TEACHING AND LEARNING WITH TECHNOLOGY
AN INTEGRATED APPROACH

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by

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Abstract

This report summarizes the program of study done to complete a graduate internship in the field of Teaching and Learning. The theme of the report is the integration of technology within and across the curriculum particularly with respect to the role of the Learning Resource Teacher. This document consists of three components: the first, a theoretical framework providing the foundation for practical application, the second, a critical reflective analysis of the internship, and the third, a reflective analysis of specific internship projects.

The theoretical framework explores the literature related to the role of technology in society and education. It summarizes current thinking on the appropriate application of technology and integration strategies. The implications of current learning theory and curriculum perspectives are discussed as well as the problems of initiating change in a conservative educational system.

The critical reflective analysis component includes a description of the school and its current status with respect to technology, but focuses on the experiences of the internship that contributed to the development of an in depth understanding of the realities of the role of the Learning Resource Teacher. Particular emphasis is placed on the projects and strategies for integrating technology.

The final component of the report includes a description and critical reflective analysis of two specific projects: the first involved the development of a primary and

elementary information skills continuum incorporating the technology outcomes identified in current curriculum guidebooks; the second involves using a Stellar School Project, ISLE-Net, to integrate technology within and across the curriculum. It outlines the planning and preparation procedures followed, a description and analysis of the implementation process, recommendations for the further development of the ISLE-Net project, and a discussion of its implications for future projects.

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Chapter 1

Theoretical Framework

Introduction

We live in a world of technology. It has influenced our beliefs and values and has transformed how we live, work, play, and learn. The importance of being competitive in an international economy has placed increased demands on the educational system to generate citizens and employees equipped with lifelong learning skills who can work effectively and productively in today's technological work environments. Currently there is a public outcry for educational reform. Political, business and community leaders are calling for higher educational standards and measurable learning outcomes. In response, a common core curriculum for the Atlantic provinces was developed which identifies Technological Competence as one of the Essential Graduation Learnings.

Stakeholders agree that technology has a key role to play in educational reform. "Information technology is seen as the modern engine of progress, and education is promoted as the means to realize the change from an industrial age to an emerging information age" (Froese-Germain & Moll, 1997). There is however, a great deal of concern among educators on how such technologies should be applied in education and on the desired outcomes with respect to those technologies. The guiding principles of The Royal Commission Report, Our Children, Our Future, (Government of Newfoundland and Labrador, 1992) suggest that educational reform should be aimed at encouraging

societal growth and change through the growth and development of the individual. Yet in the provincial document, Adjusting The Course Part II : Improving The Conditions for Learning (1994), the business like language and the uncompromising dedication to what is designated as core subject areas suggests that educational success is determined by students' abilities to master the content and skills that will ultimately best serve the needs of the business community, thereby contributing to the solution of our provincial economic woes. Students become the products of an educational system designed to serve the business stakeholders thereby maintaining the status quo in society rather than facilitating change and growth.

If schools are to avoid a return to what Elizabeth Vallance suggests was the major purpose of schools in the Post Civil War era in the U.S.A., that of providing "specific skills to large numbers of people, developing capabilities that would assure survival of the industrial order" (1973/74, p.85), then the role of technology in society and in schools must be critically considered.

A Technological Society

Technology has improved many aspects of our lives; the printing press led to the increase and dissemination of knowledge that ultimately resulted in the democratizing of much of the world, transportation technologies have allowed us to colonize the planet, and medical technology continues to save lives. Yet it has also had many unexpected

and less desirable effects. Technology has contributed to destructive forces within society - e.g., atomic weapons, environmental pollution, and factory sweatshops that exploit children - problems that continue to plague society today. In an historical review of the ideology of technological progress in America, Howard Segal (1996), concludes that "technological progress has invariably been a mixed blessing, with the exact mix varying with the particular technology and with the perspectives of those affected differently by it" (p.45)

Ursula Franklin (1990) describes information and communication technologies as doors that can lead to emancipation and power or to enslavement reminiscent of the industrial revolution. Franklin fears that nature and the human element have become the acceptable losses in the pursuit of efficiency and productivity, the goals of technology. Her warning that "Today the values of technology have so permeated the public mind that all too frequently what is efficient is seen as the right thing to do" (p.123), is echoed within the education community. Dr. Stephen Kerr (1996), the head of the Educational Communication and Technology program in the College of Education at the University of Washington, suggests that we should examine our inclination to believe

> that technology is *good*, that it is *value-free*, that it *should* find application in *many* fields, disciplines, and aspects of our lives. Perhaps most troubling is the assumption that if technology makes it possible to do something, then that thing *should* be done. (p.1)

Technology is a force that is shaping society. It is not neutral, nor is its impact on

education limited to how it is used in the classroom. It encompasses a way of thinking about the world (Apple, 1991; Franklin, 1990; Froese-Germain & Moll, 1997; Kerr, 1996; McLuhan, 1964). McLuhan suggested that new technologies change the pattern of human interactions, "the medium is the message", that technology does not just change how things are done, it changes what is done and why it is done, "It is the framework itself that changes with technology, and not just the picture within the frame" (p. 219). E.J. Lias in Future Mind maintains that "the original reason for embracing a new medium may be lost as the medium "suggests" other uses for itself" (Lias, p.27 cited in Froese-Germain & Moll, 1997).

There has been a tendency to equate technological progress with social progress. This tendency is becoming more and more suspect as people struggle to cope with the individual and societal problems evolving from our technological revolution. Theorists maintain that people are not helpless victims of a technological age, that technology has opened the doors of possibility and that critical reflection and a demand for political accountability with respect to the application of technology, offer the opportunity to determine the *what's* and *why's* of technological progress (Franklin 1990; Froese-Germain & Moll, 1997; Kerr, 1996; Perelman, 1992; Segal, 1996). As in the construction of a house, it is the combination of the builder's vision, commitment and expertise, and the tools available that determines the form, function, and appeal of the structure created. Like the builder, people determine the vision of society that the tools of technology will enable them to construct.

Various writers maintain that in such a time, vision must reach beyond a financial "bottom line". Franklin suggests that society must also look at environmental, and human and community gains and losses (p. 129). Senge (1990) argues that people must learn to consider the bigger picture and to evaluate the consequences of their choices, referring to this as systems thinking. Such systems thinking requires a commitment to continuous learning and change agentry. Today's students are tomorrow's leaders. How they learn to think with and about technology will shape the future. Fullan (1993) maintains that teaching must include moral purpose, "care must be linked to a broader social, public purpose" (p.11). Applying systems thinking to the role of technology in society provides such moral purpose to the integration of technology into education, allowing schools to respond to the challenge of technology in such a way that students can embrace technology and the opportunities it provides to shape the direction and quality of their lives.

The Role of Technology in Education

How can technology be incorporated into schools to ensure that the world of technology meets the needs and demands of the people it was designed to serve? Before considering this question, it is useful to examine relevant government policy that determines educational mandates and implementation strategies with respect to the use of technology in education. Various documents have been developed that articulate the

government's vision in this regard. One such document, A Curriculum Framework for Technology Education : Living in a Technological Society (1995), provides an overview of the technology education program for schools in Newfoundland and Labrador. It implies that technological competence includes not only an understanding of how to use hardware and software, but embraces a broad knowledge of technologies and how they affect people individually and collectively, as well as the ability to choose and use appropriate technology to analyse and solve problems effectively and efficiently.

The Technology In Learning Environments (TILE) report (1995), outlines a "plan for the integration of information technology into the teaching/learning environment, the curriculum development process, and the learning resource management process of the K-12 education system" of the province (Government of Newfoundland and Labrador, p.1). Although this document places a great deal of emphasis on the economic need for technologically literate graduates, it also recognizes the importance of empowering our youth to make choices and to take control rather than be controlled by technology.

