THE EFFECTS OF USING TECHNOLOGY TO ENHANCE STUDENT ABILITY TO READ, ORGANIZE AND WRITE INFORMATIVE TEXT

by

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A Thesis Submitted to the Faculty of Graduate Studies in Partial Fulfillment of the Requirements for the Degree of

MASTER OF EDUCATION

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Laurie E. Dodson

A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirements of the degree of Master of Education

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Abstract

This research evaluated the efficacy of an instructional intervention that employed technology to enhance the learning of informative text. Over the course of a two month period, the investigator and two teachers worked collaboratively training students to use the *Inspiration 5.0* (1997) computer program. Students learned to: recognize the structure of the text selections they were studying, make notes of the material on a computer-generated conceptual-map, and use the map as a guide for writing text summaries.

To assess progress and maintenance of students' proficiency with conceptual-mapping and summary writing, three passages counterbalanced to control for order effects, were administered. Students created a paper-pencil map of passage ideas, and wrote a summary which was graded for both content and form or organization using previously developed scoring guidelines.

Analysis of t-test scores showed that changes in performance for both the maps and summaries from pre- to post-testing were statistically significant. The scores for the conceptual-maps and summaries indicated that over time students continued to use the intervention strategies to learn from text, suggesting that students saw the value in using the author's organizational framework to facilitate comprehension and recall.

Overall results suggested that when students used the computer mapping procedure to enhance learning, there were positive effects on their ability to process text, organize information and write expository text summaries. Qualitative data gathered during the instructional process also supported the findings of the statistical analysis.

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CHAPTER I

Nature of the Study

Educational practices have been, and continue to be, heavily influenced by the thinking of educational psychologists and their research on learning and literacy processes (Dole, Duffy, Roehler, & Pearson, 1991; Hiebert & Raphael, 1996). Coupled with social constructivist perspectives (Palincsar, 1998), current educational reform efforts endeavour to engage students actively in the learning process. The development of learning strategies and work habits is a critical determinant of student learning and overall school success.

Unfortunately, many students lack the kinds of strategies needed to enhance learning. They fail to understand what they read, have difficulty organizing and retaining information, appear passive when faced with interpreting written material, and are unable to integrate prior knowledge with incoming information. Furthermore, some students may have slow information-processing skills and spatial-organizational problems that, together with such affective factors as inhibitions to learning and high distractibility, negatively affect their communicative and academic productivity.

In order to reach prescribed educational standards, students need to develop learning strategies. In order to understand content, students must actively engage in accessing, analyzing and synthesizing information, then consciously transform that information into meaningful knowledge. Learning is thus not a passive act, but rather an activity that requires effort and sustained attention.

This study documents an instructional intervention that used technology to teach students strategies for developing first, conceptual-maps and second, written summaries of text content. The emphasis was on teaching learning strategies that students could eventually apply independently to help them both understand and remember the material they studied.

Purpose of the Study

Reading informative text poses special challenges to students that are far greater than those encountered in primary grade academic tasks (Harper, 1989). During the middle years, students must make a shift from "learning to read" to "reading to learn" (Herber, 1978). Still, many students feel completely overwhelmed with the demands of the social studies or science curricula (Irvin, 1997) and the idiosyncrasies of other complex text materials.

The Teacher's Role

Ciborowski (1995) suggests that in order to address the learning needs of divergent learners, teachers must rethink their traditional role of knowledge dispenser and adopt a new instructional paradigm. Within this context, teachers are viewed as collaborators who must first determine the best match between the level of instruction, the difficulty of the learning materials, and the range of student abilities (Lipson & Wixon, 1992). Knowledge acquisition is best achieved when students are guided and supported by a more capable other (Vygotsky, 1978). The role of the instructor, then, becomes that of a strategist, orchestrating the what, how and when of teaching and learning.

Ellis (1993) and Swanson (1989) suggest that an effective classroom promotes the learner's active participation as well as risk-taking through the

use of scaffolded instruction, modelling, demonstration and re-teaching, with adequate reinforcement, feedback and extensive explanations. These explanations are structured and restructured to fit students' difficulties. Ongoing teacher reflection is mandatory in order that appropriate instructional adjustments can be made to ease the transfer and generalization of strategies (Ciborowski, 1995; Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989).

Educators carry the sole responsibility for making such accommodations in the classroom (Palincsar, 1998). Obviously, teachers as more knowledgeable others remain at the center of the learning process, and must manipulate the instructional context in a way that engages even the most reluctant participants (Ciborowski, 1995).

Palincsar and Brown (1984) underscore the dyadic social relationship between the adult and student-apprentice, as teachers gradually release responsibility for learning (Pearson & Gallagher, 1983). The long term goal becomes the development of learners who have a repertoire of learning strategies that can be readily executed when the need arises.

Learning from text is a necessary academic skill and one which demands informed instruction (D'Angelo-Bromley, 1985). Moss, Leone & Dipillo (1997) postulate that one reason for student confusion in reading informative text is that they lack early involvement with such materials. Sadly, in many schools across the country, narrative literacy continues to eclipse informational literacy at precisely the time when the ability to read and write exposition appears to be increasingly more important in our society (Moss, Leone, & Dipillo, 1997). When so many students lack the requisite skills (Ciborowski, 1995), the teacher is faced with the formidable task of igniting student interest in curricular content, as well as providing inspiration so that

learners become engaged in reading and studying.

One possible solution is to offer students opportunities to interact with well-written informative text earlier in their school career. By reading and writing in response to exposition, engagement with text strengthens, recall of key ideas improves and thinking about text deepens. Both reading and writing are integral to comprehension and information processing (Tierney & Shanahan, 1991). The question of how to assist students in processing text, organizing information for study, and improving comprehension and the writing of non-narrative passages continues, however, to be a concern for classroom teachers.

Good and Weak Readers and Writers

Early years students have numerous experiences that help them refine and expand their schemata about the structure of story. By the time they reach middle school, students have acquired a substantial understanding of what constitutes narrative discourse (Piccolo, 1987), and exhibit an intuitive knowledge of story. Significantly fewer students possess awareness of informative text structure (Englert & Hiebert, 1984), and consequently have difficulty comprehending and remembering content area material as they accelerate through the school system. Researchers affirm that some of the other underlying factors that contribute to the problem of processing informative material may include limited initial content area knowledge and low interest (Cudd & Roberts, 1989; Piccolo, 1987).

Furthermore, some students do not possess adequate word recognition skills and are not fluent readers. As a result, comprehension suffers. Such readers are unable to experience the intrinsic gratification that spurs reading speed and accuracy (Stanovich, 1986), and therefore remain at

risk for failure. Thus, what begins as a highly specific reading deficiency later compromises the ability to learn from text (Ciborowski, 1995). Early reading deficiencies spiral, negatively affecting the ability to manage more conceptually dense content materials. Because weak students have not learned to read efficiently, they are often ill-prepared to complete higher-level thinking and learning activities.

Competent readers, on the other hand, are skilled in analyzing the learning situation, and in selecting strategies that match the demands of the assignment (Armbruster, Echols, & Brown, 1982; Brown, Campione, & Day, 1981). They are equally adept at organizing ideas and information (McTighe & Lyman, 1988). While good readers and writers use text structure to chunk information and distinguish main ideas as a means of retrieval, students who are weak readers are not prepared to begin reading from their textbooks, and as suggested, tend not to possess the reading strategies necessary for efficient comprehension (Ciborowski, 1995).

Not surprisingly, there is a high correlation between good readers and good writers, and between weak readers and weak writers (Belanger, 1987; Moore, 1995; Stotsky,1983). In fact, research has demonstrated that better writers tend to be better readers, that better writers read more than weaker writers, and that better readers author more sophisticated products than do weak readers (Randolphe-Moore, 1995).

Proficient readers and writers also differ from weak ones in terms of their ability to process informative text. Analysis of the behaviours of proficient readers reveals that such readers and writers are more skillful because they have access to schemata for text structure that is activated spontaneously (Randolphe-Moore, 1995). The question of how to address

the learning needs of weak readers in the upper grades still persists.

The Problem

One of the issues is whether or not we are requiring some students to achieve learning outcomes for which they are developmentally not ready. According to Brown and Day (1983), adults more readily recognize aspects of text structure that facilitate passage recall. They do so by organizing the retelling of what was read in a hierarchy similar to that used by the author in developing the text. Nonetheless, without instruction, weak readers are less likely to construct such summaries successfully. Meyer (1975) suggests, however, that grammars of exposition exist. Therefore, teachers need to teach the organizational structures and students need to internalize these basic patterns to facilitate both the understanding and recall of content area prose.

McGee (1982) claims that in order to develop this kind of expertise, students must be given direct, explicit instruction in noticing the structural aspects of the text and in creating summaries that follow that text's organizational framework. In fact, studies have confirmed that students who are taught to identify and use text structure in the form of graphic organizers as a memory aid, understand and retain more information than students who do not (Berkowitz, 1986; Englert & Hiebert, 1984). Furthermore, when children learn to become actively involved in generating summaries from the text frames they design while reading, they significantly increase their comprehension, recall and writing ability compared to those engaged in more passive forms of studying (Armbruster, Anderson & Ostertag, 1989; Berkowitz, 1986; Moore & Readence, 1984; Rinehart, Stahl & Erickson, 1986; Taylor & Beach, 1984). This research has instructional implications for classroom practice.

Some practitioners argue further that special programs to improve

reading and study skills tend to be more successful, particularly when such programming is related to the academic courses in which students are enrolled (Pflaum, Walberg, Karegianes, & Rasher, 1980). It is likely that a combination of using advance organizers at the beginning of a new topic, developing further organizational and graphic aids for chapter or unit review, as well as generating appropriate questions, summaries or study guides, will have a substantial effect on student progress (Bloom, 1984).

Integrating Technology

The effectiveness of instruction in the use of graphic representations was tested in empirical studies conducted by Anderson-Inman, Knox-Quinn and Horney (1996), but with an interesting twist. These theorists explored how computers and other forms of advanced technology can assist at-risk students to acquire and use study techniques more competently, and ultimately maximize their performance across the curriculum. Other studies have also shown how computers can be used to strengthen understanding of content area material by facilitating students' abilities to process the information they are learning (Outhred, 1989).

The literature describes computer-based mapping and outlining programs as powerful mechanisms for improving the text comprehension of average and below-average students (Anderson-Inman, Redekopp, & Adams, 1992; Tenny, 1992). Likewise, there is preliminary evidence suggesting that using these programs as processing instruments can increase the academic performance of at-risk students (Adams, 1992; Adams & Anderson-Inman, 1991, cited in Anderson-Inman, Knox-Quinn, & Horney, 1996).

Observations of teachers who are integrating computer-based outlining software into their curricula point out that such programs are easily

implemented and widely effective across varying conditions (Anderson-Inman, 1992). Studies that have emphasized computer-generated conceptual-mapping tools as vehicles for synthesizing information and improving learning report similar positive results (Anderson-Inman et al., 1996). One caveat for the successful development of these skills is that students must receive clear direction in terms of recognizing the structural features of text, and in creating summaries that follow the original text format (McGee, 1982).

This study. While this technological research has led to the development of many interventions aimed at improving students' information-processing skills and overall academic achievement (Deshler & Lenz, 1989, cited in Anderson-Inman et al., 1996), this study will focus on exploring the effectiveness of one conceptual-mapping program as a means of assisting learners to process, record, organize, manipulate and visualize the connections between the ideas contained in content area texts. This study represents an adaptation of similar investigations presented in the literature (Anderson-Inman, 1992; Anderson-Inman et al., 1996; Berkowitz, 1986; Taylor & Beach, 1984; Tenny, 1992).

Statement of the Problem

The question is how the use of computer-based conceptual-mapping will affect students' ability to read, organize and write informational text. More specifically, this study investigates how well students can learn to recognize and follow the structure in a text, record notes within the context of a computer-generated frame or map and write a cohesive, organized summary to reflect the important content.

To answer this question, the investigator collaborated with two part-time teachers who shared the teaching in a Grade six classroom. The investigator engaged in after-lesson reflections with teachers, and gathered field notes documenting instructional procedures. Technical difficulties, student activities, ongoing concerns and recommendations for improvement, instructional efforts, technical needs, student activities, and teacher observations were documented. Post intervention interviews with teachers were also carried out. As instruction proceeded, students electronically created conceptual-maps and, using these as a guide, produced written summaries. These were collected and returned to students with corrective feedback as the intervention proceeded.

This research sought to demonstrate that when students use the computer-developed mapping procedure and summary writing to support their learning, there would be a positive effect on their ability to process text, organize information and write expository text summaries.

Specific Research Questions

This study was designed to answer these specific research questions:

1) Will students' ability to determine the superordinate and subordinate ideas of the assigned informational material be enhanced as a result of engaging in conceptual-mapping activities?

2) In general, what will be the effects of conceptual-mapping on students' content area knowledge and organizational skills?

3) Will students' ability to compose summaries of informative text improve as a result of constructing conceptual-maps of the assigned reading material?

Significance of the Study

This study contributes to the existing body of knowledge that surrounds the pedagogy of students' ability to read, organize and write informative text. Within a classroom-based learning environment, the focus was on using computer-generated mapping to tease out key information in content area text and to organize that information into coherent, complete, written summaries. Instruction was ongoing with the gradual release of responsibility from teacher to student (Pearson & Gallagher, 1983), as the technology was used for the independent creation of organizational maps, outlines and text summaries.

The specific classroom parameters of this research permitted the exploration of a computer-based mapping procedure to enrich learning across the curriculum. The major thrust, then, was on examining innovative ways to integrate technology into the classroom to support the efforts of students in acquiring and using transferable learning strategies.

The present instructional intervention was linked with the expository writing component of the 1998 English Language Arts (Grades 5-8) curriculum, the provincial standards test, and the mapping strategies outlined in the provincial *Success for All Learners* (1996) document. This teaching technique provided an opportunity to integrate curriculum and technology, to teach computer-based writing strategies and for the investigator, who was a reading resource teacher, to team with two classroom teachers. The intervention also offered a motivating teaching environment that encouraged students' active participation in the learning process.

Definition of Terms

Conceptual-Map A visual representation that makes thinking visible, and depicts important elements such as central purpose, main and supporting ideas and text organization (Lipson & Wixon, 1991).

Direct-Explicit Instruction Explicit instruction is intended as a framework for developing reading comprehension skills and strategies that students are capable of applying to other reading situations without teacher support. The features that constitute explicit instruction include modelling and demonstration, think-alouds, relevance, definition, guided practice, self-regulation and the gradual release of teacher responsibility (Pearson & Gallagher, 1983; Roehler & Duffy, 1989).

Exit Slip An exit slip provides learners with an opportunity to reflect on and verbalize their learning (reading, writing, content). It also provides the teacher with an informal assessment of what each student learned in a particular lesson and what needs to be re-taught and reviewed (Calkins, 1991; Hartse, Short, & Burke, 1988).

Expository Text A nonfiction text containing factual, conceptual and technical information. It usually involves unfamiliar content, a heavy concept load, complex syntax and a hierarchical pattern of main ideas (Calfee & Curley, 1984), the purpose of which is to provide information about a topic to the reader. In this study, expository text is used interchangeably with the terms informative text and content area text.

Gradual Release of Responsibility A concept used to denote the process by which students engage in activities that support their learning, and then gradually take over the process of becoming independent learners (Pearson & Gallagher, 1983).

Inspiration 5.0 A computer software program using mapping as a means of recording, organizing, manipulating and visualizing the connections between the ideas contained in written text (Inspiration Software, Inc., 1997).

Learning Strategy A technique that learners use to make sense of new material, organize it and connect it with their background knowledge or a tool by which learners process information.

Low Achievers/At-Risk Learners Referring to individuals or a group whose prospects for success are marginal or worse (at least 2 years behind their peers academically).

Main Idea/Gist/Macrostructure A main idea is a single summary statement containing a topic and a comment. The main idea consists of a summary of the explicit content of a text achieved by creating generalized statements that subsume specific information and then deleting redundant information (Cunningham & Moore, 1986).

Metacognition Metacognition refers to one's knowledge concerning one's own cognitive processes and products or anything related to them. It can be differentiated into metacognitive knowledge and metacognitive experience, as well as between metacognitive and cognitive strategies (Flavell, 1985; Garner, 1994). The term metacognition goes beyond the notion of *learning strategy* in that learners are consciously aware of and exert deliberate control over the strategies they employ to enhance their thinking and learning.

Rubrics Detailed descriptions of performance levels used in evaluating student achievement (Aker, 1995).

Scaffolding Instructional approaches or strategies that provide adjustable and temporary assistance or support to students in their achievement of a learning task (Vygotsky, 1978).

Overview of the Study

Instructional interventions are not developed in a theoretical vacuum (Reed, 1998). For the purposes of this study, the rich resource base regarding the reader's ability to process text, organize information as well as improve reading comprehension and writing ability were examined. The work of Alvermann and Boothby (1986), Anderson-Inman, et al. (1996), Armbruster, Anderson and Ostertag (1989), Berkowitz (1986), Brown and Day (1983), Englert and Hiebert (1984), Moore and Readence (1984), Rinehart, Stahl and Erickson (1986), and Taylor and Beach (1984) served as a basis for this classroom-based inquiry. More specifically, the conceptual-mapping procedure featured in this study has ties to theory and research related to social constructivism, text processing and organization, metacognition, the reading-writing connection, and strategy- and technology-based instruction as related to the content areas. These issues are addressed in Chapter Two.

The study documented the process whereby classroom teachers and resource staff worked in collaboration to guide students through a unique learning experience, using the computer as a tool for organizing thinking and writing. The instructional procedure was aimed at introducing technology to support the efforts of students in the acquisition and use of specific strategies when interacting with informative texts. The teachers modelled and scaffolded

instruction, as well as provided immediate, specific and corrective feedback. Chapter Three describes this methodology. Chapter Four documents results, and Chapter Five discusses findings and provides final conclusions, implications for instruction and recommendations for future research.

CHAPTER II

Review of the Literature

The following chapter presents a review of the literature as it pertains to this study. The empirical background combines theory and research from a number of social constructivist and information processing sources, describes a model of reading comprehension as related to content area instruction, and addresses the topics of text structure, metacognition, strategy-based instruction, the reading-writing connection, and the use of technology as a support for learning. Finally, connections are made between the theory and research cited and the present study.

