *Teacher change and the staff development process: A case in reading instruction* (pp. 135-153). New York: Teachers College Press.
- PM Storybooks (Silver) [Computer software]. (2000). Melbourne, VIC: Thomas Nelson Learning.
- Pollard, A., & Tann, S. (1993). *Reflective teaching in the primary school: A handbook for the classroom* (2nd ed.). London: The Open University.
- Polonoff, K. E. (2001). Integrating technology into the classroom: Three questions principals must ask. *Principal Leadership, 2*(4), 34-38.
- PowerPoint [Computer software]. (1997). (Version Office 97): Microsoft.
- Pressley, M. (2000). What should comprehension instruction be the instruction of? In M. L. Kamil, P. B. Mosenthal, P. D. Pearson & R. Barr (Eds.), *Handbook of Reading Research* (Vol. Volume III, pp. 545-561). Mahwah, NJ: Lawrence Erlbaum.
- Pressley, M. (2002). Metacognition and self-regulated comprehension. In A. E. Farstrup & S. J. Samuels (Eds.), *What research has to say about reading instruction* (3rd ed., pp. 291-309). Newark, Delaware: International Reading Association.
- Printmaster 8 [Computer software]. (n.d.). Broderbund.
- Publisher [Computer program]. (2000). Microsoft.

- Pumfrey, P. D. (1985). *Reading tests and assessment techniques* (2nd ed.). London: Hodder and Stoughton.
- Ramsey, G. (2000). *Quality matters. Revitalising teaching: Critical times, critical choices*. Sydney: NSW: Report of the Review of Teacher Education.
- Raphael, T. (1984). Teaching learners about sources of information for answering comprehension questions. *Journal of Reading*, 30(7), 632-636.
- Rashotte, C. A., & Torgeson, J. K. (1985). Repeated reading and reading fluency in learning disabled children. *Reading Research Quarterly*, 20, 617-621.
- Rasinski, T. (1990). The effect of cued phrase boundaries in texts. *ERIC Document ED313689*.
- Rasinski, T. (1994). Developing syntactic sensitivity in reading through phrase-cued texts. *Intervention in School and Clinic*, 29(3), 165-168.
- Rasinski, T., & Padak, N. (1996). Five lessons to increase reading fluency. In L. Putnam (Ed.), *How to become a better reading teacher* (pp. 255-265). Toronto: Prentice Hall.
- Rasinski, T., & Padak, N. (2000). *Effective reading strategies: Teaching children who find reading difficult* (Second Edition ed.). Upper Saddle River, NJ: Merrill.
- Raskind, M. H., & Higgins, E., L. (1999). Speaking to read: The effects of speech recognition technology on the reading and spelling performance of children with learning disabilities. *Annals of Dyslexia*, 49, 251-281.
- Reader Rabbit's Reading Development Library 2 [Computer program]. (1997). London: The Learning Company.
- Reading blaster 7-8 [computer software]. (2000). Torrance, CA: Knowledge Adventure.
- Reading blaster 9-12 [Computer software]. (2000). Knowledge Adventure.
- Reading for literacy 3 [Computer software]. (2000). Warners Bay, NSW: Nightingale Software.
- Reading for literacy 4 [Computer software]. (2000). Warners Bay, NSW: Nightingale Software.
- Reading for literacy 5 [Computer software]. (2001). Warners Bay, NSW: Nightingale Software.
- Reigeluth, C. M., & Frick, T. W. (1999). Formative research: A methodology for creating and improving design theories. In C. M. Reigeluth (Ed.), *Instructional design theories and models: A new paradigm of instructional theory* (Vol. II, pp. 633-651). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Reinking, D., & Bridwell-Bowles, I. (1991). Computers in reading and writing. In R. Barr, M. L. Kamil, P. Mosenthal & P. D. Pearson (Eds), *Handbook of reading research (Volume I)*. NY: Longman.
- Reinking, D., Labbo, L., & McKenna, M. C. (2000). From assimilation to accommodation: A developmental framework for integrating digital technologies into literacy research and instruction. *Journal of Research in Reading*, 23(2), 110-123.
- Reinking, D., & Watkins, J. (2000). A formative experiment investigating the use of multimedia book reviews to increase elementary students' independent reading. *Reading Research Quarterly*, 35(3), 384-419.
- Rhodes, L. K., & Dudley-Marling, C. (1996). *Readers and writers with a difference* (2nd ed.). Portsmouth, NH: Heinemann.
- Ricci, C. A., & Beal, C. R. (2002). The effect of interactive media on children's story memory. *Journal of Educational Psychology*, 94(1), 138-144.

- Richardson, V. (1994). The consideration of teachers' beliefs. In V. Richardson (Ed.), *Teacher change and the staff development process: A case in reading instruction* (pp. 90-105). New York: Teachers College Press.
- Richardson, V., & Anders, P. L. (1994). A theory of change. In V. Richardson (Ed.), *Teacher change and the staff development process: A case in reading instruction* (pp. 199-216). New York: Teachers College Press.
- Rivalland, J. (2000). Definitions and identification: Who are the children with learning difficulties? *Australian Journal of Learning Disabilities*, 5(2), 12-16.
- Robeck, M., & Wallace, R. R. (1990). *The psychology of reading: A interdisciplinary approach* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Roffey, C. (1995). Electronic books ... fad or future. *Learning* (April/May), 88-89.
- Rohl, M. (2000). Learning about words, sounds and letters. In M. Rohl & C. Barratt-Pugh (Eds.), *Literacy learning in the early years*. Crows Nest, NSW: Allen & Unwin.
- Rohl, M., House, H., Loudon, W., Milton, M., & Rivalland, J. (2000). *Successful programs and strategies for children with learning difficulties*. Department of Education, Training and Youth Affairs, Commonwealth of Australia.
- Rohl, M., & Milton, M. (1993). The importance of syntactic and phonological awareness to literacy learning. *The Australian Journal of Language and Literacy*, 16(2), 157-168.
- Rohl, M., & Milton, M. (2002). What's happening in Australia for students with learning difficulties? A survey *Australian Journal of Language and Literacy*, 25(1), 25-48.
- Rohl, M., & Rivalland, J. (2002). Literacy learning difficulties in Australian primary schools: Who are the children identified and how do their schools and teachers support them? *Australian Journal of Language and Literacy*, 25(3), 19-40.
- Rosner, J. (1993). *Helping children overcome learning difficulties* (3rd ed.). New York: Walker and Company.
- Ruff's bone [Computer software]. (1994). Novato, CA: Living Books Broderbund.
- Sadler, C. R. (2001). *Comprehension strategies for middle grade learners*. Newark, DE: IRA.
- Salomon, G. (1998). Technology's promises and dangers in a psychological and educational context. *Theory into Practice*, 38(1), 4-10.
- Salomon, G. (2002). Technology and pedagogy: Why don't we see the promised revolution. *Educational Technology*, March/April, 2002.
- Salomon, G., Globerson, T., & Guterman, E. (1989). The computer as a zone of proximal development: Internalizing reading-related metacognitions from a reading partner *Journal of Educational Technology*, 89(4), 620-627.
- Samuels, S. J. (1979). The method of repeated readings. *The Reading Teacher*, 21, 360-407.
- Samuels, S. J. (2002). Reading fluency: Its development and assessment. In A. E. Farstrup & S. J. Samuels (Eds.), *What research has to say about reading instruction* (3rd ed., pp. 166-183). Newark, Delaware: International Reading Association.
- Sandholtz, J. H. (2001). Learning to teach with technology: A comparison of teacher development programs. *Journal of Technology and Teacher Education*, 9(3), 349-374.