> It is now possible to have a level of synchronicity between the social, economic, and educational functions of our society. We can put into the hands of our bright young minds tools undreamed of just a few years ago; tools which can amplify their intellectual ability, open doorways to futures unknown, challenge their thinking and stimulate creative solutions to the problems we face. The potential that arises from having thousands of fresh young minds pushing the boundaries of conventional thinking can have

only positive results for this Province. (p. 87)

Although there is a strong economic rationale provided for integrating technology into education, the relevant policy documents do include a vision of technology consistent with that of Franklin (1990), Kerr (1996) and Segal (1996). The vision they articulate encourages the incorporation of technology in a manner that will meet the human needs within a technological world. Within the framework of such supporting policy, the focus can shift to the question of how to go about integrating technology to meet this goal.

Educational Theory and Technology

Technology Education as described in provincial curriculum documents, includes both specific courses designed to teach the tools of technology, and practises that integrate technology across the curriculum. A Curriculum Framework for Technology Education: Living in A Technological Society (1995), describes Technology Education as:

> a complex, multi-dimensional facet of the total education program. It is an essential component of general education. It assists students to understand the relationships of technology to science, society, and the world of work. It deals with the fundamental issues of technology as product, technology as process, and also with technological systems. It has an integrating influence which helps students understand the totality of the educational experience. (p. 5)

Effective integration of technology within and across the curriculum, requires consideration of what we know about learning and curriculum.

Beliefs about learning, the nature of knowledge, and the role of the teacher and student, have changed dramatically over the years. The teacher is no longer seen as a font of all knowledge and the student as the passive recipient of that knowledge, the empty vessel to be filled. The role of the teacher has changed to that of guide and facilitator of learning. Students have become active learners who are in control of, and responsible for their own learning. The information explosion has resulted in less emphasis being placed on content knowledge and more on the process of learning; accessing, evaluating, analysing and synthesizing information and the construction of knowledge (Association for Teacher-Librarianship in Canada, 1998; Government of Newfoundland and Labrador, 1995; McGregor, 1995; Pappas, 1997).

The historical application of technology within education reflects the evolution of these beliefs about learning, knowledge and teaching. In the 1960's computer technology consisted of large expensive mainframe computers and their application to education focused on using traditional pedagogical approaches to accomplish traditional curricular goals. The Stanford project directed by Richard Atkinson (1966, in Reinking & Bridwell-Bowles, 1991) is an example of a computer based reading curriculum program that was designed to eliminate the need for a reading teacher. Such applications of technology and the teaching machines that followed, demonstrated a transmissional approach to curriculum and learning. With the advent of the microcomputer, the pedagogical

advantages of computers to teach or to reinforce specific skills, were recognized and built on. Computer Assisted Instruction (CAI) and Computer Managed Instruction (CMI) provided the advantages of immediate feed back, increased motivation, individualized instruction and computer tracking of student progress.

Educational researchers looked at how technology could be applied to education to increase learning. The applications they developed or investigated reflected the current theories of learning. Software companies were quick to respond to the lucrative *educational market and many new products grounded in learning theory ensued.*

Technology & Behaviourism

Behaviourist Theory which grew out of the work by B. F. Skinner, supported a transmissional pedagogical approach. The teacher's role was to identify and sequence the student's experiences to ensure that learning occurred. Learning was inferred from student behaviour. The content was *learned* when an appropriate stimulus (question) produced a correct response (answer). Students learned specific content and then demonstrated mastery in some manner (Newby, Stepich, Lehman, & Russell, 1996; Seifert, 1995) .

Applications of technology that reflected this thinking included Computer Assisted Instruction (CAI), drill and practise, tutorials, and mastery learning. Mastery learning programs, or tutorials are often used in foreign language acquisition classes or labs. They

have also been used to teach basic skills such as typing, or computer applications like *Windows*, or *Excel*. These types of programs have proven to be effective in the acquisition of such basic skills and knowledge as well as for remediation.

Drill and practise programs have been particularly beneficial for individuals with reading disabilities who require a greater than normal amount of practice coupled with immediate feedback. (Barker & Torgensen, 1995; Lundberg, 1995; Sands & Buchholz, 1997). Programs such as *Number Munchers*, and *Math Blaster* provide drill and practise in mathematics in game format. Although these types of programs have proven effective in developing or reinforcing discrete or specific skills, alone they do not provide students with the technological competencies that will empower them to grow and thrive in a technological world.

Information Processing Model

While behaviourism focused on the external behaviours that demonstrated learning, an information processing model directs attention to the internal process that characterize learning. Learning is viewed as a "change of knowledge stored in memory" (Newby, Stepich, Lehman, & Russell, 1996). The focus of attention shifts to how information is processed, integrated, stored and retrieved.

Dual coding theory of Paivio (1971) characterizes this perspective on learning. Dual coding theory suggests that information is encoded either verbally through text or

audio, or visually through images. Multi-modal encoding through including illustrations with text, or sound with video, increases the likelihood that multiple cognitive paths are generated through the activation of more than one sensory input system. When channels provide complementary information learning may increase (Jonassen, 1996, p.185). Recall is more likely when multiple cognitive paths to the information are formed (Mayer and Sims, 1994).

The information processing model reflects a transactional curriculum orientation which is child oriented, resource-based and relies on direct experience versus teacher explanation. It recognizes the role of prior knowledge in learning and is built on the premise that knowledge is relative. Students come to the educational setting with a cognitive framework that contains information and misinformation. Learning involves assimilation and accommodation and the formation of connections between concepts or ideas. The goal of education is to develop rational thinking and problem solving skills in students.

Constructivism

Constructivism builds on the information processing model. It focuses on how learners construct knowledge through thinking about and interpreting experience.

> How learners construct knowledge depends on what they already know, which depends on the kinds of experiences that they have had, how they

> have organized those experiences into knowledge structures, and the beliefs they use to interpret objects and events that they encounter in the world. (Jonassen, 1996, p. 11)

Under a constructivist position, knowledge is produced by the individual learner rather than processed from information received from an external source (Forcier, 1996, p. 222). It encompasses more than the processes of encoding, and retrieval. It involves the construction of new knowledge and understandings usually within collaborative learning environments.

> Learning is said to have occurred when our knowledge has changed in a way that allows us to interpret our experience in a way that is more complete, complex, or refined, that is, when our lens allows us to see something we couldn't see before or to see things in sharper focus. Learning is determined by the complex interplay among students' existing knowledge, the social context, and the problem to be solved. (Newby et al. p. 34)

The constructivist perspective requires a combined transactional and transformational curriculum orientation. Although it encompasses the rational thinking and problem solving attributes of a transactional curriculum orientation, its metacognitive focus incorporates some of the self actualization characteristics of a transformational orientation. Thinking about their thinking helps students develop a better understanding of themselves. A transformational approach to education accepts that children are in

control of their own learning and that each learning experience is significant and unique by virtue of how it relates to the prior knowledge and experiences and interests of the learner. It reflects a belief that all things are interconnected and as such cannot be understood if separated from their context. This same belief in interconnectedness places value on the whole child with both unique and common characteristics.

Constructivism is evident in the generative learning theory of Wittrock, (1989), and the discovery learning approach of Bruner (1961 as cited in Newby et al, 1996). The effectiveness of many of the computer applications widely used in schools today is supported by cognitive and constructive learning theory.

Although computers originally presented information in purely textual form, technology has advanced to multimedia, hypertext, and hypermedia. Multimedia is the term used to describe the presentation of information in two or more sensory modes such as visually presented video and verbally presented narration. The premise that multimedia can help people learn is based on dual coding theory. In a review of the research on the effectiveness of multimedia on learning, Najjar (1996) concludes that multimedia does help people learn by supporting the way people understand, organize, and access the information (p. 143).