Social Constructivism

Although cognitive science research has provided many insights into the processes and knowledge of expert readers, it never considered how such knowledge was actually acquired. The social-constructivist position, however, furnishes some answers by posing questions about literacy in relation to culture, context and authentic activity (Wertsch, 1985, 1991).

For philosopher D.C. Phillips (1995), partial explanations to the question of how knowledge is acquired can be found in reflecting upon three distinct aspects of constructivism. These include: the active learner (knowledge and understanding are actively acquired), the social learner (knowledge and understanding are socially constructed), and the creative learner (knowledge and understanding are created or recreated).

Knowledge is viewed as being socially constructed by a specific community. It is precisely this social element that distinguishes social

constructivism from cognitive science (Hiebert & Raphael, 1996). Social constructivism thus provides a lens that extends and magnifies our definitions of literacy, as well as our understanding of how literacy is acquired through social interaction.

Research on comprehension instruction and study strategies has also underscored the interactive nature of learning (Loranger, 1994). Much of this discussion is consistent with the tetrahedral model introduced by Jenkins (1979), that identifies four interacting variables that affect learning from text. They are: (1) the activities or strategies used by learners as they seek to master content such as summarizing, notetaking and outlining, (2) the characteristics of the learner including memory capacity and prior knowledge, (3) the nature of the material to be learned such as the way the text is organized and the conceptual difficulty, as well as (4) the criterial task used to assess learning, be it a recall, a simple recognition task or one that calls for transfer or problem solving (Loranger, 1979).

Given the emphasis on the central role of background knowledge, readers respond to texts in terms of prior experience, personal schemata and earlier literacy interactions. As such, the constructivist view of reading sees meaning as being built in the learner's mind through the dynamic interplay of the reader, and what the reader brings to the text in terms of background knowledge, the text and the reading context. According to Alexander (1997), reader prior knowledge depends upon the learner's age, sex, race, religion, nationality and occupation. She contends that students' knowledge and strategic processing can be modified through direct, explicit instruction or training. This instruction, however, must be linked to the individual's previous experiences.

Fogarty (1999) argues that constructivism reflects the legacies of such educational visionaries as John Dewey, Jean Piaget and Lev Vygotsky. These authorities view constructivism as having instructional implications because it helps explain how people learn, and embraces the notion of active, hands-on learning during which students are encouraged to think and to reason. Accordingly, teachers acknowledge the fundamental role that mental processing plays in cognitive growth when they listen to students' points of view, orchestrate lessons to challenge students' suppositions, recognize students' need for curricular relevance, plan lessons around major ideas, and assess student learning within the social context of the classroom (Brooks & Brooks, 1999). Thus, collaborative learning has become an instructional mainstay that provides for exploratory talk (Barnes, 1995), which is ultimately constructive.

In collaborative talk, students construct the meaning of content by interacting with their peers through speaking, listening, reading, writing, viewing and representing. In such a learning environment, they have the opportunity to articulate concepts and vocabulary, obtain feedback from peers, pose questions and become actively involved in their learning (Cooper, 1997).

Gardner (1991) believes that students' understanding is characterized by many gaps and a surplus of passive knowledge as a result of exposure to traditional, "broadcast" model teaching methods. Constructivists hold that the stimuli encountered are never logically sufficient to convey meaning. Information must be processed in some way. Therefore, constructivist learning is an intensely subjective, personal process. Incoming information demands constant, active modification by the individual in light of previous experience (Abbott & Ryan,1999) in order to make sense and construct new

knowledge. This type of active engagement in learning leads to better retention, understanding and spontaneous use of knowledge. But the social dimension of learning, in the form of social collaboration, is vital to the process.

Vygotsky is prominently associated with theory related to the role of social processing as a mechanism for learning (Palincsar, 1998). Many of the assumptions related to social-constructivism are rooted in Vygotsky's (1962; 1978) learning theory, and are therefore important as a frame of reference for this study.

Although, a multiplicity of ideas characterize Vygotsky's work, three inter-connected themes form the core of his theoretical framework and account for the interdependence between learning and development: (1) the notion that higher mental processes have their origins in social sources, (2) the claim that human action, both social and individual, is mediated by tools and signs, and (3) a reliance on a genetic or developmental model, which is linked to the idea that to meet the demands of the complex information age, society must cultivate higher-order thinking processes which include sustained attention, deliberate memory and symbolic thought rather than sensory motor thought. Vygotsky's ideas are reviewed next.

Social Origin of Higher Mental Processes

The first theme, the social origin of higher mental processes, represents one of Vygotsky's most important and unique contributions (Wertsch, 1985). In studying the learning process, Vygotsky considered the influence of both nature and the environment. He also emphasized the place of instruction and collaboration in the development of intelligence.

Vygotsky (1978) supposed that learning occurs first on the social plane where, through interactions and scaffolding by more knowledgeable

others, learners come to understand new concepts and strategies. Individuals eventually internalize and extend these concepts and strategies for use in other contexts.

Vygotsky also postulated that language plays an important role in the development of systematic thinking, and that intelligence and language follow different but related developmental routes. Language, a tool of immense power, ensures that linguistically created meanings are common, social meanings.

Vygotsky presumed that each child, in any domain, has an actual developmental level which can be assessed by testing, and an immediate potential for development within that domain. This difference between the two levels is known as the *zone of proximal development* (ZPD). The ZPD graphically illustrates the notion that what children can perform collaboratively or with assistance today, they can perform independently and competently tomorrow.

Vygotsky held, for example, that the most beneficial instruction goes beyond the child's developmental level and leads it by awakening "a whole series of functions that are in a stage of maturation" within the zone of proximal development (Newman & Holzman, 1993). The basis of proficient teaching, then, is a knowledge of children's readiness for instruction, a recognition of the most appropriate progressive steps to be taken, and a systematic approach to the development of students' individual potentials.

The most essential feature of Vygotsky's theory is the notion that developmental processes do not coincide with learning processes. Rather, the development process lags behind the learning process in such a way that initial mastery provides the basis for the subsequent development of more

sophisticated internal processes in thinking (Vygotsky, 1978). Although learning is directly related to the course of children's development, the two are never accomplished in equal measure or in a parallel fashion (Vygotsky, 1978).

The Concept of Mediation

The second theme states that human action, both social and individual, is mediated by tools and signs. The constructive principle of the higher functions lies outside the individual. Referring to the tools as instruments, Vygotsky (1978) wrote that "in the instrumental act, humans master themselves from the outside, through psychological tools" (p. 141). As such, these semiotic means both facilitate the co-construction of knowledge and are internalized to aid future independent problem-solving (Palincsar, 1998).

Psychological tools are internally oriented, transforming human abilities into increasingly more complex mental functions. Therefore, Vygotsky made a principal distinction between lower, natural mental functions (ex. perception, reactive attention, sensory motor thought), and the higher or cultural functions, which include concentration, deliberate memory and abstract thought which are important for academic learning (Kozulin, 1990; Werstch, 1985). As individuals perceive and interpret their environment, the lower functions do not disappear, but are structured and organized according to the social goals and codes of conduct of the culture (Vygotsky, 1978).

Genetic or Developmental Model

The third theme maintains that to adequately understand human cognitive development, one must first be aware of the natural history and cultural variability of the development of collective human thinking. Vygotsky viewed learning as largely a process of appropriating the social-historical experiences to which individuals of a given culture adhere. His analysis of

development, then, is based on a vision of psychology which is historically determined and culturally transmitted.

What distinguishes Vygotsky from other developmental theorists is his assumption that mental processes can be understood by considering how and where they occur in growth. Learning and development evolve in socially determined contexts, and are influenced by the interplay of individual, interpersonal and socio-cultural variables.

The essence of this orientation has an influence on evolving learning theories, which advocate that students must be actively engaged in constructing knowledge and mediating their learning. This participation may involve sharing ideas with others, discussing differences of opinion or collaboratively unravelling elaborate problems. Interactions, such as those found in many classroom settings, provide ideal mechanisms for enhancing higher-order thinking (Palincsar, 1998). The instructional intervention implemented in this study embodies this Vygotskian theory.

Information Processing

Historical Antecedents

Over the past several decades, psychological models of comprehension emphasized the study of both narrative and expository text processing. Although many of the earliest scientific investigations of the cognitive dimensions of reading and the comprehension of expository text began almost forty years ago, this line of inquiry remains in its infancy (Weaver & Kintsch, 1991). This study considers current models of expository text comprehension as they apply to processing curriculum-based content area materials. More precisely, the focus of this research is on the content contained in informative text.

According to Moore, Readence and Rickelman (1983), the predominant tradition in schools, prior to the 1900s, consisted of mental discipline and concentrated on imitation and rote learning. Later attention was turned to promoting memorization and elocution. At the turn of the century, however, new views emerged. Humanists emphasized reasoning and meaningful learning, developmentalists stressed individual growth, those with a scientific bent promoted efficient schooling through standardized testing, and reading educators recognized content area reading instruction as a specialty domain.

Although research in content area reading instruction blossomed during the first half of the 20th century, it began to wane because of the predominance of a reductionistic, behaviourist philosophy. Theorists continued to deal with learning from text, but few innovative theories or practices evolved.

According to the historical inquiry conducted by Moore and his colleagues (1983), today's emphasis on content area reading for middle and senior years children began in the 1940's and 1950's. During those two decades, the dominant form of reading instruction at the secondary level was the "pull-out" model of remedial reading (Alvermann & Boothby, 1986). Once educators realized the ineffectiveness of such programming for helping students transfer newly acquired reading skills, there was a movement towards teaching reading across disciplines (Strang, 1937). Every teacher, it was decreed, was a teacher of reading. Science and social studies teachers were to support text processing as well as teach content.

By the 1970s, a resurgence of interest in content area reading instruction coincided with a dramatic paradigm shift within the psycholinguistic and cognitive psychology communities. Also reshaping the thinking of the

day was the first edition of Herber's book *Teaching Reading in the Content Areas* (1978) and Durkin's (1977) widely read study which concluded that educators were not *teaching*, but rather *testing* reading comprehension using the restricted approach of only posing specific short answer questions after reading (Irvin, 1997). Others have argued that the lack of attention to teaching reading in content area subjects has contributed to the literacy crisis within present day schools (Manzo, 1991). This study considers these historical antecedents as a foundation for creating the intervention procedures.

Research in Metacognition

Garner (1987; 1994) describes metacognition as an awareness of one's own activities while reading, solving problems or studying. This cognitive process involves knowing *that* comprehension is occurring (declarative knowledge), knowing *how* to repair comprehension failure (procedural knowledge), and knowing *why* and *when* to apply strategies (conditional knowledge). Metacognitive knowledge can be automatically activated, remains relatively stable, is highly interactive, and involves knowledge about ourselves as learners, the tasks we face, and the strategies we use before, during and after a learning activity.

Metacognition is at work when students understand or do not understand what they are reading, and respond accordingly. When students become aware of their thinking and comprehension, they can consciously try different "fix-up" strategies when comprehension is interrupted, and in so doing, are more likely to become competent, autonomous learners.

Many educators accept that metacognitive and cognitive strategies can be deployed to remedy or assess perceived cognitive difficulty. The effectiveness and efficiency of the strategies used in achieving the desired

outcome are determined by learners' control over their own cognition and their motivation.

Therefore, use of text structure schemata in any of these areas involves strategic metacognitive activity. Once the manipulation of these schemata reaches a metacognitive level, the strategies appear to be generalizable from one context to another (Randolphe-Moore, 1995).

This study considers the role of strategic metacognitive activity when students read content area materials.

Strategy-Based Instruction

One explicit instructional approach that promotes improved academic performance is strategy-based instruction. Based on their background in reading skills, instruction, metacognition and learners' cognitive development within social contexts, Paris Lipson and Wixon (1994) see strategies as deliberate, preplanned actions, at the core of which is metacognition. Again, the criticality of metacognitive knowledge about specific strategies is particularly important for the adequate transfer of skills to occur (Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989).

Justification for implementing this form of instruction is also specified in the recent literature pertaining to human information processing. If we consider the limits of our working memory, the need for practice, and the importance of continuing until students are fluent, we realize that learners need opportunities to process unfamiliar concepts in order to transfer and apply them in novel situations (Rosenshine, 1986).

Within this vision of instruction, there is an emphasis on frequent modelling and re-teaching, guided practice and scripting of lessons

(Ciborowski, 1995; Ellis, 1993; Hiebert & Raphael, 1996; Pressley, El-Dinary, Gaskins, Schuder, Bergman, Almasi, & Brown, 1992; Swanson, 1989). Unquestionably, learning strategies are more likely to be used by students when instruction explicitly demonstrates that the use of the strategy has a positive effect on learning. Hence, if students are to employ strategies consistently and skillfully, they must know the value of procedures, as well as specific information as to why, when and under what circumstances each strategy should be used (Pressley, et al., 1989). This understanding plays an absolutely essential role in the autonomous use of strategies.

Clearly, strategy instruction is more than simply remediation (Pressley et al., 1989). This methodology requires the instructor to employ specific instructional techniques that will draw students into a more strategic and participatory role in the classroom (Ciborowski, 1995). Strategy instruction is scaffolded in the Vygotskian sense, and is responsive to the learning demands and opportunities of the moment.

Knowledge acquisition is best achieved when the learner is guided and supported by a more knowledgeable other. Thus, scaffolded instruction is a shared process involving teacher modelling and direction, so that new concepts can be socially transferred (Kozulin, 1990; Vygotsky, 1978). Throughout the instructional sequence, the teacher fades input at a pace permitting competent performance by the student (Pressley & Harris, 1990). According to Pressley et al. (1989), theoretically-derived strategy instruction such as this is more typical of elementary education settings.

There are three necessary ingredients in order for strategic behaviour to occur: a capable agent, an attainable goal, and an allowable action that the agent can perform to reach the desired outcome. Strategic learning is built on

both development and instruction, and the notion that "schooling and development are intertwined in children's acquisition of strategic behaviour" (Paris, Lipson, & Wixon, 1994, p. 789).

Paris, Lipson and Wixon (1994) further deduce that "the major distinction between experts and novices in any domain is self-controlled strategic behaviour..." (p. 789). Strategic readers and writers, then, understand how different goals and various types of texts require particular strategies, discriminate between reading to study for a test and reading for pleasure, possess positive attitudes towards reading and writing, and monitor comprehension.

The strategic student accesses applicable strategies for each learning situation. In other words, by evaluating declarative, procedural, and conditional knowledge, selecting relevant actions to attain certain goals, adjusting actions recursively to correspond with changing conditions, and managing available resources, the learner is able to respond more appropriately to separate learning challenges. Also important is the fact that successful execution of these strategies necessitates both cognitive skill and motivational will, so that one is better prepared to become a skilled reader, independent thinker, and enthusiastic learner (Paris, Lipson, & Wixon, 1994).

Ideally, the classroom is characterized by teachers and students jointly constructing and reconstructing meaning from text, direct instruction, demonstration and practice of the strategies during each lesson, ties between previously learned strategies, as well as frequent discussions about the use of strategies and how they are related to the content (Moss, Leone, & Dipillo, 1997). Within such a context, commitment to reading as well as improved academic performance and self-confidence are possible (McGee & Richgels, 1985; Pressley et al., 1992).

In order to encourage generalized strategy use, all models of instruction advocate teaching a few strategies at a time and teaching them well (Pressley et al., 1989). This is best accomplished when strategies are rehearsed and mastered as students work through the curriculum, and when instruction involves ongoing supervised practice and feedback from teachers (Irwin, 1997; Dole, Brown, & Trathen, 1996).

This is particularly essential for students who are weak readers. Often they are not prepared to begin reading from their textbooks, and tend not to possess the necessary repertoire of reading techniques for efficient comprehension (Ciborowski, 1995). The less strategic learner often lacks adequate background knowledge, and thus has difficulty setting goals in terms of intended audience, generating sufficient appropriate content, and organizing written material carefully (Flower & Hayes, 1981). As a result, instruction must help learners incorporate and activate their prior knowledge, so that meaningful connections can be conceived, and accurate written products can be generated (Ciborowski, 1995).

In sum, training studies indicate that teaching needs to be explicit, intensive and extensive. Teachers must provide reinforcement, feedback and thorough explanations about the rationale for application. In particular, explanations should be retailored to fit individual students' difficulties, and instruction should continue until mastery. The importance of explaining the value of strategies and under what circumstances each strategy might be accessed cannot be overstated. Teachers expect transfer and general use of strategies that are taught, with the goal being for students to use the strategies autonomously and competently (Pressley et al., 1989).

Summarization. Although many reading comprehension strategies have been proposed, only some have proven effective in practice (D'Angelo-Bromley, 1985; Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989). For example, there are data substantiating the benefits of the summarization strategy as a means to improve reading comprehension, and as a technique for comprehension-monitoring (Belanger, 1987; Brown & Day, 1983; Brown, Day & Jones, 1983; Kintsch & van Dijk, 1978). Not only does summarizing encourage processing that is mature and sophisticated (Pressley, et al., 1989; Pressley & Harris, 1990), there is also evidence to suggest that summarizing fosters the development of cognitive skills and their general application (Duffy, 1993).

Investigators report that, compared to those engaged in more passive forms of studying, when trainees are actively involved in generating summaries of what they read, their comprehension, recall and writing ability are significantly improved (Armbruster, Anderson & Ostertag, 1989; Berkowitz, 1986; McGee, 1982; Moore & Readence, 1984; Rinehart, Stahl & Erikson, 1986; Taylor & Beach, 1984). In fact, the research data in favour of developing text summaries as a strategy to facilitate comprehension and memory are so significant that summarizing has been consistently recommended without hesitation (Pressley et al., 1989).

The most theoretically well-grounded approach to summarization is based on the rules that Kintsch and van Dijk (1978) hypothesized to be the framework with which mature readers can successfully construct summaries. Kintsch and van Dijk's (1978) model of reading comprehension offers an explanation for the strategies readers employ in constructing main ideas. They assume: (1) readers are strategic at arriving at a representation of the text, (2) the processes are automatic, (3) the model is interactive in nature, and (4) readers bring their prior knowledge and experience to the reading act.

In this way, readers construct their own meaning for the text.

For individuals to correctly summarize a text requires them to allocate attention to the major content, and to monitor for understanding (Brown & Day, 1983). An unmistakable indication that comprehension is impaired is when the learner cannot formulate an adequate synopsis of what has been read (Palincsar & Brown, 1984).