- Sands, S., & Buchholz, E. S. (1997). The underutilization of computers to assist in the remediation of dyslexia. *International Journal of Instructional Media*, 24(2), 153-175.
- Schank, R. C. (1994). Active learning through hypertext. *Multimedia*, 1(1), 69-78.
- Schön, D. A. (1987). *Educating the reflective practitioner*. San Francisco: Jossey-Bass.
- Schmider, P. A. (1980). On the acquisition of reading fluency. *Journal of reading behavior*, 12, 177-186.
- Schunk, D. H., & Zimmerman, B. J. (1997). Developing self-efficacious readers and writers: The role of social and self-regulatory processes. In J. T. Guthrie & A. Wigfield (Eds.), *Reading engagement: Motivating readers through integrated instruction*. Newark: IRA.
- Schwab, J. (1969). *College curricula and student protest*. Chicago: University of Chicago Press.
- Shane, S. (2001). A study on teachers' knowledge about multimedia and copyright: the problems and some possible answers. *TechTrends*, 45(6), 3-5.
- Shany, M., & Beimiller, A. (1995). Assisted reading practice: Effects of performance for poor readers in grades 3 and 4. *Reading Research Quarterly*, 30, 382-395.
- Short, P. M., Miller-Wood, D. J., & Johnson, P. E. (1991). Risk taking and teacher involvement in decision making. *Education*, 112(1), 84-89.
- Siegel, L. S. (1989). IQ is irrelevant to the definition of learning disabilities. *Journal of Learning Disabilities*, 22, 469-478.
- Siegel, L. S. (2003). IQ-discrepancy definitions and the diagnosis of LD: introduction to the special issue. *Journal of Learning Disabilities*, 36(1), 2-3.
- Sindelar, P. T., Monda, L. E., & O'Shea, L. J. (1990). Effects of repeated readings on instructional and mastery level readers. *Journal Of Educational Research*, 8(4), 220-226.
- Skilling, M. J., & Ferrell, R. (2000). Student-generated rubrics: Bringing students into the assessment process. *The Reading Teacher*, 53(6), 452-455.
- Smith, P. L., & Ragan, J. R. (1999). *Instructional design* (2nd ed.). Upper Saddle River, New Jersey: Merrill.
- Snow, C., Bums, S. M., & Griffin, P. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Research Council. National Academy Press.
- Snyder, I. (1999). Packaging literacy, new technologies and 'enhanced learning'. *Australian Journal of Education*, 43(3), 285-299.
- Snyder, I. (Ed.). (1997). *Page to screen*. St Leonards, NSW: Allen and Unwin.
- Snyder, V. E. (1990). What we know about learning styles from research in special education. *Educational Leadership*, 48(October), 53.
- Sofie, C. A., & Riccio, C. A. (2002). A comparison of multiple measures for the identification of children with reading disabilities. *Journal of Learning Disabilities*, 35(3), 234-244.
- Solso, R. (1995). *Cognitive psychology* (4th ed.). Boston: Allyn and Bacon.
- Sound recorder [Computer program]. (2001). Microsoft Corporation.
- Speech Analyser [Computer software]. (2000). (Version 1.5). Waxhaw, NC: Summer Institute of Linguistics.
- Spiegel, D. L. (1995). A comparison of traditional remedial programs and Reading Recovery: Guidelines for success for all programs. *The Reading Teacher*, 49(2).

- Spiro, R. J., Feltoich, P. J., Jacobson, M. J., & Coulson, R. L. (1991). Cognitive flexibility, constructivism and hypertext. *Educational Technology, 31*(5), 24-33.
- Squires, D., & McDougall, A. (1994). *Choosing and using educational technology: A teacher's guide*. London: Falmer Press.
- Stahl, S. (1999). Different strokes for different folks? A critique of learning styles. *American Educator, 23*, 27-31.
- Standish, D. (1992). The use of CD-ROM based books to improve reading comprehension in second grade students. *ERIC Document Reproduction Service Document Number ED352605*.
- Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*, 360-406.
- Stanovich, K. E. (1999). The sociopsychometrics of learning disabilities. *Journal of Learning Disabilities, 32*(4), 350-361.
- Stellaluna [Computer Program]. (1996). Living Books/Broderbund.
- Storybook Weaver Deluxe [Computer software]. (1998). London: Softkey/The Learning Company.
- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park: Sage.
- Strickland, D. S., Ganake, K., & Monroe, J. K. (2002). *Supporting struggling readers and writers*. Portland, Maine: Stenhouse Publishers.
- Superspell - A Day at the Beach [Computer software]. (1997). Ulverstone, TAS: Hoopers Multimedia.
- Swanson, H. L., & Alexander, J. E. (1997). Cognitive processes as predictors of word recognition and reading comprehension in learning-disabled and skilled readers: Revisiting the specificity hypothesis. *Journal of Educational Psychology, 89*, 128-158.
- Taylor, L., & Adelman, H. S. (1999). Personalizing classroom instruction to account for motivational and developmental differences. *Reading and Writing Quarterly, 15*, 255-276.
- Taylor, R. (Ed.). (1980). *The computer in the school: Tutor, tool, tutor*. New York: Teachers College Press.
- Teale, W., Leu, D. J., Labbo, L., & Kinzer, C. Z. (2002). The CTELL Project: New ways technology can help educate tomorrow's reading teachers. *The Reading Teacher*.
- Tennyson, R. D. (2002). Linking learning theories to instructional design. *Educational Technology, May-June*, 51-55.
- Tergan, S. O. (1997). Multiple views, contexts, and symbol systems in learning with hypertext/hypermedia: A critical review of research. *Educational Technology, 37*(4), 5-18.
- The Computer Classroom Reading at Home 3-4 [Computer software]. (2000). Warners Bay, NSW: Nightingale Software.
- The Magic School Bus [Computer software]. (1994). Microsoft and Magic Pen.
- The New London Group. (2000). A pedagogy of multiliteracies: Designing social futures. In B. Cope & M. Kalantzis (Eds.), *Multiliteracies: Literacy Learning and the design of social futures* (pp. 9-37). South Yarra, Victoria: Macmillan.
- Topping, K. (1987). Paired Reading: A powerful technique for parent use. *The Reading Teacher, 40*, 608-614.