Hypertext adds still another dimension. Hypertext is a non-sequential, non-linear method for organizing and displaying text. Learners impose the organization of information through choosing the links they determine to be relevant or interesting. By nature, hypertext is a web of ideas with a common thread. Wittrock's (1989) theory of

generative learning suggests that learning involves understanding concepts and generating links between these concepts and between the concepts and our prior knowledge. How hypertext is read seems to closely reflect the generative learning process that Wittrock describes. The organizational structure of hypertext can be compared to cognitive strategy of concept mapping. Hypertext then, seems to reflect how our thinking is organized. This is in keeping with Najjar's suggestion that improved information organization may be responsible for the learning advantages associated with computer-based multimedia instruction (1996, p. 131). In hypermedia, the digressions may include audiovisual presentations, thus the learner is presented with the combined benefits of multimedia and hypertext.

Problem solving software, computer simulations and games are all examples of technology applications that reflect a cognitive theory of learning. Early work in this area was done by Samuel Papert (1980) and his colleagues who developed Logo which allowed even very young learners to control the movements of a turtle on the computer screen through simple programing commands. The program was designed not to be taught, but to be discovered by students requiring them to think about the thinking and learning process. Papert believed that the best learning occurred when the student rather than the technology was in control.

Computer simulations such as Oregan Trail, Carmen Sandiago, Sim City, and Civilization II provide realistic microworlds where students engaged in problem solving activities to accomplish life-like goals. Simulations of galaxies, atoms, and frog

dissections offer the advantage of allowing students to experience or "see" situations that might not otherwise be available to them, or are too dangerous, time consuming, or costly to allow for real life participation. Medical schools can even provide surgery and diagnostic simulations that provide practise opportunities for future doctors.

Games provide motivational and challenging opportunities for learning. *The Incredible Machine* provides students with the challenge to use given materials to solve science puzzles. *Mathville* presents students with opportunities to do realistic "jobs" such as shopping or yard work, which require mathematical problem solving, to earn money that will allow them to shop which in turn requires calculating costs and change. Many games involve the multiple attributes of drill and practise, tutorial, simulation and problem solving.

Such programs clearly have a legitimate role to play in the integration of technology across the curriculum.

Implications for Practise

Computers themselves do not equal better learning or thinking. "What learning demands not what technology can do best points up the potential contributions of technology" (Salomon and Perkins,1996, p. 114). It is how computer technologies are used that will determine their impact on how students think and learn.

Many of the applications described previously represent learning *from* computers.

Although they do have a place within the educational setting, they do not represent the single best use of computers in schools. It is learning *with* computers rather than *from* them that provides the greatest opportunity for enhancing educational outcomes (Forcier, 1996; Glennan & Melmed, 1996; Jonassen, 1996; Papert, 1980; Perkins, Schwartz, West, Wiske, 1995). Computers should be used as merely tools for thinking (Jonassen, 1996; Papert, 1983). They offer an environment that supports students efforts to think and manipulate ideas and to represent their understandings. "Computers should be used as unintelligent tools, relying on the learner to provide the intelligence, not the computer" (Jonassen, 1996, p. 14). Jonassen compares the role of the computer in constructing knowledge to the role of a carpenter's tools in the construction of a house:

> Just as carpenters cannot work effectively without a proper set of tools to help them assemble wood and construct furniture or houses, students cannot work effectively at thinking without access to a set of intellectual tools to help them assemble and construct knowledge. (p. 3)

He coins the phrase "Mindtools" to describe computer applications that require students to think in meaningful ways in order to use an application to represent what they know (p. 3). He describes these applications as "cognitive reflection and amplification tools that help learners construct their own representation of a new content domain or revisit an old one" (p. 11). Representations generated *by* the learner rather than *for* the learner enhance learning with understanding (Jonassen, 1996; Perkins et al., 1995). Databases, spreadsheets, semantic networks, expert systems and computer mediated

communication are the applications that Jonassen proposes best suit the goals of a constructivist approach to learning. Using these applications, students actively engage in goal-directed and intentional construction and manipulation of information.

The literature reviewed above reveal that Software which simply displays the consequences of users' actions and allows students to raise their own questions and assess their own actions offers the greatest potential to engage students in meaningful learning situations. Using an on-line database requires logical thinking and basic computer skills. Creating a database on the other hand, requires a great deal of logical, analytical and creative thinking. It allows students to define the structure of the information. It extends and demonstrates students' understanding of content and provides a new resource for others. The software itself offers no instruction nor provides any information. It simply operates as a tool for organizing, manipulating, and representing information that students' have collected, analysed and synthesized.

Hypertext and hypermedia can be used to organize and represent very complex networks of ideas and concepts. The creation of a hypermedia environment to represent the interrelationships of concepts being studied requires extensive critical and creative thinking. This type of activity challenges students to articulate what they know and to build and extend their knowledge and ideas by developing links between them. Learners must consciously reflect on and assess what they know and need to learn. The network of ideas represented, could be extended and modified as learning continues throughout the year. Watching and listening to students involved in this type of project offers the teacher

a window into their thinking. The measure of learning lies in the process of construction rather than in the glitz of the finished product.

Computer and information technologies provide students with a means for obtaining information as well as for organizing and creating new information. Multimedia encyclopedias, commercial databases, and other subject specific content software is now readily available on CD-ROM. E-mail capabilities and the Internet extend the learning environment beyond the walls of the classroom into the school, the community and the world. Students need to learn how to find and access the information they need, how to collect, compile, and evaluate it, and how to synthesize and present it in an accurate. and effective manner. Collaborative projects with students from other schools and other countries provide students with the opportunity to become sources as well as seekers of information. Communication technology allows students to explore multiple perspectives on issues they are studying. It allows for discussions of ideas and opinions and the development of systems thinking.

Reciprocity: Student & Machine

Under a constructivist model there exists a reciprocal relationship between the learner and the technology. Each complements the abilities of the other, together accomplishing more than either could alone. Salomon and Perkins (1996) suggest that the computer and the student become partners in cognition with the computer performing the

computations and other lower order processing activities, while facilitating the student in his or her engagement with the higher order thinking activities that even 'intelligent' software cannot duplicate. (p.124) This notion of a reciprocal relationship is supported by Jonnasen (1996) who states:

> When students work with computer technology instead of being controlled by it, they enhance the capabilities of the computer and the computer enhances their thinking and learning. The result of this partnership is that the whole of learning becomes greater than the sum of its parts. (p. 4)

The benefits of technology to the student lie in the opportunities for activities that it affords. Such activities centre around helping students learn how to generate good questions and the development of sound research practises for answering their questions. They challenge students to think in new ways while providing opportunities to work in collaborative settings on real problems. "The thoughtful engagement required as students express concepts, offer viewpoints, build arguments, capture analogies, and so on, can advance their understanding as they think with what they know" (Salomon & Perkins, p. 124). Metacognitive skills are continually developed as students engage in self reflection and revision in learning.

Technology and the Learning Organization

The aim of schooling is to develop students with the skills, initiative, social

conscience, and commitment to life long learning that will enable them to grow as individuals, as citizens, and as members of an economic and global community. Teachers are trying to help students develop the personal characteristics that will enable them to be participants in what Senge (1990) describes as learning organizations. His five disciplines - personal mastery, mental models, shared vision, team learning and systems thinking - are personal ways of thinking and doing that, collaboratively practised, translate into a holistic, collective perspective and system of behaving. The ability to learn within a group or an organization has tremendous implications for how members of organizations think and how society will function.