Although it is also true that many young children understand the essential features of a summary (Brown, Day, & Jones, 1983), maintenance over time and generalization across settings and within conceptual domains are uncommon (Palincsar & Brown, 1984). According to Fogarty, Perkins and Barell (1992), more deliberate transfer tends not to occur unless the learning experience includes opportunities for students to be thoughtful, to seek generalizations, to apply prior knowledge, to monitor their thinking, and to be metacognitively aware of their personal learning style. Another plausible reason for this inconsistent transfer may be the general diagnosis of the child as a relatively passive participant who responds to instruction, but has not fully integrated the purpose of the tasks.

Some of the most important research efforts on summarization of more sophisticated texts have been spearheaded by Barbara Taylor and her associates (1984). They describe significant changes on both reading and writing measures following the teaching of a hierarchical summary procedure to middle years social studies students.

Students were taught to use text headings, subheadings, and paragraphs to develop an outline of the text. Subjects then learned to generate main idea statements for every paragraph, subsection, and section

of text. Students also developed topic headings to connect the different textual components. Students received instruction on how to generate a key idea, to summarize the entire passage, to study by reviewing their summaries, and to determine text structure when reading unfamiliar passages. The group that wrote summaries scored better than a control group on tests of reading for both familiar and unfamiliar passages. Training in using text structure for writing expository text resulted in more intelligible prose, and improved the ability to recall information after reading. Taylor's trained students were more proficient at remembering newly acquired expository materials than untrained students. Guthrie, Britten and Barker (1991) add that readers and writers benefit from an awareness of text structure. They are better able to identify relevant information, and to participate as writers of various genres.

Also noteworthy is that studies that have reported significant results on writing measures have normally included direct instruction in reading and writing (Belanger, 1987). Rinehart, Stahl, and Erickson (1986), for example, developed instruction aimed at helping grade school children understand the structure of summaries that included main ideas and key supporting details. Grade six students received direct instruction about the rules for creating summaries that were modelled on Kintsch and van Dijk's (1978) and Taylor's (1984) earlier work. Again, there were positive effects in terms of the students' ability to organize and recall information. Further, even though writing was not the focus of instruction, writing quality improved.

Other studies have included instruction in summarization rules and spatial outlining or mapping. For instance, Berkowitz (1986) showed grade six students how to construct maps of passages. Students were instructed to write the title of the passage in the center of a plain sheet of paper. They then surveyed the text for four to six main ideas. Students paraphrased

these ideas around the title. Afterwards, students found two to four important details in the passage that were associated with each main idea. These were summarized briefly, and written under the main idea. A box was drawn around each main idea and its supporting details. Students were then taught to use the graphic summary to self-test until they could recite the main ideas in order, along with their supporting details. Overall recall of passages was improved as a result of using the graphic summarizing procedure.

Armbruster, Anderson, and Ostertag (1987) introduced grade five students to the problem/solution structure that is typically featured in many social studies passages. Students practised using this structure to organize their summaries. As in the other studies of summarization training, students recalled more of the text when they used this strategy.

The consistency of the outcomes disclosed in many summarization studies is striking. Two types of memory measures are usually used: free recall of passages following a general question, and answering specific short answer or multiple-choice comprehension questions. Summarization training promotes better performance on both types of measures relative to control groups that receive no training, with moderate gains on the average (Taylor & Beach, 1984).

As Taylor discovered in her 1982 study, not all students were able to learn the summarization strategy to mastery levels. Students who had not consolidated the strategy showed little evidence of improvement. Taylor concluded that teachers need to monitor students' progress in acquiring the strategy. Berkowitz (1986) also established that there were minimal effects when prepared summaries were given to students. Hence, successful summarization instruction seems to depend on students' active involvement

in text processing and the generation of summaries (Pressley et al., 1989).

Conceptual-mapping. The use of mapping as a tool to sort information gives the learner a practical means to actively process data (McTighe & Lymans, 1988). Strategies such as webs, semantic feature analyses, structured overviews, cognitive or conceptual-maps, and other visual organizers can assist students in arranging their thoughts and thereby enhance comprehension (Irvin, 1997). Likewise, cognitive maps provide a visual, holistic representation of facts or concepts, and their relationships within an organized framework (McTighe & Lyman, 1988). This helps students to represent abstract or implicit information in a more concrete form, depict the relationships among facts and concepts, generate and elaborate ideas, compare the new to the known, as well as store and retrieve information (Armbruster and Andersen, 1980).

McTighe and Lyman (1988) further postulate that these graphic representations are effective instructional instruments because they provide an aid to memory and a common frame of reference, achieved through a type of "mental templating". In this way, maps act as organizers to review important concepts and ideas in text, highlight relevant associations between ideas, and thus aid and consolidate student learning.

Maps can be particularly efficacious because they help readers focus on what is salient in the text by sensitizing students to the main ideas (Ciborowski, 1995). Because mapping actively involves learners in the reading-thinking process, it improves students' comprehension and recall of text material, develops their reading and thinking skills, and can be used as a teaching device that permits dynamic interaction through discussion (Davidson, 1982). This study considers how such strategies can assist

learners in understanding text structure and construct meaning.

Research in Text Structure and Comprehension

Instructional research validates students' knowledge of text structures as one important step toward understanding its role in facilitating comprehension. Hiebert and Raphael (1996) submit that our understanding has evolved as different theoretical perspectives have been popularized within the discipline. Behavioural science, for example, characterized literacy as an observable product, in which the learner's objective was to recognize and remember print information. Cognitive theorists shifted this emphasis from decoding words and studying what was observable to examining narrative and expository texts, and the underlying mechanisms of successful reading and comprehension.

The evolution of perspectives on text structure has spurred a number of important advances in reading, in the areas of cognitive science and strategic teaching. Consequently, many educators have begun to rethink the prevailing constructs that surround reading comprehension instruction, and how these constructs affect both our teaching practices and student learning (Dole, Duffy, Roehler, & Pearson, 1991).

What educators discovered was that effective comprehension requires a balanced allotment of limited attentional resources (Weaver & Kintsch, 1991). Discourse comprehension requires not only a repertoire of processing strategies at the perceptual, linguistic and discourse levels, but also specific knowledge related to text content. While all discourse theories contend that understanding is difficult without a considerable amount of knowledge activation, how this occurs is a matter of dispute (Weaver & Kintsch, 1991). Many experts have focused on the role of text structure in

knowledge construction.

All cognitive psychologists who identified with the information-processing framework made basic assumptions about the biological underpinnings of mental functioning (Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989). Our awareness of the role of text structure in processing expository writing continues to be heightened (Randolphe-Moore, 1995) as a result of numerous investigations.

Studies by McGee and Richgels (1985) and Gordon (1990) have looked at instructional factors, which appear instrumental in further developing student awareness of text structure in order to optimize processing abilities. The most significant body of research around the nature of text has centred on describing the structure or organizational patterns (Hiebert & Raphael, 1996). To gain a more thorough understanding of how text works, scholars began identifying the broad macrostructure that characterizes narrative and expository text forms, identifying factors that contribute to text coherence, and finding clues that make text more memorable.

Although most of the preliminary work in this area looked at narratives (Mandler & Johnson, 1977), similar research was conducted on the structure of expository text (Kintsch & van Dijk, 1978; Meyer & Rice, 1984). Like narratives, research on expository text has emphasized the identification of the elements of structure. Expository text structure refers to the patterns an author employs to represent ideas and achieve a particular purpose (Piccolo, 1987). This structure binds a text's segments together and gives it form (Meyer, 1985). These relationships are known as a text's top-level structures (Meyer, 1985).

Meyer (1985) delineated a number of organizational patterns common to content area text. Some examples are: (1) sequential, (2) enumeration, and (3) compare and contrast. These structures are signalled to the reader by various semantic and syntactic techniques, which inform the reader that the author has used a distinct pattern (Armbruster & Anderson, 1980; Meyer, 1985; Piccolo, 1987).

In scrutinizing the nature of text and the organizational factors that affect the ability to understand and remember, experts presented two theories. First, ideas higher in the structural hierarchy are remembered more readily (Meyer, 1985) and second, readers form a gist for the ideas by connecting what they are reading with what they already know, and reducing the text to its essence by discarding irrelevant and redundant information as they proceed (Kintsch, 1994).

Pearson and Camperell (1994) further stipulated that perceiving the organization of a text is an effective reading strategy, since the knowledge of how ideas can be held together to form a logical whole enables the learner to understand, and later recall details more effectively. Therefore, it follows that readers who are knowledgeable about the text structure have an advantage in comprehension and in remembering over those who are unaware of text organization. Story grammars and advance organizers (Mandler & Johnson, 1977), for example, assist learners in developing a schema for the way the text is organized, and provide a transferable framework for storing and retrieving textually presented information.

Meyer (1985) approached the study of prose with an interest in what makes some components in text more memorable than others. She weighed the relative impact of text structure, serial position of information, and

the relative importance of the ideas as measured by readers' ratings. Her findings revealed that structure was the variable that most influenced memory.

Once the organization patterns of informative text were identified, instructional research was designed to present these text structures to students and to create strategies for successfully implementing this knowledge to enhance comprehension and recall (Raphael et al., 1989). Usually readers and writers benefit from an awareness of text structures. They are better able to identify relevant information, to understand and to store and retrieve information (Gagne, 1978; Meyer, 1985; Raphael, Englert, & Kirschner, 1989; Reder, 1980). They use rhetorical text structure schemata to chunk large blocks of arbitrary information and distinguish main ideas as a means either to facilitate or to plan the production of discourse (Herber, 1978; Kintsch, 1990; McGee, 1982; Taylor, 1982). In theory, the schemata serve as "velcro" to which categories of information are attached (Randolphe-Moore, 1995).

Examination of the organization of students' recall protocols indicates that good comprehenders use the author's top-level structure to store text in memory (Meyer, Brandt, & Bluth, 1980; Taylor, 1982). In addition, their recall protocols tend to be written in accordance with the author's top-level structure, while those who do not use text structure schemata generally produce protocols lacking clarity or main ideas (Taylor & Beach, 1984). Hence, in the production of text, text structure schemata allow the writer to design a "blueprint" for the construction of a unified text, which conveys the intended message (Randolphe-Moore, 1995).

Several investigators have concluded that comprehension and recall are enhanced when students: (1) understand different text structures (Armbruster, Anderson, & Ostertag, 1989; Herber, 1978; Meyer, Brandt, &

Bluth, 1980; Taylor & Beach, 1984), (2) possess strategies for creating plans (for example, identifying audience, purpose, main ideas), (3) use text organization and text signals throughout the writing process, and (4) have self-regulatory abilities to direct reading and writing (Englert & Hiebert, 1984; McGee, 1982; Meyer, 1985). Thus, teaching children common expository text structures (McGee & Richgels, 1985), and how to create visual representations of these structures (Armbruster & Anderson, 1980) is very effective.

Other studies based on schema theory have demonstrated that the structure of text and how adeptly readers recognize that structure affect the amount of information that will likely be retained (McGee & Richgels, 1985). Investigators have decisively confirmed students' knowledge of text organization as one critical step towards understanding the role of structure in the comprehension of expository writing (Hiebert & Raphael, 1996; McGee, 1982; McGee, 1985). Gordon (1990) speculated that students who used text structure in forming a gist when reading had a better understanding of the need to insert it into their individual writing. It appears good readers use top-level structure to frame their writing, while weak readers fail to use any discernible organizing structure when they write (Crowhurst, 1991).

In terms of comprehension, teachers must examine texts from the perspective of students' knowledge and cultural backgrounds to become cognizant of the linkages that learners might formulate between text ideas and the schema they bring to the reading task. This awareness enables teachers to anticipate the connections that students are likely to make between ideas in the text and their personal schema. In general, including knowledge-building in instruction, presenting learning projects that accelerate the integration of information, and developing text structures that assist students to cope with new academic materials remain important components of any successful

classroom program.

This study addresses the issue of content instruction by modelling the processing of informative text.

Instructional Implications

The reading-writing connection. Early in the century, behavioural specialists were concerned with textbooks, readability formulas, and applying Skinner's (1954) principles of operant conditioning to the learning environment. In contrast, cognitive scientists attempted to explain the nature of text (Meyer, 1985), students' metacognitive knowledge related to text (Flower & Hayes, 1994), and factors that contributed to readers' and writers' ease or difficulty in processing information (Armbruster & Anderson, 1980).

The literature substantiates that weak writers tend to lack ability in using text structures to produce well organized expository writing (Englert, & Hiebert, 1984; Moss, Leone, & Dipillo, 1997). Instead of targeting logical relationships, as proficient writers do, weak writers are more concerned with external standards such as appearance and length (Taylor & Beach, 1984). Not having schemata for text structures seems to result in a type of "cognitive overload", making the production of cohesive text problematic (Randolphe-Moore, 1995).

Another dilemma for weak readers and writers is the ambiguous and unorganized nature of some writing found in content area textbooks. Moss, Leone and Dipillo (1997) suggest that many textbooks provide students with less-than-excellent models of expository writing. But by integrating reading and writing, students' comprehension of content area textbooks and their consequent development as competent readers and writers are

facilitated (D'Angelo-Bromley, 1985).

In an attempt to gain a deeper understanding of children's learning processes, some studies have focused on identifying the underlying components shared by these two interrelated psychological processes (Belanger, 1987; Randolph Moore, 1995). Perhaps the foremost component is that language is basic to reading and writing and that both draw upon common cognitive phenomena to construct meaning (Flood & Lapp, 1988; Squire, 1983; Kintsch & van Dijk, 1978).

While research exploring the reading-writing connection is limited, correlations between reading achievement and writing proficiency are considered to be well established in a broad range of investigations, featuring different subjects, measures and treatments (Belanger, 1987). These data give further credence to the common observation that able readers are usually skilled writers, while those who have difficulty with one, often face problems with the other. Other surveys of the literature by Moore (1995), Randolphe-Moore (1995), and Stotsky (1983) also reveal that better writers tend to be better readers, that better writers read more than weaker writers, and that better readers produce syntactically more complex writing than weaker readers.

Other empirical inquiries exploring the relationship between good and weak readers and writers and their use of top-level structures have found patterns that reflect the reading-writing connection in general (Randolphe-Moore, 1995). McGee (1982) demonstrated that better comprehenders recognized structure while reading, and reproduced structure in their own writing. Belanger (1987) illustrated that the study of syntax and paragraph structure and the organization of expository writing has consistently produced meaningful gains on reading measures. Stotsky (1984) contended that

almost all the studies involving writing activities designed specifically to ameliorate reading comprehension or the retention of information resulted in substantial gains in both comprehension and recall. This has led to the hypothesis that interventions involving both reading and writing are undoubtedly beneficial for improving student academic performance (Randolphe-Moore, 1995).

Literacy experts have not yet been able to fully explain how teachers can best promote reading and writing development, while simultaneously exploiting this complex relationship. Research has shown, however, that writing cultivates understanding and retention of text material, and orientates learners to some of the organizational features used by authors to share information (Cudd & Roberts, 1989; Harper, 1989). Writing also augments content learning if student attention is focused on important text information (D'Angelo-Bromley, 1985). Both recent theory and research indicate that the concurrent development of these skills also extends factual or conceptual learning (Irwin, 1977; Stotsky, 1983).

Among the numerous empirical studies, the most promising reading and writing treatments have been those which have taught prose structure directly through sentence and paragraph analysis, story schemata, and hierarchical summaries (Belanger, 1987). The study of structure enables students to improve their understanding of what they read, and assist them in presenting their own ideas. As outlined earlier, studies by Taylor and Beach (1984) also corroborate the notion of teaching prose structure and story schemata to improve both reading and writing ability, while others report similar findings when average students in the upper elementary are shown how to write outlines and summaries of content area materials (D'Angelo-Bromley, 1985).

Research on technology-supported instruction. weak information-processing skills are frequently associated with learning delays and academic difficulties (Perkins, 1985). When composing, many students are unable to manipulate the complex cognitive resources needed to set writing goals, formulate content, arrange ideas or evaluate and revise their work (MacArthur, 1996). This reality has led to the creation of various instructional applications that use technology to boost student achievement (Lajoie, 1993; Salomon, Perkins, & Globerson, 1991).

In the current vernacular, the computer can be considered as a "cognitive tool" (Lajoie, 1993; Perkins, 1985; Salomon, Perkins, & Globerson, 1991). Recent research has assessed the effects of instruction and practice on the use of computer-generated maps as a means of processing text, organizing information for study and improving students' writing and comprehension of content area print materials.

Although many options have been tested, the literature proves that three computer-related activities have been effective for student learning and academic growth (Anderson-Inman, 1996). These are real-time note taking, synthesizing materials (mapping), and developing strategies for studying textbooks.

Data from a series of studies indicate that computer-based outlining and mapping programs can be useful tools for improving text comprehension of average and below-average students (Anderson-Inman, Redekopp, & Adams, 1992). Furthermore, there is preliminary evidence that using computer-based outlining programs as study aids is effective in improving the test scores of at risk students (Adams, 1990; Adams & Anderson-Inman, 1991, cited in Anderson-Inman et al., 1996).

The explorations conducted by Anderson-Inman, Knox-Quinn and Horney (1996) specify a number of projects that have used technology as an additional support to expand the repertoire of learning strategies available to at-risk students. In one study, Anderson-Inman and her colleagues (1996) taught students a four-step procedure for synthesizing material using outlining software. Students listed major headings, read and inserted information, restructured their work by incorporating additional subheadings, and rearranged ideas to fit the revised structure. This process facilitated and accelerated student learning, enhanced academic performance, and reduced learner anxiety.

Observations of teachers who have integrated computer-based outlining and mapping into their curriculum imply that the programs are easily initiated and widely effective across varying conditions (Anderson-Inman, 1992). The software has also been shown to have the potential to support students' planning processes, and facilitate their access to prior knowledge (MacArthur, 1996).

In other investigations, Anderson-Inman (1996) reported that students in a high school science class were successful in learning to use a computer-based concept-mapping program as a vehicle to synthesize information across seven days of reading and lectures. As evidenced by performance on curriculum-embedded quizzes, the more complex their maps, the more students learned. In another study, impressive results were also obtained when secondary students were given access to lap-top computers to facilitate the recording, organization, and manipulation of content area subject matter (Anderson-Inman et al.,1996).

For the purposes of this study, one computer program (*Inspiration 5.0, 1997)* is examined as a means to assist students in recording, synthesizing and understanding the inter-relationship of ideas contained in informative text.