- Trochim, W. M. K. (2002). *The Planning-Evaluation Cycle*. Retrieved 11/9/02, 2002, from <http://trochim.human.cornell.edu/kb/pecycle.htm>
- Trushell, J., Burrell, C., & Maitland, A. (2001). Year 5 pupils reading an "Interactive Storybook" on CD-ROM: Losing the plot? *British Journal of Educational Technology*, 32(4), 389-401.
- Tyler, B. J., & Coard, D. (2000). Using Readers Theatre to foster fluency in struggling readers: A twist on the Repeated Readings strategy. *Reading and Writing Quarterly*, 16, 163-168.
- Tyner, K. (1998). *Literacy in a digital world: Teaching and learning in the age of information*. Mahwah, New Jersey: Lawrence Erlbaum Associates.
- Underwood, J. D. M. (2000). A comparison of two types of computer support for reading development. *Journal of Research in Reading*, 23(2), 136-148.
- Unsworth, L. (2001). *Teaching multiliteracies across the curriculum*. Buckingham: OUP.
- van Lier, L. (1996). *Interaction in the language classroom: Awareness, autonomy and authenticity*. New York: Longman.
- Vogel, D., & Klassen, J. (2001). Technology-supported learning: Status, issues and trends. *Journal of computer assisted learning*, 17, 104-114.
- Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.
- Walker, B. J. (2000). *Diagnostic teaching of reading: Techniques for instruction* (4th ed.). New Jersey: Longman.
- Watts, M., Lloyd, C., & Jackson, C. (2001). ICT in the literacy hour: Studying a classroom innovation. *Research in Education*(66), 84-90.
- Welch, M. (2000). Descriptive analysis of team teaching in two elementary classrooms: A formative experimental approach. *Remedial and Special Education*, 21(6), 365-376.
- Wepner, S. B., & Tao, L. (2002). From master teacher to master novice: Shifting responsibilities in technology-infused classrooms. *The Reading Teacher*, 55(7), 642-651.
- Wepner, S. B., Valmont, W. J., & Thurlow, R. (Eds.) (2000). *Linking literacy and technology: A guide for K-8 classrooms*. Newark, Delaware: International Reading Association.
- Westwood, P. (2003). *Commonsense methods for children with special educational needs: Strategies for the regular classroom* (4th ed.). London: RoutledgeFalmer.
- Wheldall, K. (1996). *The Wheldall assessment of reading passages (WARP): Experimental edition*. Macquarie University Special Education Centre: Unpublished manuscript.
- Whetstone, L., & Carr-Chellman, A. A. (2001). Preparing preservice teachers to use technology: Survey results. *Tech Trends*, Jul/Aug.
- Wiggleworks [computer software]. (n.d.). Scholastic.
- Wilder, A. A., & Williams, J. P. (2001). Students with severe learning disabilities can learn higher order comprehension skills. *Journal of Educational Psychology*, 93(2), 268-278.
- Williams, J. P. (1998). Improving the comprehension of disabled readers. *Annals of Dyslexia*, 48, 213-238.
- Wissick, C. A., & Gardner, J. E. (2000). Multimedia or not to multimedia. *Teaching Exceptional Children*, 32(4), 34-43.

- Wray, D., Medwell, J., Poulson, L., & Fox, R. (2002). *Teaching literacy effectively in the primary school*. London: Routledge Falmer.
- Yin, R. K. (1994). *Case study research: Design and methods* (2nd ed.). Thousand Oaks, California: Sage.
- Yopp, H. K. (1992). Developing phonemic awareness in young children. *The Reading Teacher* 45(9), 696-703.
- Young, A., Bowers, P., & MacKinnon, G. (1996). Effects of prosodic modelling and repeated reading on poor readers' fluency and comprehension. *Applied Psycholinguistics*, 17, 59-84.
- Zakaluk, B. L. (1996). *Sun Valley Elementary School Reading and Writing Assessment project: Final report*. ERIC Reproduction Service, Document Number ED401520.
- Zhao, Y., Pugh, K., Sheldon, S., & Byers, J. L. (2002). Conditions for classroom technology innovations. *Teachers College Record*, 104(3), 482-515.
- Zutell, J., & Rasinski, T. V. (1991). Training teachers to attend to their students' oral reading fluency. *Theory into Practice*, 30(3), 212-217.

APPENDICES

Appendix 1.1

(Pages 400-406 of the original thesis)

Article from Australian Journal of Learning Disabilities has been removed from this version of the thesis for copyright reasons.

The original article is available at:

Oakley, G. (2002). Using CD-ROM 'electronic talking books' to help children with mild reading difficulties improve their reading fluency. *Australian Journal of Learning Disabilities*, 7(4), 20-27. doi: 10.1080/19404150209546713

Appendix 1.2.

Glossary

CD-ROM	Compact Disc-Read Only Memory. An bytes, eg 550Mb, which is equivalent to 250,000 pages of text.
CD-ROM drive	A device for reading CDR OM discs.
DPI	Dots Per Inch -- the number of 'pixels' in a square inch of a graphic.
Hard disc	A magnetic mass storage device inside a computer system.
Icon	A symbolic, pictorial representation of a function or task.
Install	To set up a program or part of a program in a computer's hard drive to enable it to run.
Internet	A worldwide network of computers. The Internet is composed of the WWW, email, FTP and a range of other protocols. Although some use it synonymously with WWW, this is not strictly accurate.
RAM	Random Access Memory. This part of a computer's memory can read and write information, and can be updated by the user.
Text Box	A box that is drawn into a document or screen and into which text is entered.
THRASS	Teaching Handwriting, Reading and Spelling Skills
WAV	A sound file.
WWW	World Wide Web. Part of the Internet, composed of networked web pages.

Appendix 4.1.

'Start List' of Codes

startlistofcodes

QSR N5 Full version, revision 5.0.
 Licensee: Grace Oakley.

PROJECT: Start List

REPORT ON NODES FROM Tree Nodes '--/'
 Depth: ALL
 Restriction on coding data: NONE

(1)	/Resources
(1 1)	/resources/Software
(1 1 1)	/Resources/Software/Culturally Appropriate?
(1 1 2)	/Resources/Software/Interactivity
(1 1 3)	/Resources/Software/Gender Appropriateness
(1 1 4)	/Resources/software/Age Appropriateness
(1 1 5)	/Resources/Software/readability
(1 1 6)	/Resources/Software/Defining IIM
(1 1 7)	/Resources/software/Software previously used
(1 1 8)	/Resources/Software/Software Type
(1 1 8 1)	/Resources/Software/Software Type/Games
(1 1 8 2)	/Resources/Software/Software Type/Electronic Storybooks
(1 1 8 4)	/Resources/Software/Software Type/Tutorial
(1 1 8 5)	/Resources/Software/Software Type/Drill & Practice
(1 1 9)	/Resources/Software/Evaluating the Software
(1 1 10)	/Resources/Software/Support Offered by Software
(1 1 11)	/Resources/Software/Quality
(1 1 12)	/Resources/Software/Attractive to teacher?
(1 1 13)	/Resources/Software/Suitability for Group work
(1 1 14)	/Resources/software/Finding out about software
(1 1 14 1)	/Resources/Software/Finding out about software/Vendors
(1 1 14 2)	/Resources/Software/Finding out about software/What Software Exists
(1 1 14 1)	/Resources/Software/Finding out about software/What Software Exists

*startlistofcodes

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software/What does it do?
(1 1 14 3 1) /Resources/software/Finding out about s
software/What does it do?/Relating this to known theories about
reading and instructional strategies
(1 1 16 4) /Resources/Software/Finding out about a
software/Where can I get it?
(1 2) /Resources/Hardware
(1 2 1) /Resources/Hardware/Accessibility
(1 2 2) /Resources/Hardware/Suitability
(1 2 2 1) /Resources/Hardware/Suitability/Sound
(1 2 3) /Resources/Hardware/Plug-ins
(1 2 4) /Resources/Hardware/Laptops
(1 3) /Resources/Time
(1 4) /Resources/Internet
(1 4 1) /Resources/Internet/Search Engines
(1 4 2) /Resources/Internet/Evaluating Web Site
#
(1 5) /Resources/Collecting Resources
(2) /Impeding Factors
(2 1) /Impeding Factors/Planning
(2 1 1) /Impeding Factors/Planning/What will st
udents think?
(2 2) /Impeding Factors/Implementing
(2 3) /Impeding Factors/Evaluating
(2 4) /Impeding Factors/Modifying
(2 5) /Impeding Factors/General
(3) /Facilitating Factors
(3 1) /Facilitating Factors/Planning
(3 2) /Facilitating Factors/Implementing
(3 3) /Facilitating Factors/Evaluating
(3 4) /Facilitating Factors/Modifying
(4) /Unintended Consequences
(5) /Baseline
(5 2) /Baseline/Teaching Techniques
(5 3) /Baseline/Use of ICT
(5 3 1) /Baseline/Use of ICT/1994
(5 3 2) /Baseline/Use of ICT/Other
(5 4) /Baseline/Classroom Environment
(5 5) /Baseline/Teacher Attitudes/Philosophies
(5 6) /Baseline/Teacher Experiences
(6) /Pedagogical Goal & Underlying Theory
(6 1) /Pedagogical Goal & Underlying Theory/W
ord Identification
(6 3) /Pedagogical Goal & Underlying Theory/W
luency
(6 3 1) /Pedagogical Goal & Underlying Theory/W