An information and thinking skills curricular focus is consistent with the development of these five disciplines. Senge's first discipline, personal mastery is defined as "the discipline of continually clarifying and deepening our personal vision, of focusing our energies, of developing patience, and of seeing reality objectively" (p.7). Senge claims that it is achieved through commitment to lifelong learning. This is clearly an educational goal which teachers hope to achieve with, or without technology. Technology however, provides a unique means of achieving that goal. The learner-centred, learner-controlled nature of meaningful technological activities provides a learning environment that is personally stimulating and motivational. Students generate and investigate questions that have meaning for them. They have access to information and expertise that would otherwise be unavailable. Technology provides a means for students to construct and deconstruct their own knowledge from the flood of information available to them. It gives

them the means to explore and interpret reality. Students learn how to direct their thinking and the importance of personal investigation, reflection, and lifelong learning.

Mental models, the second discipline described by Senge (1990), are deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action. When computers are used as Mindtools (Jonassen, 1996) students are encouraged to think about what and how they *know*, to use computers to develop and represent their understandings. Computer technology allows users to construct representations of their mental models. They become tools for reflecting on and revising assumptions and understandings of the world.

The development of a shared vision, Senge's third vision, requires a sense of commonality. There must be a sense of shared knowledge or experience. The application of today's communication technologies assist in the development of this discipline, for, "As a result of the widespread use of electronic media, there is a greater sense of personal involvement with those who would otherwise be strangers -- or enemies" (Meyrowitz, 1996, p. 97). There is a greater sense of the common human bond and a more widespread knowledge of the problems that society faces as a global community.

Technological competency requires the ability to work within a group. Collaboration fosters the development of communication and leadership skills. It helps students learn social patterns of interaction. Collaboration fosters skill in negotiating ideas and dealing with controversy. It provides the basis for the development of team learning, Senge's fourth discipline.

Senge's fifth discipline is system's thinking which he defines as " a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static 'snapshots'" (Senge, 1990, p. 68). Computer applications are well designed for helping students investigate relationships. Senge cites an example of a computer simulation developed by John Sterman and used at MIT to allow students to experiment with management strategies (p. 134). This particular simulation allows students to 'discover' the concept of systems thinking. Computer technologies allow students to build diagrams of relationships, construct webs of related concepts, investigate the consequences of manipulating variables in mathematics or science, and to consider different perspectives through role plays and simulations. Technology can help students develop a disposition towards systems thinking. Continued practise in looking for relationships and considering consequences, trains the subconscious to "think in circles" rather than in straight lines (p.366). Technology can be used as tools to "practice thinking and acting systemically" (p. 367).

Individuals working together, who have developed these five disciplines, form the foundation of a learning organization. They are a community of learners who can successfully integrate individualism and collegiality (Fullan, 1993, p. 36). If the goal of education is to facilitate the growth of these disciplines in our students so that they can develop and thrive as participants in learning organizations, then the school itself must become a learning organization (Fullan, 1993).

Technology and Change

Technology has the potential to become a catalyst for school reform. Meaningful technological integration requires broad changes in the learning environment. Computer technologies are creating the need and the means for a shift away from a content based curriculum towards a curriculum that centres around information and thinking skills.

> The very technology that now cries out for a new mode of education creates means for getting it...the very first casualty of the present-day school system may well be the whole business of teacher-led instruction as we know it. (McLuhan in Meyrowitz, 1996, pp. 102-103).

The rapid developments and changes that are characteristic of computer technology require educators to be comfortable with the change process if they are to successfully integrate it. Instructional materials are changing to meet new needs and new instructional approaches and revised school organization are required.

Despite an expectation that computer technology will transform education, significant change has not materialized (Government of Newfoundland and Labrador, 1995). Although the number of computers in schools has increased significantly, the presence of computers in classrooms has not resulted in any meaningful change in the way classrooms are organized or in the way teachers teach (Fullan, 1993). As Fullan also points out, change in a fundamentally conservative educational system does not occur easily.

> The way that teachers are trained, the way that schools are organized, the way that the educational hierarchy operates, and the way that education is treated by political decision-makers results in a system that is more likely to retain the status quo than to change. When change is attempted under such circumstances it results in defensiveness, superficiality or at best short-lived pockets of success. (p. 3)

How can students be expected to develop the characteristics of systems thinkers and life-long learners if teachers do not exhibit them? If, as Fullan (1993) states, education has moral purpose, "to make a difference in the lives of students regardless of background, and to help produce citizens who can live and work productively in increasingly dynamically complex societies" (p. 4), then teachers must also recognize the need to embrace change.

Demonstrating the caring inherent in moral purpose requires a commitment to competence. Forcier (1996) argues that "Who dares to teach must never cease to learn" (p. 300). New technology and changing curriculum means that teachers will need to reflect on, and to modify practise, to recognize that there is no finish line, that learning is continuous. The research on the learning organization (Senge, 1990) makes it clear that striving for personal mastery leads to competence; that a commitment to competence requires collaboration with other teachers; and that effective collaboration generates a shared vision of what *might* be. Like-minded individuals working towards continuous improvement constitute a learning organization as individuals embracing change lead to a

change within the system.

Information and Technological Literacy: Implications for the Learning Resource Teacher

Traditionally the primary teaching function of the Learning Resource Teacher focused on information literacy and the need to develop learners who are independent information seekers. The curriculum models used go by various names: the information seeking model (Kuhlthau); the information problem-solving model (American Association of School Librarians, Eisenberg & Berkowitz); and the research-process model (Pitts & Stripling). However they share a common theme: the development of independent learning skills (as cited in Washington Library Media Association Online, 1998). The Newfoundland Government has adopted the SUCCEED Model for Independent Learning, developed from the research steps outlined in *Information Skills in the Secondary Curriculum* (Marland, as cited in Government of Newfoundland and Labrador, 1991, p. 5). Although the various models differ in the number and names of the steps involved, they all include the same basic procedures and were designed to be implemented in an integrated fashion across all learning areas. Their underlying goal was to facilitate the development of information literacy.

The explosion of information and the development and availability of affordable technological resources have resulted in an expansion of the concept of information

literacy to include the subset of technological literacy. The Association for Teacher-librarianship in Canada now describes information literacy as:

> The ability to: recognize the need for information to solve problems and develop ideas; pose important questions; use a variety of information gathering strategies; locate relevant and appropriate information; assess information for quality, authority, accuracy and authenticity. Includes the abilities to use the practical and conceptual tools of information technology to understand form, format, location and access methods, how information is situated and produced, research processes, and to format and publish in textual and multimedia formats and to adapt to emerging technologies. (Association for Teacher-librarianship in Canada, 1998)

As such, the information age has also expanded the role of Learning Resource Teacher to include that of Information Technology Expert. The role of the Learning Resource Teacher encompasses more than just providing and facilitating access to information. Information Literacy is a multi-dimensional concept that does not naturally develop with maturation but must be explicitly taught (Association for Teacher-Librarianship in Canada, 1998; Farah, 1995; Government of Newfoundland and Labrador, 1995; McGregor, 1995). Neither computer nor information skills should be taught in isolation (Barron, 1997; Craver, 1995; Johnson & Eisenberg, 1996; Mergendoller, 1996). These authors suggest that they must be taught in meaningful contexts across the curriculum. Otherwise students may not develop an understanding of how these skills can help them organize and

manipulate information and construct new knowledge from it.

Although accessing information through computer technologies is an important skill, it alone, as Farah (1995) argues, does not constitute technological literacy: "We are now at a point where teaching students how to sift through huge amounts of information, make connections to prior knowledge, and transform data to knowledge in an informed and critical way is imperative" (p. 128). Students can become overwhelmed with quantity of information available to them. As Loertscher (1996) points out, the quantity of information cited is not a measure of the learning that has taken place. Computer technologies make it easy to prepare a report using cut and paste features and a few transitional sentences. Information is not knowledge, and the presence of technology does not ensure meaningful use.