Relationship to the Study

The theoretical background for the present study draws from the work of a number of literacy theoreticians and practitioners. The empirical theories underpinning social constructivism and the model of information processing and its relationship to content area instruction, text structure, metacognition, as well as information related to the reading-writing connection, and strategy- and technology-based instruction all provide the foundation for this study. The main tenets of this research are highlighted as they pertain to the question of how to implement a conceptual-mapping intervention as a means of assisting learners to process, record, organize, manipulate, and visualize the inter-relationships of ideas contained in content area texts.

Rather than teaching skills in isolation in the form of "pull-out" programming, the intervention in this study stresses the importance of teaching reading and writing within the content area classroom. This increases the possibility that transfer of newly acquired skills will occur.

This study attempts to capitalize on the interactive nature of learning. Based on their prior knowledge of the topic as well as their knowledge of text structure, learners create a schema that facilitates both learning and recall of text content. A further premise is that students' knowledge and strategic processing can be modified through direct, explicit instruction or training. As such, the intervention includes knowledge-building and direct, explicit

instruction that allows children to integrate and transfer information more efficiently.

This instructional approach acknowledges the importance of students' awareness of their own strategies, alternative methods, and techniques for self-monitoring as a means of improving comprehension performance. It also includes prereading activities, guided practice, post reading, modelling and demonstration, in-depth explicit explanations, as well as coaching and feedback to promote the intended metacognitive behaviours.

We are cognizant of the importance of text structure in determining what readers will learn, understand and retain. We consider the notion that graphic organizers or maps aid recall when readers engage in rearranging information, as well as help students recognize and use the author's top-level structure (Alvermann, 1981).

In terms of the connection of reading and writing to this study, we have considered that writing facilitates the understanding and retention of text material and enhances content learning. We also are aware that interventions involving both reading and writing can be significant in fostering metacognitive development.

This instructional intervention supports the learner's active participation and engagement through the use of scaffolded instruction. This strategy-based approach can also be applied fluidly and adaptively as needed.

The present study represents an adaptation of investigations that have shown much promise. It is based on research that surrounds the pedagogy of students' ability to read, organize and write informational text. The focus is on using computer-generated mapping to tease out key

information in text, and to organize it into coherent, tightly structured written summaries. Technology is used to support the efforts of students to acquire and apply learning strategies when interacting with informative texts.

CHAPTER III

Research Methodology

This research investigated and evaluated the extent to which computer-based learning strategies improved students' ability to process text, organize information, enhance comprehension for content area texts, and strengthen the quality of informative writing. The study involved one class of sixth grade French Immersion students and their two classroom teachers at one school.

The division had already committed to the integration of technology across the curriculum for instructional purposes. It had invested in the appropriate hardware and software to support this study, and was prepared to develop the computer literacy skills of the staff who were interested in exploring this question of whether the use of computer-based conceptual-mapping would have a positive effect on students' ability to read, organize and write informational text. More specifically, this study investigated how well students learned to recognize and follow the structure in a text, record notes within the context of a computer-generated frame or map and write a cohesive, organized summary to reflect the important content.

During the planning phase, the two classroom teachers, the investigator, and the Coordinator of Media Services and Gifted Education met several times to brainstorm how best to conduct the study. The divisional Computer Coordinator also assisted on a consultative basis. During this period, teachers learned the technology, formulated a feasible time line, selected curricular learning materials, organized student groups, created lessons, as well as devised and implemented plans for lessons.

The principal investigator organized, implemented and assessed all aspects of the study. There were a number of tasks including: obtaining consent from the school division, principal, teachers and parents, writing a funding proposal to cover the cost of the additional software, consulting with divisional representatives, facilitating orientations for teachers, students and parents (power point presentation), working in collaboration with teachers in locating instructional materials and selections for pre- post- and delayed post-testing, organizing the timetable, creating conceptual-mapping templates and scoring rubrics, teaching students, providing feedback on their work, assisting the library technician in preparing the computer lab, as well as gathering, synthesizing and analyzing both the quantitative and qualitative data.

The actual instructional intervention began during the first week of February, 1999 and continued for two periods a six-day cycle for eleven sessions, ending the third week in March. The pre-test was administered in January, prior to the intervention. The post-test was administered in late March following the intervention. The delayed-post test was administered eight weeks later. Ongoing data collection included: (1) taking field notes to document feedback from teachers describing instructional efforts, technical needs, student activities, concerns, and recommendations for improvement, as well as (2) recording teacher observations and data from teacher interviews (Appendix A), and (3) analyzing student exit slip responses (Appendix B) and the conceptual-maps and written summaries.

Setting

The dual track elementary school in which the study took place was located in an urban community. The school population was predominantly middle class, stable and served approximately 350 students in kindergarten

through to grade six. The school was staffed by twenty teachers and four teaching assistants. About 10% of the population received some form of additional support services, and 1% of these students were identified as children with special needs. The school had adopted an inclusion model for students, meaning that all children attended regular education classes most of the day, with some students receiving individualized or small group resource or counselling "pull-out" programming as needed.

Participants

As anticipated, all 21 students in one grade six French immersion class participated in the study. Students were organized into groups of two. The class was comprised of 6 boys and 15 girls. As stated earlier, the investigator facilitated a brief orientation for parents and students, after which permission to participate was obtained from all interested parents (Appendix C).

Upon completion of the study, parents had an opportunity to use the technology at the end of March, 1999, with their child acting as teacher. Permission was also obtained from the classroom teachers, in order to use their observations and interview responses as part of the data gathered over the course of this study (Appendix D). These two teachers were employed part-time in a job share situation.

Materials

Instructional materials. A series of 600-700 word passages, approximately a page and a half in length, taken from a variety of grade six level content area materials (textbooks, videos, newspapers, magazines),

were read during the instructional and measurement phases of the study. The teachers helped select reading material on subject matter not yet covered in class. Text readings consisted of running text and were written in both French and English. Newspaper articles and videos were presented in English only.

Measures. To assess the pre-post treatment gains, as well as transfer effects of the instructional intervention, students: (1) read three different passages (Appendix E), one before, one immediately after and one after an eight week delay, (2) generated a paper-pencil map of the passage ideas, and (3) wrote a summary. For each passage, conceptual-maps were rated against teacher-created templates (Appendix F) by counting the number of superordinate and subordinate ideas contained in the maps. Points were given for all relevant ideas presented. A refined version of the scoring rubric (Appendix G) provided in the *Grade 6 English Language Arts, English, LA-Immersion and Anglais Standards Test Information Bulletin* (Manitoba Education and Training, 1998) was used to rate the protocols for content and form/organization. Summaries were scored out of a possible eight points. All computer-created products obtained from students during the intervention were assessed in this way, in order to provide immediate feedback to both students and instructors in regard to the efficacy of the instruction and the mapping procedures.

Throughout the study, investigator field notes, student exit slip responses, teacher reflections and data from teacher interviews were accumulated. As previously stated, the conceptual-maps and written summaries were scored using specific procedures and instruments. Eight weeks after the intervention, student products for the delayed post-test in May, 1999 were evaluated following the same process.

Instructional Procedures

As indicated, the investigator, the divisional representatives, and the two classroom teachers worked together to develop a suitable implementation plan that coincided with the school timetable and availability of part-time personnel. This planning took into consideration the following features: (1) existing procedures for developing computer literacy skills, (2) the six-day cycle timetable, (3) curriculum expectations and outcomes outlined by the Department of Education, (4) the writing component of the provincial ELA curriculum and examination, (5) student characteristics, (6) the investigator's and teachers' work schedules, (7) the staff's existing technological skills, (8) the strategies highlighted in the *Success for All Learners* (1996) document, and (9) the distribution of existing technology resources. As anticipated, these initial implementation plans were refined over time as the study proceeded, and modifications were initiated as data and feedback became available.

All participating students were scheduled in the computer lab during their assigned computer periods on Days two and five in February and March, 1999. This enabled the investigator and teachers to provide direct instruction to students as a group, and support students' use of the conceptual-mapping strategies.

Instruction in the technology was coordinated with teachers' expectations, student needs, and the content area assignments. The focus was on using computer-generated mapping to tease out the important ideas in a text and to organize the ideas into a coherent, complete written summary. Instruction was ongoing with the gradual release of responsibility (Pearson & Gallagher, 1983) from teachers to students as they progressed towards

consolidation and independent application of the technology in creating conceptual-mapping diagrams and outlines of their content area passage information.

The Intervention

Students may experience difficulty when reading and extracting important facts from text, recording salient information that facilitates retrieval, and synthesizing this information into an original document that illustrates understanding. To help students accomplish these ends, the investigator and teachers used conceptual-mapping as a vehicle for recording and integrating information. Students learned to: (1) create topical conceptual-maps, (2) read and insert information into their maps, and (3) organize the information into conceptual units within maps and linear outlines. In other words, students were taught a number of procedures involved in conceptual-mapping, that were applicable to learning and writing content area material. The procedures included many adjustments to accommodate the realities related to time constraints and the availability of the computer lab and the software.

The training procedures were based on many of those already described in the literature (Anderson-Inman, 1992; Anderson-Inman & Zeitz, 1994; Horney, Zeitz, & Anderson-Inman, 1991, cited in Anderson-Inman et al., 1996; Rinehart, Stahl, & Erickson, 1986). More specifically, this study relied most heavily on the work of Anderson-Inman et al., (1996), in combination with Berkowitz (1986) and Taylor & Beach (1984). Underpinning all of the procedures, however, was an emphasis on students' active participation and literacy development, supported by software for information access, organization and manipulation.

This computer-based information organizer allowed learners to produce electronic outlines and pictorial representations of information. Consequently, students learned strategies for organizing content area reading material into well-written summaries. Through modelling, explicit instruction, demonstration and practice, students were taught to use the conceptual-mapping program as a computer-generated information organizer, arranged in a format similar to that used by the author of the text. These computer-mapping representations were then converted into hierarchical summaries. Students worked in pairs when constructing their maps, but wrote their summaries independently. At the end of each lesson, students completed an exit slip (Harste, Short & Burke, 1988) stating what they learned, what they were uncertain about, plus additional questions.

Since the outliner is fully integrated with a graphics component that enables students to change outlines into diagrams and vice versa, the computer program *Inspiration 5.0* (1997) represents an exceptional instrument for organizing student writing. Various mapping configurations can be individually created to meet the parameters of the different tasks, and pictorial or linear text can be moved into any area of the page. Collectively, these features provide students with a wealth of alternatives in terms of organizing their summaries.

Instruction. The investigator and the teachers followed a specific instructional process. Students were taught to construct a skeleton map of the reading selection by typing in the information they found for topic headings and main ideas or subheadings for each paragraph. Then students were shown how to use the computer program to insert the headings and subheadings as informational nodes linked to the topic title or paragraph subheadings. This crystallization of the chapter's content into an overview of

significant ideas and vocabulary required active processing of the text and manipulation of the information into a meaningful end product, which was consistent with the text's structure. This instructional process provided students with the framework they needed to identify, organize and learn important information.

The training thus consisted of four basic parts. Students were taught how to: (1) manipulate the technology, (2) distinguish the structure of texts, (3) use a computer-based, visual frame or conceptual-map to take notes which were consistent with the text structure, and (4) write an accurate summation of the information contained in the map.

Teaching featured direct-explicit instruction with teacher modelling of explicitly defined procedures within the eleven sessions of instruction. These included guided practice as students worked on the different passages, teacher monitoring with corrective feedback, and independent practice. The strategy was first described and demonstrated to students by the teacher. The modelled use of the strategy was accompanied by think-aloud statements about how to execute the procedure, an explanation of the rationale underlying the strategy, and situations where the strategy could be applied (metacognitive background about the strategy and teaching for transfer). Teacher-guided practice was also provided along with corrective feedback about how to improve performance. Practice continued until the students could independently carry out the strategy proficiently. Reinforcement occurred in the form of praise, and continued throughout the learning phase of the intervention. Generalization was encouraged by varying the types of material used to practice the strategy (for example, summarizing both social studies and science texts). More specifically, the instructional steps proceeded as indicated below.

During the instructional phase, the first two, forty-five minute sessions were devoted to teaching students how to construct a conceptual-map using the computer program. The teacher provided a rationale for the instruction -- the idea that texts use different structures to present information, and that learning to create visual representations can provide a framework for locating the main ideas and then help in remembering important points. The teacher explained how to record and organize information in the conceptual-map, and had students practise in their partner groupings.

During lessons three through eleven, students received standardized instruction, which focused on accessing or providing knowledge of topic, and presenting new vocabulary. The teacher modelled the map construction procedure for the students. Students learned to compile text material according to the organization of superordinate and subordinate ideas in the selected passages.

The teacher asked students to open their files by clicking on the *Inspiration* icon, typing the title into the main idea symbol which appeared at the center of the screen. Next, students read the text to determine three to five central ideas, which they listed by clicking two grid squares to the left of the title, typing, and pressing "enter". This was repeated for each paragraph heading. Each heading appeared within a separate oval/symbol on the screen.

Students then skimmed the passage again and recorded two or three important details under each main idea. Students selected the paragraph #1 symbol, clicked on the "rapid fire" icon, then typed in one detail, and pressed "enter", then the next detail and so on. Students were able to click in any

open grid with the mouse to deactivate the "rapid fire" feature. This procedure was repeated for all other entries. To convert the pictorial diagram into an linear outline, students clicked on "outline", which was one of the menu items located at the top of the screen. Student outlines were then expanded, edited, and printed. Finally, each student submitted his or her map and summary to the instructors, who after class wrote corrective feedback, and returned the protocols in time for the next lesson.

This same procedure was followed for sessions three through eleven. Teachers provided guided practice throughout these lessons. During the twelfth session, students were expected to perform all tasks independently. The post-test was conducted during the final lesson, while delayed-post tests occurred during the month of May, 1999. Student maps and summaries were evaluated using the same scoring procedures indicated earlier (Appendices F & G). Exit slip and teacher interview data were gathered together.

Assessment and Scoring Procedures

Assessment conditions. Individual student conceptual-maps and summaries were collected throughout the intervention. Each of the conceptual-maps and written protocols was evaluated and returned to students. Products of the pre- post- and transfer tests were analyzed in the same manner as the maps and summaries generated during the implementation phase. Written protocols were scored independently by the investigator and the two classroom teachers. As well, ten percent of the protocols from the pre- post- and delayed post-tests mixed to ensure scoring objectivity were scored by an outside evaluator to obtain inter-rater reliability ($r = .90$).

Scoring. Each conceptual-map was segmented into idea units and was compared to a teacher-created mapping template of the corresponding passage, and scored accordingly. Full points were awarded for maps that distinguished main ideas from details, organized main ideas using the author's text structure, embellished main ideas with details, categorized details under the appropriate main idea, and included the title for each topic. One point was tabulated for each idea unit that the student either used verbatim or paraphrased from the text selection. The summaries were evaluated using the scoring rubric highlighted earlier (Appendix G). Marks were earned for content and form or organization, based on the designated scoring criteria. More specifically, students received a possible five points for content, and three points for form or organization.

Analyses of Data

Quantitative data. Quantitative data consisted of pre- and post- as well as delayed post-testing protocols gathered in response to three counterbalanced prompts that required students to create first, conceptual-maps and second, written summaries using pencil and paper. Analysis of the conceptual-mapping and written summary scores was carried out in order to assess pre-post treatment gains, as well as transfer effects before and after the intervention. Three follow up t-tests were then conducted to locate the source of the variance for each dependent variable: (1) conceptual-maps, (2) summary writing (content), and (3) summary writing (form).

Qualitative data. The second set of data described recurring patterns or behaviours observed during the intervention itself. These sources included student exit slip responses, as well as the field notes documenting teacher observations and interview results. These data were analyzed

through repeated searches in order to identify emerging themes or generalizations.

Chapter IV

Data Analysis

The purpose of this study was to investigate the effect of using a computer-based conceptual-mapping program on students' ability to read, organize and write informational text. There were two major data sources.

Quantitative data. Quantitative data consisted of pre- and post- as well as delayed post-testing protocols gathered in response to three counterbalanced prompts that required students to electronically create first, conceptual-maps and second, written summaries. The conceptual-maps and written summaries were rated in order to assess pre-post treatment gains, as well as transfer effects before and after the intervention. There were 21 students who participated in the study.

Qualitative data. The second set of data described patterns or behaviours observed during the intervention itself. These sources included student exit slip responses, field notes that documented teacher observations and teacher interviews. Ongoing searches through the data revealed three categories of information that related to: (1) the use of technology, (2) the instructional process, and (3) student performance.

Quantitative Analyses

Creating Conceptual-Maps

The first major item for statistical analysis sought to answer:

1) Will students' ability to determine the superordinate and subordinate ideas of the assigned informational material be enhanced as a result of engaging in

conceptual-mapping activities? Mean scores for pre- post- and delayed post-testing are shown in Table 1.

Table 1 - Means for Conceptual-Map

Pre-test	Post-test	Difference
11.52	12.48	.96 *

Pre-test	Delayed Post-test	Difference
11.52	12.28	.76 *

*** statistically significant ($p < 0.05$)**

When conceptual-map performance was compared across test times, as shown in Table 1, the means were: 11.52, 12.48 and 12.28 respectively for the pre-, post- and delayed post-test performance. The mean difference between pre- and post-test was 0.96 in favour of the post-test. The mean difference between pre- and delayed post-test was 0.76 in favour of the delayed post-test.

Follow up statistical analysis comparing mean performance from pre- to post-test and from pre- to delayed post-test respectively indicated statistically significant differences, t (21) = 1.76, $p < .05$; t (21) = 2.05, $p < .05$. There was no significant difference between post- and delayed post-test scores. Thus, following the focused instruction and use of the computer mapping program, students made statistically significant gains in terms of their ability to discern subordinate and superordinate components in a text and to represent them in a mapping configuration from pre- to post-test and from

pre- to delayed post-test. This indicated that, over time, students maintained their post intervention ability to create conceptual-maps.

Creating Hierarchical Summaries

The second and third major items for statistical analysis sought to determine the effects of conceptual-mapping on students' content area knowledge and organizational skills as assessed through summary writing. The question for study was:

2) Will students' ability to compose summaries of informative text improve as a result of constructing conceptual-maps of the assigned reading material as rated first, for content, and second, for form or organization? Mean scores for pre- post- and delayed post-testing are presented in Table 2.