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STATISTICS

fluency/Comprehension (6 3 2)	/Pedagogical Goal & Underlying Theory/P
fluency/Rate (6 3 3)	/Pedagogical Goal & Underlying Theory/T
fluency/Accuracy (6 3 4)	/Pedagogical Goal & Underlying Theory/P
fluency/Prcaedy (6 4)	/Pedagogical Goal & Underlying Theory/C
fluency a pedagogical goal (6 5)	/Pedagogical Goal & Underlying Theory/T
tree Node (7)	/intervention
(7 1)	/intervention/Rationale
(7 2)	/intervention/Description
(7 3)	/intervention/Planning
(8)	/Establishing Preferability
(9)	/Instructional Techniques
(9 1)	/Instructional Techniques/Modelling
(10)	/Tree Node
(A)	//Document Annotations
(F)	//Free Nodes
(T)	//Text Searches
(N)	//Node Searches
(C)	//Node Clipboard.

Appendix 4.2.

Letter of Consent to Teachers

STATEMENT OF DISCLOSURE AND INFORMED CONSENT

Dear _____

This letter is to inform you of the purpose and nature of the research I am carrying out as part of my PhD degree at Edith Cowan University. The research is entitled, *Exploring the Potential of Interactive Multimedia to Help Children with Learning Difficulties in Literacy: A Formative Approach*.

The purpose of this study is to find out how educators can best use a 'formative' approach to plan, implement, evaluate and modify Interactive Multimedia based activities to help children with learning difficulties in literacy. This type of process has been described as a 'formative experiment'.

The aim will be to reach specific teaching outcomes. An investigation of the factors that seem to facilitate and inhibit reaching the outcomes will be an important part of this research. This will include looking at the difficulties we as educators encounter whilst carrying out the 'formative experiments'.

What I am asking of you

I wish to work with you (and any other teachers who are involved) over one or two school terms to plan, implement, evaluate and modify IMM-based activities for children with learning difficulties in literacy. I will be present for one or two days a week (or up to four half days).

In order to carry out this research, I request that you allow me to assist and observe in the cycle of planning, implementing, evaluating and modifying IMM-based activities for children with learning difficulties in literacy.

I will also ask you to keep a journal, noting any problems and successes relating to using IMM for children with reading difficulties.

We will also need to have regular tape-recorded meetings in order to discuss the progress of the 'formative experiments'. These will be conducted at your convenience and will be kept as brief as possible.

I will also need to observe the children in the classroom context in order to assist in the development of the new IMM-based activities. Tape recorders and video recorders will be used in some circumstances. I will also carry out some literacy assessments.

I will need access to artefacts such as student work samples and also your programs and lesson plans.

What I am offering you

Assistance in planning, implementing and evaluating IMM-based activities to help children with learning difficulties in literacy.

Resources, such as Web Pages addresses and the use of some software.

Technical advice and assistance.

On-going support and advice after the study has finished, if you would like.

Your Rights

You will be free to withdraw from this study at any time. Your identity will be concealed so you will not be identifiable in any articles or presentations arising from this study. All data will be kept locked away at my home or in my office at Edith Cowan University, and will not be seen by anybody but myself, other members of your teaching team, and my two University Supervisors.

There are no risks associated with the study, other than the normal risks relating to computer use.

What will be the outcomes of the study?

A description and analysis of the problems and successes of using IMM to help children with reading difficulties, which may be of use to other teachers.

A series of 'vignettes', which other teachers may use to help them plan for children with similar difficulties.

You personally will have investigated how to plan, implement and evaluate IMM for children with reading difficulties, which may help you in your future practice.

It is anticipated that the participating children will benefit from their interaction with IMM.

Please do not hesitate to contact me if you would like to discuss this further. I look forward to working with you in this study, and thank you for your extremely valuable assistance.

Grace Oakley

Edith Cowan University

Telephone: [REDACTED]

CONSENT FORM

I _____ have read the information above and understand what the research involves. All of my questions have been answered satisfactorily. I agree to participate in this research, *Exploring the Potential of Interactive Multimedia to Help Children with Learning Difficulties in Literacy: A Formative Approach*. I realise that I may withdraw from the research at any time.

Signed: _____

Date: _____

Appendix 4.3.

Letter of Consent to Parents

STATEMENT OF DISCLOSURE AND INFORMED CONSENT

Dear _____

I am writing to seek your permission for your child _____ to participate in a study at _____ School. The study is being carried out as part of my PhD degree at Edith Cowan University.

The purpose of this study is to find out how teachers can use Interactive Multimedia computer software to help children who may be having some difficulty in reading. Your child may benefit from using Interactive Multimedia (IMM) as part of her reading program. She will be given special activities using IMM (CD-ROMs and the Internet) in addition to some of her normal language activities. Most children find using IMM highly enjoyable and stimulating. All activities will be planned in conjunction with your child's teacher, who will be involved in all aspects of this study.

I will need to use a tape recorder and a video camera in order to record how your child interacts with the computer software. The video camera will focus on the computer and will not show your child's face, unless you would like to give me special permission to do this. Your child's real name will not be used in any reports, so her identity will not be revealed in any reports or publications resulting from this study. All data will be secured either in my home or locked away on University premises. The only other people who will see data will be the teachers involved in the study and two University colleagues, who will verify my interpretations.

There are no risks associated with the study, other than the normal risks relating to computer use. The teacher and I will ensure that your child maintains a correct posture at the computer and does not remain at the computer for longer than the recommended periods. Although your child will be using the Internet (the World Wide Web), she will be appropriately supervised to ensure that unsuitable sites are not accessed.

You will be free to withdraw your child from this study at any time.

Please do not hesitate to contact me if you would like to discuss this further. Thank you for considering this request.

Grace Oakley

Edith Cowan

Telephone: [REDACTED]

CONSENT FORM

I _____ (Name of parent/legal guardian)
have read the information above and understand what the research involves. All of
my questions have been answered satisfactorily. I agree to allow my child
_____ to participate in the research on using
Interactive Multimedia to help children who may be having some difficulties in
reading. I realise that I may withdraw my child at any time.

Signed: _____

Date: _____

Appendix 4.4.

Letter of Consent to School Principals

Letter to Principal

STATEMENT OF DISCLOSURE AND INFORMED CONSENT

Dear _____

This letter is to inform you of the purpose and nature of the research I am carrying out as part of my PhD degree at Edith Cowan University. The research is entitled, *Exploring the Potential of Interactive Multimedia to Help Children with Learning Difficulties in Literacy: A Formative Approach*

- The purpose of this study is to find out how educators can best use a 'formative' approach to plan, implement, evaluate and modify Interactive Multimedia based activities to help children with learning difficulties in literacy. This type of process has been described as a 'formative experiment'.
- The aim will be to reach specific teaching outcomes. An investigation of the factors that seem to facilitate and inhibit reaching the outcomes will be an important part of this research. This will include looking at the difficulties we as educators encounter whilst carrying out the 'formative experiments'.