> It is becoming increasingly clear that technology in and of itself, does not directly change teaching or learning. Rather, the critical element is how technology is incorporated into instruction (U.S. Congress, Office of Technology Assessment, 1995, p. 57, cited in Grégoire, Bracewell, & Laferrière, 1996).

Learning requires reflection on the information compiled. It requires that consideration and deliberation be given to inconsistencies in information and to the accuracy and reliability of sources. This is particularly true when considering information obtained from the Internet. The value of information must be determined through careful consideration of its sources and context (Caruso, 1997; Gilster 1997; Schrock, 1998;

Uline, 1996). A key role of the Learning Resource Teacher is to help students apply critical thinking skills to the information they uncover.

The evidence from studies indicates that students need to apply the same information processing models to information obtained electronically as they would to information obtained through print or other media. This is the expertise that the Learning Resource Teacher brings to the learning situation. The Learning Resource Teacher brings a knowledge of resources, information technology and information processing models and how they can be used to implement the curriculum.

The information and technological literacy curriculum goals addressed by Learning Resource Teachers are process goals that are hard to measure (Brown, 1997). Stakeholders are looking for accountability for the money spent on new informational technologies and for teacher allocation. It is the responsibility of Learning Resource Teachers to provide evidence that what they do is valuable. Brown argues that Learning Resource Teachers must provide a way of articulating and measuring the outcomes that they work to develop, for "What gets measured, or assessed, gets valued" (Stoll & Fink, as cited in Brown, 1997, p. 10). Worsnop (1997) suggests that Learning Resource Teachers work with classroom teachers to develop a rubric for measuring learning outcomes. He suggests that it is easier to develop a route when the destination is clarified. Teachers with a clear understanding of what they are trying to achieve become willing and competent partners in the process of getting there. Johnson and Eisenberg (1996) have developed a model that combines computer literacy and information literacy

curricula, *Computer skills for Information Problem-Solving: A Curriculum Based on the Big Six Skills Approach*. This type of document provides a foundation for the development of measurable learning outcomes for technological literacy within an information literacy framework.

The Role of the Learning Resource Teacher in the Integration of Technology

Many teachers are still struggling with their own technological competencies. For example, Newfoundland teachers face implementing the vision expressed in the TILE document in a period of severe fiscal restraint without the support of professional development opportunities and with classes that are rapidly increasing in size and diversity. The provincial document, *Learning to Learn* (Government of Newfoundland and Labrador, 1991) identifies a critical role of the Learning Resource Teacher to be that of staff developer, introducing and promoting new resources and technologies, and providing guidance regarding their use (p. 25).

Responsibility for providing leadership and support to teachers in their quest for competency in learning and applying educational technology is increasingly the role of the Learning Resource Teacher (Brown & Sheppard, 1997). Professional development opportunities for teachers is provided by the Learning Resource Teacher on a meaningful and continuous basisis through an apprenticeship model "where people who need to learn go to people who know more than they do. Those people then lecture, teach, demonstrate

and help apprentices learn more" (Gilster as cited in Pool, 1997, p. 10). This is delivered through workshops, after school training sessions, and just-in-time tutoring opportunities. The Learning Resource Teacher provides the leadership in organizing and training staff who can then apprentice others.

Instructing teachers on new learning technologies does not ensure technological integration. Teachers must relate their knowledge to the teaching and learning process (Gilster, 1997; Henri, 1997). Leadership in this area can best be provided through collaborative teaching situations. Resource based learning environments and collaborative teaching strategies provide opportunities to use technology to achieve curriculum goals in ways that are meaningful and satisfying for students and teachers.

In a resource-based learning environment, students engage in active learning situations where they construct their own knowledge by collecting, analysing, and synthesizing information using a variety of resources. The classroom teacher brings a knowledge of the students and the specific curriculum objectives to be addressed. The Learning Resource Teacher is an information specialist bringing a knowledge of appropriate resources and the information seeking processes, tools, and strategies. Such an environment allows collaboration between these two professionals and provides a way for teachers to step outside of the isolation of a traditional classroom setting. It brings together an effective combination of competencies, knowledge, and support to the learning environment. This combination of talents and knowledge operating in a resource based learning environment provides the ideal setting for true technology integration.

Conclusion

Computer technologies have enabled teachers to extend their reality. Such technologies allow a sense of shared experience and an awareness of our place in the global community. If students are to thrive in the world of technology they must develop a critical awareness of the cognitive and social impact that technology has on society.

The information explosion resulting from rapid technological advances has impacted the focus of education. Today there is a great need for individuals who know how to learn and who understand the nature of change, as well as a need for individuals with specific skills or knowledge (Fullan, 1993; Government of Newfoundland and Labrador, 1991). Computer technology integrated with learning strategies developed from a Constructivist perspective responds to this need. Computers extend the information available and help students to construct their own knowledge by facilitating the exploration of new information and ideas and by providing the means for students to compile, represent and modify their understandings.

Fullan (1993) points out that the education system is fundamentally conservative and resistant to change and that change must occur at the individual level if the system itself is to undergo any meaningful change (Fullan, 1993). Technology can help individuals develop the personal characteristics described by Senge (1990) that will empower them to initiate and maintain growth and change at a personal and systemic level. The Learning Resource Teacher, as a leader in the integration of technology, has a

greater role than ever to play in supporting an educational environment that is conducive to the development of individuals who can participate in the evolution and growth of learning organizations.

Learning Resource Teachers were among the first in schools to embrace technology as it fit so well with their primary curricular domain, information literacy. Information technologies have extended the list of resources used in the information seeking and problem solving processes that are such an essential component of the Resource Centre curriculum. Technology has expanded the concept of information literacy and has broadened the role of the Learning Resource Teacher. The instructional goals of Learning Resource Teachers have traditionally focused on the process of learning rather than on the product, and an integrated approach to the various subject areas within the curriculum has been a traditional methodology (Kuhlthau, 1995, McGregor, 1995; Pappas, 1997). As such, technology as a means to an end, rather than as a subject area has not been a new or difficult concept for Learning Resource Teachers. Technology has simply added depth and breadth to the realm of possibilities. This places Learning Resource Teachers in an ideal position to provide leadership in how the newest technologies can be integrated with those that are already in place, in a manner that will best serve students' needs.

Educational objectives require students to be critical consumers as well as producers of information, to look beyond the glitz, glitter and gadgetry of technology to the purpose that it serves. "Technology must be seen as a means to an end, rather than an

end unto itself" (Mergendoller, 1997, p. 14). To use technology in a positive and constructive manner, students must demonstrate critical literacy. They must learn to sift through the enormous quantity of information available to them, evaluating it and synthesizing it to create their own knowledge. Teachers facilitate this process by modelling the behaviours and thinking strategies that they want students to develop. If students are to be lifelong learners then teachers must demonstrate those same characteristics.

Technology is not a panacea for the problems in education. How the computer and other new technologies will reshape the institution of education depends on the beliefs educators hold about the place and value of technology, their commitment to lifelong learning, and their willingness to become educational change agents. Inequities exist between schools with respect to available funds, computer to student ratios, the quality of equipment, and Internet access. Schools face growing pressure to provide current technologies in financially difficult times. Administrators and teachers wonder if they can afford to bring technology into the education system in any meaningful way. Perhaps the question that should be asked is, can they afford not to?

