A blended-learning approach to strategy training for improving second-language reading comprehension in South Africa

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Declaration

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it to any university for a degree.

Signature:

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1 November 2007

Summary

It is widely recognized that learning to read is one of the most crucial learning processes in which children are involved at primary school. However, becoming a proficient reader is not equally easy for all learners. When it comes to the development of reading comprehension many children appear to have persistent problems.

In order to meet the reading needs of students in the 21st century, educators are pressed to develop effective instructional means for teaching strategies to improve reading comprehension. The ability to read academic texts is considered one of the most crucial skills that students of English as a Second Language need to acquire. Reading comprehension has become the "essence of reading" (Dreyer & Nel, 2003:349). Literacy, and more specifically reading, is one of many areas where research has provided evidence of the potential impact of technology such as multimedia and hypermedia. If one looks broadly at the issue of technology and literacy, one of the more rewarding issues for educators is the role of technology in literacy acquisition and instruction, especially for primary grade learners (Pearson et al, 2005:3).

This study aims to support the growing trend of an increasingly "paired" literacy, namely that of general literacy and computer (or technological) literacy. The study proposes that through implementing an overall blended-learning methodology for teaching learners how to use reading strategies, it will be possible to improve learners' general reading comprehension levels.

Opsomming

Dit is algemeen bekend dat om te leer lees een van die mees kritiese leerprosesse is waarby kinders op laerskool betrokke is. Tog is dit nie vir alle leerlinge ewe maklik om bedrewe lesers te word nie. Wanneer dit by die ontwikkeling van leesbegrip kom, blyk dit dat heelwat leerlinge voortdurende probleme ondervind.

Om te verseker dat die leesbehoeftes van leerlinge in die 21ste eeu nagekom word, word opvoeders gedring om effektiewe leermetodes te vind om leerlinge se leesbegrip deur middel van die gebruik van leesstrategieë te verbeter. Die vermoë om akademiese tekste te lees word beskou as een van die belangrikste vaardighede wat leerders met Engels as tweede taal moet aanleer. Leesbegrip het dus ontaard in die “essensie van lees” (Dreyer & Nel, 2003:349). Geletterdheid, en meer spesifiek lees, is een van die vele gebiede waar navorsing bewys gelewer het van die potensiële impak van tegnologie soos multimedia en hipermedia. As 'n mens breedweg kyk na tegnologie en geletterdheid, is die rol wat tegnologie in die aanleer en onderrig van geletterdheid speel, een van die meer lonende kwessies vir opvoeders, veral op laerskoolvlak (Pearson et al, 2005:3).

Hierdie studie beoog om die groeiende neiging tot 'n toenemend “gekoppelde” geletterdheid te ondersteun, naamlik dié van algemene geletterdheid en dié van rekenaar- (of tegnologiese) geletterdheid. Hierdie studie stel dit dat leerders se algemene leesbegrip verbeter kan word deur die implementering van ‘n algemene gemengde-leer (“blended-learning”) metodiek vir die aanleer van leesstrategieë.

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Chapter 1
Introduction

This study is based on three perceived needs: (1) a need for the improvement of reading comprehension in second-language learners, (2) a need for strategy instruction in teaching reading comprehension, and finally (3) a need for a blended-learning approach to strategy instruction.

Need 1: Improving reading comprehension

In today's modern society reading is an essential skill. New knowledge is transferred either through printed or digital text at an ever increasing rate. Every day we choose, or are required, to read texts for understanding, enjoyment or task completion (Koppenhaver & Erickson, 1998).

The 2005 Intermediate Phase Systemic Evaluation Report by the National Department of Education (Department of Education, 2005) reports on, amongst other things, the impact of the Language of Learning and Teaching (LOLT) on learner achievement levels. The language learning area covers the language skills of listening comprehension, reading and writing through specific tests for each of these skills.

The report states on page 96: "Learners who took the test (as part of the Evaluation Report Survey) in their home language, where this was the same as the LOLT, obtained substantially higher scores than learners whose home language was different from the LOLT, and as a result, wrote the test in a second or third language. This trend was noted across all provinces …"

In the foreword of this survey, the Director-General of the Department of Education, Mr. D.B. Hindle, states that one of the most important facts that were highlighted by the survey, is that “language is a major factor in children’s learning” and that it is urgently necessary to “turn around low levels of learner achievement, especially in … language ability – both home language and the language of learning” (Department of Education, 2005:v).

Part of the aim of this study is to propose a method for improving reading comprehension by applying what is available to most learners: their own existing knowledge and technology.

Need 2: Strategy instruction and reading comprehension

Simply put, a strategy is a tool, plan or method used for accomplishing a task (Beckman, 2002). The goal of strategy-based instruction is to help second-language students become more aware of ways in which they read most effectively, ways in which they can enhance their own comprehension of the target language and ways in which they can continue learning after leaving the classroom (Cohen, 1996:13).

When referring to reading strategies a distinction is often made between cognitive and metacognitive strategies. Cognitive strategies can be defined as mental and behavioural activities, such as rereading, using existing knowledge and changing reading speed to increase the chance of comprehension. Metacognitive strategies are self-monitoring and self-regulating activities which focus on the process and product of reading. This would include a reader’s awareness of whether they comprehend what they are reading, their knowledge of how and why to apply a certain cognitive strategy and their own cognitive abilities (Van Keer, 2004:38). Invariably a

combination of strategies is used, depending on the learner and his frame of reference. Research indicates that successful learners use numerous strategies, ranging from visualization, verbalization, making associations, chunking, questioning, scanning, underlining, sounding out words, etc.

A further point worth mentioning is that learning strategies are not always used solely for (language) learning, but also for obtaining social skills and “fitting into society”. These strategies are categorized as social/affective strategies, and do not form part of the focus of this study.

Experienced language learners (readers) can approach language-learning problems in a systematic way and are usually successful in selecting and applying the correct strategies to complete a task. Novice learners, however, may be less efficient at selecting and applying the most appropriate strategies (O’Malley & Chamot, 1995:146, cited in Kinoshita, 2003), and may need strategy instruction.

Regardless of language-learning experiences, both experienced and novice learners need to know how to use strategies effectively as a tool for improving (language) learning performance. One way of achieving this is to provide formal strategy training in the classroom, or to integrate strategy use into everyday language learning. The instructional practice of teaching reading in primary school is still very traditional. It is characterized by a large amount of comprehension “testing”, consisting of questions about a text after learners have read the text. There is very little, if any, explicit and continuous strategy instruction (Van Keer, 2004:39).

Need 3: A blended-learning approach to strategy instruction

Gray (2006) defines blended learning as follows: “Blended learning … combines e-learning with a variety of other delivery methods for a superior learning experience”.

A more comprehensive definition is provided by Thorne (2003:16) when she states that “[b]lended learning is the most logical and natural evolution of our learning agenda. It suggests an elegant solution to the challenges of tailoring learning and development to the needs of individuals. It represents an opportunity to integrate the innovative and technological advances offered in the best of traditional learning. It can be supported and enhanced by using the wisdom and one-to-one contact of personal coaches.”

Thorne (2003:17) goes on to say that blended learning is a mix of multimedia technology, CD ROM video, virtual classrooms, voicemail, email and conference calls, online text animation and video streaming – and that all these are combined with traditional forms of classroom training and one-on-one coaching.

Using technology to aid language learning (and indeed learning across the school curriculum) is supported by the White Paper on e-Education of 2004, entitled “Transforming Learning and Teaching through Information and Communication Technologies (ICTs)”. In the foreword of this White Paper, the Minister of Education states the following: “ … [a]dvances in ICTs have dramatically changed the learning and teaching process. This has opened up new learning opportunities and provided access to educational resources well beyond those traditionally available.” (Department of Education, 2004:6). The paper further states that the goal of the e-Education Policy is to ensure that “… every learner in the general and further education training bands be ICT capable by 2013 …” (Department of Education, 2004:17).

This study therefore proposes that not only is the formal introduction of strategy instruction necessary to ensure competent readers and learners, but also that the time is right for the implementation of a blended-learning solution to support this learning approach. Furthermore, the use of technology to support strategy instruction has a dual benefit: (1) where learners are already competent computer users, their computer literacy will aid the implementation of the overall blended-learning strategy-instruction approach, and (2) where learners are being exposed to the use of technology for the first time, they will gain a double benefit: computer literacy and language literacy.

Hypothesis

A blended-learning approach to strategy instruction improves reading comprehension in second-language learners.

Purpose of the study

The purpose of this study is threefold:

1. To propose a blended-learning approach to strategy instruction as the recommended *overall* learning approach to teaching L2 reading comprehension in South Africa.
2. To develop a prototype multimedia sample, which would form part of the *overall* blended-learning approach, to illustrate the use of technology in a blended-learning approach to strategy training.
3. To determine, through research, whether this blended-learning approach indeed does improve reading comprehension in L2 learners.

Outline of thesis

The following is a brief outline of this thesis:

Chapter 2 provides a short literature review about reading comprehension, which includes reading models such as the top-down, bottom-up and interactive approach and schema theory. It also describes the important role of metacognition in reading and goes on to illustrate how this links to strategy training. It further provides information about Computer-assisted Language Learning (CALL) in general, CALL learning theories and the general role of computer-based training in education. Finally Chapter 2 will provide detail about blended learning and why it is considered important in this study and in the application of strategy training.

Chapter 3 provides information about the research design and method used for this study. This will include information about the participants, variables, instruments & materials, experimental design and statistical analysis used. It will also include information on the method used to determine text readability in selecting the reading text for the research instrument.

Chapter 4 will discuss the results of the research study.

Chapter 5 provides a conclusion to this study, and includes an overview of significant findings in the study, an examination of findings that fail to support or only partially support the hypothesis, limitations of the study that may affect the validity of the results and recommendations for further research.

Chapter 2
Review of Literature

In this chapter an overview of previous research on the key issues in this study is provided. This will include a discussion on reading comprehension, taking into account reading models, the role of metacognition in reading and the use of strategies in reading. Various strategy training models will be discussed. Because this study proposes a blended-learning approach to strategy training, a brief history of Computer-assisted Language Learning (CALL) will be provided to illustrate the role of computers and technology in language learning. This will include a brief description of the main learning theories used in CALL, and identify the learning theory used in this study. Lastly the concept of blended learning will be discussed, along with the reason for recommending a blended-learning approach to strategy instruction.

Reading comprehension

2.1 Models of Reading

When studying anything that has to do with reading, the question that inevitably arises is “What goes on in the eyes and the mind of the reader during the reading process?” In other words, how does the reader comprehend what is being read? This is not an easy question to answer, and over the years numerous attempts have been made to answer this question by formulating models of the reading process. A model refers to a formalized, usually visually represented theory of what goes on in the eyes and mind of a person who is reading and comprehending (or not comprehending) the text (Davies, 1995:57).

2.1.1 The Bottom-Up Model

This is the earliest and most basic model of reading, and it provides a description of what one could consider a “common sense” process of reading:

(a) eyes look,

(b) letters are identified and sounded out,

(c) words are recognized,

(d) words are allocated to grammatical class and sentence structure,

(e) sentences provide meaning,

(f) meaning leads to thinking (Davies, 1995:58).

This model seems to “mimic” what can be observed when a person reads, and has also been called the phonic-based model. The focus of this model is on the *printed* matter and word and letter recognition which in turn leads to meaning. It states that reading is driven by the process that results in meaning (i.e. text is the driving force behind reading) and that progress is made by constructing meaning from small parts to the whole. In other words, reading is a single-direction, part-to-whole processing of text (Boothe et al, 1999c). The main proponents of the Bottom-Up model were Gough (1985), Flesch (1955) and LaBerge and Samuels (1985).

Bottom-Up models are now seen as inadequate because they fail to explain certain empirical findings (Garner, 1987:2). Two such findings are (1) that when word recognition errors are made, the word that is substituted tends to be the same part of speech to the word in the text, i.e. syntactic processing affects word perception, and (2) prior presentation of a sentence context lowers the threshold for word

recognition, i.e. semantic processing affects word perception (Tulving & Gold, 1963 cited by Garner, 1987:2).

2.1.2 The Top-Down Model

This model is almost the reverse of the Bottom-Up model, and is described as follows: (Davies, 1995:58)

(a) Eyes look
(b) Thinking – predictions about meaning
(c) Sample sentence as a whole to check meaning
(d) To check further, look at words
(e) Study letters if still uncertain
(f) Back to meaning predictions

Whereas the focus of the Bottom-Up model was the printed text, the focus of the Top-Down model is *meaning*. The model focuses on thinking and meaning at an early stage, and acknowledges that the reader brings something to the reading situation by his predictions or assumptions about the meaning of text. The Top Down model basically believes that comprehension is the basis for decoding meaning, and that meaning is brought to print, not derived from print (Boothe et al, 1999b). Reading is, therefore, a meaning-driven process, or an assumption about the meaning of the text. It emphasizes what the reader brings to the text and progresses from whole to smaller part. Two main proponents of this model were Goodman (1970) and Smith (1982).

Top-Down models are now also seen as inadequate for the same reasons that the Bottom-Down models are, namely that they fail to

explain existing data that the learner brings to the reading process (Garner, 1987:2).

2.1.3 The Interactive Model

The Interactive model attempts to combine the most important aspects of the Bottom-Up and Top-Down models, making it one of the more promising approaches to the theory of reading today (McCormick, 1988, cited by Boothe, 1999a).

Rumelhart was the main proponent of the Interactive model. His objective was to incorporate the possibility of parallel processing, in other words, the simultaneous processing from more than one source. He stated that “reading is at once a perceptual and cognitive process. It is a process which blurs these two traditional distinctions” (1985, cited by Boothe, 1999a). He proposed that a skilled reader had to be able to make use of sensory, syntactic, semantic and pragmatic information to enable effective reading comprehension. These various sources of information appeared to interact in complex ways within a reader during the reading process. Goodman (1981, cited by Boothe, 1999a) describes the Interactive model as using “print as input and text as output”.