Table 2 - Means for Summary Writing (Content)

Pre-test	Post-test	Difference
3.19	3.57	.38 *

Pre-test	Delayed Post-test	Difference
3.19	3.57	.38 *

*** statistically significant ($p < 0.05$)**

When summary scoring comparisons for content were made across test times, as shown in Table 2, the means were: 3.19, 3.57 and 3.57 respectively for pre-, post- and delayed post-test performances. The mean difference between pre- and post-test was 0.38 in favour of the post-test.

The mean difference between pre- and delayed post-test was 0.38 in favour of the delayed post-test.

Statistical analysis comparing mean performance from pre- to post-test and from pre- to delayed post-test respectively indicated statistically significant differences, t (21) = 1.79, $p < .05$; t (21) = 2.36, $p < .05$). Thus, following the focused instruction and the writing of hierarchical summaries, students made statistically significant gains from pre- to post-testing in terms of their ability to show evidence of purpose, as well as include a range of details to support topic, use language and vocabulary to enhance meaning and create emphasis.

Over time, students maintained their post intervention ability to write content in summaries. These results indicated no loss of gain between post- and delayed-post testing.

Table 3 - Means for Summary Writing (Form)

Pre-test	Post-test	Difference
1.52	1.86	0.34 *

Pre-test	Delayed Post-test	Difference
1.52	2.00	0.48 *

*** statistically significant ($p < 0.05$)**

When summary scoring comparisons for form were made across test times, as shown in Table 3, the means were: 1.52, 1.86 and 2.00 respectively for the pre-, post- and delayed post-test performances. The mean difference between pre- and post-test was 0.34 in favour of the post-test. The mean difference between pre- and delayed post-test was 0.48 in favour of the delayed post-test.

Statistical analysis comparing mean performance from pre- to post-test and from pre- to delayed post-test respectively indicated statistically significant differences, t (21) = 2.32, $p < .05$; t (21) = 3.63, $p < .05$. Thus, following the focused instruction and the writing of hierarchical summaries, students made statistically significant gains in terms of their ability to show evidence of following the template for the summary, including lead and concluding sentences, and using language appropriate to form. There was a significant difference between post and delayed post-test scores indicating that gains were maintained. These results indicated significant effects for form or organization.

Summary of Quantitative Analysis Results - Maps and Summaries

Performance results for both the maps and summaries (content and form) for pre-, post and post-testing (Tables 1, 2, 3) are all statistically significant. These findings reinforced the value of the technology-based intervention as an effective means for students to recognize and follow the structure in a text, record notes within the context of a computer-generated map, as well as write a cohesive, organized summary that accurately embodies the author's original message. Gains were either maintained or improved after the intervention.

The quantitative data described in the preceding section established that the use of this computer-based mapping program as a writing tool for the grade six student in the study had a statistically significant impact on their ability to: (1) identify the superordinate and subordinate ideas in informative text, (2) compose summaries of text that contained the main ideas, and (3) organize their writing.

Qualitative Analysis

While the statistical analysis of pre-, post- and transfer intervention performance was informative in terms of program evaluation, further insight into the intervention process was provided by documenting what transpired during instruction. The information obtained from investigator field notes, student exit slip responses, teacher reflections and data from teacher interviews was analyzed. Repeated searches through the data revealed three categories of information that related to: (1) the use of technology, (2) the instructional process, and (3) student performance.

Use of Technology

Teachers agreed that it was extremely difficult to plan, follow up and meet on a regular basis. The availability and overall functioning of the computer lab equipment were problematic.

Students also reported concerns in regard to technical problems. The technician was often required to assist with printing problems which frustrated some students and slowed progress. Although there were technical frustrations, the use of technology contributed to students' success in reading, organizing and writing informational text, as shown by the statistical analyses.

Instructional Process

All students remarked that the program directions were clear and simple to follow. They reported that the most useful *Inspiration 5.0* (1997) options for mapping out their ideas were the arrange, "rapid fire", outline, diagram, colour and print options. They also used the enlarge and nudging options to place items on the page.

In general, the teachers agreed that the conceptual maps served as effective tools for assisting in the recall and organization of information, as well as planning for future writing. The visual outlines and diagrams helped students to "see the big picture", and to develop some precision in defining characteristics or key ideas pertaining to the given topic. The expository text frames such as those presented in *Inspiration 5.0* (1997) helped students to understand and replicate text structure in their own writing. The conceptual-maps fostered students' ability to represent their understanding and to develop insight into the author's intended message.

When asked what seemed to work well for the class in terms of the computer-based mapping and summary writing, the teachers indicated that they liked the flexibility of the program. The conceptual-maps or frames allowed students to use different colours, symbols and shapes to convey meaning and organize ideas in categories, and to manipulate maps into linear outlines or vice versa.

The mapping helped some students to further develop their comprehension skills as related to constructing and confirming meaning, outlining, summarizing, and creating their own texts which communicated and demonstrated understanding of the textual information. Mapping also permitted students to create and follow a predetermined plan to collect and record information, make notes on a topic, combine relevant information from

more than one source, and carry out further practise using the organizational patterns of informational text to facilitate meaning making.

The students also highlighted numerous advantages of the mapping program when recording and organizing text information. When asked what made it easier to organize or understand the text information using the computer mapping program, they stated that the diagram/outline options expedited the reading and arranging of ideas, as well as the sequencing of the material or concepts. The categorization of thoughts was simplified by using the different colours and shapes in the conceptual-map or diagram. Furthermore, the maps were infinitely expandable and therefore, it was less difficult to edit and rework material because students did not need to erase, start over or re-write.

Students indicated that using the technology was a faster and more efficient way to work, and that they did not have to flip back and forth between many pages of notes. Internal summary changes such as additions, modifications and deletions from any area of the document were easily completed without the usual time-consuming recopying required in paper-based outlines or drafts. The writing and editing of summaries were facilitated because the maps were neater, organized and clearly presented. Students related that working with the computer was more fun than using paper and pencil. This indicates deeper and more rewarding engagement of students in the writing activity.

When asked what made it easier to write the summary with the program outline provided, students indicated that it was more organized. They knew what to include because they could check against the ideas presented in the maps or outlines. The writing of summaries was facilitated because it did not take as long to delineate the main ideas and secondary

details, since these had already been analyzed and were present in the conceptual-map.

Partner groupings. Teachers supported the idea of students working in pairs, which made the classroom a supportive setting for collaborative learning. Teachers encouraged the exchange of ideas and appreciated the value of students' ideas. Collaborative small group work and peer critiquing placed the responsibility for improvement with the students. Students had an opportunity to engage in exploratory communication, develop and extend understanding, explain opinions, and search for ways to reorganize ideas and information to promote further understanding.

Students learn content and increased their ability to express ideas by interacting with others (Barnes, 1995; Vygotsky, 1978). In general, students' comments confirm that having "two heads thinking together" was beneficial. Students indicated that the collaborative dyads facilitated the process of determining main ideas, understanding the material more clearly, finding additional details to complement the main ideas, locating all relevant information, arranging thoughts, increasing productivity, enhancing each other's knowledge base, evaluating the coherency of the writing, and remembering how to use the various options in the program.

There were drawback to the collaborative learning. Some students reported that sometimes it was more difficult to collaborate with someone who did not contribute their share or work together. At times, it was challenging to reach a consensus about the main ideas and the appropriate place to add secondary details. Students indicated that working together was not always desirable.

Efficacy and time management. The features of the mapping program facilitated and accelerated activities that traditionally were conducted using pencil and paper. By introducing the electronic writing tool, the academic task of mapping ideas during reading helped to enhance performance and minimize frustration. Students' comments further validated the advantage of using technology to write compared with pencil and paper. Students reported that the technology took the tedium out of writing. Students also felt that they could write more complete summaries. Writing with a computer was thus more interesting, less stressful and time efficient than writing with paper and pencil.

As suggested previously, when writing with paper and pencil, erasing and rearranging can become time consuming and illegible. Using technology allowed students to insert or delete information without having to rewrite the entire paragraph or summary. The computer also produced neat, clear summaries, and facilitated the construction of coherent meaningful text.

Students also confirmed that the computer assisted them in managing their writing. They could save their work, thereby reducing the number of papers to organize. Whereas students often misplaced their drafts, the technology made it easier to retrieve and manage written work.

Student Outcomes

When asked how effective the project was in terms of improving the quality (content, organization/form) of students' informative writing, teachers responded that for some of the at-risk learners in particular, the *Inspiration 5.0* (1997) program gave them a frame of reference from which to start their writing. The skeletal structure helped these students to recognize different paragraph structures and create their own organized paragraphs. It served to provide them with a visual representation of the topic, which showed

connections and relationships between the different ideas. It also furnished them a meaningful overview of the learned information, and an alternate method of recording ideas.

Transfer of skills. When asked about the effect of computer mapping and summary writing on students' computer-literacy, teachers' responses were positive. They indicated that there was evidence that skills had been transferred to other curricular subjects in their class. The visual learners seemed to use this technique repeatedly. They invented ways to categorize information using different colours, frame configurations and shapes.

In examining the effectiveness of the project in terms of improving student learning by integrating the curricular goals with thinking, mapping and technology, teachers attested that, for many students, the project had been very effective. As stated, teachers also noticed that some students were spontaneously using mapping in other subject areas and assignments.

When asked how well the activities helped to better prepare students for the grade six standards exam, teachers affirmed that it was very useful. Results indicated good scores/understanding on the writing/mapping component of the examination. Students were more adequately prepared to access and interpret exam questions presented in the various diagrams and organizers.

Given another opportunity to use this technology or do future projects, teachers stated they would give more feedback more often, use this technology in mathematics or science, and experiment with some of the prefabricated templates included in the *Inspiration 5.0* (1997) package. They would also extend the use of technology to other text structures (for example, compare/contrast text).

Teachers also specified that this technology fits perfectly with the General Outcomes outlined by the Department for Language Arts. In this way, mapping and summary writing using the computer allowed students to be comfortable with the organization, and to focus more on the content and ideas presented in the various texts.

Reluctant learners. With regard to rating the project as a whole for its effect on students' learning, teachers suggested that it had varying degrees of effect depending on the students' interest and level of ability. Motivation was a factor for some students. For other students, working with the technology in a collaborative context provided a more motivating environment in which to learn. Collaboration seemed to encourage some of the most reluctant learners.

In terms of overall academic performance, teachers indicated that the biggest changes were evident with the at-risk learners. Mapping helped these students gain further confidence. Some learners appeared to have less resistance to revising work in order to eliminate redundant or unnecessary information when using the pre-established templates and organizing capabilities of the *Inspiration 5.0* (1997) program. Some students seemed more engaged in their learning.

Teacher Recommendations

Teachers expressed the feeling that they enjoyed the opportunity to engage in this kind of classroom-based research, and to collaborate and reflect about instructional practices. In examining the most important insights that they gained from this project, teachers stated that participating in the intervention reminded them that the computer serves only as a tool for student learning, and that computer use must be coupled with explicit instruction and ample opportunity for feedback.

Teachers did not specify any significant changes in their teaching as a result of this project, except perhaps a heightened awareness of the value of ongoing teacher reflection, re-teaching, consistency, the value of accommodating all modalities, and using differentiated instructional techniques.

They also recognized the need for more demonstration time, modelling and guided practice in reading, writing and discussing texts which use expository text structures, so that students could successfully represent the content and structure. In order to develop a repertoire of strategies for summarizing knowledge or information about a given topic, teachers concluded that students require frequent and varied opportunities to engage in authentic composing tasks.

Other teacher recommendations for introducing this technology to other students in the school or in alternate settings included:

- using the same program frequently so that students reach a level of automaticity that allows them to focus on the content of the material that they are placing in their maps.

- posting enlarged examples of maps in the class or laminating key frames for extended use.

- displaying more examples of student work in the classroom and computer lab.

- modelling the use of other types of frames or maps to show students several more ways of organizing the same information.

• allowing more time for students to spend on the revising and editing stages of writing.

• featuring mini-lessons on conventions of spelling, grammar and punctuation as required and related directly to students' writing needs.

• encouraging more peer and self-assessment and personal goal setting throughout the composing process (having students reflect on their composing processes).

• allowing more opportunities to share ideas, take risks, plan, organize and work collaboratively and cooperatively.

• giving students more feedback using their own products as a starting point.

• focusing on improving paraphrasing and gathering "like ideas" together.

• providing more opportunities for students to practise extracting and combining information from multiple sources into a meaningful whole.

• providing students with partial frames or maps initially and gradually fading out support as their proficiency increases.

• giving students more time to learn the steps on "how to write a summary", using more examples, models and think alouds.

• providing students with more time for demonstrations about "how to write paragraphs" (walking the students through their summaries paragraph by paragraph, showing them how to paraphrase ideas in the maps, then putting these ideas in the summaries, and using their work as authentic teaching examples).

• printing out an hierarchical outline each time a student creates a conceptual-map.

The descriptive data supported the results of the statistical analysis. Overall findings are summarized in Chapter Five.

Chapter V

Results and Discussion

In general, content area reading instruction helps students cope with the learning demands of the difficult materials they encounter in school (Moore, Readence, & Rickelman, 1983). This research studied the use of a conceptual-mapping program and subsequent summary writing to support academic progress.

Two part-time classroom teachers and a resource teacher worked in collaboration to guide students through a unique learning experience, using the *Inspiration 5.0* (1997) program as a tool for organizing thinking and writing. The instructional intervention was modelled on the work of Alvermann and Boothby (1986), Anderson-Inman et al. (1996), Armbruster, Anderson and Ostertag (1989), Berkowitz (1986), Brown and Day (1983), Englert and Hiebert (1984), Moore and Readence (1984), Rinehart, Stahl and Erickson (1986), as well as Taylor and Beach (1984).

Students learned to recognize and follow the structure in a text, record notes within the context of a computer-generated map, and write a cohesive, organized summary reflecting passage content.

Conclusions

In general, the results revealed that when students used the computer-developed mapping procedure to support their learning, there was a positive effect on their ability to process text, organize information, and write expository text summaries. These findings further confirmed the value of the conceptual-mapping program as an excellent means of helping students to

process, record, organize, manipulate, and visualize the interrelationships of ideas contained in informative text, as well as write coherent, structured summaries that adequately incorporated the essential text ideas or concepts.

Documentation during the process of instruction revealed that direct, explicit instruction in the use of learning strategies was effective. Although difficult logistically at times, the collaborative efforts of the two classroom teachers and the resource teacher enhanced the quality of instruction.

As shown in the accompanying Figure, the success of this study is a result of a number of interacting factors. This instructional intervention acknowledged the importance of:

- connecting theory with practice. This study incorporated the empirical theories underlying social constructivism and the model of information processing and its relationship to content area instruction, text structure, metacognition, as well as information related to the reading-writing connection, and strategy- and technology-based instruction.

- teaching reading and writing within the context of authentic classroom activities rather than focusing on isolated skill development.

- capitalizing on the interactive nature of learning, and assisting students to actively engage in constructing and mediating their learning (for example, sharing ideas, discussing differences of opinion, collaboratively solving problems).

• enhancing students' knowledge and strategic processing using direct, explicit instruction and demonstration, and by providing repeated opportunities to practise strategies.

• using scaffolded practice and modelling, pre- and post-reading activities, coaching and feedback to improve self-monitoring and comprehension.

• analyzing text structure to provide a format for what readers will learn, understand and retain (for example, maps aid recall when readers engage in rearranging information).

• developing reading and writing skills concurrently in order to extend understanding and retention of material and reinforce metacognitive awareness.

• using technology-based mapping as an effective tool for adapting learning experiences, minimizing reading and writing difficulties, and promoting the development of more complex information processing.

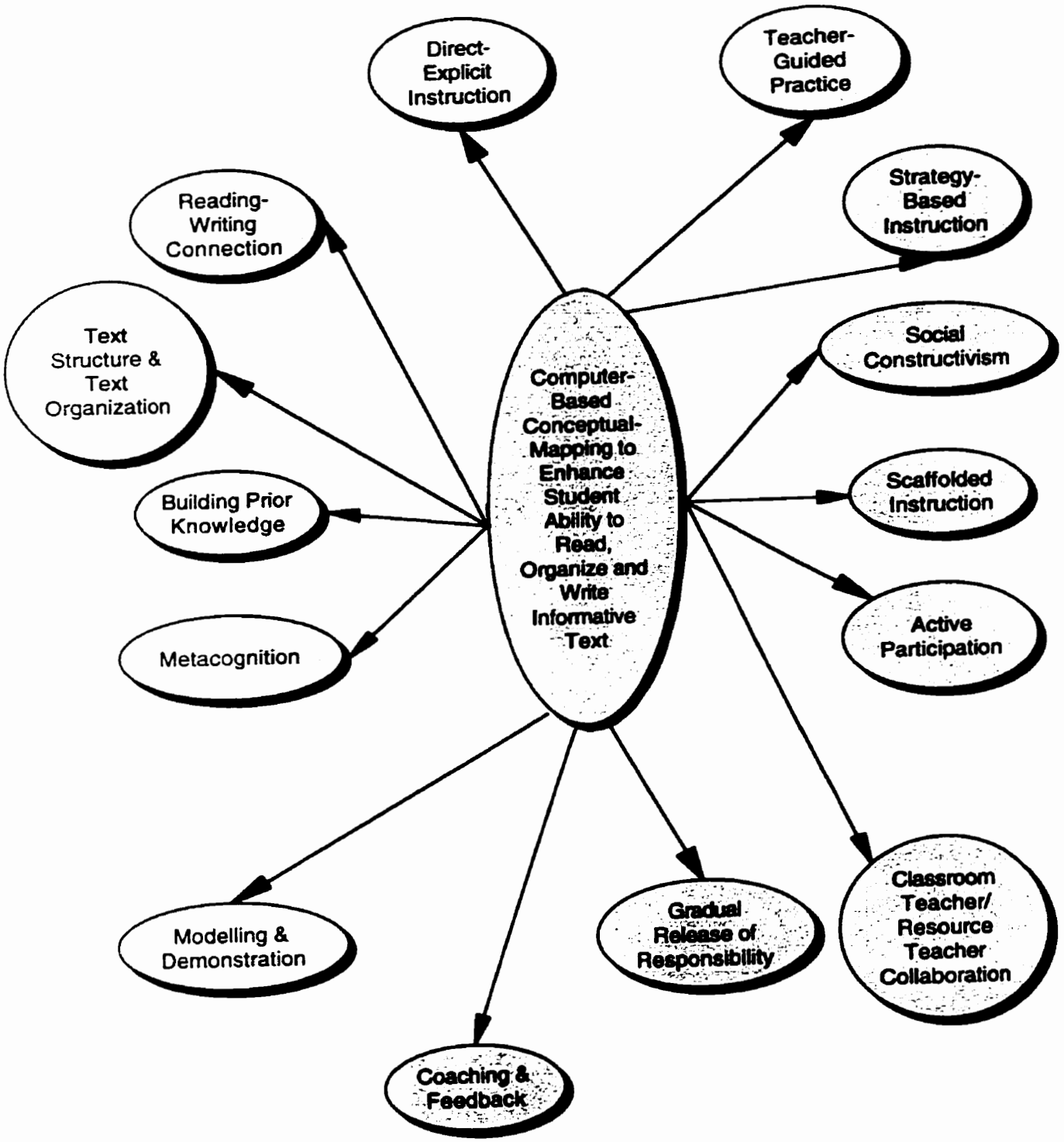


Figure. Factors that Contributed to Instructional Success in Addition to Technology

Implications for Instruction

With the advent of computer technology, most children have the opportunity to use computers in the classroom. Based on the outcomes of this study, it seems that quality computer programs not only stimulate and motivate, but also add variety to instructional activities. Under the skilled direction of teachers, computers can be used as tools to improve academic performance.