Educators are not only responsible, but accountable for preparing literate students to be capable of thriving in the new technological world. They must seriously consider the characteristics of computer hardware and software, and what is known about learning, the learner, and the learning environment to make informed decisions about the technology that schools invest in and how it can be integrated within the curriculum to foster critical

and creative thinking. The literature suggests that technology does indeed offer potential to positively impact learning (See Appendix A). If teachers are to truly make a difference in students' lives, then they must be willing to reflect on and modify their practise. "Systems do not change themselves, people change them" (Fullan, 1993, p. 7).

The purpose of the internship is to explore the ideas discussed in this chapter in a school recognized for a commitment to technology integration. Chapter One provides a theoretical framework for the reflective practise that is discussed in the next two chapters. This literature review provides a foundation for practise based on a thorough knowledge of the goals of technology in education and the role of the Learning Resource teacher, and an understanding of the importance of grounding that practise within the curriculum framework. Chapter Two includes a description of the school and its current status with respect to technology as well as a description and reflective analysis of the role of the Learning Resource Teacher particularly as it relates to technology and its integration. Chapter Three describes and reflects on specific internship projects which demonstrate application of the ideas explored in this literature review.

Chapter 2

Critical Reflective Analysis of the Internship Program

Introduction

The purpose of any internship program must be to establish an in depth understanding of the purpose and responsibilities of the position being monitored. Although an understanding of the role of the Learning Resource Teacher can be developed through an intensive course of study at a qualified university such as Memorial, the true essence of the role can only be understood through living it. The internship program allows for personal construction of knowledge through participation and reflection.

The Association for Teacher-Librarianship in Canada and the Canadian School Library Association lists as essential, ten professional competencies and eleven personal competencies related to the Learning Resource Teacher's knowledge and skills, attitudes and values (1997). An internship program allows new teachers to see these competencies modelled by a skilled, qualified, and successful professional. It also provides an opportunity for professional feedback and a sharing of skills and knowledge.

This report provides a description of the school and it's current status with respect to technology. The focus of the report, however is a critical reflective analysis of the experiences of this particular internship, that contributed to the development of an in depth understanding of the realities of the role of the Learning Resource Teacher and the theoretical framework that have given rise to that reality. Particular emphasis is placed on

the projects and strategies for integrating technology.

The Physical Environment

Macdonald Drive Elementary is a K-6 school located in the east end of St. John's, with a student population of approximately 530, and a teaching staff of 32. The open area design of the school makes it unique in the province. Each grade level, with the exception of Kindergarten, is grouped together in one large room called a Pod. Within each Pod there are three classes and an area for Special Education groups. There are three classrooms for the two and one-half Kindergarten classes. Each of the six Pods has its own exterior entrance and teacher work area. The spacious Learning Resource Centre is located in the very centre of the circle formed by the Pods. It has no walls, its perimeter being defined only by bookshelf units. The Resource Centre is at the *heart* of the school both physically, and conceptually. Circulation is on flexible scheduling so as not to interfere with the scheduling of resource based units.

Current Status with Respect to Technology

Macdonald Drive Elementary is a school on the cutting edge of technology. It is equipped with two modern LCD units with new dedicated VCR's, three T.V. sets also with dedicated VCR's, a Sony Digital Camera, a flatbed scanner, a video camera with

tripod, three 16 mm projectors with an accompanying film collection, and an extensive software collection of approximately 130 CD-ROM programs. There are 39 computers in classrooms throughout the school with five more expected before the end of the school year. The Learning Resource Centre has nine computers, plus the network server. Four of these are older machines capable only of running the Columbia Library System. Although most other computers in the school are Pentiums with multimedia capabilities, they vary in memory, speed, and hard drive capacity. There is a printer in each pod as well as a network printer in the Learning Resource Centre and in the office. One computer is equipped with a specialized keyboard for Special Needs Students.

Most computers are running Windows 95 and are connected to a school network with a Windows NT server and have high speed cable access to the Internet. Although there is no computer lab, students are not restricted to the computers located in their own Pod. They frequently move around the school using computers wherever they are available. All classroom computers are on moveable trolleys allowing for flexibility in location. Currently the maximum number of computers in each Pod is six, as this is the number of network connections available. The purchase of a supplementary network hub is planned which will provide additional, flexible connections allowing mini labs to be established where needed.

Clearly this is a school committed to providing a technologically rich environment for all students and staff.

Administering a School Network

A major goal of this internship is to obtain experience in using and administering a school network. This area proved to be one of the greatest learning challenges of the internship program. Limited print resources are available to provide information on how to use the network and on troubleshooting. Due to tremendous workloads, on-site technical service by personnel of the Avalon East School Board is available only when major network problems occur. Assistance can be obtained through e-mail contact with these technical support staff, but prompt and effective advice depends on clearly articulating the problems and any problem solving strategies employed. Good communication skills are essential under this system. Experience, combined with the application of good problem solving stategies and creative and logical thinking skills is also critical to effective network administration. In this area particularly, the internship program provided valuable knowledge and experience that could not be obtained in any other setting.

The existence of a school network raises the issue of access control - e.g. what students and staff should be allowed to do on the network. Restricting access prevents users from installing software, possibly violating copyright laws, changing critical settings, deleting important files, and filling up hard drives with personal or inappropriate files. It is therefore important that acceptable use guidelines be established and enforced. Restricted access creates additional responsibilities for a network administrator, the most

significant being that the installation of new software and the clearance of print queues can only be done by the administrator.

Restricting access also creates network problems when there is a large amount of software being used throughout the school. The Windows NT network will only allow groups of users access to a limited number of programs. The large software collection at Macdonald Drive exceeds that limit, causing problems with adding and removing software. Opening the network and allowing all users unrestricted access would alleviate this problem but it would also create new ones, including allowing users access to administrative programs. Without an acceptable use policy in place and signed permission slips from parents, unrestricted student access to the Internet is inappropriate. As a revised draft of the acceptable use policy of the former Avalon Consolidated School Board has not yet received approval by the representatives of the school community, Internet access at Macdonald Drive remains restricted to the staff.

The position of network administrator brings with it the responsibility of technical support to staff and students. Resource based units are continuously ongoing and it is a challenge to juggle teaching responsibilities with the role of technical support. Although teachers and students are involved in the problem solving process, the solution often requires the administrator to access to the network and make necessary corrective actions. Aging equipment, with resources that are too limited for the demands made on them, often cause hardware problems. As well limited financial resources require that exhaustive problem solving strategies be employed before outside repair services are engaged.

Considerable time is spent in maintaining equipment and troubleshooting.

Professional Development

An important role of the Learning Resource Teacher includes providing and participating in professional development. The educational community is comprised of a variety of stakeholders all of whom have a need and a responsibility to engage in activities that will help them develop the knowledge and skills needed to be effective in their role.

The role of the Learning Resource Teacher includes teaching students with a wide range of abilities, interests and learning styles, selecting appropriate resources, including technological resources, and helping individuals locate the information they need to be effective in their roles. Recognizing the importance of the Learning Resource Teacher in the delivery of quality programs and services for learning disabled and gifted students, the administration and staff of Alexander Street School invited Learning Resource Teachers working in the Avalon East School Board to an inservice on the needs of these students with respect to instruction and resources. The session was informative and timely. It raised awareness leading to a redistribution of resources, providing a student with dysgraphia, greater access to word processing technology.

Knowledge sharing and collaborative problem solving were key ideas behind a professional development session organized by the Special Needs Teachers and the Guidance Councillor of Macdonald Drive. Specifically addressed in the session were the

needs of the learning disabled, and students with behavioural problems. The inservice was provided as part of an action plan developed by the School Improvement Committee in response to needs identified by staff. Participants included parents, and staff from other schools within the board. The session led to participants increasing their understanding of themselves and others, and the adoption of a collaborative problem solving and support model.