Unlike the Bottom-Up and Top-Down models, the Interactive model does not predict any predetermined direction or sequence of processing. It proposes that a reader is able to draw simultaneously – but selectively – from a variety of sources of information: orthographic (spelling in general), lexical, semantic, syntactic and schematic. (*cf* Figure 1 on next page).

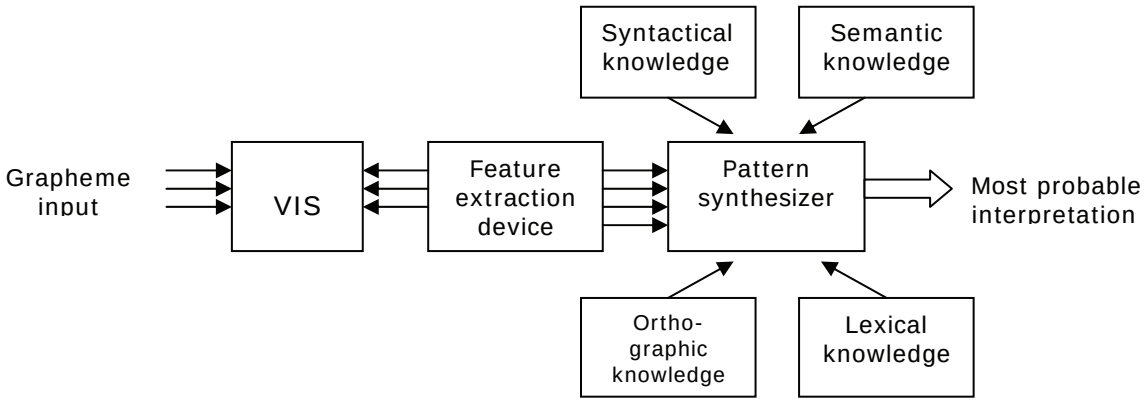


Figure 1: Interactive Model (Davies, 1995:64)

A description of the model is quite obvious from the figure. The process starts with graphemic (visual) information being registered in the Visual Information Store (VIS). From this information important features are extracted by the so-called “feature extraction device”, whereafter the features are fed into the pattern synthesizer which has simultaneous access to information about orthography, syntax, lexis and semantics. In other words, all sources of knowledge come together in one place and the reading process is a product of the simultaneous application of all knowledge sources.

What makes this model important for this study is that it leaves room for different kinds of reading behaviour and different levels of reading competence. One could hypothesize that if a reader is inexperienced in processing visual and orthographic information, they could rely more on semantic information. Or, if a reader lacks strong syntactic skills, they might rely more on orthographic or lexical information. The model, therefore, provides a basis for investigations of performance and processing strategies of different groups of readers under different

conditions, whether first language (L1) or second language (L2) (Davies, 1995:65).

The Interactive model also seems to underline the importance of readers (L1 and L2) becoming proficient in accessing all sources of information rather than relying on one source, such as letter-sound correspondences - as Gough (1985) would recommend in the Bottom-Up model, or prior expectations, as Goodman would recommend in the Top-Down model (1970).

2.1.4 Schema Theory

Rumelhart (1984, cited by Davies, 1995:66) later broadened the Interactive model by paying more attention to the role of the semantic level of processing. With this he proposed a schema-theoretic account of the comprehension process, where the focus was more on the higher-level processes than the lower-level processes. The basic construct that he proposed, he called a schema, or unit of knowledge. The function of the schema is to provide frameworks for interpreting the world, including the world of text in the reading process. The fundamental assumption of this schema theory is that we can only interpret visual and written information according to our prior knowledge and experience, and that this prior knowledge and experience is packaged into an infinite number of knowledge units. Rumelhart further suggested that an individual's knowledge units or schemata could change with time and experience, and therefore could not be regarded as complete or stable, but rather constantly changing (Davies, 1995:66).

R.C. Anderson and Pearson (1984, cited by Garner, 1987:4) provide the example of a ship christening schema. Anyone who has seen a ship being christened or has read about such an occurrence will have certain expectations about the information that would be contained in a text about or description of such an event. One could expect a (new) ship to be mentioned, a celebrity who will perform the christening, a bottle (that probably will be broken), etc.

When the following paragraph is read, these existing knowledge units are “filled” or “substantiated” by certain bits of information in the text.

> *Queen Elizabeth participated in a long-delayed ceremony in Clydebank, Scotland, yesterday. While there is still bitterness here following the protracted strike, on this occasion a crowd of shipyard workers numbering in the hundreds joined dignitaries in cheering as the* HMS Pinafore *slipped into the water.* (Garner, 1987:4)

In terms of the schema theory, the “fit” of this new information to existing information about ship christening is fairly good. Queen Elizabeth fits in the “celebrity slot”, the HMS Pinafore fits the new ship slot, and although there is no mention of a bottle or champagne, it is fair to assume that this would be inferred by the reader, perhaps when reading “ … slipped into the water” since this usually happens after the christening.

According to the Schema Theory the process of comprehension seems to depend largely on the reader’s schemata. The more closely the reader’s schemata matches the schemata intended by the author, the

easier it is to comprehend the text. A reader's background seems to have a greater influence on the comprehension of implied or inferred information than on directly stated information. The reason for this is that readers seem to understand implied information only when it can be related to their own knowledge or prior experiences. These differences in learners' schema can pose a challenge for teaching reading comprehension in countries with a large and diverse population. When learners come from a wide spectrum of cultural and socio-economic backgrounds, they are likely to have considerably different schemas about a subject – this could affect the comprehension of the same text by readers of a similar age (i.e. supposedly relatively similar reading competence) but different backgrounds (i.e. different "knowledge units"). In teaching reading comprehension this has a considerable impact on the choice of text – the text almost has to breach the "known" and the "unknown" knowledge of the reader. However, by presenting text electronically, as recommended by the blended-learning approach proposed by this research, it is possible to make information that is essentially "unknown" to a reader "known" through the use of judicious hyperlinks, thereby enhancing the possibility that a single text, if presented well, can cater for a diverse audience.

2.2 Metacognition and Reading

The aforementioned sections about reading models clearly show that readers play an active role in the reading process by directing their own cognitive resources to learn from text. This fact has been very appealing to researchers, and two bodies of research are very useful in this regard: the work done with children in the area of "metacognition" and with adults in the area of "executive control" (Garner, 1987:15).

The research has been important in examining readers' knowledge of the reading process, monitoring their own comprehension and using different reading strategies. The research has also been important in the sense that readers have been taught how to use strategies to make and monitor cognitive progress while reading (in cases where use of strategy does not occur naturally). It is this use of reading strategy, and specifically learning to use these strategies through the use of blended learning, that is the main focus of this study.

Flavell (1976) first used the term "metamemory", i.e. knowledge of one's own memory, in the 1970's (Garner, 1987:16). Flavell and his colleagues had the following to say about metacognition and metacognitive knowledge respectively:

"Metacognition refers to one's knowledge concerning one's own cognitive processes and products or anything related to them, e.g. the learning-relevant properties of information or data." (Flavell, 1976, cited in Garner, 1987:16)

"Metacognitive knowledge consists primarily of knowledge or beliefs about what factors or variables act and interact in what ways to affect the course and outcome of cognitive enterprises." (Flavell, 1979, cited in Garner, 1987:16).

The above statements emphasize that metacognition is essentially cognition about cognition, in other words knowing about knowing. If cognition means "perceiving, understanding, remembering", etc. then metacognition involves thinking about one's own perceiving, understanding, remembering, etc.

Town (n.d.) describes metacognition as “being aware of our thinking as we perform a specific task and then using this awareness to control what we are doing …” Yet another, more recent, definition of metacognition is that of Anderson (2002a, cited in Rasekh & Ranjbary, 2003:3), when he defines metacognition simply as “thinking about thinking”.

Flavell (1976) went on to distinguish between metacognitive knowledge, metacognitive experiences and strategy use (Garner, 1987:16). The reason for the distinction is important: to be able to distinguish between what is cognitive, and what is metacognitive.

Flavell suggested that metacognitive knowledge can serve as a base for metacognitive experiences, which in turn result in use of strategy/ies. The figure below is an illustration of Flavell’s model of metacognitive components.

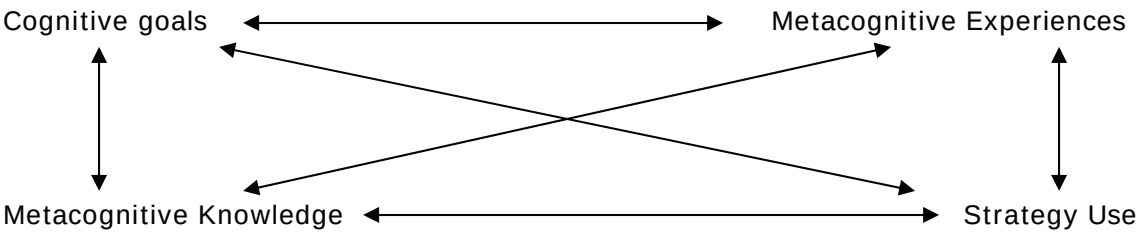


Figure 2: Flavell’s model of metacognitive components (Garner, 1987:21)

Since this study focuses on the use of strategy training for L2 readers, and strategy training involves teaching readers to be aware of their metacognitive processes while reading, a bit more detail is necessary

about metacognitive knowledge, metacognitive experiences and strategy use and how they fit together.

2.2.1 Metacognitive Knowledge

Metacognitive knowledge is relatively stable, usually statable information about cognition. It is knowledge about ourselves, the tasks we apply and the strategies we use (Baker & Brown, 1984b cited by Garner, 1987:17).

Knowledge about *ourselves* might involve things such as knowing at what kind of test we have a better chance of success: a test with open-ended answers or a test with multiple choice answers. It is about knowing that some texts must be read with more attention than others. For example, if reading a text for study purposes, it will require more effort and care than when a text is read for enjoyment or entertainment.

Knowledge about *tasks* is knowing what level of difficulty the task is likely to present. For example, knowing that when reading a text about an unfamiliar topic it will be more difficult to understand than a text about a familiar topic.

Knowledge about *strategies* could include things such as knowing that verbal repetition of what has been read may promote remembering the information more effectively, re-reading certain parts of a text may assist in answering questions about the text, making notes in the sideline will enhance text recall, etc.

Flavell (1985) points out that these three “knowledge sets” are highly interactive, and that metacognitive knowledge is not qualitatively different from any other kind of knowledge. Similarly, as with other knowledge, metacognitive knowledge grows with experience, and can be flawed, just like any other knowledge set can be flawed (Garner, 1987:18).

2.2.2 Metacognitive Experiences

Metacognitive experiences are likely to appear before, during and after the reading process (Flavell, 1979, cited in Garner, 1987:17). The experiences will invariably have to do with progress towards the objective of the successful completion of the study/reading activity.

Assuming that the reader already possesses some metacognitive knowledge of self, task and strategy, the following scenario might well occur: the reader is about to prepare for a class quiz the following day. Before starting preparation, the reader might experience relief that the quiz will be a “fill in the blank” format as opposed to a multiple choice format, because the reader knows that he is good at “fill in the blank” questions and is therefore likely to perform better. While reading, the reader might realize that certain actions may enhance information retrieval, such as repeating important facts aloud, finding patterns between dates (if dates are important for the quiz), etc. After reading the whole text, the reader may also become aware that the first and last sentence in each paragraph provides the most salient points to be remembered (Garner, 1987:17).

Garner (1987:19) states that the so-called before-reading knowledge is knowledge of self, the during-reading information is knowledge of

strategy, and the after-reading knowledge that is applied is task information. In all three instances, metacognitive knowledge serves as the base for metacognitive experiences, or “aha’s” or, as Anderson (1980, cited in Garner, 1987:19) puts it, “clicks and chunks” of actual or anticipated cognitive success and failure.

Metacognitive experiences can occur even when cognitive processes fail. An example would be when, while performing a task, a learner asks himself “Do I understand?” or “Am I doing this correctly?” It is in this process of attempting to think through a task that information will be obtained about how well processing is taking place. When the learner experiences some feeling of unease upon asking this question, his subsequent actions (what he decides to do about it) are driven by metacognitive knowledge.

2.2.3 Strategy Use

Strategy use is the final “leg” of the process in the use of cognitive and metacognitive knowledge to fix or assess perceived cognitive failure in the reading process.

As described in previous sections, a distinction is usually made between cognitive and metacognitive strategies. Cognitive strategies are usually what a learner uses to perform academic tasks (or improve social skills). Invariably a combination of strategies is used, depending on the learner and his schema. Research indicates that successful learners use numerous strategies, ranging from visualization, verbalization, making associations, chunking, questioning, scanning, underlining, sounding out words, etc.

A learner could use the cognitive strategy of verbal rehearsal (repeating certain facts out loud), and might use a metacognitive strategy such as writing down the most important facts and/or ticking off the facts he thinks he already knows. According to Flavell (1979, cited in Garner, 1987:20) cognitive strategies are employed to enable cognitive progress, whereas metacognitive strategies are used to monitor cognitive progress and strategies, and the learner's ability to make corrections during the task, if needed. It also serves as an indicator of the level of understanding the learner has about how he learns and an awareness of the cognitive strategies that need to be applied.

2.3 Learning Strategies

In the 1980's and early 90's research focused mainly on categorizing strategies identified in studies of the previous decade (Rasekh and Ranjbary, 2003:2). Various classifications of strategies began to appear, such as O'Malley and Chamot (1990) who divided strategies into three main branches: cognitive, metacognitive and social/affective, each with their own subcategories such as rehearsal, summarizing, deducing, etc.

Another classification was provided by Oxford (1990a, cited in Rasekh & Ranjbary, 2003:2), who proposed a more comprehensive model consisting of six categories divided into two main groups – direct and indirect. He included memory, cognitive and compensation in the direct strategy group, and metacognitive, affective and social in the indirect group.