When students were taught to identify and use text structure in the form of graphic organizers or maps, their ability to understand textual information improved. Findings from this study further suggested that when students received direct, explicit instruction in noticing the structural aspects of the text, creating summaries that followed that text's organizational framework, and became actively involved in generating summaries from the maps they designed while reading, they significantly increased their comprehension and writing ability.

As suggested from study findings, when students participate in special programs to improve reading and study skills, they tend to learn more efficiently. It seems likely that a combination of using conceptual-mapping at the beginning of a new topic, developing an organizational framework for the text, and writing summaries of the textual material taken together had a cumulative effect on student progress. Thus, computer programs can be used to strengthen the understanding of content area material by facilitating the processing of textual information.

Teachers' comments during this study confirmed that the integration of computer-based outlining or mapping software into instruction was relatively easy and adaptable across varying conditions. This intervention emphasized

that computer-generated conceptual-mapping was a proficient vehicle for synthesizing information and improving learning, particularly when students received clear direction in terms of recognizing the structural features of text, and in creating summaries that followed the format of the original material. Most notably, the findings from this study substantiated the benefits of integrating a computer-mapping program with a solid research-based instructional component.

Communication among teachers was a necessary element to the success of the intervention. Assessment of progress was ongoing. Teachers remained at the center of the learning process, orchestrating learner skill development .

In conclusion, data from this study should raise further awareness concerning the positive effects of direct, explicit instruction and practice in conceptual-mapping as a device for enhancing text processing in order to improve comprehension, and organizing information to improve the summary writing of content area text. Based on teacher recommendations, this research suggests other possible instructional applications of the conceptual-mapping strategy across the curriculum, which would also facilitate learning and positively impact students' overall academic performance.

Limitations

Even under ideal conditions, accompanied with high expectations and motivated educators, problems arise when introducing new instructional interventions. Teachers play a pivotal role in recognizing, understanding and minimizing problems before they become barriers. This means being proactive, identifying key issues, concerns and potential roadblocks to ensure that the desired change remains constant.

Some limitations have been identified. The first is the small sample size, and the second is the relatively short term of the intervention. This study involved an instructional intervention executed by two part-time classroom teachers and a resource teacher over the course of two months. Thus, the population of the study precluded a large sample size and the generalizability of the findings is limited.

A third limitation was the potential confounding effect of the computer lab orientation. The orientation to the computer program occurred prior to testing, which may have made pre-test scores inordinately high. Findings are also limited to the use of one computer program and caution must be exercised in transferring findings to computer programs in general.

Directions for Future Research

As the capabilities of computer have increased, a variety of exciting new tools have been developed that have the potential to enhance student learning. The challenge for educators is twofold: First, existing research on computer technology makes it clear that simply providing technology to teachers and students will not result in improvements in students' achievement (Anderson-Inman et al.,1996; Lajoie, 1993; Perkins, 1985; Salomon, Perkins, & Globerson, 1991). Sound instructional methods must also accompany the introduction of computers in the classroom (Ciborowski, 1995; McGee, 1982).

Second, research on computers and writing has been relatively limited (Weaver & Kintsch, 1991). Researchers need to go beyond this to investigate the effects of instruction using a range of technology programs to support learning. This study has attempted to provide a framework for the development of one possible instructional intervention.

Although the findings from this study are preliminary and should be viewed as suggestive in nature, results offer potential points of departure for future studies related to enriching students' ability to read, organize and write informational text. Finally, this work should provide a more accessible lens through which to examine the underlying processes involved in reading and writing, and how classroom/resource teacher collaborations can be strengthened to benefit students in the classroom.

References

Abbott, J. & Ryan, T. (1999). Constructing knowledge, reconstructing schooling. *Educational Leadership, 57(3),* 66-69.

Adams, M.J. (1990). *Beginning to Read: Thinking and Learning About Print.* Urbana-Champaign, IL: University of Illinois, Center for the Study of Reading.

Adams, A., Carnine, D., & Gersten, R. (1982). Instructional strategies for studying. *Reading Research Quarterly, 8,* 27-55.

Alexander, P.A. (1997). *Knowledge and Literacy: A Transgenerational Perspective.* Paper presented at the annual conference of the National Reading Conference, Phoenix, AZ.

Alvermann, D.E. (1981). The compensatory effect of graphic organizers on descriptive text. *Journal of Educational Research, 75(1),* 44-48.

Alvermann, D.E. (1991). The discussion web: A graphic aid for learning across the curriculum. *The Reading Teacher, 45(2),* 92-99.

Alvermann, D.E., & Boothby, P.R. (1986). Children's transfer of graphic organizer instruction. *Reading Psychology, 7(2),* 87-100.

Anderson-Inman, L. (1992). Computer-supported studying for students with reading and writing difficulties. *Reading and Writing Quarterly: Overcoming Learning Difficulties, 8,* 317-319.

Anderson-Inman, L. (1996). Computer-assisted outlining: Information organization made easy. *Journal of Adolescent and Adult Literacy, 39(4),* 316-320.

Anderson-Inman, L., Knox-Quinn, C., & Horney, M.A. (1996). Computer-based study strategies for students with learning disabilities: Individual differences associated with adoption level. *Journal of Learning Disabilities, 29(5),* 461-484.

Anderson-Inman, L., & Redekopp, R. (1992). Electronic studying: Using computer-based outlining programs as study tools. *Reading and Writing Quarterly: Overcoming Learning Difficulties, 8,* 337-358.

Applebee, A.N. (1977). Writing and reading. *Journal of Reading, 20,* 534-537.

Armbuster, B.B. (1992). Content reading in RT: The last two decades. *The Reading Teacher, 46(1),* 166-167.

Armbruster, B.B., & Andersen, T.H. (1980). *The Effect of Mapping on the Free Recall of Expository Text* (Tech. Rep. No. 160). Urbana-Champaign, IL: University of Illinois, Center for the Study of Reading.

Armbuster, B.B., Andersen, T.H., & Ostertag, J. (1989). Teaching text structure to improve reading and writing. *The Reading Teacher, 43(2),* 130-137.

Armbruster, B.B., & Gudbrandsen, B. (1986). Reading comprehension in social studies programs. *Reading Research Quarterly, 21,* 36-48.

Bahr, C.M., Nelson, N.W., & Van Meter, A.M. (1996). The effects of text-based and graphics-based software tools on planning and organizing stories. *Journal of Learning Disabilities, 29(4),* 355-370.

Barnes, D. (1995). Talking and learning in classrooms: An introduction. *Primary Voices, 3(1),* 2-7.

Baumann, J.F. (1984). The effectiveness of direct instruction paradigm for teaching main idea comprehension. *Reading Research Quarterly, 20(1),* 93-115.

Belanger, J. (1987). Theory and research into reading and writing connections: A critical review. *Reading-Canada Lecture, 5(1),* 10-21.

Berkowitz, S.J. (1986). Effects of instruction in text organization on sixth-grade students' memory for expository reading. *Reading Research Quarterly, 21(2),* 161-178.

Bloom, B.S. (1984). The 2 stigma problem: The search for methods of group instruction as effective as one-to-one tutoring. *Educational Researcher, 13(6),* 4-16.

Boothby, P.R., & Alvermann, D.E. (1984). A classroom training study: The effects of organizer instruction on 4th grade comprehension. *Reading World, 23,* 325-339.

Brooks, M.G., & Brooks, J.G. (1999). The courage to be constructivist. *Educational Leadership, 57(3),* 18-24.

Brown, A.L., & Campione, J.C., & Day, J.D. (1981). Learning to learn: On training students to learn from texts. *Educational Researcher, 10,* 14-21.

Brown, A.L., & Day, J.D. (1983). Macrorules for summarizing texts: The development of expertise. *Journal of Verbal Learning and Verbal Behaviour, 22,* 1-14.

Brown, A.L., Day, J.D., & Jones, R.S. (1983). The development of plans for summarizing texts. *Child Development, 54,* 968-979.

Calkins, L.M. (1986). *The Art of Teaching Writing.* Portsmouth, N.H.: Heinemann.

Ciborowski, J. (1995). Using textbooks with students who cannot read them. *Mart Journal, 15(2),* 19-31.

Corno, L., & Mandinach, F. (1983). The role of cognitive engagement in classroom learning and motivation. *Educational Psychologist, 18,* 88-108.

Cooper, J.D. (1997). *Literacy: Helping Children Construct Meaning (3rd ed.).* Boston: Houghton Mifflin Company.

Crowhurst, M. (1991). Interrelationships between reading and writing persuasive discourse. *Research in the Teaching of English, 25,* 324-348.

Cudd, E.T., & Roberts, L. (1989). Using writing to enhance content area learning in the primary grades. *The Reading Teacher, 43,* 392-404.

D'Angelo-Bromley, K. (1985). Précis writing and outlining enhance content learning. *The Reading Teacher, 7(4),* 406-411.

Davidson, J.L. (1982). The group mapping activity for instruction in reading and thinking. *Journal of Reading, 26(1),* 52-56.

Dole, J.A., Brown, K.J., & Trathen, W. (1996). The effects of strategy instruction on comprehension performance of at-risk students. *Reading Research Quarterly, 31(1),* 62-88.

Dole, J.A., Duffy, G.G., Roehler, L.R., & Pearson, P.D. (1991). Moving from the old to the new: Research on reading comprehension instruction. *Review of Educational Research, 61(2),* 239-264.

Duffy, G.G. (1993). Teachers' progress toward becoming expert strategy teachers, *Elementary School Journal, 94,* 109-120.

Durkin, D. (1978-1979). What classroom observations reveal about reading comprehension instruction. *Reading Research Quarterly, 14* , 481-533.

Education Development Center & RMC Research. (1989). *Improving Textbook Usability: Final Report.* (ERIC Document Reproduction Service No. ED, 310-585).

Ellis, E.S. (1993). Integrative strategy instruction: A potential model for teaching content area subjects to adolescents with learning disabilities. *Journal of Learning Disabilities, 26,* 358-383, 398.

Englert, C.S., & Hiebert, E.H. (1984). Children's developing awareness of text structures in expository material. *Journal of Educational Psychology, 76,* 65-74.

Flavell, J.H. (1985). *Cognitive Development (2nd ed.).* Englewood Cliffs: NJ: Prentice Hall.

Flood, J., & Lapp, D. (1988). Conceptual mapping strategies for information texts. *The Reading Teacher, 41(8),* 780-783.

Flower, L. & Hayes, J.R. (1994). A cognitive process of theory of writing. In R.B. Ruddell, M. R. Ruddell, & H. Singer (eds.). *Theoretical Models and Processes of Reading (4th ed.)* (pp. 928-950). Newark, DE: International Reading Association.

Fogarty, R., Perkins, D., & Barell, J. (1992). *The Mindful School: How to Teach for Transfer.* Arlington Heights, Illinois: SkyLight Training and Publishing Inc.

Fogarty, R. (1999). Architects of the intellect. *Educational Leadership, 57(3),* 76-78.

Gardner, H. (1991). *The Unschooled Mind: How Children Think and How Schools Should Teach.* New York: Basic Books.

Garner, R. (1987). *Metacognition and Reading Comprehension.* NJ: Ablex Publishing Corporation.

Garner, R. (1994). Metacognition and executive control. In R.B. Ruddell, M. R. Ruddell, & H. Singer (eds.). *Theoretical Models and Processes of Reading (4th ed.)* (pp. 715-732). Newark, DE: International Reading Association.

Gagne, E.D. (1978). Long-term retention of information following learning from prose. *Review of Educational Research, 48,* 629-665.

Gebhard, A.O. (1983). Teaching writing and reading and the content areas. *Journal of Reading, 27(3),* 207-211.

Geva, E. (1983). Facilitating reading comprehension through flow-charting. *Reading Research Quarterly, 18(3),* 384-405.

Gordon, C. (1990). Contexts for expository text structure use. *Reading Research and Instruction, 29,* 55-72.

Guskey, T.R.(1994). The most significant advances in the field of staff development over the last twenty-five years. *Journal of Staff Development, 15(4),* 5.

Gutherie, J.T., Britten, T., & Barker, K.G. (1991). Role of document structure and metacognition awareness in the cognitive process of searching for information. *Reading Research Quarterly, 26,* 330-324.

Harper, B. (1989). How are we using what we know about literacy processes in the content areas? *The Reading Teacher, 42(9),* 726-727.

Harste, J.C., Short, K.G., & Burke, C. (1988). *Creating a Classroom for Authors.* Portsmouth, NH: Heinemann.

Herber, H. (1978). *Teaching Reading in Content Areas (2nd ed.).* Englewood Cliffs, NJ: Prentice-Hall.

Hiebert, E.H., & Raphael, T.E. (1996). Perspectives from educational psychology on literacy and literacy learning and their extensions to school practice. In R. Calfee & D. Berliner (eds.). *Handbook of Educational Psychology* (pp. 550-602). New York: Longman.

Horton, S.V., Lovitt, T.C., Givens, A., & Nelson, R. (1989). Teaching social studies to high school students with academic handicaps in a mainstreamed setting: Effects of a computerized study guide. *Journal of Learning Disabilities, 22,* 102-107.

Inspiration Software, Inc. (1997). *Inspiration 5.0* [Computer software]. Portland, OR: Author.

Irvin, J.L. (1997). Building sound literacy learning programs for young adolescents. *Middle School Journal, 28(3),* 4-9.

Irvin, J.L., & Connors, N.A. (1989). Reading instruction in middle level schools: Results of a U.S. survey. *Journal of Reading, 32(4),* 306-311.

Jenkins, J.J. (1979). Four points to remember: A tetrahedral model and memory experiments. In L.S. Cermak and F.I.M. Craik (eds.). *Levels and Processing in Human Memory* (pp. 429-466). Hillsdale, NJ: Erlbaum.

Kintsch, W. (1990). Macroprocesses and microprocesses in the development of summarization skill. *Cognition and Instruction, 7,* 161-195.

Kintsch, W (1994). The role of knowledge in discourse comprehension: A construction integration model. In R.B. Ruddell, M. R. Ruddell, & H. Singer (eds.). *Theoretical Models and Processes of Reading (4th ed.)* (pp. 951-995). Newark, DE: International Reading Association.

Kintsch, W., & van Dijk, T. (1978). Toward a model of text comprehension and production. *Psychological Review, 85,* 363-394.

Kozulin, A. (1990). *Vygotsky's Psychology: A Biography of Ideas.* MA: Harvard University Press.

Lajoie, S.P. (1993). Computer environments as cognitive tools for enhancing learning. In S.P. Lajoie & S.J. Derry (eds.). (pp. 261-288). *Computers as Cognitive Tools*, Hillsdale, NJ: Erlbaum.

Langer, J. (1986). Learning through writing: Study skills in the content areas. *Journal of Reading, 29,* 400-406.

Levy, S. (1996). *Starting from Scratch.* New York: Heinemann.

Lipson, M. Y., & Wixon, K.K. (1991). Assessment and Instruction of Reading Disability: An Interactive Approach. New York: HarperCollins Publishers.

Loranger, A.L. (1994). The study strategies of successful and unsuccessful high school students. *Journal of Reading Behavior, 26(4),* 347-359.

MacArthur, C.A. (1996). Using technology to enhance the writing processes of students with learning disabilities. *Journal of Learning Disabilities, 29(4),* 344-354.

MacArthur, C.A., & Haynes, J.A. (1995). Student assistant for learning from text (SALT): A hypermedia reading aid. *Journal of Learning Disabilities, 28(3),* 150-159.

Malouf, D.B., Wizer, D.R., Pilato, V.H., & Grogan, M.M. (1990). Computer-assisted instruction with small groups of mildly handicapped students. *Journal of Special Education, 24,* 51-68.

Mandler, J.N., & Johnson, N.S. (1977). Remembrance of things parsed: Story structure and recall. *Cognitive Psychology, 9,* 111-151.

Manitoba Education and Training. (1996). *Success for All Learners: A Handbook on Differentiating Instruction.* Winnipeg, MB: Author.

Manitoba Education and Training. (1998). *Grade 6 English Language Arts, English, LA-Immersion and Anglais Standards Test Information Bulletin.* Winnipeg, MB: Author.

Manzo, A.V. (1991). Training teachers to use content area reading strategies: Description and appraisal of four options. *Reading Research and Instruction, 30(4),* 67-73.

McCreath, J. (1998).Technology. *Reading Manitoba, 19(1),* 14-16.

McGee, L.M. (1982). Awareness of text structure: Effects on children's recall of expository text. *Reading Research Quarterly, 17(4),* 581-590.

McGee, L.M., & Richgels, D.J. (1985). Teaching expository text structure to elementary students. *The Reading Teacher, 39(2),* 739-748.

McTighe, J., & Lyman, F.T. (1988). Cueing thinking in the classroom: The promise of theory-embedded tools. *Educational Leadership, 8(1),* 18-24.

Meyer, B.J.F. (1985). Prose analysis: Purposes, procedures, and problems. In B.K. Britton & J.B. Black (Eds.). *Understanding Expository Text,* Hillsdale, NJ: Lawrence Erlbaum, 11-64.

Meyer, B.J.F., & Rice, E. (1984). The structure of text. In P.D. Pearson (ed.).*Handbook of Reading Research* (pp.319-352). White Plains, NY: Longman.