As well as participating in professional development sessions, Learning Resource Teachers are proactive in developing and implementing inservices, workshops and training sessions. Teachers at Macdonald Drive Elementary identified a need for training in equipment and software. Throughout the year, lunch time and after school sessions were offered to help teachers develop proficiency with the existing technologies and software. Training was provided in Windows 95, Microsoft Word, the Internet, Eudora, the scanner, LCD units, and the digital camera.

Specific needs were addressed through just-in-time training sessions with individual teachers or small groups. This type of training included instruction in multi-tasking, report card templates, e-mail, down loading from the Internet, incorporating images into documents, using the LCD equipment with a computer and VCR, and using Optical Character Recognition software to convert scanned text to a word processing document.

The most comprehensive professional development activity delivered focused on the development of an updated information skills continuum. Teachers were asked to

sequence a list of information skills compiled from the latest curriculum documents. The full day workshop also included strategies for evaluating information and sources found on Internet and a discussion of the proposed Acceptable Use Policy. This inservice was developed as part of the research component of this internship and will be discussed in-depth in Chapter 3.

It is the philosophy of Macdonald Drive School to provide educational opportunities for all members of the school community. In keeping with this philosophy, computer training sessions for parents, volunteers, and project workers was included as part of a proposal for a government funded special project. The sessions served several purposes: to provide basic computer skills, particularly for new Canadian parents thereby improving their employment opportunities; to help volunteers develop skills that they could share with students; and to provide an opportunity for parents to model a commitment to lifelong learning. This part of the project was a unique opportunity to extend professional development beyond staff and students and to experience first hand the benefits of an integration of school and community.

Learning Resource Teachers throughout the city comprise a network of expertise that they use to share information and to provide mutual support in professional development efforts. For example, the Learning Resource Teachers of Macdonald Drive, Vanier, and Bishop Feild shared in the development and implementation of workshops offered in those schools. On a broader level, the Learning Resource Teachers in St. John's organized information sharing sessions and technology training labs for Learning

Resource Teachers in an effort to enhance their knowledge base and to provide equitable services to students. This is a group of dedicated professionals who are setting the standard for excellence in their field. They demonstrate systems thinking though a commitment to collaborative learning, and joint problem solving initiatives. They share an expanding vision of information literacy needs and work together to provide an equitable infrastructure that supports the acquisition of the skills needed to meet those needs.

The Learning Resource Centre

Among the essential indicators of competency is the ability to organize the Learning Resource Centre so that it requires a minimum of teacher time to run smoothly. The key to success here lies in establishing a well trained and committed, core group of volunteers. The clerical duties involved in running a Resource Centre can significantly intrude on time allocated for other professional responsibilities. Volunteers play a vital role in the efficient running of the Resource Centre.

Many new volunteers worry about not knowing enough to cope with the demands of a busy Learning Resource Centre. Explaining not only how to do something but why it is to be done in a particular way helps to build a knowledge base and increases confidence. Volunteers who understand how the system works can make better decisions. At Macdonald Drive, comfort level and confidence is developed through hands-on training and peer support. New volunteers are paired with other competent, experienced

volunteers for training. The Learning Resource Teacher determines work priorities when necessary, but otherwise works with the volunteers primarily as a consultant. Although the Resource Centre is humming with activity and the workload is high, a pleasant and relaxed atmosphere prevails. In addition to enjoying the social aspects associated with their volunteer work, volunteer parents are rewarded with the knowledge that their children enjoy seeing their parents participate in the daily activities of the school.

Running a Resource Centre also requires public relations and marketing skills. Advocacy involves ensuring that all members of the school community understand the role of the Learning Resources program in the development of the essential graduation learnings. Two pamphlets were designed to respond to this advocacy need, one outlining the current status of technology in the school and the future goals for technology, the other describing the Resource Centre facility and programs. These pamphlets were distributed to parents on Curriculum Night. A display of resources and technologies, including a video of a group of children working on a resource based unit was also set up. An LCD projector connected to a computer demonstrated how the Internet is used by teachers to meet curriculum objectives. Sites displayed included web pages of children's authors, space information sites from NASA, a children's site on human anatomy, and the Lego home page. A display of curriculum related software and print resources was also available. Parents were encouraged to explore the Resource Centre and to ask questions or make comments about the programs offered.

In May, 1998, Macdonald Drive Elementary was also visited by a delegation of

Swedish educators interested in the integration of technology and in the role of the Learning Resource program. Ms. Lilly gave a presentation on these issues and the delegates were invited to observe and participate in an ongoing unit. It is interesting to note that although Learning Resource Teachers in Canada are struggling to maintain their programs against educational cuts, these programs serve as models for school improvement in other countries. It is apparent that advocacy reaches beyond local borders.

Collection Development, Organization, and Maintenance

Another key indicator of competence involves the ability to develop, organize, and maintain a resource collection. Although the collection at Macdonald Drive is quite large, consisting of over 11,000 books, portions of it require considerable weeding. The Resource Centre is in the process of automating, a perfect time for evaluating the collection. This was done as books were removed from the shelf for cataloguing and/or barcoding. Standard criteria were applied to select books to be weeded and as books were removed, collection needs were assessed.

Selecting new resources requires a knowledge of the curriculum and resources. In addition to the needs identified during the weeding process, a newly introduced science program required additional resources to support it. Choices were made based on curriculum needs and through consultation with teachers. Standard selection aids were

used to evaluate available resources where possible. Vendors were chosen based on price, reputation for quality binding, and service record. A local firm was chosen to provide basic fiction and picture books. In addition to offering competitive pricing and exceptional service, the owner's extensive knowledge of children's literature was very helpful in the selection process. Marc records were ordered where possible.

Automating a collection takes a considerable amount of time that is simply not available to a Resource Teacher. A project worker, trained and supervised by the Intern, worked for eight weeks cataloguing and barcoding. The Resource Centre will be ready for on-line circulation as soon as network cables and electrical outlets are installed in the circulation area.

Collection growth required a reorganization of the physical setup. Changing established traffic patterns in an open area school proved challenging but not impossible. Access to the Learning Resource Centre must be convenient for all grade levels while maintaining an organizational structure that allows for browsing and use of reference, and OPAC (On-line Public Access Catalogue) centres while resource based units are in progress. Consultation with administration and staff allowed for a mutually satisfactory arrangement.

Funding

Funding is always a major issue when selecting resources. A book fair is held

during the fall to raise funds for new resources. A lockable room is necessary to ensure the security of the materials for sale. In an open area school the only room large enough is the gymnasium. The Resource Centre personnel are given the gymnasium for two days to conduct the book fair, one day for viewing and the other for purchasing. Two book companies are represented which requires keeping merchandise and profits separate to ensure accurate accounting. Approximately 25 volunteers work in shifts at various stations around the gymnasium for the two day period. Setup and tear-down of the fair is done in the evenings before and after the fair. A book fair is a successful and exhausting enterprise.

Funding for technology is augmented for this year by a matched funds technology grant from the School Board. The Board responded to a school proposal with an offer to contribute one dollar for every two dollars committed by the school. Macdonald Drive must relinquish their portion of the technology money to the School Board and submit requisitions for purchases. Three written quotes must accompany each requisition before approval is obtained. Centralized control of funds creates frustration and extra work for the Learning Resource Teacher and the school secretary. The on-line requisition system is fraught with technical problems, and delays are common.

Central control of funds also creates problems with servicing computers. Vendors providing technical service are required to submit estimates before they can actually repair machines. Technicians must work on the equipment twice before they can actually submit a bill. All of this results in equipment being out for service for long periods of time.