O'Malley and Chamot (1990) claimed that cognitive and metacognitive strategies were often used together and in support of each other, and that using a combination of strategies had more impact than a single strategy. Graham (1997, cited in Rasekh and Ranjbary, 2003:2) stated that the distinction between cognitive and metacognitive strategies was important, mainly because the distinction between the two helped a learner to decide which strategies are the most important in determining the effectiveness of learning. He believed that metacognitive strategies play the most important role in the improvement of learning.

The strategies proposed in the overall learning approach being proposed by this study, will mainly be cognitive strategies, since this learning approach is being proposed as a first-time implementation for language teaching in schools. The assumption of the learning approach is this: if no strategies are presently being taught or used by learners, the first step is to implement cognitive strategies to familiarize learners with the concept of strategies.

Once learners become familiar with the use of cognitive (conscious) strategies, the introduction of metacognitive strategies will follow. It is necessary to provide learners with metacognitive information because it plays a critical role in the maintenance of strategies. Learners must know when and where strategies should be used (Snyder & Pressley, 1990:15).

A useful classification of metacognition that could be applied in the overall learning approach will be based mainly on Anderson (2002a, cited in Rasekh & Ranjbary, 2003:3) and his proposed five main

components for metacognition: (1) preparing and planning for learning, (2) selecting and using learning strategies, (3) monitoring strategy use, (4) orchestrating various strategies, and (5) evaluating strategy use and learning.

In the previous sections of this thesis it has been shown that strategies rarely occur independently, and, as illustrated by the Interactive Reading model, that the reading process is not linear but rather a combination of simultaneous “happenings”. It, therefore, becomes fairly obvious that some form of strategy training for L2 learners’ reading comprehension is recommendable. Regardless of language-learning experiences, both experienced and novice learners need to know how to use strategies effectively as a tool for improving (language) learning performance. One way of achieving this is to provide formal strategy training in the classroom, or to integrate strategy use into everyday language learning. It should always be remembered, however, that strategies should not be taught as a separate topic in the curriculum, but should form part of the overall curriculum and be woven into as many of the learners’ academic tasks as possible (Snyder & Pressley, 1990:16).

2.4 Strategy Training Models

Apart from classifying learning strategies (as described in the previous section), some researchers have gone further and tried to present strategy training models, i.e. ways in which teachers could teach strategies.

O'Malley and Chamot (1990, cited in Rasekh and Ranjbary, 2003:6) found two approaches in strategy training, namely the direct (explicit) and embedded approach.

2.4.1 The direct approach

The direct approach involves learning strategy training where learners are made aware of the fact that they are being taught specific strategies, and what the value and purpose of the strategies are. This strategy training model is also called informed strategy training.

The aim of informed strategy training is to make students aware of how they can improve their own learning, and when applied to literacy, being aware of what efficient readers do.

Many researchers seem to be in favour of this approach, and indicate that "students are more likely to transfer the skill they acquire from a practice activity to a new situation if they are informed of what skill they are actually learning and why" (Wenden, 1987, cited in Pouwer, 2001). Eilers and Pinkley (2006:14) support this statement in their research on strategy instruction and its effect on reading comprehension by stating that "[I]n order for students to become effective readers they need explicit instruction in specific reading comprehension strategies that may be applied to everything they read".

Snyder & Pressley (1990:17) propose the following steps in strategy instruction:

(1) Describe the strategy to the learners. This can be done by the teacher demonstrating the use of the strategy to ensure that

learners are clear what must be done. Descriptions of the strategy should be included, such as why it should be used and/or what it accomplishes. These descriptions provide important metacognitive knowledge about the strategies.

(2) Once students know what the strategy entails, they should be given the opportunity for guided practice. This will enable the teacher to provide feedback where learners don't apply the strategy correctly and reinforce correct application.

(3) Practising the strategies is best done by applying it to different types of materials, since different strategies are suited to different materials.

(4) Strategy instruction should be explicit, intensive and extensive. The ultimate goal is to develop learners that can use the strategies independently, skilfully and appropriately.

2.4.2 Embedded approach

The indirect approach is about guiding learners in the use of strategies that are embedded in the task material. The learner is, therefore, not explicitly informed that strategy instruction is taking place.

It seems few researchers are in favour of this approach, for example O'Malley & Chamot (1990) and Wenden (1987, cited in Kinoshita, 2003) who support the direct approach and are of the opinion that an embedded approach has little effect on the learners and that no transfer of skill occurs because learners who are unfamiliar with cognitive strategies would not be able to use metacognitive strategies.

This study agrees that the conscious use of cognitive strategies is necessary for knowledge and use of metacognitive strategies to occur

– especially in lesser-skilled readers. Therefore the *overall* learning approach being proposed by the study will support direct instruction of strategies.

2.5. Computer-assisted language learning (CALL)

In this section a definition and overview of computer-assisted language learning (CALL) is provided, with a view to providing background information on the choice of learning methodology in this study.

2.5.1 What is Computer-assisted Language Learning (CALL)

Computer-assisted Language Learning (CALL) may be defined as "the search for and study of applications of the computer in language teaching and learning" (Levy, 1997:1). The name was coined fairly recently, but the concept of CALL has been around much longer. Educators first began using computers for educational purposes about forty years ago (Alessi & Trollip, 2001:3). Since then incredible advances have been made in computer technology development and the availability of both hardware and software. As a result, the nature of CALL at any time is to a large extent a reflection of and dependent on the level of development of computer technology (Levy, 1997:1). During the 60's and 70's education on computers took place on large mainframe computers and sometimes on medium-sized computers, and the concept of educational computing existed only at universities and in the form of reading and typing text.

With the invention of the personal computer in the 1970's things changed rapidly. Computers were more widely available and could be found in businesses, schools and homes. The release of the IBM personal computer in 1981 resulted in the real expansion of the

microcomputer into businesses and homes, and from then every version of personal computer resulted in better integration of text, graphics and sound. The mouse was first produced in conjunction with Apple's Macintosh computer in 1984, and again changed the way a human could interact with a computer (Alessi & Trollip, 2001:3)

The current state of instructional computing is still in flux, with users constantly facing software and hardware incompatibility as well as lack of excellent and effective educational software. Two factors hinder the success of instructional computing: a lack of people who are skilled course developers, and a disagreement about how computers should be applied in (language) learning. The increase in the development of multimedia capabilities in personal computers has aggravated this problem, because many designers and developers think that a course can be made more instructionally effective simply by adding multimedia elements (Alessi & Trollip, 2001:5).

Part of the objective of this study is to show that computers can effectively be used for language learning without an abundance of unnecessary multimedia, but rather through combination of training methodologies, in other words, through a blended-learning approach.

2.5.2 Learning Theories

Learning theories have been in development for many years. Although the Cognitive-Constructivist learning theory has been proven to be one of the more widely acknowledged learning theories in CALL, a short history of the development of learning theories is provided in the sections that follow.

2.5.3 Behaviourist Approach

The first type of learning theory (or psychology) that was developed was the Behavioural Learning Psychology which led to what is called Behaviouristic CALL. Behavioural Psychology is strongly rooted in Edward Thorndike's (1932) work on behaviour and learning which helped lay the scientific foundation for modern education psychology, and the work of Ivan Pavlov (1927) on classical conditioning.

B.F. Skinner (1938) greatly refined Thorndike's work to give rise to the behavioural school of psychology and learning (Alessi & Trollip, 2001:18). Skinner remains Behaviourism's best-known theorist and exponent. He is credited with having founded a new version of psychological science, which has come to be called behavior analysis. The main principle of Behaviourism is the stimulus of a subject to determine or instil certain behaviour at the end of the learning exercise.

The main characteristics of Behaviouristic CALL are the following:

- Repeated exposure to the same material is beneficial and essential to learning
- A computer is ideal for repeated drills, since a computer cannot get bored by the same material and is able to provide consistent non-judgemental feedback
- A computer is able to provide material on an individualised basis, thereby enabling learners to progress at their own pace.

The PLATO system is one of the most well-known tutoring systems that was developed according to the Behaviourist learning theory. It was a government-funded project on mainframe and minicomputers (Alessi & Trollip, 2001:4) and was mainly used for vocabulary drills, short grammar explanations and drills and translation tests.

2.5.4 Cognitive Approach

During the last third of the 20th century, the popularity of Behaviourism began to wane when it was increasingly criticised for overlooking important unobservable aspects of learning such as thinking, reflection, memory and motivation, and for placing too much emphasis on the instructor and instructional materials and too little on the learner.

A new approach, called cognitive psychology, manifested in reaction to the limited approach to learning evident in Behaviourism. The Cognitive approach takes its name form the word “cognition” which means “the process of knowing”. The Cognitive approach emphasises “intangible” or unobservable objects or constructs, such as the mind, memory, attitudes, motivation, thinking and other so-called internal processes (Alessi & Trollip, 2001:19). Although the cognitive approach recognised that learning does involve repetition and reinforcement, and that the role of feedback was certainly important, it maintained that there were many other facets to learning and many other ways in which humans stored or acquired information. This was linked to the Schema Theory (which began with Bartlett in 1932) which proposed that people stored information in “schemata” or sets of information (*cf* 2.1.4).

The Cognitive Approach emphasises active learning, because it believes people learn not only by observation, but also by doing. This demonstrated the importance of interactivity in CALL, not only because it engaged the learner's attention, but it helped to create and store new knowledge and skills (new schemata) and increase comprehension.

The main effect that the Cognitive Approach had on CALL is the incorporation of motivational principles. Whereas CALL in the 1960's and 1970's was very program controlled, the developments during the 1980's started providing a more balanced mixture of learner and program control, and instructional strategies were more focussed on individual learner needs and differences.

2.5.5 Constructivist Approach

Just as the cognitive learning theory challenged the Behaviourist theory in the 1970's, the Constructivist approach began questioning the Cognitive approach. The Constructivist approach, like the Cognitive, is also a philosophical view and contends that the only reality that matters in the learning process is an individual's interpretation of what they perceive. Constructivists maintain that learning is not received from the outside, but rather from the construction of knowledge in our minds (Alessi & Trollip, 2001:31). For CALL this means that learning is a process of actively constructing knowledge, and that traditional methods such as memorising, demonstrating and imitating are not compatible with the notion that learning is a process of constructing knowledge.

Some of the principles of the Constructivist learning approach are as follows:

- knowledge is gained through experience
- learning is a personal interpretation of the world
- learning is an active process in which meaning is derived from experience
- conceptual growth comes from the negotiation of meaning and the sharing of multiple perspectives, as well as the changing of what we have already internalised
- learning should be realistic – in other words, learning and testing thereof should be integrated with the task and not be a separate activity.

2.5.6 The Cognitive-Constructivist Approach

The Cognitive-Constructivist approach is a combination of the Cognitive and Constructivist theories, and attempts to utilise the best approaches from both theories.

The similarities between the Cognitive and Constructivist approaches are as follows (with the impact on CALL in brackets):

- Learning is an active construction process (there is no “fixed” menu or lesson plan; the learner directs himself, and learning is primarily open ended.)
- Learning is an autonomous process (learning is self-directed, the learner works at his own pace, in his own time. There are no time limits to the lesson or exercises, and no limit to repetition in exercises.)

- Learning is a discovery process (lesson content links to existing knowledge and expands to new knowledge. The learner decides how to link new knowledge to existing knowledge.)
- Group work enhances learning (group work is included, e.g. email group, chat sessions, shared tasks.)

A major difference between the Cognitive and Constructivist approaches is that in the former the CALL intervention has a predetermined outcome and there is intervention in the learning process by determining the outcomes. In Constructivism the learning outcome is not determined, because the Constructivist approach believes the learning outcome is not predictable and can differ from learner to learner – therefore the CALL intervention should foster learning and not control it.

2.6 The effect of technology on reading comprehension

It is fair to say that today's modern learners can be called the "digital generation", as opposed to the "print generation" of earlier years. The modern learner does the majority of his/her daily reading and communicating through digital text, whether through SMS, cell phone chat sessions, email, internet chat rooms, personal digital assistants (PDAs), etc.

Up and till the 90's learning was more oriented toward printed matter, i.e. books. Technology was utilized for specific purposes only and for short periods of time. Furthermore, in the early technological years, only a small percentage of people had access to computers or any other form of digital communication. Today, by contrast, there are millions of cell phone users in South Africa and access to personal

computers is becoming more commonplace than it was a few years ago with internet and computer facilities being made available in townships and rural areas. In other words, the young learners of today are born into a world of technology, and it is not unusual for a child to be able to use a computer keyboard before they are able to write a sentence by hand.

This level of computer literacy enables an easy transition from printed to digital text, but it has a downside too. This overwhelming use of technology has an effect on the literacy levels of children. In a study by Radi (2001) amongst Australian junior high school children, it was found that the use of computers did not improve learners' use of language (specifically vocabulary) because a new language with an unconventional spelling was being used to communicate in digital format. For instance, "you are" became "UR", "for" was substituted by "4" and so forth. Some teachers were finding that their students were reading less than they used to – when confronted by a computer, the students opted for playing computer games instead of performing research for their projects. When students were taken to the library, they preferred using the computers to reading a book. Other teachers commented that the "immediacy" of information on the Internet resulted in learners reading with less care and comprehension (as would be the case with normal research). It is almost as if today's learners are satisfied with a kind of "just enough" reading – in other words they read just enough to be able to progress to a different step in a computer game, a different screen on a website, etc. Children also displayed a lack of concentration in comprehension activities. The study concludes that computers "might have a negative impact on

young people who are still in a process of learning and developing their basic language literacy skills" (Radi, 2001).

Radi (2001) further argues that the use of computers still requires adequate literacy skills so that readers may interpret messages, look for different meanings in a text and participate fully in reading and writing. A balance is needed in education in order to effectively teach both computer and language literacy skills. It is this need for a balance that supports this study's proposal of a blended-learning method where learners are exposed to a variety of methods - of which the computer is one.