What I am asking of the participants

1. I wish to work with the teachers over one or two school terms to plan, implement, evaluate and modify IMM-based activities for children with learning difficulties in literacy. I will be present for up to one or two days a week (or up to four half days).
2. In order to carry out this research, I will request that the teachers allow me to assist and observe in the cycle of planning, implementing, evaluating and modifying IMM-based activities for children with learning difficulties in literacy.
3. I will also ask teachers to keep a journal, briefly noting any problems and successes relating to using IMM for children with reading difficulties.
4. I will also need to have regular taperecorded meetings with the teachers in order to discuss the progress of the 'formative experiments'. These will be conducted at the teachers' convenience and will be kept as brief as possible.

5. I will ask to observe the children in the classroom context in order to assist in the development of the new IMM-based activities. Tape recorders and video recorders will be used in some circumstances. I will also need to carry out some literacy assessments.
6. I will request access to artefacts such as student work samples and also programs and lesson plans, as well as any relevant school policy documents.

What I am offering

1. Assistance and support in planning, implementing and evaluating IMM-based activities to help children with learning difficulties in literacy.
2. Resources, such as Web Pages addresses and the use of some software.
3. Technical advice and assistance.
4. On-going support and advice after the study has finished, if this is requested.

Rights of the Participants

Participants will be free to withdraw from this study at any time. The identity of all schools and participants will be concealed so that they will not be identifiable in any articles or presentations arising from this study. All data will be kept locked away at my home or in my office at Edith Cowan University, and will not be seen by anybody but myself, members of your teaching team, and my two University Supervisors.

There are no risks associated with the study, other than the normal risks relating to computer use.

What will be the outcomes of the study?

- The teachers involved in the study will have an opportunity to explore how best to plan, implement and evaluate IMM for children with reading difficulties, which may help their future practice.
- It is anticipated that the children involved the study will benefit in that alternative approaches will be used to help them improve their reading.
- A description and analysis of the problems and successes of using IMM to help children with reading difficulties will be constructed, which may be of use to other teachers.
- A series of 'vignettes' will be constructed, which other teachers may use to help them plan for children with similar difficulties.

Please do not hesitate to contact me if you would like to discuss this further. I look forward to working with the teachers and children at _____, and thank you for your extremely valuable assistance.

Grace Oakley
Edith Cowan University
Telephone: _____
g.oakley@cowan.edu.au

CONSENT FORM





I _____ have read the information above and understand what the research involves. All of my questions have been answered satisfactorily. I agree to participate in this research, *Exploring the Potential of Interactive Multimedia to Help Children with Learning Difficulties in Literacy: A Formative Approach*. I realise that I may withdraw from the research at any time.

Signed: _____

Date: _____

Appendix 4.5.

Elementary Reading Assessment Form (ERAS) Example Page

Copyright © by Pearson Education, Inc.	<p>17. How do you feel about the stories you read in reading class?</p> 
<p>18. How do you feel when you read out loud in class?</p> 	
<p>19. How do you feel about using a dictionary?</p> 	
<p>20. How do you feel about taking a reading test?</p> 	

Appendix 4.7

Multidimensional Fluency Scale

Name: _____

Date: _____

Use the following scales to rate reader fluency on the three dimensions of phrasing, smoothness, and pace.

A. Phrasing

1. Monotonic with little sense of phrase boundaries, frequent word-by-word reading.
2. Frequent two and three word phrases giving the impression of choppy reading; improper stress and intonation that fails to mark ends of sentences and clauses.
3. Mixture of run-ons, mid-sentence pauses for breath, and possibly choppiness; reasonable stress/intonation.
4. Generally well phrased, mostly in clause and sentence units, with adequate attention to expression.

B. Smoothness

1. Frequent extended pauses, hesitations, false starts, sound-outs, repetitions and/or multiple attempts.
2. Several 'rough spots' in text where extended pauses, hesitations, etc., are more frequent and disruptive.
3. Occasional breaks in smoothness caused by difficulties with specific words and/or structures.
4. Generally smooth reading with some breaks, but word and structure difficulties are resolved quickly, usually through self-correction.

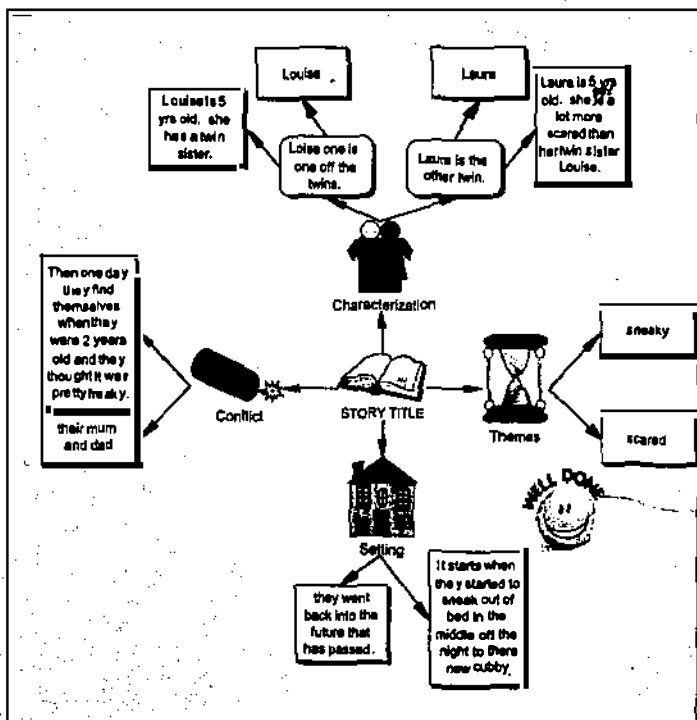
C. Pace (during sections of minimal disruption)

1. Slow and laborious.
2. Moderately slow.
3. Uneven mixture of fast and slow reading.
4. Consistently conversational.

D. Comments

Appendix 5.1.

Inspiration Concept Map



Appendix 5.2.

Internet Software Review Sites

<http://edweb.sdsu.edu/SPED/ProjectLitt/LITT> Project LITT (Literacy Instruction Through Technology) software reviews.

<http://www.eddept.wa.edu.au/cmisis/eval/technology/software> Education Department of Western Australia software review site.

<http://www.eddept.wa.edu.au/cmisis/eval/library/selection/sc123.htm#electronic> Education Department of Western Australia software selection criteria site

<http://www.edna.edu.au/edna/browse/3830:759:4814:sofireview> EDNA (Education Network Australia) software review site.

<http://www.superkids.com/> Superkids educational software review site (commercial site).

<http://besd.becta.org.uk/search/index.php3> BECTA (British Educational Communications and Technology Agency) software review site.

<http://www.teem.org.uk/> Teachers Evaluating Educational Multimedia site.

<http://www.englishsoftware.com.au/review.htm> English software review site. A commercial, Australian site.

http://scs.une.edu.au/EDIT312/resources/Evaluation/Eval_Menu.htm University of New England (Australia) software review and evaluation site.

<http://www.teachers.nsh.org.au/aussieed/educsoftware.htm> Aussie School House software review site for teachers.

<http://nsep.edna.edu.au/> EDNA (Education Network Australia) National Software Evaluation Project site.

Appendix 5.3.

Retell: Claudia

Master Frog

There was a frog that had been born by humans and umm he acts like a person .. like a human, and so he goes to the king and he says umm 'Can I marry the Princess?' and he wanted to marry umm the youngest princess so he goes to the King and he laughs when he asks him that and the princess comes out and she notices that he's human under the skin, underneath him, and so they got married and they had a great relationship and then the princess thought she was dead so the sisters took the frog and burnt his skin and melted it all in the fire and then she got another Prince and she thought that the Prince that she loved killed the frog. And he said ... I forgot ... oh well. And then the two evil sisters got jealous and they threw her into the river and so the frog goes down to the river and jumps in because he has now survived, he was alive and everything, then he asks the ... I forgot ... something of the river ... the father of the river ... if he could get the princess back and so she appeared straight away when he asked him so they went and they lived happily ever after.