Meyer, B.J.F., Brandt, D.M., & Bluth, G.J. (1980). Use of top-level structure in text: Key for reading comprehension of ninth-grade students. *Reading Research Quarterly, 16(1),* 72-103.

Meyer, B.J.F., & Freedle, R.O. (1984). Effect of discourse type on recall. *American Educational Research Journal, 21 (Spring),* 121-43.

Moore, D.W., Readence, J.E., & Rickelman, R.J. (1983). An historical exploration of content area reading instruction. *Reading Research Quarterly, 18(4),* 419-438.

Moore, D.W., & Readence, J.E. (1984). A quantitative and qualitative review of graphic organizers research. *Journal of Educational Research, 78(1),* 11-17.

Moore, R.S. (1995). Questions for research into reading-writing relationships and text structure knowledge. *Language Arts, 72(8),* 598-606.

Mosenthal, P. (1983). Review of reading and writing: Developing a transactional theory of the writing process.*Journal of Reading Behaviour, 17,* 75-77.

Moss, B., Leone, S., & Dipillo, M.L. (1997). Exploring the literature of fact: Linking reading and writing through information trade books. *Language Arts, 74(6),* 418-429.

Newman, F. & Holzman, L. (1993). *Lev Vygotsky: Revolutionary scientist.* New York: Routledge.

Outhred, L. (1989). Word processing: Its impact on children's writing. *Journal of Learning Disabilities, 22,* 262-264.

Palincsar, A.S. (1998). Social constructivist perspectives on teaching and learning. [Online]. URL: <http://www.ciera.org.html>

Palincsar, A.S., & Brown, A.L. (1984). Reciprocal teaching comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1(2),* 117-175.

Pardo, L.S. & Raphael, T.E. (1991). Classroom organization for instruction in content areas. *The Reading Teacher, 44(8),* 556-565.

Paris, S.G., Lipson, M.Y., & Wixon, K. (1994). Becoming a strategic reader. In R.B. Ruddell, M. R. Ruddell, & H. Singer. (eds.). *Theoretical Models and Processes of Reading (4th ed.)* (pp. 788-811). Newark, DE: International Reading Association.

Pearson, P.D. & Camperell, K. (1994). Comprehension of text structures. In H. Singer & R.B. Ruddell (Eds.). *Theoretical Models and Processes of Reading (4th ed.)* (pp. 323-342). Newark, DE: International Reading Association.

Pearson, P.D., & Gallagher, M.C. (1983). The instruction of reading comprehension. *Contemporary Educational Psychology, 8,* 317-344.

Perkins, D.N. (1985). The fingertip effect: How information-processing technology shapes thinking. *Educational Researcher, 14(7),* 11-17.

Perkins, D.N. (1986). Thinking frames. *Educational Leadership, 43(8),* 4-10.

Perkins, D.N. (1992). *Smart Schools: From Training Memories to Educating Minds.* New York: Free Press.

Pflaum, S.W., Walberg, H.J., Karegianes, M.L., & Rasher, S. (1980). Reading instruction: A quantitative synthesis. *Educational Researcher, 9,* 12-18.

Piccolo, J.A. (1987). Expository text structure: Teaching and learning strategies. *The Reading Teacher, 40(9),* 838-847.

Phillips, D.C. (1995). The good, the bad, and the ugly: The many faces of constructivism. *Educational Researcher, 24(7),* 5-12.

Pressley, M., El-Dinary, P.B., Gaskins, I., Schuder, T., Bergman, J.L., Almasi, J., & Brown, R. (1992). Beyond direct explanation: Transactional instruction of reading comprehension strategies. *Elementary School Journal, 92,* 511-554.

Pressley, M., Goodchild, F., Fleet, J., Zajchowski, R., & Evans, E.D. (1989). The challenges of classroom strategy instruction. *The Elementary School Journal, 89(3),* 301-342.

Pressley, M., & Harris, K.R. (1990). What we really know about strategy instruction. *Educational Leadership, 48(1),* 31-34.

Pressley, M., Johnson, C.J., Symons, S., McGoldrick, J.A., & Kurita, J.A. (1989). Strategies that improve children's memory and comprehension of text. *The Elementary School Journal, 90(1),* 3-32.

Randolph-Moore, S. (1995). Focus on research: Questions for research into reading-writing relationships and text structure knowledge. *Language Arts, 72(8),* 598-606.

Raphael, T.E., & Englert, C.S. (1990). Writing and reading: Partners in constructing meaning. *The Reading Teacher, 43(6),* 388-400.

Raphael, T.E., Englert, C.S., & Kirschner, B.W. (1989). Students' metacognitive knowledge about writing. *Research in the Teaching of English, 23,* 343-379.

Raphael, T.E., Kirschner, B.W., & Englert, C.S. (1988). Expository writing programs: Making connections between reading and writing. *The Reading Teacher, 42(5),* 790-795.

Readence, J.E., & Moore, D.W. (1979). Strategies for enhancing readiness and recall in content areas: The encoding specificity principle. *Reading Psychology, 1(1),* 47-54.

Reder, L.M. (1980). The role of elaboration in the comprehension and retention of prose: A critical review. *Review of Educational Research, 50,* 5-53.

Reed, M.W. (1998). Assessing the impact of computer-based writing instruction. [Online]. URL: <http://www.epnet.com/ehost.html>

Rinehart, S.D., Stahl, S.A., & Erickson, L. G. (1986). Some effects of summarization training on reading and studying. *Reading Research Quarterly, 21(4),* 422-438.

Roe, M.F. (1992). Reading strategy instruction: Complexities and possibilities in middle school. *Journal of Reading, 36(3),* 190-197.

Roehler, L.R. & Duffy, G.G. (1989). Direction explanation of comprehension processes. In G.G. Duffy, L.R. Roehler, & M.L. Kamil, P. Mosenthal, P.D. Pearson (eds.). *Handbook of Reading Research (Vol. II)* (pp.861-883). New York: Random House.

Rosenshine, B.V. (1986). Synthesis of research on explicit teaching. *Educational Leadership, 23(7),* 60-69.

Ruddell, R.B., Ruddell, M.R., & Singer, H. (eds.). (1994). *Theoretical Models and Processes of Reading (4th ed.).* Newark, DE: International Reading Association.

Salomon, G., Perkins, D.N., & Globerson, T. (1991). Partners in cognition: Extending human intelligence with intelligent technologies. *Educational Researcher, 20,* 10-16.

Schirmer, B.R., Bailey, J., & Fitzgerald, S.M. (1999). Using a writing rubric for writing development of children who are deaf. *Exceptional Children, 6(3),* 383-397.

Schmitt, M.C.(1990). Metacognition. *The Reading Teacher, 43(6),* 454-461.

Slater, W.H. (1985). Teaching expository text structure in structural organizers. *Journal of Reading, 28(8),* 712,-718.

Squire, J. R. (1983). Composing and comprehending: Two sides of the same basic process. *Language Arts, 60,* 581-589.

Stotsky, S. (1983). Research on reading/writing relationships: A synthesis and suggested directions. *Language Arts, 60,* 627-643.

Strang, R. (1937). The improvement of reading in high school. *Teachers College Record, 39,* 197-206. Cited in: Alvermann & Boothby (1986).

Swanson, H.L. (1989). Strategy instruction: Overview of principles and procedures for effective use. *Learning Disabilities Quarterly, 12(1),* 3-16.

Taylor, B.M. (1982). Text structure and children's comprehension and memory for expository material. *Journal of Educational Psychology, 74(3),* 323-340.

Taylor, B. & Beach, R.W. (1984). The effects of text structure instruction on middle grade students' comprehension and production of expository text. *Reading Research Quarterly, 19(2),* 134-146.

Taylor, B., & Berkowitz, S.J. (1980). Facilitating children's comprehension of content material. In *29th Yearbook of the National Reading Conference* (pp. 64-68). Washington, D.C.: National Reading Conference.

Tenny, J.L. (1992). Computer-supported study strategies for purple people. *Reading and Writing Quarterly: Overcoming Learning Difficulties, 8,* 359-377.

Tierney, R.J., Readence, J.E., & Disher, E.K. (1990). *Reading Strategies and Practices.* Needham Heights, MA: Allyn and Bacon.

Tyson, H., & Woodward, A. (1989). Why students aren't learning very much from textbooks. *Educational Leadership, 47(3),* 14-17.

Vacca, R.T., & Vacca, J.L. (1989). *Content Area Reading.* Boston: HarperCollins Publishers.

Vygotsky, L. (1962). *Thought and Language.* Translation E. Hanfmann & G. Vakar, MA: Massachusetts Institute of Technology.

Vygotsky, L. (1978). *Mind in Society: The Development of Higher Psychological Functions.* M. Cole, V. John-Steiner, S. Scribner & E. Souberman (Eds.). MA: Harvard University Press.

Wade, S.E. (1983). A synthesis of the research for improving reading in the social studies. *Review of Educational Research, 53,* 461-498.

Weaver, C.A., & Kintsch, W. (1991). Expository text. In R. Barr, M. Kamil, P. Mosenthal, & P. Pearson. *Handbook of Reading Research, Volume II* (pp. 230-246). NY: Longman.

Wertsch, J. V. (1985). *Vygotsky and the Social Foundation of Mind.* MA: Harvard University Press.

Wertsch, J.V. (1991). *Voices of the Mind: A Sociocultural Approach to Mediate Action.* MA: Harvard University Press

Winitzky, N., Stoddart, T., & O'Keefe, P. (1992). Great expectations: Emergent professional development of schools. *Journal of Teacher Education, 43(1),* 3-18.

Witte, P.L., & Otto, W. (1981). Reading instruction at the postelementary level: Review and comments. *Journal of Educational Research, 74(3),* 148-158.

APPENDICES

APPENDIX A

Teacher Inteview Questions

(This informal interview will be conducted at the end of the study. It will not be tape recorded).

1. How would you rate this project as a whole in terms of its effect on students' learning: (1) very effective; (2) moderately effective; or (3) slightly effective? How do you explain these effects?

2. What seemed to have worked well for your class in terms of the computer-based mapping and summary writing?

3. What seemed not to have worked as well for your class?

4. What effect did the mapping and summary writing have on your students' computer-literacy?

5. How effective was this project in terms of improving students' learning by integrating thinking, mapping, and technology with the curriculum. What did you notice specifically?

6. How effective was this project in terms of improving the quality (content, organization, form) of your students' informative writing?

7. What differences did you notice between the high, average and low-achievers?

8. How did this project help to better preparing students for the Grade 6 standards exam?

9. What were the signs that the skills learned in this project were transferred to other contexts in the classroom?

10. What changes did you notice in your students' overall academic performance? What individual students progressed beyond/below your expectations? Why?

11. What part of this project did you find most valuable or meaningful?

12. What is the most important insight that you gained by participating in this project?

13. How are you teaching differently because of the experiences gained throughout this project?

14. If you had another opportunity to use this technology or do another project, what would you change?

15. What other recommendations would you make in terms of implementing this project with other students in our school or in another building?

(Adapted from Richardson & Anders, 1990)

APPENDIX B

EXIT SLIP Date: / / 99

1. Did you understand all the directions today? *yes*____ *no*____

2. List two *Inspiration* options that you tried in the lab today that helped you map out your ideas (ex. arrange, outline/diagram icon, rapid fire, etc.).
(1)_____ ; (2)_____

3. Did you have any problems today? What should we review next time?
_____

4. a) Was it easier to organize/understand the text information using the computer mapping program? *yes*____ *no*____
b) What made it easier?_____

5. a) Was it easier to write your summary by having the outline provided by the program? *yes*____ *no*____
b) What made it easier?_____

6. Explain how working with a partner helped your learning today. _____
_____

• PLEASE COMPLETE YOUR EXIT SLIP BEFORE LEAVING THE LAB, AND SUBMIT IT TO THE TEACHERS. •

APPENDIX C

February 1, 1999

Dear Parents,

As you learned during the Parent Orientation Evening on January 11, 1999, I am a graduate student at the University of Manitoba and a Resource/Gifted Education teacher at Ecole Dieppe School. I am in the process of completing the final requirements for a Master's Degree in Education (Reading Specialization).

I also explained that I am undertaking a collaborative study, involving the Grade 6 teachers, as well as the Media Services & Gifted Education Coordinator and the Computer Coordinator from Assiniboine South School Division.

Mme Markovich, Mme Manaigre-Sims and I are interested in assessing the effects of using the computer on students' ability to process print material in science, social studies or language arts, organize information for study, and write summaries. The program will run over 12, forty-five minute sessions, during the months of February and March 1999. During this time, I will be documenting the results of the instruction, and collecting student work samples to assess progress. Students will also complete exit slips as they leave class. This will give them an opportunity to make suggestions on how to improve instruction. I have forwarded a complete description of this project to the principal and the superintendent. The Board Office has given me tentative support for this initiative.

All students in the French Immersion Grade 6 class are invited to participate in this extension learning opportunity. This project provides an opportunity for students to further enhance both their ability to organize information and their writing skills with the support of an innovative computer program called *Inspiration 5.0*. As such, this collaborative initiative will introduce students to a writing process which fully integrates thinking skills, conceptual-mapping skills, and technology skills with specific topics from the Grade 6 curriculum. To assess the effectiveness of instruction, students will read a test passage, create an outline map of the ideas in the passage, and then write a summary of the material, before, immediately after, and again after 6 weeks.

Each pair of participants will have access to a Macintosh computer within the computer lab. Through modelling, explicit instruction, demonstration and practice, students will be taught strategies to organize the main ideas and details from various kinds of reading materials into electronic web representations and coherent written summaries. At the end of the program, you will be invited back for another evening, in

which your child will facilitate a hands-on demonstration using the *Inspiration* software.

This project provides an ideal opportunity to integrate technology across the curriculum. It also complements classroom instruction, and gives students another occasion to improve their writing, which will be tested in the provincial English Language Arts standards examination at the end of the year. In addition, the activities support many of the learning outcomes outlined by the Department of Education in the most recent curriculum.

Since the project incorporates the regular topics of study from February to March, all students will participate. However, your child has the option of withdrawing, without penalty, from the before and after tasks that will help measure the effectiveness of the project. All information regarding student progress over the two month period will be kept in the strictest confidence. All data in my research will be reported anonymously using pseudonyms. A one page summary of the findings will be available upon request in June 1999.

If you have any questions or concerns, please contact me (889-1034), or my advisor, Dr. Beverley Zakaluk, at the Faculty of Education (474-9028).

Sincerely,

Laurie Dodson

• PARENT CONSENT FORM •

Please sign below to give permission to use your child's worksheets and record of progress as measured before and after the project as part of the data in my report. Pseudonyms, not your child's name, will be used in recording results. Please return this form to Ecole Dieppe School during the first week of February 1999.

_____

Child's Name

_____ _____

Parent Signature *Date*

APPENDIX D

February 1, 1999

Dear _____,

As you are aware, I am a graduate student at the University of Manitoba and a Resource/Gifted Education teacher at Ecole Dieppe School. I am in the process of completing the final requirements for a Master's Degree in Education (Reading Specialization).

I am inviting you to participate in a collaborative study involving you, the students, and divisional support staff. The Media Services & Gifted Education Coordinator and the Computer Coordinator, from Assiniboine South School Division, will assist us with implementation. I have forwarded a complete description of the project to both the principal and the superintendent. The Board Office has given me tentative support for this initiative.

This study will examine how learning is increased by integrating thinking, concept-mapping, and technology with portions of the curriculum. I will assess the effects of instruction and practice using a computer-generated graphic map as a means of processing text, and organizing information for study. A second purpose is to investigate the effects of this computer-assisted instruction and practice on the quality of students' informative writing.

All students in your French Immersion grade 6 class will be invited to participate in this study. Students will be organized into groups of two. Over the course of 12, forty-five minute computer classes in February and March 1999, I will be working closely with you. We will be using *Inspiration 5.0* software as a unique tool for student learning. To assess the effectiveness of our instruction, before, after, and again after 6 weeks, students will read a passage, create conceptual maps of the ideas in the passage, and write summaries. They will also be asked to complete exit slips (see attached).

Each pair of participants will have access to a Macintosh computer within the computer lab. Through modelling, explicit instruction, demonstration and practice, students will be taught strategies to organize the main ideas and details from various kinds of reading materials into electronic web representations and coherent written summaries. At the end of the program, parents will be invited to school in the evening, so that their child can facilitate a hands-on demonstration of their learning using the *Inspiration* software.

Throughout February and March 1999, I will be engaged in ongoing data collection, taking field notes and asking you to share your observations about our instructional efforts, technical needs, student activities, concerns, and recommendations for improvement. I will collect the students' electronically-produced conceptual maps and summaries. As indicated, I will also be giving the students text passages before, after, and again after 6 weeks to measure the effectiveness of our intervention. At the end of the project, I will be interviewing you informally to obtain your final reflections (45 minutes). This interview will not be recorded.

This project provides an ideal opportunity to integrate technology across the curriculum. It also complements classroom instruction, and gives students another occasion to improve their writing, which will be tested in the provincial English Language Arts standards examination at the end of the year. In addition, the activities support many of the learning outcomes outlined by the Department of Education in the most recent curriculum.

You have the option of withdrawing from the interview and rescinding permission to use your reflections in my final report without penalty. Student may also withdraw from the pre, post, and delayed-post testing at any time, without penalty. They also have the option of rescinding permission to use their work samples and progress scores as data in my final report, even though these will be reported anonymously. All information regarding student progress and teachers' feedback will be kept in the strictest confidence. A one page summary of the findings will be available upon request in June 1999.

If you have any questions or concerns, please contact me or my advisor, Dr. Beverley Zakaluk, at the Faculty of Education (474-9028).

Sincerely,

Laurie Dodson

• TEACHER CONSENT FORM •

Computer-Based Idea Mapping and the Writing Process

I grant permission to Laurie Dodson to use all teacher reflections (observations and interview data) obtained during the computer-based idea mapping and writing program in her final report. I understand that my name will not be used.

_____ _____

Teacher Signature *Date*

APPENDIX E

FIRST CANADIAN IN SPACE

In the early 1980's, several advertisements were placed in Canadian newspapers throughout the country. These ads were aimed at locating qualified people who were interested in applying for training as the first Canadian astronauts. At that time, there were well over 4,300 men and women who applied.

In 1883, only six of these highly educated professionals were chosen for an intensive initial training program which could lead to a voyage in space. Among those applicants who are best known were Roberta Bondnar, who was a neurologist at McMaster University Medical Centre in Hamilton, Ontario, and Marc Garneau who was a combat systems officer in the navy, and a graduate of the Ph D program in electrical engineering in London, England. The other four people were professionals in physics, physiology, medicine, and engineering at various well known institutions across Canada.