2.7 Blended Learning

2.7.1 What is blended learning?

E-learning, of which CALL forms a part, has many definitions, but ultimately it is learning (instruction) that is delivered electronically through the internet, an intranet or through multimedia platforms. What makes e-learning unique is that it removes the fixed classroom structure with its constraints of time and place and replaces it with a variety of study materials and activities that can be accessed without these constraints. E-learning is capable of delivering huge amounts of information, but to be truly effective and successful it must deliver a rich variety of content through an equally impressive variety of learning processes (Smedley, 2005:80).

Alessi & Trollip (2001:24) states the following about e-learning:

> *Of course, learner activity in a multimedia environment does not have to be just between the learner and the computer. Learner activities can be on paper, on a peripheral connected to a*

computer, or with other people working collaboratively in the multimedia environment. Choosing actions to facilitate learning goals should go beyond human-to-computer interactions and include human-to-human interactions, human-to-computer-to-human interactions (via a network), human-to-paper interactions, and human-to-equipment interactions.

This statement not only provides a definition of blended learning, but also provides an excellent motivation for using blended learning - the fact that the learning objective (goal) should drive the selection of learning media, and not visa versa (as is often the case in mass-produced multimedia solutions).

One of the criticisms of traditional education is that learners are trained to be dependent learners – in effect they learn when told to learn. The traditional classroom interaction of the teacher-question/student-response evaluation of reading comprehension means the teacher remains the primary interpretive authority. This could lead to learners becoming passive in the reading comprehension process (Van Keer, 2004:39). Blended learning is based on the assertion that learners learn best when exposed to a rich variety of learning experiences where assumptions are challenged and knowledge is “reframed” (Smedley, 2005:80). Blended learning, therefore, makes use of a variety of methods and media in order to optimize each method and medium to enhance the overall learning outcome.

In the strictest sense, blended learning occurs whenever an instructor uses two or more methods of delivery of instruction.

Researcher Chris Procter (cited in Heinze, 2004) developed the following definition for blended learning in higher education: “Blended learning is learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning …” He further states that blended learning refers to the integration (or blending) “of e-learning tools and techniques with traditional methods”.

They identify the two most important factors in the blending process as being the time spent on online activities and the amount of technology utilised (Heinze, 2004). This statement is conceptualised in the figure on the following page.

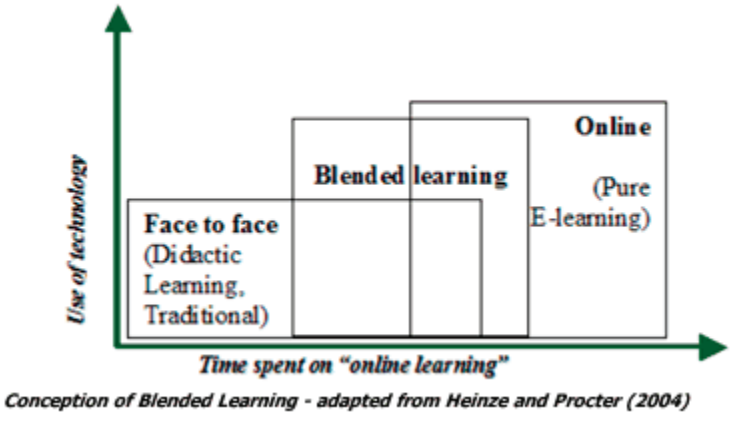


Figure 3: Conception of blended learning by Heinze (2004)

Thorne (2003:16) describes blended learning as a mix of traditional forms of classroom training and one-on-one coaching with:

- Multimedia technology
- CD ROM video streaming
- Virtual classrooms
- Voicemail, email and conference calls
- Online text animation and video streaming.

The above delivery methods imply that blended learning is the combination of traditional classroom instruction with computer-based mediums.

There are, however, non-computer related mediums that can also be combined with traditional classroom instruction to form a blended-learning delivery. Some of these mediums, however, would primarily still be in use in situations where little or no access to computer technology is possible (*cf* Table 1 on next page).

Table 1: Computer and non-computer based educational tools for use in blended-learning solutions

Computer-based educational tools	**Non-computer educational tools**
Multimedia technology	Classroom based audio-tape resources (language laboratories)
CD ROM video streaming	Auditorium multimedia visual resources (movie projectors, slideshows, VCRs)
Virtual classrooms	Home-learning resources (video recordings, audio recordings)
Printing whiteboards and online whiteboards	Blackboard and whiteboard resources
Online text animation and video streaming (the Web)	Demonstration resources, including "museum exhibits", "laboratory experiments", live theatre, historic re-enactment, hands-on workshops, role-playing, etc.
Mobile learning or m-learning (PDAs, handheld computers)	Non-instructional education resources, such as examination, quizzes, invigilation, test-grading
Voicemail, email, SMS and conference calls	Classroom discussion, group discussions, handwritten notes

2.7.2 Why a blended-learning approach for strategy training?

There are many reasons for using a blended-learning approach for teaching reading comprehension, but this study proposes the following reasons:

2.7.2.1 Alignment to White Paper on e-Education of 2004

In the foreword to the White Paper on e-Education (Department of Education, 2004:6) the Minister of Education states that information and communication technologies (ICTs) have "opened up new learning opportunities and provided access to educational resources well beyond those traditionally available". The White Paper further states that ICTs have the potential to improve the quality of education and training and has had an impact on curriculum development and delivery. The introduction of ICTs into South African schools will also serve to help to improve local content development – in other words, finding uniquely South African solutions to education objectives.

One of the main challenges identified in the White Paper is the need to roll out an ICT structure that is suited specifically to (South) Africa. Two critical elements are identified which will determine the ICTs future, namely: cost sustainability and efficient utilisation.

This study proposes that a blended-learning approach to reading comprehension, and indeed all forms of learning, will ensure that the two critical elements are supported. One of the concerns about cost stated in the White Paper is that ICTs should be able to reach the most remote parts of our country. A blended-learning solution means that any given learning solution or objective is not supported solely by complex multimedia or high-end hardware and software, and that

high-end technology is not necessarily needed (cf Table 4 in Chapter 3) where it is geographically difficult to supply, because the blended-learning programme can be adjusted to suit all situations and meet the learning objective. Where high-end technology is available the multimedia component(s) (including connection to the internet) of a blended-learning programme could be maximised, whereas the multimedia component in rural areas could be "minimised" yet effective enough to expose learners to ICTs and support the blended-learning approach.

In terms of sustainability the White Paper states that it is no use giving schools state-of-the-art technology if it cannot be sustained. Again, with knowledge of the exact level of technology available to schools in South Africa, a blended-learning approach can ensure that the learning content is produced and presented through methods that ensure the continued and sustained use of technologies available at the respective schools. The sustainability issue links to the efficient utilisation of ICTs. Merely supplying schools with expensive and high-end technology does not mean it will be applied in the best manner possible. This study proposes that utilising a blended-learning methodology not only ensures that technology is applied at schools, but that where teachers and/or learners are unfamiliar with the concept of ICTs (e.g. rural areas), the "blend" of methods in the blended-learning approach ensures a more gradual introduction to technology – compared to the possibility of teacher and/or learner resistance had they been expected to engage in high-end technological learning solutions from the outset. This "gap in the ability of learners and teachers to use [these] technologies effectively" (Department of Education, 2004:13) is indeed identified as a concern in the White Paper.

2.7.2.2 ICT is a familiar concept

The use of computers in education is not the compelling issue it was a few years ago when everyone jumped on the IT bandwagon. A new education curriculum and a focus on outcomes-based education in South Africa are competing for attention and funding which until recently was reserved for purchasing computers (Langhorne et al, 1989:3).

This is a time of evaluation and reassessment in the area of instructional computing, and, in fact, education as a whole in South Africa. It is a time to examine carefully exactly how computers are being used in schools – this would include investigating issues as "simple" as whether the purchase of equipment is delivering a best return on investment, to investigating more complex issues such as what kind of infrastructure exists and whether it is being utilized to the maximum or not. Looking back at the introduction of computers into education, there seem to be three distinct phases (Langhorne et al, 1989).

Based on Langhorne's figure (*cf* Table 2 on the next page), one could speculate that the use of computers in South African education has reached Phase 3 – at least in schools where computers have been available from the outset. On the other hand South Africa has many schools, especially in rural areas, where computers have not yet been introduced, or are being introduced systematically. The White Paper on e-Education (Department of Education, 2004) states that government aims to rectify this situation.

Table 2: A three-phase model of Instructional Computing (Langhorne et al, 1989:4)

Phase	Place of computer instruction	Program planning	Software	Hardware	Staff develop-ment
Phase 1: **Getting on the band-wagon** **1980's**	Used as novelty Computer seen as object of studying, programming emphasis Limited to affluent schools	Limited to decisions on what hardware to purchase	Very little available Teacher written, public domain software needed	Acquisition of hardware is primary focus Emphasis on quantity	Non existent Interested teachers learn on their own
Phase 2: **The shotgun approach** **1990's**	Used for drill and practice, simulations, educational games Some applications Separate computer literacy courses taught	Some central coordination exists, software evaluation seen as important	Software purchase increases; single copies of a variety of programs purchased	Begin to buy hardware, especially peripherals; based on need	Generic in-service development provided; attendance is voluntary Some teachers begin to use applications software
Period of evaluation and reassessment of priorities					
Phase 3: **Planned integration** **Present**	Computer used when it is most appropriate medium for instruction Computer literacy occurs through regular, varied use	Planning emphasizes instructional soundness Similar building level planning exists Evaluation occurs	Purchase of software based on planning Multiple copies, lab packs purchased Formative evaluation provided	Computers purchased for specific levels and applications	In-service development geared to specific teaching needs; participation compulsory

This study proposes that by promoting a blended-learning approach for reading comprehension, it can enable schools to purchase the right kind of hardware and software from the outset, and for the right

reasons and application – as opposed to installing technology simply because it is "the done thing" or forms part of a government rollout (such as suggested in the White Paper on e-Education). This brings us to the third reason for recommending a blended-learning approach.

2.7.2.3 Lack of effective CALL software

The debate about what constitutes an effective CALL application is a continuous one. The quantity of educational software has increased dramatically, but at the same time the availability of bad courseware has increased because the tools for producing instructional software are so affordable. However, software that promotes truly active learning is still the exception. Also, more than ever before, the debate about how computers *should* be used in learning still continues (Alessi & Trollip, 2001:*X*). Furthermore, the majority of CALL software that has been produced abroad, specifically in Europe or the United States, does not always address our uniquely South African learning issues.

The question arises whether there is such a thing as a "best" method for applying CALL. This study is of the opinion that there is no single, final answer to which methodology is best, and proposes that the methodology should be driven by the learning objective. By using blended learning as the overall learning approach, it is possible to include a variety of CALL solutions based on a variety of learning methodologies which together improve the chances of creating a successful learning event. Furthermore, using a blended-learning method – of which computer-assisted learning is but a part – opens the way for the development of uniquely South African language content – shorter, more compact solutions that form part of the overall blended-learning approach.

2.7.2.4 Learner differences

Learner differences include, amongst others, learning styles, learning strategies, affective variables, age, gender, culture, learning aptitude and other demographic variables (Ehrman et al, 2003:313). In order to enable learners to learn as much as they can, they need to be given the opportunity to learn in their preferred style(s). Blended learning caters for more styles in a single learning event, for example group work (with and/or without ICT) and individual work (with and/or without ICT). Methods could include writing tests by hand or through the internet, submitting work via email or in hard copy, discussions in an online or physical forum, creating posters, etc.

Regarding strategy training in language learning, Ehrman et al (2003:318) states that strategy instruction is most effective when woven into everyday second-language learning, and that it is often more effective when adjusted for learners' learning styles.

Research has also shown that differences exist between the way different cultures learn and how they approach their learning (Lanham & Zhou, 2003:279). In Western cultures learning tends to be more learner-centred, and learners are open and used to being instructed in ways other than by a teacher in the classroom. However, other cultures where learning is more instructor-centred struggle to accept pure online learning because they regard online instruction as a replacement of the instructor and therefore "disrespectful".

In a country as diverse as South Africa, a blended approach could enable the facilitation of a solution by providing a blend of cultural learning styles.

Chapter 3

An overall blended-learning approach to strategy instruction

This chapter provides a short overview and description of the proposed overall blended-learning approach to strategy instruction. It must be re-emphasized that the purpose of this study is (1) to show that a need for strategy training in teaching reading comprehension exists, (2) that strategy training is best implemented through a blended-learning approach and that (3) using the blended-learning approach improves reading comprehension. The latter will be done through a small research study. The purpose of the study is not to design the actual blended-learning method in minute detail, but merely to propose a broad-strokes framework for such a methodology. Furthermore, the computer-based module that was designed and used as part of this study forms only one part of the proposed overall blended-learning methodology. It should, therefore, be seen as such and not be regarded as a fully-fledged multimedia program.

Components of the blended-learning approach

The following components were applied in this study:

Table 3: Components of blended-learning approach in this study

Component (medium)	Description
Classroom instruction	Introduction to reading strategies
Computer-based module	• Exercise 1 – Activating Prior Knowledge Strategy • Exercise 2 – combination of Summarisation & Lookback Strategies
Paper-based reading matter	Reading Text
Online assessment via internet	Comprehension Test
Group discussion	Learners share experiences

The following provides a more detailed explanation for the rationale behind each component of the blended-learning methodology.

3.1. Classroom instruction

The classroom instruction section of this research was included to support the principle that using the Direct Approach in strategy instruction produces better results. In the direct approach to strategy instruction, the teacher informs the learners beforehand of the purpose and rationale for strategy use, and also identifies the specific strategy being used in the lesson. As discussed in Chapter 2 (*cf* 2.4.1) research has shown that learners seem to benefit more from this approach than the Indirect Approach where they are left to "discover" the strategies in exercises.

For this study the teachers were given a brief overview of strategies, and specifically about the two strategies used in the blended-learning research treatment. This was used to position the research treatment to the Experimental group (*cf* Chapter 4).