Comprehension Questions

What did the princess think when she saw the prince appear in her room?
That he killed the frog.

Why were the sisters jealous?
Because they don't have a boyfriend.

Who returned the princess to life?
The frog.

Why did the princess agree to marry the frog?
Because she could notice the human underneath.

Appendix 5.4.

Journal Instructions

Instructions for using this journal
Students

1. Always write the date and time.
2. Always write the name of the software or the WebPage address.
3. Write what your thoughts and feelings are. Any problems? Anything you really like?
4. What did you learn?
5. Write whatever you like about reading using the computer.

Instructions for using this journal
Teachers:

1. Always write the date and time.
2. Always write the name of the student concerned.
3. Always write the name of the software or the WebPage address.
4. Write what your thoughts and feelings are. Any problems? Any successes? Ideas for the future?
5. Feel free to write whatever you like about the use of IMM to help children who have reading difficulties.

Appendix 5.5.

Record Sheet

Repeated Readings Record Sheet

Your name: _____

Name of story: _____

- Please record the date each time you read your chosen 4 pages.
- Also write H (highlighting on) or NH (no highlighting).
- Follow the examples that have already been written in the boxes.
- Please note anything else you did in your journal.

	I read along silently	I read along aloud	I read on my own but clicked on words I didn't know	I read aloud on my own
1		20/6/2001 H		
2			22/6/2001 H	
3			22/6/2001 NH	
	Name of Story:			
1				
2				
3				
	Name of story:			
1				
2				
3				
	Name of Story			
1				
2				
3				

Appendix 5.6.

Technical Support from 'The Learning Company' (1)

Dear g.oakley@cowan.edu.au:

Thank you for your inquiry and for choosing The Learning Company for your software needs.

Make sure your monitor is set to a 256 color display and 800x600 resolution:

- 1) Click on 'Start', go up to 'Settings' and click on 'Control Panel'.
- 2) On the 'Control Panel' double-click on the 'Display' icon.
- 3) On the 'Display Properties' screen click on the 'Settings' tab.
- 4) In the section labeled 'Color Palette' or 'Color Settings' change the color setting to '256 color'.
- 5) In the section labeled 'Desktop Area' or 'Screen Area' change the resolution by dragging the slider bar to '800x600 pixels'.
- 6) Click on the 'Apply' button at the bottom. If a screen appears asking how you want to apply the color settings, choose to restart the computer.

- 1) On your keyboard press CTRL, ALT, DELETE all at the same time
- 2) In the Close Program window click on an item
- 3) Click on the button that says End Task
- 4) Repeat steps 1, 2, and 3 until there is nothing left in the Close Program window except Explorer, Systray (or anything that ends in tray), and anything that refers to your video card (Compaq users should not do this until they have spoken with Compaq technical support to find out which ones can be closed)

Try running the program.

In order to better answer your inquiry, we would like to request more information about your computer system. Please follow the instructions below to record this information.

1. From the Desktop, right-click My Computer.
2. Select Properties from the Menu.
3. Click the Device Manager tab.
4. If there are any minus signs on the left side of the window, record their listings.
5. Double-click CD-ROM and record the name and model number which appears beneath this heading.
6. Double-click the model number, then click on the Driver tab. Record the driver date, and then close that window.

7. Double-click Display Adapter and record the name and model number which appears beneath this heading.
8. Double-click the model number, then click on the Driver tab. Record the driver date, and then close that window.
9. Double-click Sound, video, and game controllers and record the names and model numbers that appear beneath this heading.
10. Double-click the model number, then click on the Driver tab. Record the driver date, and then close that window.
11. Please reply with the information above so that we may better diagnose the issue you are experiencing.

If we can be of further assistance, please contact us. Thank you again for being a customer of The Learning Company.

Sincerely,

Jay F. - Education Consumer Technical Support

The Learning Company

1 Martha's Way Hiawatha, IA 52233

Web: <http://support.learningco.com>

E-Mail: support@learningco.com

Appendix 5.7.

Technical Support from 'The Learning Company' (2)

Dear g_oakley@cowan.cdu.au:

Thank you for your inquiry and for choosing The Learning Company for your software needs.

Issue Description:

Error: RDLI_32 Caused Invalid Page Fault RDLI_32.exe

Issue Detail:

When launching the program the error message "RDLI_32 Caused an Invalid Page Fault in module RDLI_32.exe occurs.

Issue Solution:

This is a 32-bit compliant application and requires 32-bit CD-ROM drivers. To check for 32-bit CD-ROM drivers, use the following steps.

The installer program is designed to run on either 16 or 32 bit operating systems. It is a separate program and is not dependent on 32-bit drivers.

- 1) Right click on My Computer and select Properties.
- 2) Click the tab labeled Device Manager.
Look for CD-ROM, it should appear near the top of the list.
- 3) If CD-ROM is not listed, 32-bit CD-ROM drivers are not installed.
- 4) If CD-ROM is listed, click the tab labeled Performance. There will be a listing of system specs. File System should be 32-bit. If it refers to MS-DOS compatability, it is not utilizing 32-bit drivers.
- 5) Contact your CD-ROM manufacturer or computer manufacturer for 32-bit drivers.

If we can be of further assistance, please contact us. Thank you again for being a customer of The Learning Company.

Sincerely,

Karinen F. - Education Consumer Technical Support.

Appendix 6.1.

Hillview's Information Technology Plan

Information Technology Plan

Focus: To develop the understanding of and use of information technology in the school we need to:

1. In-service staff (teachers, aides, administration) in all areas of Information Technology.
2. Develop Information Technology as a student based program.
3. Provide hardware/software relevant to the needs of children and staff.
4. Evaluate students' ability to access information.
5. Develop a plan for further school development.

Strategies: 1. In-service Staff.

- One day in-service on plan for Information Technology, use of technology in the classroom and types of software available.
- One hour in-service courses - TECHNO CAFE - after school, 3.30-4.30pm. Staff choose area of interest from the following sessions:

- Word processing (school officer)
- Digital camera (co-ordinator)
- Laptops (co-ordinator)
- Internet / E-mail (librarian)
- School software (coordinator/individual)

➤ All sessions run depending on demand each week. Nearby schools are offered places to send participants.

➤ One day in-service - each teacher allocated one day to explore software and use of their classroom computer.

➤ External Professional Development: IT Committee/Staff to be in serviced as the need arises eg Librarian - internet, Technician/Librarian - web page authoring.

➤ Half day in-service end Term 2 to discuss Information Technology Plan and future directions.

2. Develop Information Technology as a Student Based Program.

➤ Define skills needed by students and develop a school based Information Technology Continuum.

➤ Develop a research marking key to give students feedback on their research topics.

➤ Allow access to hardware.

➤ Staff to discuss and document their beliefs about teaching/learning and best teaching practice with the aim of providing meaningful learning environments for students integrating Information Technology.

3. Provide Hardware/Software Relevant to the Needs of the Children and Staff.

➤ Follow "Operational Plan" so that children moving through the school have access to IBM compatible computers.

➤ Each class to have access to one then two 486 Multimedia computers and a Printer.

➤ Provide access to the internet in the library then to the upper primary classrooms.

➤ Library to have two computers with children having access before school and at lunchtime as well as during normal school times.