The six Canadian trainees had to undergo a gruelling training program which involved hours and hours of physical and mental challenges. Some television film crews documented such activities as counting backwards from one thousand by twos as trainees were spun head over heels in a large contraption the size of a refrigerator.

After several months of initial training, Marc Garneau was selected as the first Canadian to participate in the American Space Shuttle Mission 41-G abroad Challenger. This flight was scheduled for October 1984. He went to Johnson Space Station in Houston Texas where he

had to learn many skills. His major duties on this first flight involved the testing of highly specialized, scientific equipment which would be transported into space aboard the next American space shuttle mission. He was known as a "payload specialist". Since that time, Garneau has flown other missions in 1996 and 1999.

As an astronaut, Garneau had several responsibilities. He was required to learn the numerous procedures, policies and regulations for life abroad a spacecraft. He spent months memorizing the information contained in over a dozen thick instruction manuals. As a payload specialist, Garneau needed to learn how to carry out a number of complex experiments under intense conditions.

The equipment used for such experiments had been thoroughly tested and undergone rigorous study at great expense. One example of the equipment that he used to conduct scientific experiments was the photometer. A photometer is an important instrument that helps to determine how the ozone layer of the atmosphere is affected by such things as pollution, dust, moisture and acidic haze. Satellites are also used to collect valuable scientific information. The space crew also study pure crystals which are used in a wide range of technology products, as well as conduct experiments on small marine animals.

Another part of Garneau's job as an astronaut involved working with the public and keeping the media informed about various aspects of the mission. Several types of industrial and scientific agencies had worked hard to perfect different kinds of specialized equipment in order to produce and sell it to the space agency or other companies and research organizations. Garneau was also responsible for sharing information about using this unique equipment with the media, which in

turn helped to provide advertizing for the various manufacturers. Much of the work completed by astronauts like Garneau in space will affect the quality of life on Earth in the future, and will be used to assembly the International Space Station.

Shortly before leaving on his first space mission, Garneau agreed to participate in twenty-six separate interviews, in order to respond to many questions about his upcoming voyage. He was also willing to take part in the production of a film, and to travel across Canada to share various aspects of his experiences as an astronaut. It seems that it was not enough for Garneau to be an astronaut, he also needed to be a scientist and a performer.

(641 words)

SLEEP FACTS FROM A TO ZZZZZZZZZ

Sleep! It's one of life's real mysteries. Sleep research is only 30-40 years old, and scientists are still trying to find answers to many questions about it. They still do not know exactly how sleep restores energy to the body, mind, and the nervous system. They are not certain how or why we dream. But they are discovering more and more interesting facts every day.

Sleep deprivation may be due to medical reasons, the demands of modern life, emotional problems or stress. Research has shown that after just two or three days without sleep, we will have difficulty seeing, hearing, and thinking clearly. As more time passes, we begin to hallucinate. In other words, we imagine things that do not exist. Denied sleep for extended periods of time, our mental state gets progressively worse. Gradually we have the potential to lose complete contact with reality. We can become suspicious and fearful of others. Sleep is a necessity of life, and is important for overall good health. If we are unable to rest for long stretches of time, it is possible that we will die. Sleep is as necessary to our survival as water, healthy food and exercise.

Sleep is like a mini-holiday for the brain and body. When we fall asleep, activity decreases and our muscles relax. Our heartbeat and breathing slow down, and we can become completely unaware of our surroundings.

But whether we are awake or asleep, our brain produces electrical waves. When we are awake, our brains give off about ten waves a second, but when we fall asleep these brain waves get slower but larger

and larger. Slow sleep waves or deep sleep takes place during the first hours after we fall asleep. Later on as we continue to sleep, our brains send out small fast waves similar to those when we are awake. During these fast waves, our eyes start moving rapidly beneath our eyelids as though we were watching the events of a dream. Under normal circumstances, we drift in and out of dream sleep three to five times. During sleep, the brain alternates between stages of intense activity and stages of practically no activity at all.

Normal sleep times range from five to ten hours daily, with adults averaging about seven and a half hours a night. For teenagers, it can be much different. Most of the time many of us get less sleep than we need. If we do not get enough rest, we tend to build up what we call a "sleep debt" that accumulates over time. Sometimes we may not even realize how sleep-deprived we actually are. A sleep debt can become so great that we cannot resist it. It may cause us to fall asleep even in a potentially dangerous situations, like when we are driving a car.

It is a known fact that people today are working more and more and resting less. When there are not enough hours in the day for all we have to do, we steal from the night. Sometimes we drink coffee or take short naps as short term solutions to sleepiness.

Sleep deprivation has created what some sleep specialists call the silent epidemic of daytime drowsiness. Many people do not make the connection between the amount of sleep they get at night and how tired they feed during the day. When they start yawning or nodding off, they blame the heavy meal they just ate, the stuffy air in the room, or the boring school assignment. These things do not cause sleepiness, but simply unmask it.

Daytime drowsiness is not the only price people pay for their lack of sleep. Weariness breeds irritability, depression and can result in serious accidents. Sleepy people snap at others, complain about everything, loose their ability to concentrate, and lack energy or motivation. They will function best in the mid-morning and early evening, which are the usual high points of the daily cycle. But most of the time, they cannot perform at their best. The moral to all of this is to get the sleep you need.

(688 words)

BLIZZARDS

Falling air pressure is a signal that a blizzard might be on the way. The official definition of a blizzard is a fierce storm of intensely cold wind, that is laden with fine, blinding snow which is mostly or entirely picked up from the ground. A snow storm must have winds of at least 45 mph, a temperature well below freezing, and a windchill factor of at least 20 degrees below zero.

Although there is no need for actual snowfall, the air as high as two or three hundred meters above the ground will be filled with swirling snow whipped up by powerful gale winds. The snow is much like powder or flour, and has the ability to penetrate everywhere. Although very rare in eastern Canada or along the coast of British Columbia, at least one major blizzard occurs in Manitoba, Saskatchewan or Alberta every year. Some storms are much worse than others and result in the closure of schools, roads, bus service, airports, railroads, and other businesses throughout any given city or small community. Under the weight of heavy snow falls, roofs of houses and other buildings have been known to collapse. Driving can be very treacherous, and is often not recommended when visibility is poor or when roads are ice covered. When travel is necessary, people will often use snowmobiles, skis or even snowshoes.

Several distinct types of blizzards are recognized by weather experts. The first kind is associated with a very cold wave of arctic air which surges southward from the ice-covered polar regions of the far north. It brings a large amount of snow, rapidly plunging frigid temperatures, and strong excessive winds. Nicknamed the "norther", these types of storms frequently arrive in quick succession, one chasing

another with a separation of only a few days. People caught out in one of these blinding storms cannot see more than a few meters in any direction. They are often required to find shelter and wait for the storm to pass through the area.

A second type of blizzard often follows the "norther", and is accompanied by a brisk wind from the south or southeast. It occurs mainly in the prairie provinces of Canada, and is bitterly cold. After it crosses the Rocky Mountains, the center of low pressure usually follows a more or less parallel path along the international boundary between Canada and the United States. Snow picked up from the ground is mixed with snow falling from the clouds. One of the worst dangers of a blizzard is the possibility of getting lost.

A third type of blizzard is located primarily in arctic regions of Canada. The intense winter cold causes snowflakes to break up into tiny ice crystals or to appear as a huge cloud of ice needles. An arctic blizzard produces a blinding white isolation in which a person's sense of direction is easily lost. The wind howls mercilessly across the barren frozen waste. People caught in such storms risk frostbit or even death.

People have also been known to unknowingly stray from a familiar path and to perish only a meter or two from a house they were unable to find. In farming communities across Canada where blizzards are common, careful farmers will often keep coils of rope on hand, so that when they have to go a short distance outside in a bad storm, they can tie one end to the building and the other end around their waist. In this way, they are able to safely venture outdoors into a blinding snow storm, and still be able to return safely indoors.

(604 words)

APPENDIX F

First Canadian in Space - Map Scoring Post-test

Scoring: *Title: Award 1 point for the general topic heading/title*

Main Ideas: Award 2 points for each superordinate (main) idea

Supporting Details: Award 1 point for few details/too many details provided
Award 2 points for adequate details provided
Award 3 points for all relevant details provided

Ideas Contained in Map:	**Point Value:**
A. Title:	
First Canadian in Space	/ 1
B. Superordinate & Subordinate Ideas:	
1. Selection of Canadian Astronauts	/ 2
Few details/too many details provided Adequate details provided All relevant details provided	/ 3
2. Training of the Astronauts	/ 2
Few details/too many details provided Adequate details provided All relevant details provided	/ 3
3. Marc Garneau's Responsibilties	/ 2
Few details/too many details provided Adequate details provided All relevant details provided	/ 3
TOTAL:	**/ 16**
	%

Sleep Facts from A to ZZZZ - Map Scoring

Scoring: ***Title: Award 1 point for the general topic heading/title***

Main Ideas: Award 2 points for each superordinate (main) idea

Supporting Details: Award 1 point for few details/too many details provided
Award 2 points for adequate details provided
Award 3 points for all relevant details provided

Ideas Contained in Map:	**Point Value:**
A. Title:	
Facts About Sleep	/ 1
B. Superordinate & Subordinate Ideas:	
1. Sleep Research	/2
Few details/too many details provided Adequate details provided All relevant details provided	/3
2. What Happens During Sleep	/2
Few details/too many details provided Adequate details provided All relevant details provided	/3
3. Effects of Sleep Deprivation	/2
Few details/too many details provided Adequate details provided All relevant details provided	/3
TOTAL:	**/ 16**
	%

Blizzards - Map Scoring

Scoring: ***Title: Award 1 point for the general topic heading/title***

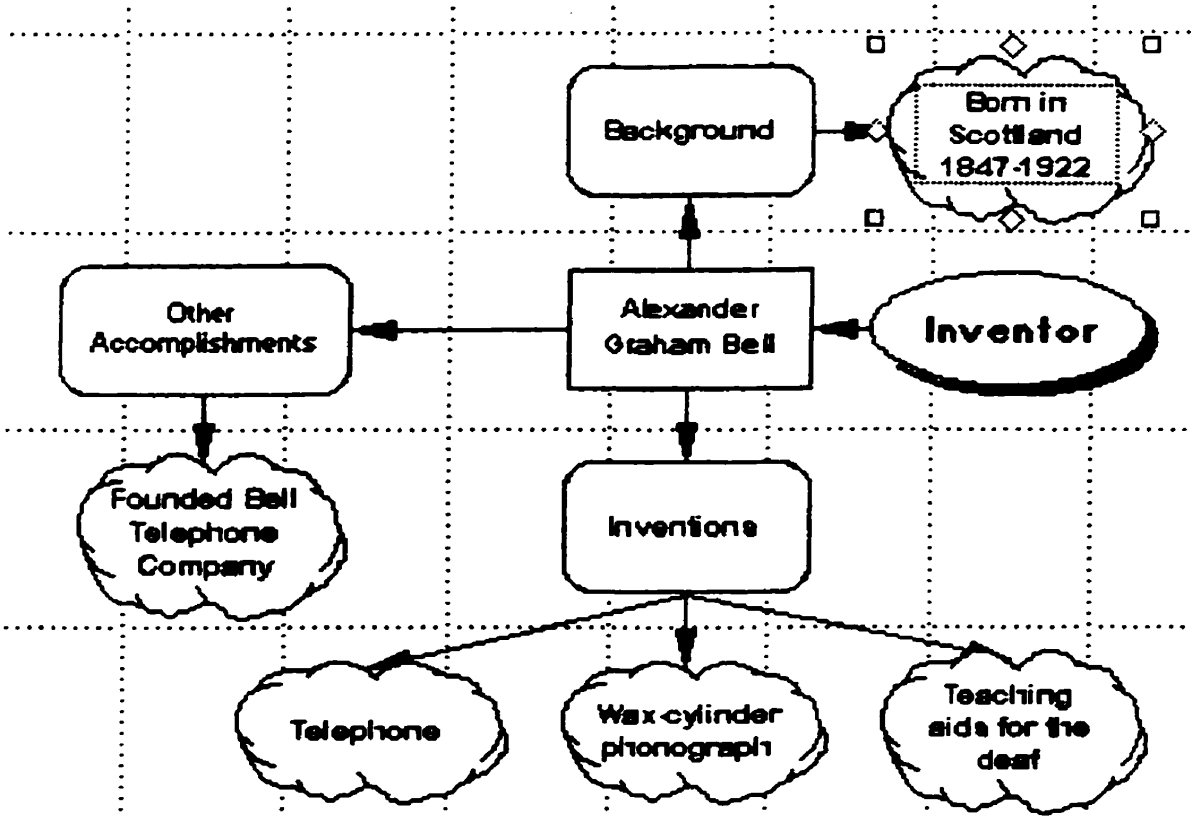
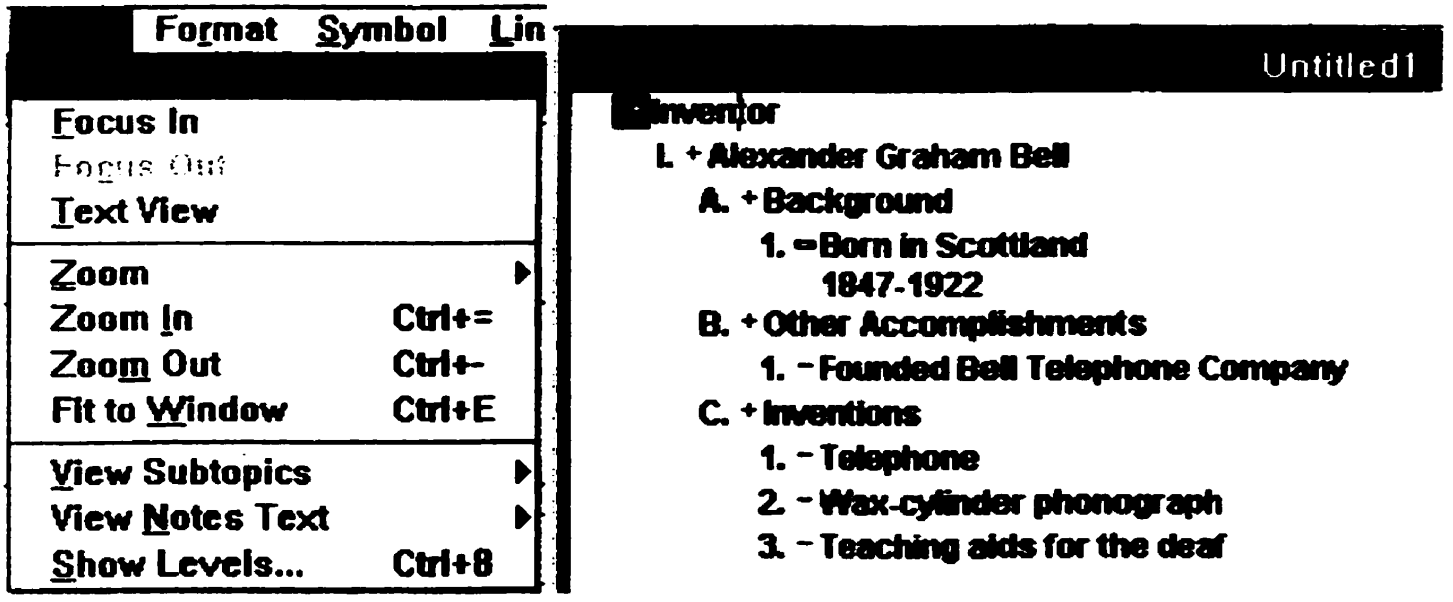
Main Ideas: Award 2 points for each superordinate (main) idea

Supporting Details: ***Award 1 point for few details/too many details provided***
Award 2 points for adequate details provided
Award 3 points for all relevant details provided

Ideas Contained in Map:	**Point Value:**
A. Title:	
Blizzards	/ 1
B. Superordinate & Subordinate Ideas:	
1. Definition & Location of Blizzards	/ 2
Few details/too many details provided Adequate details provided All relevant details provided	/ 3
2. Types of Blizzards	/ 2
Few details/too many details provided Adequate details provided All relevant details provided	/ 3
3. Dangers of a Blizzard/Safety	/ 2
Few details/too many details provided Adequate details provided All relevant details provided	/ 3
TOTAL:	**/ 16**
	%

	Out-come	Above	At	Below
Content	1 3 2 3 5	Demonstrates ALL of: • evidence of purpose/focus • main ideas/events with a wide range of details/supporting details that pertain to purpose • use of language/vocabulary, sounds and or images, including transitional devices and figurative language, to enhance meaning and create emphasis • evidence of connections, references, reflections, evaluation or comparison • evidence of promoting sensitivity/regard for situations, feelings, opinions and rights of others (when and where applicable, for the required form) **(5 marks)**	Demonstrates THREE or FOUR of: • evidence of purpose/focus • main ideas/events with sufficient details/supporting details that pertain to purpose • use of language/vocabulary, sounds and/or images, including transitional devices, to enhance meaning and create emphasis • some attempt to make connections, references, reflections, evaluation or comparison • sensitivity/regard for situations, feelings, opinions and rights of others (when and where applicable, for the required form) **(4 or 3 marks)**	Demonstrates TWO or fewer of: • evidence of purpose/focus • details/supporting details • limited use of language/vocabulary, sounds and/or images to clarify meaning and create emphasis • connections, references, reflections, evaluation or comparison • inconsistent sensitivity/regard for situations, feelings, opinions and rights of others (when and where applicable, for the required form) **(2, 1 or 0 mark)**
Form	4 4 4 4	• consistently follows model/template (e.g., letter, recipe, etc.) • consistently addresses target audience • organizes writing with effective introduction, conclusion and a variety of sentence patterns (types, length, structure) • consistently uses language appropriate to form **(3 marks)**	• generally follows use of model/template for the form • generally addresses target audience • organizes writing with introduction, conclusion and a variety of sentence patterns (types, length, structure) • generally uses language appropriate to form **(2 marks)**	• inconsistent use of model/template for the form • inconsistently addresses target audience • limited skill in writing basic sentences on topic • inconsistent use of language appropriate to form **(1 mark)**

APPENDIX H



5. Your diagram can also be viewed as an outline using the VIEW menu. Click on View, Outline.