3.2 Computer-based module

3.2.1 Content

The computer-based module comprises a multimedia lesson which was installed on every learner's computer. It contains the following:

- Table of Contents
- Guide to icons used in the lesson
- Exercise 1 – Activating Prior Knowledge strategy
- Exercise 2 – Summarisation & Lookback strategy
- Link to internet-based comprehension test.

3.2.2 Learning methodology of computer-based module

It can be argued that there is no “ultimate” learning methodology. At most, learning methodologies are guidelines and different learning situations and objectives require different guidelines. Therefore, a blended-learning approach may require the inclusion of more than one learning methodology, or a combination of more than one, or simply just one, depending on the learning objective.

For this study, the Cognitive-Constructivist Approach (*cf* 2.5.6) was chosen. This method was chosen to suit the specific objective of the research – to expose first-time learners to reading strategies and prove that this exposure improved reading comprehension. A less linear and less “restrictive” approach would be recommendable for learners who are already familiar with

(1) the use of a blended-learning method, and

(2) applying reading strategies.

Once learners become familiar with the “blend” of methodologies, including becoming more computer literate, it will be possible to offer them more choice and freedom of movement in online or multimedia applications.

Research has also shown that various variables exist that may influence reading comprehension in any given research situation (Bimmel & Van Schooten, 2004:89). Two variables were identified which could possibly impact on this research, namely school type and reading attitude. These two factors influenced the following during the development of the multimedia (online) section of the research: type

of methodology used, strategies selected, level of interactivity, level of complicatedness, duration of lesson and use of sound and video clips.

School type involves the type of school (former Model C, Section 21, etc.) according to the Western Cape Department of Education. The school type could impact on the availability of technology at the school used for the research, since availability of technology has been impacted by political factors in the past, and continues to be affected by geographic location (rural schools have less access to technology than schools in metropolitan areas).

Secondly, school type also involves the school “level”, i.e. primary vs. secondary school. Primary school learners can be assumed to have lower levels of reading comprehension by virtue of their younger age and having had fewer years to receive reading instruction.

Reading attitude refers to learners’ attitude towards reading in general. The assumption could be made that if a learner’s attitude toward reading is negative, the usefulness of learning a reading strategy is questionable. Furthermore, the learner’s level of interest in wanting to learn a reading strategy could be low.

The link between learning methodology and choice of strategy type for this research can be illustrated by the following figure:

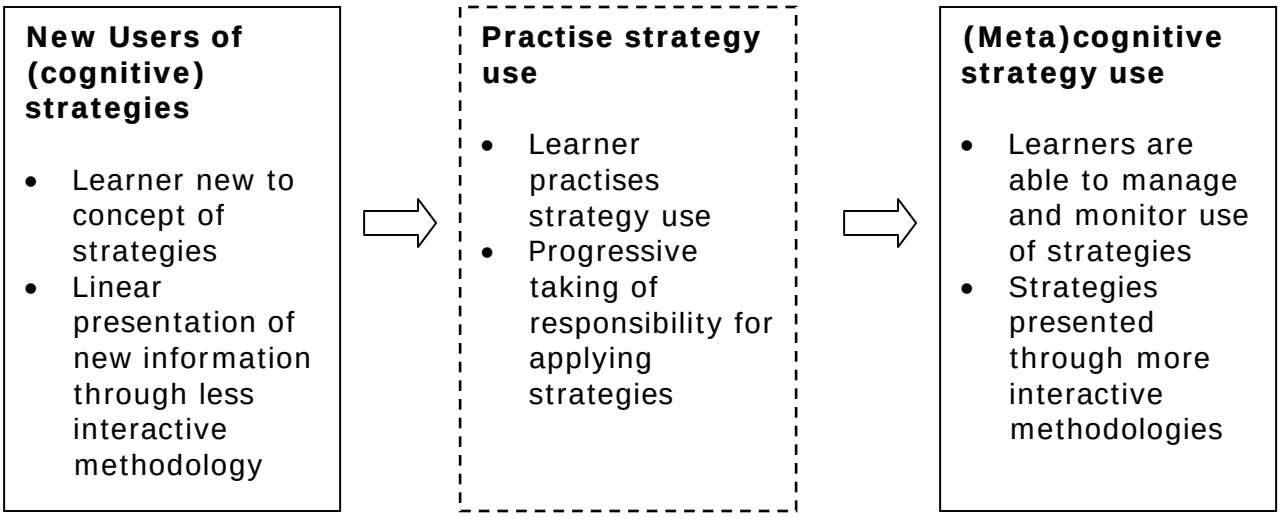


Figure 4: Link between strategy type and learning methodology

Therefore, for the purpose of this study, the lesson was presented in a mostly linear fashion which forced the learner in a direct line from screen to screen within an exercise where pertinent information was at stake, while allowing the learner more freedom in terms of information that was less pertinent to the reading text. Apart from the reasons stated above, this method was used because:

(1) The assumption was made that the research participants had never been exposed to strategies or strategy instruction before; therefore it had to be introduced to them in a structured manner. Allowing participants to move around freely within the menu items would not have accomplished the objective of the lesson, especially given the timeframe of one school period.

(2) The strategies used in this research required that the participants encounter them in a certain sequence. First they were given an exercise (through the multimedia lesson) to activate prior knowledge, then they were required to read the text, and only thereafter were they

required (allowed) to do the second exercise on the CD Rom which introduced them to the strategies of Activating of Prior Knowledge and a combination of the Summarisation and Lookback strategies.

(3) The most important learner controls are about sequence. This includes moving forward, backward, selecting what to do next and the pace of the movement. More optional controls could be provided according to content difficulty and learning strategy. Alessi (2001:41) states that certain types of learner control may increase motivation but decrease achievement. Where pertinent information was at stake in the multimedia lesson used for this research, learner control was decreased with the objective of increasing achievement (the overall objective being improved reading comprehension).

The items on the main menu (Exercise 1, Exercise 2 and Comprehension Test) were not hyperlinked for the reasons stated earlier – to "force" the learner into a certain sequence. However, because a learner might need to close the multimedia lesson for whatever reason between doing the exercises and reading the text, a Bookmark button was provided on the toolbar. This button enabled the learner to bookmark the page they were on when intentionally closing the lesson midway. Furthermore, the Contents button on the toolbar was left active. This enabled a learner to go directly to a specific exercise if, for some reason, a break occurred between Exercise 1, reading the text and starting Exercise 2. It would prevent a learner from having to page through an entire section in order to get to the required screen. The teachers were asked to explain this functionality to the learners beforehand, but to stress that the Contents button was only to be used for this specific purpose. The Bookmark and Content functionality adhered to one of the most basic requirement of effective

multimedia lessons: allowing the learner temporary termination of the program (Alessi & Trollip, 2001:52).

Overall the multimedia lesson was short and offered some interactive questions, a video clip, sound clip and pop-up screens with interesting information about experiments that learners could perform at home. The reason for the length of the lesson is that it forms part of the bigger blended-learning lesson (introduction to strategies by teacher, exercise 1 on multimedia, reading printed text, exercise 2 on multimedia and finally the comprehension test through the internet). All this had to be completed in a single school period (lesson).

3.3 Learning strategies used

Countless strategies exist for reading comprehension, such as summarisation, mental imagery, question generation, question answering (includes the use of lookbacks), story grammar (also known as story map), and activating prior knowledge. Just as many strategies exist for the other components of language learning, such as vocabulary, spelling, writing and grammar.

This study makes use of three reading comprehension strategies, namely Activating Prior Knowledge, and a combination of Summarisation and Lookback.

3.3.1 Activating prior knowledge

As mentioned earlier in this thesis, the reader's knowledge base or existing knowledge of a specific topic plays an important role in reading comprehension. The way a text is interpreted and remembered depends on the level of prior knowledge about the topic that the reader

brings to the situation. However, children do not activate their prior knowledge spontaneously while reading, even if they do possess prior knowledge about the topic (Symons et al, 1990:63).

Activating prior knowledge is usually done by pre- and post-reading discussions between the teacher and learners. It could include reasons why it is beneficial to discuss previous experiences, or the teacher could select three main ideas from the text and ask learners to recall previous experiences related to the main ideas. According to Symons et al (1990:64) activation of prior knowledge is especially recommended for poor readers who do not spontaneously activate their previous experience. Because this study assumes that the research subjects had not had prior exposure to strategy instruction, the Activation of Prior Knowledge strategy was included as the first strategy in the blended-learning method (*cf* Table 3).

For the purpose of this study, the Activation of Prior Knowledge strategy was done as part of a short multimedia lesson. The reason for this was to enable each learner to relate to prior knowledge in their own way and to save time in the overall introduction of the reading comprehension lesson topic because the topic (lightning) is known to all learners and doesn't require a special introduction by the teacher. Lastly, by allowing the learner to move at his/her own pace, it allowed them to progress through the multimedia lesson, read the text and write the internet-based comprehension test without pressure from faster (or slower) classmates.

Activation of prior knowledge was done by presenting the learner with a graphic depicting lightning and the title "A Shocking Story" and

letting them guess what the reading text was about. After that questions were asked about the learners' own experience with lightning and finally some additional information about lightning, which included reference to some information that would be covered in the reading text, was given in a more fun way (drag and drop exercises, information about simple experiments they could do at home and a visual representation of some parts of the reading text to aid understanding).

3.3.2 Summarisation strategy

A single reading rarely permits recall of all information in a text. Summarisation is thought to be an integral part of competent reading, but children seem to have difficulty producing summaries of text passages unless they are taught to do so. Therefore direct instruction of summarisation strategies is aimed at teaching young readers how to summarise reading texts (Symons et al, 1990:45).

There have been many approaches to instructing summarisation. The simplest method is asking the reader to produce a single sentence that captures the meaning of an entire paragraph. However, a more complex and theoretically grounded approach was developed by Kintsch and Van Dijk (1978, cited in Symons et al, 1990:46) which identified specific steps to summarisation. Their steps were:

(1) Delete trivial information
(2) Delete redundant information
(3) Substitute superordinate terms for lists of items
(4) Integrate a series of events with a superordinate action term
(5) Select a topic sentence
(6) Invent a topic sentence if there is none

Since then many researchers have used the steps in varying combinations. Symons et al (1990:48) suggest applying the steps as follows:

(1) Identify the main information
(2) Delete trivial information
(3) Delete redundant information
(4) Relate main and supporting information.

For the purpose of this study only one rule from the original Kintsch and van Dijk (1978) list was applied – Identify the main information. This was combined with the Lookback strategy generally used with Question-Answer strategy instruction. Learners were presented with a number of jumbled sentences on screen that together formed a summary of a specific paragraph in the reading text. They were required to identify the correct order in which the sentences should appear. They were allowed to refer back to the text to find the correct sequence, thereby applying the Lookback strategy. The Lookback strategy requires a learner to look back to the text only for specific information required to answer a question.

When teaching the whole Lookback strategy learners are first taught *why* they should look back, i.e. it is impossible to remember everything you read. They are then taught *when* to look back, i.e. when looking for specific information required for an answer, not information that requires your own opinion (Symons et al, 1990:58).

For the purpose of this study they were simply told to refer back to a specific numbered paragraph as an introductory step to the Lookback strategy.

The reason why the learners were effectively presented with a summary of the main ideas instead of being expected to create the summary themselves, is that the assumption of the study was that the research subjects had never been confronted with reading strategies or strategy instruction. The study therefore attempted to create a very simple first step to strategy instruction.

Future, more complex ways of applying the summarisation strategy to the same material through multimedia, could be to:

- Ask learners to type the four main ideas into blank spaces provided (the software would search for certain required key words in each main idea).
- Provide the learner with the main ideas on screen and ask them to summarise each idea in his/her own words by typing this information in or selecting an alternative description from a drop-down list.
- Ask learners to select a topic sentence for each paragraph. As a beginner they would be provided with suggestions. At a more advanced level they could be asked to provide their own topic sentence.
- Provide paragraphs on screen and ask learners to highlight the redundant information or, alternatively, highlight the pertinent information.

3.4 Paper-based reading text

The reading text was presented as a printed booklet instead of in electronic format. The reason for this is that it enables easier reference to the text where necessary. If both the comprehension test and reading text were online, it would mean the learner had to toggle between the two components. Even for computer-literate users this can become tiresome and also requires the user to remember information from the text when toggling back to the questions. Learners who are not computer literate may close one of the two components by accident while toggling between the components. This could lead to frustration and tension and hamper the strategy training and reading comprehension process. With the text readily available next to the learner's keyboard, there was no frustration in having to toggle between components or remembering information before closing the reading text screen. A further reason for the printed format of the reading text is that it is more useful in that format for the group discussion. When learners sit in groups and discuss parts of the text, it is easier to refer to a hard-copy version of the text available to every learner, than to refer to the same text on screen.

3.5 Group discussion

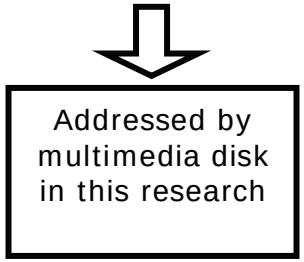
For learners to become self-regulated readers and thinkers, they must take an active role in the reading comprehension process. Through discussions, peer conferences, peer tutoring and cooperative activities learners are able to implement, evaluate and modify strategy training (Van Keer, 2004:39).

Discussions between peers also allow for opportunities to exchange and model metacognitive strategies. When children hear others talk about their reading process, they are able to increase their knowledge about reading and applying reading strategies.

The table on the following page provides examples of how strategies can be taught through a high-end or low-end blended-learning approach.