➤ Provide "Amstrad Notebooks" (word processors) for word processing to take pressure off classroom computers. We currently have 12 and need to bring it up to a class set of approximately 30. Children have access to these overnight and at weekends.

➤ All computers to have CD-ROM based encyclopaedias (Australian Infopedia, World Book Encyclopaedia).

➤ Provide software to complement classroom teaching learning programs. eg Living Books, History of Australia, Indonesian Tutor.

➤ Integrate the use of the digital camera into the teaching/learning program.

➤ Investigate the use of keyboard mix software.

4. Evaluate Students' Ability to Access Information

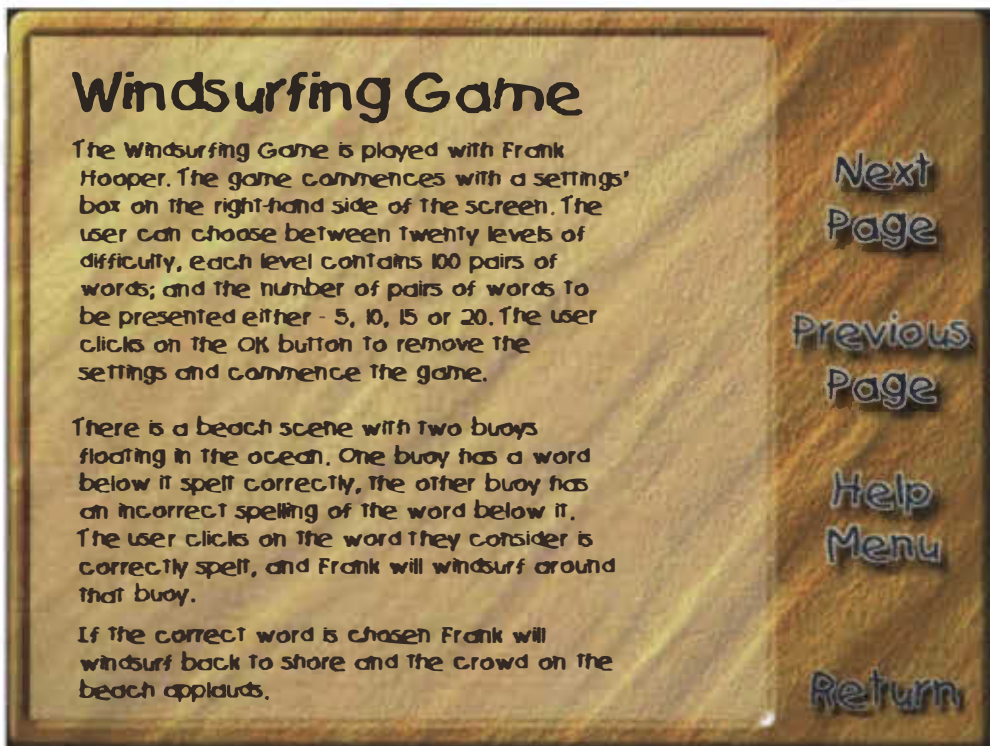
- ~~Inform~~ Teachers to complete Information Technology MIS to be analysed at beginning of Term 4.
- Teachers to keep portfolio samples of children's research and technology activities.
- Develop student self-evaluation strategies.
- Survey children on computer use and understanding.
- Develop skills checklist for comp/Net use.

5. Develop a Whole School Plan

- Whole school planning sessions (1 day beginning Term 1 and 1/2 day end Term 2).
- IT Executive Committee to meet to discuss and plan directions. Committee comprises: Principal, IT Co-ordinator, Librarian, Technician, School Officer and two Parents.
- Plans developed and taken to full staff meetings and where appropriate to the parent body (P&C Meetings, Parent Evenings).
- Plan to be integrated with School Strategic Plan on Information Technology.
- Plan to be published on the Internet.

Appendix 6.2.

Superspell – A Day at the Beach. Written Instructions



Appendix 6.3.

Feedback from Andrew

RESPONSE SHEET	Your name	Andrew	Date: 11-09-01
Name of authors:	reading Plaster 7 to 2		
As written I did:	nothing much		
What I liked best:	_____		
Why I liked it best:	_____		
What I liked least:	_____		
	It's slow. I always lose		
Why I didn't like it much:	_____		
	->		
What problems did I have?	_____		
	writing		
What did I learn?	_____		
	nothing		

Appendix 6.4.

Feedback from Ryan

RESPONSE SHEET	Your name: RYAN	Date: <u>4/1</u>
Name of software:	<u>story book weather</u>	
Activities I did:	<u>create pictures, write stories.</u>	
What I like about:	<u>talking in w: mike.</u>	
Why I liked it best:	<u>because it was funny</u>	
What I liked least:	<u>I liked all</u>	
Why I didn't like it much:	<u>N/A</u>	
What problems did I have?	<u>spelling</u>	
What did I learn?	<u>learned how to use a word with a program</u>	

Appendix 6.5.

Feedback from Ryan (2)

RESPONSE SHEET	Your name: <u>RYAN</u>	Date: <u>18-9-</u>
Name of software: <u>pm 3:14-17</u>		
Activity I did: <u>read a book</u>		
What I liked best: <u>listening to the book</u>		
Why I liked it best: <u>I liked the story because it has a good story</u>		
What I liked least:		
Why I didn't like it much:		
What problems did I have?		
<u>spelling I did is wrong</u>		
What did I learn?		
<u>a new word of story.</u>		

Appendix 6.6.

Phonics Alive! 2 Score Sheet: Rosie

Phonics Alive! 2 - The Sound Blender

Phonics Alive! 2 - The Sound Blender

Module 1

Results for **Rosie** on 9/17/01 who took 15 minutes, finishing at 3:32 PM

The module was completed

59% of responses correct on first try.

- 11a03 - Click on the letters that make the /gh/i-a/ sound - 2 mistakes
- 11b02 - Dropped 'bits' into the wrong rhyming bucket - 1 mistake
- 11b08 - Dropped 'might' into the wrong rhyming bucket - 1 mistake
- 11c01 - Click on the word for the picture - clown - 1 mistake
- 11c03 - Click on the word for the picture - cloud - 1 mistake
- 11c04 - Click on the word for the picture - crown - 1 mistake
- 11c06 - Click on the word for the picture - fern - 2 mistakes
- 11c07 - Click on the word for the picture - mouth - 2 mistakes
- 11c08 - Click on the word for the picture - church - 2 mistakes
- 11e01 - Pressed the wrong key given the word 'fight' - 2 mistakes
- 11e01 - Took too long to type the word 'fight' - 1 mistake
- 11e03 - Pressed the wrong key given the word 'light' - 1 mistake
- 11e03 - Took too long to type the word 'light' - 1 mistake
- 11e04 - Pressed the wrong key given the word 'fern' - 1 mistake
- 11e04 - Took too long to type the word 'fern' - 1 mistake
- 11e05 - Pressed the wrong key given the word 'night' - 2 mistakes
- 11e06 - Pressed the wrong key given the word 'rain' - 1 mistake
- 11e08 - Pressed the wrong key given the word 'shirt' - 3 mistakes

Phonics Alive! 2 - The Sound Blender

Started at 12A01

Results for **Rosie** on 9/17/01 who took 25 minutes finishing at 3:47 PM

The program was stopped at interaction 12e00

56% of responses correct on first try.