Table 4: Example of blended-learning strategy training in language learning

Language component	Introduction	Reading	Writing	Vocabulary	Spelling
Low-end blended solution	• Posters (hand made) • Pictures (hand made) • Video via TV	• Printout of text • Text in book • Comprehension Test written on paper	• Write work on paper • Submit by hand or fax	• Multimedia games (CD) • Marked by teacher	• Traditional spelling tests (written)
High-end blended solution	• PowerPoint slides • DVD • Online video • Content via Learning Management System	• Interactive multimedia CD combined with paper text • Comprehension test written via internet (marked by the software)	• Write in word processing program • Submit via email or fax	• Online vocabulary games or quizzes • Opportunity for endless repeats	• Online spelling tests, marked by software
Strategies used	• Activate Prior Knowledge	• Activate Prior Knowledge • Summarisation • Lookback	• Self instruction • Sentence combining • Idea generation • Revision of text	• Keyword Method • Learning from Context	• Word analogy • Correct-your-own-test, • Imitation.



Chapter 4
Research Design

The research component of this project aims to gather empirical data to investigate the effect that the use of a blended-learning approach to teaching reading strategies has on the reading comprehension of the research participants.

The method used to secure data in this research study involved the following procedures:

4.1 Research Method

In order to determine if use of reading strategies through a blended-learning method will improve reading comprehension, a quantitative experimental method was chosen. The main aim of an experimental method of research is to test the impact of an intervention on an outcome, controlling for other factors that could influence the outcome (Cresswell, 2003:168). The intervention in this research was the blended-learning program as described in 4.4.1 of this chapter.

The components of a quantitative experimental method usually consist of the following: experimental design, participants, variables, instruments & materials, data collection procedure and statistical analysis.

4.1.1 Experimental Design

A Post-test Only Control Group design was used for this research. This type of design involves the use of an Experimental and Control group where participants are randomly assigned to

groups, treatment (an intervention) is given only to the Experimental group and both groups are measured on the post-test (Cresswell, 2003:170). This design is illustrated graphically as follows, where R indicates random assignment, X represents exposure of the group to an experimental variable with measurable effects, and O represents a measurement recorded on an instrument.

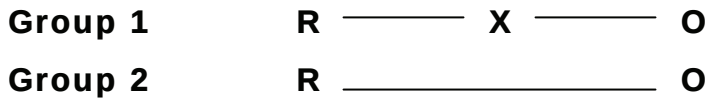


Figure 5: Post-test Only Control Group Design (Cresswell, 2003:170)

However, true randomisation was not possible for this research because participants belonged to predetermined classes in their grade at their respective schools. The participant sample is, therefore, better described as a convenience sample (Cresswell, 2003:156). A list of names was obtained from each school. The names for each school were supplied pre-divided into their assigned classes. Since mixing learners between classes for research purposes would have been logistically difficult, it was therefore not possible to obtain a completely random sample in each school. Rather, a non-equivalent randomisation of names was done *within* each class, and the names for the final Experimental and Control groups were taken from the randomised class sets.

The Experimental group was called Group 1 and the Control group was called Group 2.

4.2 Participants

Participants comprised Grade 6 learners from two primary schools in the Western Cape Province. A total of 137 learners participated in the research, of which 55 were from School A and 82 from School B. Of these totals 67 comprised the Experimental group and 70 the Control group. The reason for the small difference in the group totals is that some learners were absent on the day of the research.

The criteria for the selection of the schools was that English had to be a second language for the learners who would participate in the research, and the school had to have a computer training facility.

The medium of instruction at both schools is dual medium (predominantly Afrikaans with a limited number of English-medium classes). All of the participants were either Afrikaans or isiXhosa first-language speakers. Therefore, to ensure that the research environment represented a non-native (second or third) language for all learners, the so-called English period in the normal timetable of an Afrikaans-medium class was used.

4.3 Variables

The independent variable in this research is determined by the group which identifies the Experimental and the Control group. The group refers to the element that determined whether learners were in the Experimental group or the Control group. In this study the element was the instructional treatment, which represents the overall blended-learning approach supported by this study. The Experimental group (Group 1) was exposed to the treatment, while the Control group (Group 2) was not.

Therefore the instructional treatment is the independent variable for this research study.

The dependent variable is the comprehension test that was administered to both the Control and Experimental groups.

4.4 Instruments & materials

The instrument and instructional treatment (intervention) used in this research are as follows:

4.4.1 Quantitative instrument

The instrument for this research was a reading comprehension test that was administered to both the Experimental group and the Control group.

For the Control group the instrument was administered in the so-called traditional manner, i.e. the printed reading text with questions attached was given to the participants. After reading the text they answered the questions by hand on the answer sheet. No discussion of the text content was done beforehand and the text subject was not introduced. The answers were marked by the researcher.

For the Experimental group the instrument formed part of the instructional treatment (*cf* 4.4.2) in order to be able to obtain data that supported the hypothesis that a blended-learning method to teaching reading strategies improved reading comprehension.

The comprehension test was compiled by the researcher based on the reading text entitled “Lightning” (written by Sandra Markle and taken from the Florida Comprehensive Assessment

Test for 2003). The comprehension test consisted of 15 questions; however, question 14 required two correct answers which made the total score 16. No open-ended questions were used; most question types were True or False or Multiple Choice type questions, with the addition of a single Multiple Response question where more than one correct answer was required for the same question. There was no time limit on the test but it was assumed that participants would be able to complete all questions with ease within a single class period.

To ensure the integrity of the test and the research, the comprehension test questions were randomised in the CD Rom version. Because learners receive immediate feedback in the CD Rom version of the test, there was a greater chance that they could copy each other's answers. By randomising the order in which questions appeared on screen, it became more difficult for learners to copy each other's work.

4.4.2 Instructional treatment

An instructional treatment was developed which consisted of two parts: an interactive, multimedia lesson on CD Rom and an online (internet-based) assessment version of the comprehension test. The interactive multimedia lesson included basic sound, movie clips and various interactive exercises pertaining to the subject of the research text. The link to the internet-based comprehension test was accessed directly from the CD Rom.

In summary the instrumentation and materials can be diagrammatically illustrated as follows:

Table 5: Instrumentation and materials

Method	Description of content	Medium	Given to
1	Instructions Exercise on CD Text 1 (printed copy) Exercise on CD Comprehension test	Verbal (teacher) Multimedia CD-Rom Printed booklet Multimedia CD-Rom Internet-based	Group 1
2	Text 1 (printed copy) Comprehension test	Printout Written by hand	Group 2

4.4.3 Introduction to reading strategies

For the Experimental group session, the teacher gave the learners a brief introduction to the concept of reading strategies. She explained that the lesson they would be doing would be different from the hand-written comprehension test that their classmates were doing, and that they (the Experimental group) would do (1) specific exercises on computer to check their current knowledge of the text subject, (2) read the text on paper, (3) do a summary exercise on computer to see if they could arrange sentences in the correct order per paragraph and (4) finally write their comprehension test through an internet-based program.

4.4.4 Materials: Reading text

A single text was used in the research (see Appendix B). To determine the readability level (level of difficulty according to age group) of the text used, a readability formula was used. Much research has been done about readability of texts, and various readability formulas have been proposed. Weitzel (2003) lists the main proponents of readability formulas as Dale and Chall (1948), Flesch-Kincaid (1948) and Gunning (1952), more

widely known as the Gunning Fog Index, and Fry's Readability Graph (1977).

Readability formulas are objective, quantitative tools for determining the difficulty of a written text without assessing readers (Rush, 1985:275). These formulas are mainly the result of an interest in matching a reader's ability to the level of difficulty in a text. For example, the Flesch-Kincaid tool analyses a sample of writing by examining the number of words, syllables and sentences. This tool forms part of most Microsoft Word packages today. Fry's Readability Graph is a manual tool that determines the level of difficulty of a text by analyzing three 100-word samples and taking the average number of syllables and average number of sentences for each passage and plotting it on the Fry graph (Weitzel, 2003).

A third example, the Dale-Chall readability formula, is based on the average sentence length of a 100-150-word sample of the target text and the number of unfamiliar words within that sample, using a list of 3000 words commonly known to fourth grade learners. The idea behind this formula is that readers find it easier to read, process and recall a passage if the words are familiar (Weitzel, 2003). The outcome of all formulas is to assign the level of difficulty of the text to an appropriate age group, usually in the form of school grade levels.

For the purposes of this study, the Dale-Chall formula was used to determine, as far as is reasonable, that the research text was at the appropriate level of readability, because the Dale-Chall formula is best applied to texts appropriate for learners in grade

four and up (refer Appendix A for calculation details). The formula uses the score rating as illustrated in the table below.

Table 6: Mapping reading grade score to grade level: Dale-Chall formula (RFP Evaluation Centres).

Reading Grade Score	Reading Grade Level	Education Level	Age
4.9 -	Grade 1 - 4	Primary	5 - 10
5.0 – 5.9	Grade 5 - 6		10 - 12
6.0 – 6.9	Grade 7 – 8	Secondary	12 - 14
7.0 – 7.9	Grade 9–10		14 - 16
8.0 – 8.9	Grade 11–12		16 - 18
9.0 – 9.9	Grade 13- 15	College/University	18 - 22
10+	Grade 16 & higher		22+

Although the Dale-Chall formula grade levels are based on American school grades, the grade levels and accompanying age groups are similar in the current school grade system in South Africa. In America children aged 11 to 12 are in Grade 6; the same is true for South Africa.

After applying the Dale-Chall formula to the research text the research text scored 6.65.

Table 7: Dale-Chall readability score for research text

Step	Description	Result
1	Total number of words in sample	114
2	Number of sentences in sample	7
3	Average sentence length	16,2
4	Number of difficult words	16
5	Percentage of difficult words	14,035
6	(0.0496 * 16,2)+(0.1579 * 14,035)+ 3.6365	**6,65**[61465]

The text used in this research was not manipulated. However, one criticism about readability formulas (refer following section)

was kept in mind with the use of the Dale-Chall formula for this research, namely that readability formulas often overestimate the difficulty of texts. Since the aim of the research in this study is to prove improved reading comprehension after applying the text in strategy instruction through a blended-learning method, the texts selected for the research were pitched at a level slightly above the Dale-Chall level for Grade 6 learners. Therefore, despite being used for research with Grade 6 learners, the text was chosen at a Grade 7 level.

Criticism of readability formulas

Although readability formulas have proven to be useful educational tools, and many educators and researchers have commented on their positive aspects, much criticism has been levelled at readability formulas (Bell and Willems, 1986:269). Most authorities would agree that reading involves interaction between the reader and the text (Rush, 1985:274). As has been shown in the literature review section of this study (refer Chapter 2), a reader brings knowledge and experience to the reading situation. Because readability formulas are purely text based, they do not touch on the interactive nature of the reading process. Most formulas use syntactic (sentence length) and semantic (vocabulary) factors that do not directly address factors related to the communication of meaning (Rush, 1985:274). They measure only the properties of a text and do not take the characteristics of readers into account (Bailin & Grafstein, 2001:296). Furthermore, most formulas base their readability level score on a small sample of the target text, thereby assuming that the entire text adheres to the same characteristics. Bell and Willems (1986:270) comment on the danger of educators using the readability formulas to rewrite

texts so that they become easier to read. In a study they performed to determine whether manipulation of a text by changing sentence length and vocabulary difficulty would positively affect the material's comprehensibility, they determined that using only the reading factors assessed by the readability formulas as style guides for rewriting classroom texts is a misuse of the formulas and poor educational practice (Bell and Willems, 1986:275).

However, the aim of this study is not to discuss the educational use and value of readability formulas, but rather to demonstrate that a scientific tool was used to determine, as far as was reasonably possible, the linguistic readability of the text used in the research. For the purpose of this study, then, the view will be taken that readability formulas provide rough estimates of readability and are best applied on texts such as library books and periodicals that will be read independently. Formulas are not appropriate for matching text to a specific reader or group of readers whose characteristics are known. They are, in other words, useful for determining text difficulty when the intended audience is known only in general terms, for example, subjects in a research study (Rush, 1985:282).

4.5 Data Collection Procedure

The comprehension test results constituted the quantitative data that were collected for this research. In School A the instrument was administered by the learners' own teacher, whereas in School B the researcher administered the test due to a teacher shortage at the school. Instruments were administered in learners' own classrooms, i.e. in a familiar, non-threatening

environment. The numbers per group were represented as follows:

Table 8: Participants per group per school

School	Group	N
A	1 (Experimental)	27
	2 (Control)	28
B	1 (Experimental)	40
	2 (Control)	42

Data collection occurred over a period of two consecutive days. Each school allowed time in their normal schedule for one Control group and one Experimental group per day. A total of two Control groups (one per school) and two Experimental groups (one per school) were completed on each day.

For the Control group the comprehension test comprised the traditional form of the comprehension test (*cf* 4.4.1). Participants completed the comprehension test within a single, standard class period. The tests were marked by the researcher.

For the Experimental group the comprehension test formed part of the instructional treatment. The instructional treatment was administered to the Experimental group only. It was administered in the computer centre/class of the respective schools. Learners were instructed verbally by their teacher how to use the combination of multimedia on computer and the printed material. Once a learner had completed Exercise 1 on their computer, read the text in the printed booklet and completed Exercise 2 on computer, they completed the comprehension test (quantitative instrument) online through the internet-based assessment program. Learners were given

sufficient time to complete the whole instructional treatment, even if it meant that the time needed exceeded the single, standard class period. The answers were marked by the software and the comprehension test results were sourced from the online assessment software's reporting component by the researcher.

4.6 Statistical Analysis

The following statistical analysis was used in Chapter 5 to describe the research results:

Alpha level and P-value

The p-value is the probability of a type I error, where the type I error is when a null hypothesis is rejected. The null hypothesis is the hypothesis that the phenomenon to be demonstrated is in fact absent. The null hypothesis is important because it is what L2 researchers are most often testing in their studies. If they can reject the null hypothesis at a certain alpha level (e.g. $p < .05$), then they can accept as probable whatever alternative hypothesis makes sense. The Alpha level is a threshold indicating when a null hypothesis can be rejected.

Thus where alpha = 0.05, the null hypothesis will be rejected when $p < 0.05$. This means that the probability is less than 5% ($p < 0.05$) that any differences within or between groups occurred on chance alone.

Analysis of Variance (ANOVA)

The ANOVA was used to test hypotheses about differences in the average values of some outcome between two groups or more groups as well as combined effects (interactions) of more than one nominal variable on the outcome variable.

Bonferroni test

The Bonferroni test is used when multiple-hypothesis testing is done on the same data set in order to keep the overall error rate at the set alpha level. Thus the adjustment makes the testing of an individual test stricter than the alpha level to ensure an overall error rate of alpha.

Basic statistical analysis

A two-way summary table was done to show similarities and/or differences between groups per school per comprehension test question.

This concludes the description of the research design. This chapter is designed to facilitate the presentation and discussion of the research results in the following chapter.

Chapter 5
Research Results

This chapter aims to present and discuss the analysis of the research data gathered during the experimental study. In the conclusion to this chapter the question whether the research hypothesis was supported or rejected will be discussed.

5.1 Statistical analyses performed on research data

To determine whether the research hypothesis is supported by the research data or not, the mean scores of the Control group and Experimental group were analysed. Different tests were done to determine whether the results were statistically significant.

Analysis of Variance (ANOVA)

The ANOVA test was used to determine if any differences between the Experimental and Control group for School A were the same as any differences between the Experimental and Control Group for School B. The result (*cf* Figure 6) was a *p*-value of 0.55 (p=0.55), which indicates that the differences (if any) between the Experimental and Control groups were the same for both schools. The opposite is also true, namely that differences between the schools (if any) were the same irrespective of the Experimental and Control groups.

A further test was done to determine if the mean performance of the Experimental group (which received the treatment) and the Control group (which did not) was statistically significant. The analysis returned a p-value of .15236 ($p > 0.05$), which indicated

that there was no significant difference between the mean performance of the Experimental and Control group at both schools. The results of the analysis of the mean scores between the Experimental and Control groups for both schools are summarised below in Figure 6.

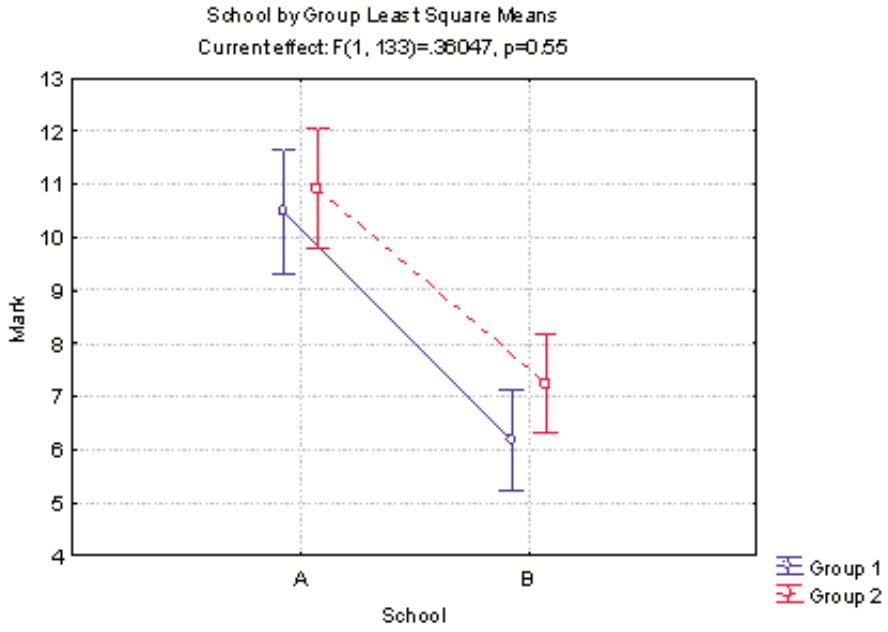


Figure 6: Comparison between groups and schools

A further comparison between the separate group types per school was done by the researcher by comparing the average scores for the Experimental and Control group per school. The results are summarised in the table below.

Table 9: Average scores (out of 16) per separate group per school

School	Class	Group	Mean score	N
A	1a	1 (Experimental)	11,5	13
		2 (Control)	8,7	14
	1b	1 (Experimental)	9,5	14
		2 (Control)	12,8	14
B	1a	1 (Experimental)	6,1	20
		2 (Control)	7,8	22
	1b	1 (Experimental)	6,2	20
		2 (Control)	6,6	20

Bonferroni test

This test provided a more detailed analysis of the scores to determine where differences occurred, if any. The results can be summarised as follows:

- The p-value indicated that any differences between the Experimental and Control groups were not dependent on the school, and that any differences between School A and B were not dependent on the Experimental and Control groups.
- When taking only the Experimental and Control groups into account, there was no significant difference ($p=0.15$) between the mean scores.
- When taking only the School into account, there was a significant difference ($p<0.01$) between the mean scores.

As described above, although there is no significant difference in the mean scores between the groups per school, there is a difference between the mean scores of School A and B. It is clear that both the Experimental and Control groups scored slightly better in School A than the same groups in School B. The possible reasons for this are discussed in the final chapter of this research.

Basic statistical analysis

An analysis of the answers to each question in the comprehension test was done, and a 2-way summary table of observed frequencies was drawn up for each question. This analysis also did not reveal any significant differences in the results of the observed frequencies per question between the Experimental and Control groups, except in two questions (question 7 & 8) where the Control group scored significantly higher than the Experimental group.

5.2 Interpretation of Statistical Results

Except for the single instance where the Experimental group in School A scored higher than the equivalent Control group (cf Table 9), the results of this research show no significant statistical difference in the mean scores between the Experimental and Control groups at both school A and B. The results, therefore, do not contain enough evidence for disproving the hypothesis that the application of a blended-learning method for teaching strategy instruction will improve reading comprehension.

There were various factors that could have influenced the outcome of the research. One factor that was clearly evident during the research treatment was the computer literacy and existing English second-language literacy of learners, particularly at School B. This factor, as well as any other factors that could have influenced the validity of the results, are discussed in detail in the following chapter.

Chapter 6
Conclusion

This chapter provides final thoughts on the results of the research study. These thoughts will include a brief examination of the findings that support or partially support the hypothesis, factors influencing the participants, limitations of the study that could have affected the validity of the results and recommendations for further research.

6.1 Examination of findings that support the hypothesis

One of the two Experimental groups in School A supported the hypothesis that the use of a blended-learning approach to strategy training improves reading comprehension when the Experimental Group scored an average of 11.5 out of a possible 16 and the Control Group scored 8.7. The second Experimental group at the same school scored similar marks, but two learners neglected (for unknown reasons) to answer more than half of the questions on the internet-based comprehension test, thereby scoring very low marks and affecting the group average. The fact that they correctly answered all the questions they did complete, indicates the possibility that, had they completed the entire test, the second Experimental group at School A could also have scored higher than its equivalent Control group, thereby further strengthening the research hypothesis.

At School B both Control groups scored marginally better in the comprehension test than the Experimental groups, but the difference in the results between the groups was not significant enough to disprove the hypothesis.

Furthermore, the factors that influenced the participants, as well as the limitations of the study, could have played a significant role in the outcome of the results.

6.2 Limitations of the study that may affect validity of results

Once-off test vs. prolonged exposure to strategies and methodology

Despite their willingness to help, both schools were able to provide only one period per day over two days for the research, which made the time available for the research shorter than had been anticipated. This did not enable the researcher to provide a proper introduction to the concept of strategy training to the Experimental group over a period of time, and allowed only for a brief introduction before the application of the research treatment. As has been pointed out in this thesis, the training of strategies is most effective when done explicitly. Snyder & Pressley (1985:17) support this through his approach to strategy instruction (*cf* 2.4.1)

- Describe the strategy to the students
- Provide sufficient guided practice
- Provide opportunity to practice on subjects other than language
- Instruction should be explicit, intensive and extensive.

While the strategies were described to the participants in broad terms, the fact that the research treatment was a once-off occurrence may have influenced the effectiveness of the treatment. In School B this may have been compounded by the fact that, due to teacher shortages, the school teacher was not available to facilitate the treatment and the researcher facilitated the treatment instead. Time also did not allow for group discussions after the treatment.

General literacy and computer literacy of participants

Two other factors that could have influenced the validity of the results were the existing computer literacy and general reading skills of the participants. This, coupled with the introduction of an unfamiliar methodology could have influenced the validity of the results.

Compared with School A, the mean test scores for School B were lower for all Control and Experimental groups (6.71 compared to 10.7 for School A). From discussions with teachers at School B it became evident that participants' English reading skills could be linked to their apparent lack of motivation for learning English as a second language. The home culture of participants was very strongly geared towards their first language (Afrikaans), and it appeared that even teachers used English with reluctance. One teacher described how English was used as a tool to keep learners quiet when a class became rowdy. Learners would be told that they could only speak if they spoke English; this apparently silenced a rowdy class very effectively.

Research has shown that reading motivation activates and guides reading behaviour (Aarnoutse and Schellings, 2003:387), and that reading motivation in general included things such as reading goal, intrinsic and extrinsic motivation and social motivation for reading. Guthrie et al (2004:403) state it is likely that "the acquisition of reading strategies and reading comprehension demands a large amount of effort and motivation". Based on these findings it is possible that the attitude towards English of participants at School B is causing their general reading skills in this second language to be lower than their peers at School A.

Furthermore, the computer skills of participants at School B were markedly lower than their peers at School A. The researcher observed many participants struggling with the use of a mouse, and general unfamiliarity with basic on-screen navigation. It should be noted that the socio-economic demographic of School B also meant that participants did not have regular access to computers at home, as opposed to their peers at School A who generally came from a more privileged background.

It is, therefore, possible that both the lack of computer skills and motivation for learning English for participants at School B, coupled with exposure to a new methodology, could have influenced the validity of the research results.

6.3 Recommendations for further research

Based on the results of existing research into the effect of technology on reading, a recommendation would be to develop a complete blended-learning strategy instruction programme (as proposed in this thesis) and implement the programme at a school(s) for a period of time. After the period has passed, a similar test to the one performed in this research could then be carried out, again by using Experimental and Control groups. It is fairly certain that those results would be more representative of the effect of a blended-learning programme than those obtained in the once-off application of the treatment in this research, because participants (1) would have had time to become familiar with the concept and use of strategies and (2) will have had repeated exposure to a blended-learning methodology. Furthermore, teachers would also have had an opportunity to implement reading strategies in other

school subjects, thereby strengthening the use of strategies across the curriculum.

A further recommendation would be to increase the use of interactive multimedia and use of ICTs in general in the overall blended-learning method so that the majority of reading is limited to the main reading text as far as possible. Some participants in the research for this thesis complained of being "tired" because the research treatment required additional reading other than that of the main text. A further suggestion to alleviate this issue would be to give students the choice of how many strategy exercises per intervention they do, instead of making it a requirement to do more than one.

6.4 Conclusion

Literacy and technology are two words that seem to be increasingly paired in today's world of research and education (Pearson, 2005:2). Becoming "digitally literate" is one of the latest discourses in schools and education in general, as is underlined by the White Paper on e-Education in South Africa. This demand for literacy which includes both reading literacy and computer literacy has implications for education in general by making fresh demands on both educators and learners. New needs are created through these demands, such as:

- Teachers who are skilled in ICT for teaching and learning
- A curriculum that includes ICT into all subjects
- Instruction that develops not only general literacy, but all literacies essential to the effective use of information
- Assessment practices that include reading on the internet and writing with word-processing software (*cf* Table 4)
- Equal access to ICT (Pearson, 2005:2).

The results of this study support and highlight these demands in the following ways:

- One of the Experimental groups showed an increase in reading comprehension through the use of the blended-learning treatment. This suggests that with sufficient computer literacy skills and increased exposure to reading strategies and ICT tools, a blended-learning approach has merit and could improve reading comprehension.
- Where the Experimental groups scored lower than the Control groups, the factors that impacted the results highlight the need for an increased focus on computer literacy. The use of a blended-learning approach promotes the development of computer literacy and provides increased exposure to ICT in general, while at the same time improving general literacy through the use of strategy instruction.
- A blended-learning approach to strategy training for improving reading comprehension can be applied across all school subjects, thereby at the same time addressing the need for both computer literacy and general literacy across the curriculum.

A final thought

One thing that should always be kept in mind with computer-assisted (language) learning, is that the field of instructional computing is in a continuous state of development. Therefore, it can be argued that there is no single, accurate approach for applying computers in learning, but rather a multitude of opportunities for enhancing the learning process through the careful and informed application of technology, rather than hindering learning through over application and uninformed use of technology. Research has shown that the use of researcher-developed technologies seems to

be more effective than those of their commercial counterparts (Pearson et al, 2005:22).

In view of this, this study is a contribution to creating effective computer-supported language learning, an answer rather than pretending to be the answer. As long as technology progresses, becomes more accessible worldwide and more important in education in general, and as long as learning (reading) must take place, the issue of the value of instructional computing is by no means a closed subject and will continue to provide opportunities for the development of improved computer-based (language) learning interventions.

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List of tables & figures

Appendix A

Dale-Chall Readability Calculation Method

Select a text sample of 100 – 150 words.

1. Count the total number of words in the reading sample.
2. Count the number of sentences in the reading sample.
3. Determine the average sentence length by dividing the number of words (item 1) by the number of sentences (item 2)
4. Count the number of words that are NOT found in the Dale-Chall Word List (i.e. count the number of difficult words). Count each difficult word each time it appears.
5. Calculate the percentage of difficult words by dividing the number of difficult words (item 4) by the total number of words (item 1). Multiply the answer by 100.
6. Transfer the values from items 3 and 5 into the Dale-Chall Readability Index:
   (0.0496 x ____ average sentence length) + (0.1579 x ____ % difficult words) + 3.6365 = ____ Raw Score.