- 12a04 - Click on the letters that make the /kn/ sound - 1 mistake
- 12b01 - Took too long for 'fing' in the rhyming machine - 1 mistake
- 12b02 - Took too long for 'thing' in the rhyming machine - 1 mistake
- 12b03 - Took too long for 'strong' in the rhyming machine - 1 mistake
- 12b04 - Took too long for 'born' in the rhyming machine - 1 mistake
- 12b08 - Dropped 'wrong' into the wrong rhyming bucket - 1 mistake
- 12c01 - Click on the word for the picture - torch - 2 mistakes
- 12c02 - Click on the word for the picture - saw - 4 mistakes
- 12c06 - Click on the word for the picture - wrap - 7 mistakes
- 12c08 - Click on the word for the picture - straw - 1 mistake

Appendix 6.7.

Feedback from Rosie

RESPONSE SHEET	Your name:	Rosie	to: 10.9.01
Name of software:	Phonics Alive 2		
Activities I did:	Level 10		
What I liked best:	frog frog		
Why I liked it best:	because it did funny things		
What I liked least:	I couldn't type fast inuff		
Why I didn't like it much:	-		
What problems did I have?	I couldn't click fast enough		
What did I learn?	insects + spelling		

Appendix 6.8.

Feedback from Anita

RESPONSE SHEET	Your name:	Anita	Date:	10/09/06
Name of software:	Reading For Literacy 5			
Activities I did:	Spelling, reading			
What I liked best:	activities			
Why I liked it best:	because it was fun and when you click it says yes or no.			
What I liked least:	nothing			
Why I didn't like it much:	nothing			
What problems did I have?	didn't have problems.			
What did I learn?	it was correct or no.			

Appendix 7.1.

Think sheet


Think Sheet

Name _____ Date 10.11.01
 CD-ROM Pm Silver Story/Text Walter's them

During Reading

**Predictions
(Before Reading)**

What will this text be about? Why do I think so?



A boy who goes into a walkathon and he had no chance of winning but he does.

Because the story is supposed to be exciting

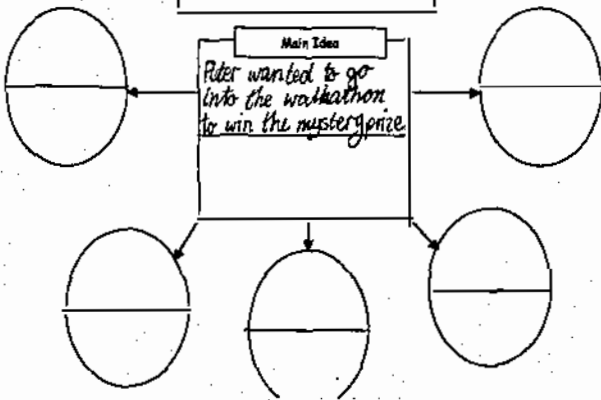
KEY WORDS

1	Walkathon
2	Who will push Peter
3	Peter is disabled
4	Take turns
5	Help Peter
6	Permission
7	wheelchair
8	strong enough
9	hard to get to sleep
10	
11	
12	

After Reading

Main Idea

Peter wanted to go into the walkathon to win the mystery prize



Appendix 8.1

The Bungarra

The Bungarra

on the Internet

School
implementation

ABC



Go to <http://www.elton.iinet.net.au/page50.html>
Click on 'The Bungarra'.

1. For each stage, write one descriptive sentence.

- Stage 1 The children got sticks and branches and
sticke together with strips made of cloth they made into a shape of a Bungarra then took the
- Stage 2 Then we covered the Bungarra with the paper
and then we covered it in tissue paper that we glued it down and the shape of
- Stage 3 ^{huge bungarra}
Next we gave it a forked tongue and painted
- Stage 4 then we let the paint dry then we made the Bungarra
garden ^{waterproof} ^{green} and wired onto a log. Its finished product was to ^{carry} it in the
It had grass

2. Fill in the gaps.

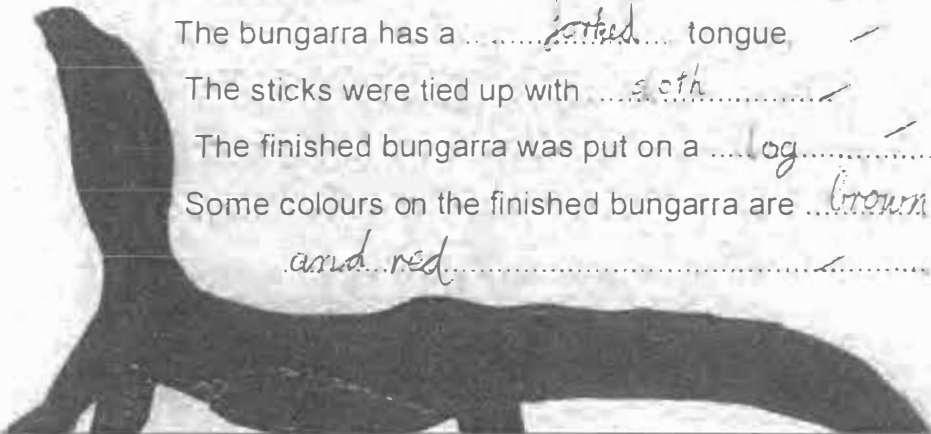
The bungarra has a forked tongue

The sticks were tied up with cloth

The finished bungarra was put on a log

Some colours on the finished bungarra are green

and red



Appendix 8.2.

Oral Reading Record




Oral reading record


Title <i>The Best Bear in Bonaroo Bay</i>	
Date <i>3/5/2001</i>	Initials _____
Comment <i>Good word attack skills and clearly read with a good volume. I can hear you are trying to add expression - Keep up the good work.</i>	

Title	
Date	Initials
Comment	

Appendix 8.2.a






Audiotape Reflection



Today I taped myself read
Wishes - Wishes

When I listen to myself on the audiotape I feel:
embarrassed

Because: *I thought that I would make a mistake.*

I can improve my reading by: *Reading more.*
aloud.

- working on my expression?
- working on my fluency?
- working on my word attack?
- working on my phrasing?
- anything else? _____

Name TAMARA _____ Date: 2/16/01

Appendix 8.3.

Retell: Bridget

Oral Retell - Jack and the Beanstalk

140601

(Says she'd never read the story before although she'd heard parts of it before).

(Cummer: 171 Tape10B)

Umm Jack and umm his muther were er... were poor and they had this cow and umm then they went to the farm and then Jack went to a farmer and got some magic beans and then umm and then went back and the mum didn't want beans and she wanted money and umm she showed it out to the bank and umm then she umm .. and then umm she sended Jack to the room and then the next day he woke up and umm the beanstalk had grown and umm he climbed up there and umm he said ... he said ... he saw a giant things like flowers and stuff and also the big castle and then umm and then umm he knocked on the castle door and he asked for some breakfast and then umm the breakfast .. he didn't get a breakfast and umm he had to hide and umm ... what did he say first? Englishman. And umm and then ... and then he saw the coins and then he umm pulled it out and ran back down the beanstalk and then everybody was cheering for him and then he went up there the next day and he umm wasted some breakfast so he knocked on the door and then he umm he knocked on the door then he umm asked for some breakfast again and then he went ... he went ... umm he umm ... he ... and then ... and the he went back up again and then he knocked on the door again then umm umm and the woman said to hide and he hid and umm and then umm he went to sleep and the umm and he took the chicken and ran away and went back down and then the last time they went ... he went up, umm hey ... umm he got the harp and (?) made a big sound and then the and then the umm the giant ran after him. And umm and then he got his .. when he went to the bottom, the boy went to the bottom, he got his axe and he cut umm the beanstalk umm down a little bit and umm the giant ran up fastly and then umm and then the next day they had a celebration and umm the people gave some coins to him. That's all.