Appendix B

Reading Text

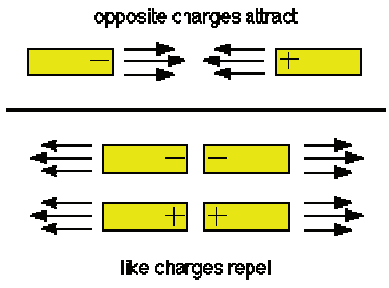
A Shocking Story

1. The puffy, cumulus cloud begins to billow up. The top spreads into an anvil head as the cloud thickens and darkens, becoming a cumulonimbus cloud. The wind begins to blow harder, and raindrops pelt the ground. Then, suddenly, a jagged streak of light slices across the sky. Thunder cracks explosively and trails off into a deep rumble.

2. It's a thunderstorm, and that lightning bolt was only one of six hundred flashes that occur somewhere in the world every second. Of these, about one hundred strike the earth. Lightning is misunderstood, underrated as a dangerous phenomenon, and unappreciated for the important way it helps the environment.

3. In 1752 Ben Franklin proved that lightning was electricity. He launched a kite with a metal rod at its tip into a cumulonimbus cloud. The kite string was silk, a very good conductor of electricity, and when the lightning flashed, Franklin touched the metal key tied to the string. The results were shocking. An average bolt of lightning packs more than fifteen million volts of electricity – enough to light one million light bulbs.

4. Today scientists know what happens in a cumulonimbus cloud is similar to what happens when you scuff across a wool carpet and touch something, getting a shock. You may even see a spark, a miniature lightning bolt, when this happens. All matter is made up of tiny atoms, and atoms are made up of even tinier negatively and positively charged particles. When friction knocks the negatively charged particles free, they collect on objects. Like opposite poles of a magnet, the opposite charges attract.



5. Strong updrafts of warm air into colder air batter water droplets, causing the cloud to become electrified. Particles with a positive charge collect in the highest layers. Negatively charged particles collect in the lower portion of the cloud. As a thunderstorm approaches, these negative charges set up an attraction with positive charges on the ground.
   At first the air acts as an insulator, preventing charged particles from leaping between the earth and the cloud. Eventually the attraction becomes too great. An invisible finger of negatively charged particles shoots down from the cloud, seeking the quickest path to the ground. Then the positively charged particles leap up to meet the negative charges, forming an electrified channel that may be as thin as a wire or as thick as a cable.

6. Lightning appears to shoot down from the sky, but slow-motion photography has proved that the bolt actually illuminates from the ground up. All of this action lasts only a fraction of a second, but the surge of power creates a burst of heat. The explosive expansion of superheated air creates sound waves – thunder. Since lightning travels at the speed of light (300 000 kilometers per second) and sound travels only 1.6 kilometers in five seconds, it really is possible to estimate how many kilometers away the storm is. Count the number of seconds between the time you see the lightning flash and when you first hear the crack of thunder. Then divide this by five. This will tell you how many miles away the storm is. Multiply the number of miles by 1.6 to find out how many kilometers this represents.

7. Thunderstorms happen most frequently during the spring and summer because it is then that the Earth's heat is most uneven. If you live on the island of Java, you have a lot of opportunities to practice figuring out how far away the storm is. Lightning flashes there about three hundred days a year. Florida is the most lightning-prone state in the United States, averaging two thunderstorms a week.

8. Although lightning may seem to be gone in a flash, it does have an important long-lasting effect. Plants need nitrogen to grow. While there is plenty of it in the air, plants can't use it in this gaseous form. Lightning causes the gaseous nitrogen to form nitrogenous compounds that are carried to the soil by the rain. So the next time there is a thunderstorm with plenty of lightning, notice whether the grass and other plants in your neighbourhood seem to have a sudden growth spurt after the storm. It isn't just the rain. The lightning provided a natural dose of fertilizer.

Appendix C

Comprehension Test

Question 1

Lightning happens after a _____ cloud has formed.

(a) Cumulus
(b) Cumulonimbus
(c) Anvil

Question 2

Thunder and lightning usually occur together.

(a) True
(b) False

Question 3

According to *A Shocking Story*, how many lightning flashes actually hit the earth every year?

(a) Six hundred
(b) Three hundred
(c) One hundred

Question 4

Lightning is dangerous to humans but it is also good for the environment.

(a) True
(b) False

Question 5

When Ben Franklin did his experiment with a kite, he got a shock and proved that lightning was electricity.

(a) True
(b) False

Question 6

When an object has a positive or negative charge, it means that …

(a) it can move very fast
(b) it will shock you if you touch it
(c) it has power or force (like a battery)

Question 7

Particles with a positive charge are found _____ of a cloud.

(a) in the middle
(b) at the top
(c) at the bottom

Question 8

Particles with a negative charge are found _____ of a cloud.

(a) in the middle
(b) at the top
(c) at the bottom

Question 9

The particles at the bottom of a cloud are drawn to the earth because …

(a) they become too heavy to stay in the air
(b) the earth has a positive charge and draws the negative particles down
(c) the positive particles at the top of the cloud push them down to the earth.

Question 10

Lightning is formed when …

(a) the negative particles in the cloud and the positive charge of the earth are drawn to each other
(b) the particles in the cloud become too heavy to stay in the air and fall towards the earth
(c) the wind drives the negative particles down to the earth.

Question 11

Lightning moves from …

(a) the ground to the sky
(b) the sky to the ground
(c) in both directions.

Question 12

Lightning travels at the speed of …

(a) light
(b) sound
(c) lightning.

Question 13

It is possible to work out how far away a lightning strike was.

(a) True
(b) False

Question 14

According to “A Shocking Story”, thunderstorms happen most during …

(a) winter
(b) summer
(c) spring
(d) autumn.

Question 15

Lightning is good for the earth because …

(a) it produces electricity for our homes
(b) it helps plants to grow
(c) it makes rain.

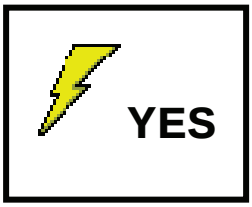
Appendix D

Booklet for instructional treatment

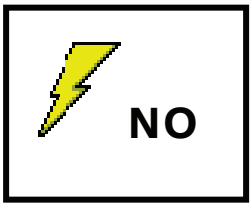
Reading Booklet

Before reading the text about A Shocking Story, answer the following question:

Have you completed Exercise 1 on the Shocking Story lesson on your computer?



Then you may turn to the next page and read the text about “A Shocking Story”.



Do not turn the page. Please turn to your computer and complete Exercise 1.

A Shocking Story

Read this story carefully. Then do Exercise 2 on your computer.

1. The puffy, cumulus cloud begins to billow up. The top spreads into an anvil head as the cloud thickens and darkens, becoming a cumulonimbus cloud. The wind begins to blow harder, and raindrops pelt the ground. Then, suddenly, a jagged streak of light slices across the sky. Thunder cracks explosively and trails off into a deep rumble.

2. It's a thunderstorm, and that lightning bolt was only one of six hundred flashes that occur somewhere in the world every second. Of these, about one hundred strike the earth. Lightning is misunderstood, underrated as a dangerous phenomenon, and unappreciated for the important way it helps the environment.

3. In 1752 Ben Franklin proved that lightning was electricity. He launched a kite with a metal rod at its tip into a cumulonimbus cloud. The kite string was silk, a very good conductor of electricity, and when the lightning flashed, Franklin touched the metal key tied to the string. The results were shocking. An average bolt of lightning packs more than fifteen million volts of electricity – enough to light one million light bulbs.

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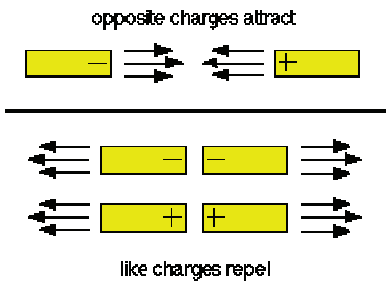


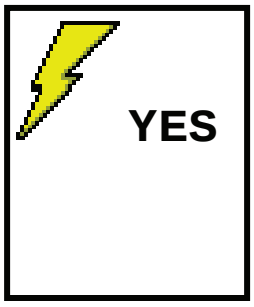
5. Strong updrafts of warm air into colder air batter water droplets, causing the cloud to become electrified. Particles with a positive charge collect in the highest layers. Negatively charged particles collect in the lower portion of the cloud. As a thunderstorm approaches, these negative charges set up an attraction with positive charges on the ground. At first the air acts as an insulator, preventing charged particles from leaping between the earth and the cloud. Eventually the attraction becomes too great. An invisible finger of negatively charged particles shoots down from the cloud, seeking the quickest path to the ground. Then the positively charged particles leap up to meet the negative charges, forming an electrified channel that may be a thin as a wire or as thick as a cable.

6. Lightning appears to shoot down from the sky, but slow-motion photography has proved that the bolt actually illuminates from the ground up. All of this action lasts only a fraction of a second, but the surge of power creates a burst of heat. The explosive expansion of superheated air creates sound waves – thunder. Since lightning travels at the speed of light (300 000 kilometers per second) and sound travels only 1.6 kilometers in five seconds, it really is possible to estimate how many kilometers away the storm is. Count the number of seconds between the time you see the lightning flash and when you first hear the crack of thunder. Then divide this by five. This will tell you how many miles away the storm is. Multiply the number of miles by 1.6 to find out how many kilometers this represents.

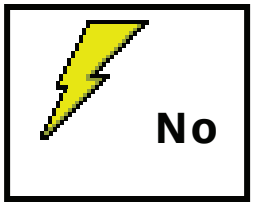
7. Thunderstorms happen most frequently during the spring and summer because it is then that the Earth's heat is most uneven. If you live on the island of Java, you have a lot of opportunities to practice figuring out how far away the storm is. Lightning flashes there about three hundred days a year. Florida is the most lightning-prone state in the United States, averaging two thunderstorms a week.

8. Although lightning may seem to be gone in a flash, it does have an important long-lasting effect. Plants need nitrogen to grow. While there is plenty of it in the air, plants can't use it in this gaseous form. Lightning causes the gaseous nitrogen to form nitrogenous compounds that are carried to the soil by the rain. So the next time there is a thunderstorm with plenty of lightning, notice whether the grass and other plants in your neighbourhood seem to have a sudden growth spurt after the storm. It isn't just the rain. The lightning provided a natural dose of fertilizer.

Have you finished reading the Shocking Story text on pages 2 and 3 of this booklet?



Turn to your computer and complete *Exercise 2* of the Shocking Story lesson.
Then write the comprehension test on the computer



Turn to page 2 of this booklet. Then read the text about A Shocking Story.

Comprehension Test

Before doing the comprehension test, answer the following question:

Have you completed Exercise 2 on the Shocking Story lesson on your computer?

 **YES**	Then you may turn to the next page and do the comprehension test.
 **NO**	*Do not turn the page.* Please turn to your computer and complete Exercise 2.

A Shocking Story
Comprehension Test

Draw a circle around the correct answer.

Question 1

Lightning happens after a _____ cloud has formed.

(d) Cumulus
(e) Cumulonimbus
(f) Anvil

Question 2

Thunder and lightning usually occur together.

(c) True
(d) False

Question 3

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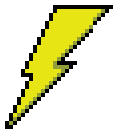
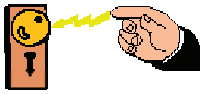
(d) False






Question 5

When Ben Franklin did his experiment with a kite, he got a shock and proved that lightning was electricity.

(c) True
(d) False

Question 6

When an object has a positive or negative charge, it means that …

(d) it can move very fast
(e) it will shock you if you touch it
(f) it has power or force (like a battery)

Question 7

Particles with a positive charge are found _____ of a cloud.

(d) in the middle
(e) at the top
(f) at the bottom

Question 8

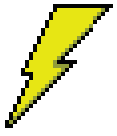
Particles with a negative charge are found _____ of a cloud.

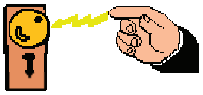
(d) in the middle
(e) at the top
(f) at the bottom

Question 9

The particles at the bottom of a cloud are drawn to the earth because …

(d) they become too heavy to stay in the air
(e) the earth has a positive charge and draws the negative particles down
(f) the positive particles at the top of the cloud push them down to the earth.






Question 10

Lightning is formed when …

(d) the negative particles in the cloud and the positive charge of the earth are drawn to each other
(e) the particles in the cloud become too heavy to stay in the air and fall towards the earth
(f) the wind drives the negative particles down to the earth.

Question 11

Lightning moves from …

(d) the ground to the sky
(e) the sky to the ground
(f) in both directions.

Question 12

Lightning travels at the speed of …

(d) light
(e) sound
(f) lightning.

Question 13

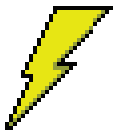
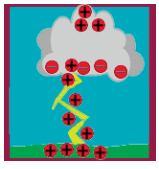
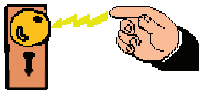
It is possible to work out how far away a lightning strike was.

(c) True
(d) False

Question 14

According to “A Shocking Story”, thunderstorms happen most during …

(e) winter
(f) summer
(g) spring
(h) autumn.


Question 15

Lightning is good for the earth because …

(d) it produces electricity for our homes
(e) it helps plants to grow
(f) it makes rain.

Congratulations! You have completed the Shocking Story comprehension test.

Appendix E

Note to the reader

Question three of the comprehension test reads “According to *A Shocking Story*, how many lightning flashes actually hit the earth *every year*?” However, the reading text makes no reference to “year”, but merely states that six hundred flashes occur somewhere in the world “every second”.

Although the researcher’s use of the words “every year” is incorrect, the question is not regarded as invalid because the question was based on the sentence “Of these, about one hundred strike the earth” and the intention was that learners would obtain the correct answer (namely “one hundred”) from this sentence, thereby indicating that they comprehended the difference between six hundred lighting strikes in total and one hundred of those striking the earth.

The conclusion was, therefore, that the question was not misleading and did not affect the outcome and integrity of the research data and results.