Resource Based Units

Newfoundland has adopted a resource based philosophy of education that is exemplified in the programs offered at Macdonald Drive Elementary. The Learning Resource Teacher engages in cooperative planning, development, and implementation with the classroom teachers. In the units, students develop the skills they need to become independent learners and collaborative team members. The integrated approach provides students with opportunities to apply new skills in meaningful ways.

Resource units at Macdonald Drive are built around curriculum outcomes, and employ a wide variety of resources and formats, including computer software, the Internet, microscopes, maps, charts, periodicals, and of course books. Students learn to compare resources and evaluate them based on information needs. Each unit also has a distinctively Newfoundland component whether it is learning about the life cycle of salmon in Grade One, or the endangered species of Newfoundland in Grade Six. Activities are hands-on and learner oriented. Units are designed to challenge, and students are encouraged to go back and re-evaluate information when they encounter problems. Student evaluation is based on process rather than on product.

Grouping is most often done heterogeneously to ensure that there is at least one good reader in each group. However, grouping homogenously for a Grade three unit brought interesting results. The high ability students who were expected to work though the centres quickly and efficiently were hampered by problems with cooperation. Each

student was accustomed to assuming a leadership role and found it difficult to share that role with others. The least able group, comprised of three special education students, had no problem with cooperation and applied good problem solving strategies to tasks. Their main problem was reading. They worked a little slower than most groups but remained very focused for long periods of time. In a mixed grouping situation during a previous unit, these students did little reading and had fewer opportunities to think through problems in their struggle to keep up with faster group members. This result should not be generalized to mean that homogeneous grouping will work better for all special education students. It does suggest however, that teachers are doing a good job teaching problem solving strategies but that children must be given the time to apply them.

Units are scheduled to run concurrently with rarely even one day in between. Each class gets one full week to complete the unit. Special activities and events can play havoc with scheduling but prioritizing centres and in some cases, moving centres into the classroom after their resource centre week allows groups to complete units.

Projects and Strategies for Integrating Technology

At Macdonald Drive, it is not the presence of technology that drives how the curriculum is implemented, but rather it is the curriculum that drives the acquisition and use of technology. A commitment to this philosophy is demonstrated by the prompt action taken to update the information skills continuum to reflect the technology skills

identified in the latest curriculum guides. The technology skills, like other information skills, are integrated across the curriculum with students progressing through various levels of competence. The new document clarifies the levels of competency that students should have when they enter and leave each grade. These levels are sequenced by teachers based on key stage outcome requirements.

As they worked on the sequencing of the continuum, the staff quickly identified the need for students to acquire good keyboarding skills to work efficiently with computer technologies. This prompted the timely installation of keyboarding software on all computers from grades three to six. The software is set up to allow monitoring and recording of individual students' progress.

Many technology skills are introduced and developed within the cooperative units implemented in the Resource Centre. Students learn how to access and apply technologies to solve problems. They use technology to engage in information seeking, location and access, organization, and synthesis. Students compare and evaluate information from electronic, as well as other resources. Each resource-based unit contains several, if not all, of the following:

- Electronic encyclopedia
- Internet
- Presentation software (PowerPoint)
- Word Processing
- OPAC (On-Line Public Access Catalogue)
- Scanner
- Multimedia CD-ROM's

Explicit technology instruction is integrated into curriculum themes through a variety of activity centres. For example, Internet activities require students to learn the *how to's* of locating URL's, making electronic bookmarks, taking notes online, and down loading graphics, to find information, or to create new documents around meaningful curriculum topics. Grade Five students studying archaeology, explore sites dealing with the archaeology of different cultures including the Incas, the Mayans, the Pueblo Indians and the Ancient Egyptians. Students visit and bookmark the award winning Carnegie Museum of Natural History site dealing with Life in Ancient Egypt. They move through the hyper links to locate specific information such as the sources of information used by archaeologists to piece together information on an entire culture. Students also create a word processing document which combines information from the Internet on how the Egyptians preserved bodies, with pictures of actual mummies down loaded from a different Internet site. Students are required to create a document that combines text and graphic using a balanced layout. In these activities students compare historical information about a variety of cultures through an exploration of archaeological sites and artifacts. They combine information and supporting graphics from a variety of sources and experiment with layout design. They also learn relevant scientific and technological terminology. Students engage in collaborative, learner oriented activities designed to meet a variety of curriculum outcomes for science, social studies, language arts, and technology.

Other important skills are developed through the use of scanning equipment and

software. Pictures can be used very effectively to support or extend text. Using a given text, students choose supporting graphics from resources provided and incorporate them into the document. This requires students to apply a number of technology skills including, copying a file from a floppy disk to their personal network drive, scanning, cropping, and saving a picture, then exporting it and inserting it into a text document. They experiment with different ways of having the text wrap around pictures as well as with page layout features such as the size and placement of the graphic and the use of white space. Students determine their information needs, choose an appropriate resource then incorporate it to enhance both the information developed and the effective presentation of that information.

Activities using presentation software require students to use the technology as a mind tool (Jonassen, 1996). The creation of a brief slide show compels students to evaluate information, extrapolate key ideas, and impose an organizational structure. They must mentally manipulate information to construct their own knowledge and the technology becomes the tool used to represent their understandings.

The extensive collection of curriculum related software at Macdonald Drive Elementary creates a variety of possibilities for integration. Multimedia programs such as Kid Works Deluxe provide wonderful opportunities for young students to create, around a curricular theme, multimedia stories that include factual information. Research and creative writing are done within the same program. Sound effects are easily added and children can evaluate their writing while listening to the computer reading back what they

have written. Students create original graphics or choose from a variety of available backgrounds and "sticker" pictures to build supporting pictures.

Other programs allow students to listen to books that are at their interest and comprehension level but are beyond their reading level. These programs often include features that give definitions, and allow adjustments to chunking and reading speed. These are particularly valuable to ESL students who are more advanced in speaking and listening, than in reading or writing in English.

Students use software to apply physics principles to build virtual machines, to construct spreadsheets and manipulate data, to compose music, and to create animation. Software such as electronic encyclopedias, and banks of multimedia, informational CD-ROM's supplement other information sources used for research. Math programs provide tutorials, drill and practise, and enrichment opportunities at all grade levels.

Technology is also infused into Individual Program Plans for students. Appropriate software provides additional instruction and practice in specific areas. Word processing is successfully used as an organizational strategy for one Grade Four student. Submitting work to the teacher on diskette solves the problem of loose paper becoming lost or left at home. Classroom behaviour is improved, as is the percentage and quality of work completed.

Access to appropriate software is ensured by placing it directly in the Pods at the most appropriate grade level. Computers can be moved to different Pods if access to specific programs is required in another grade, or small groups of students can use the

equipment within other Pods. Copyright regulations are strictly enforced at all times. Network licences or lab packs are purchased when multiple access is necessary.

The Internet is regularly used throughout the school as a resource to implement the curriculum. Students in Grade Four take a virtual tour of a chocolate factory after studying the novel, Charlie and the Chocolate Factory. Children's literature sites are used to find information for author studies, and space units would not be complete without checking out NASA's latest information.

Students have begun to contribute to the Internet through a new school home page. Science week involved numerous activities and guest speakers. Students from each grade wrote a brief report of activities for their class and submitted them to Grade Six students who took pictures of the events with a digital camera. These were compiled and edited by the older students and then added to the special events section of the school home page. Web publishing provides a direction for growth at Macdonald Drive. Future training initiatives are planned to inservice teachers and students in Internet publishing. User friendly software has been purchased with this goal in mind.

All students have access to e-mail. Grade Six students use it to participate in the CypberPals project where students from across the country work collaboratively to create a database of information on capital cities. Other students have e-mail buddies in a local high school who help them with their writing skills. Grade Five students involved in the ISLE-Net project use e-mail and a program that includes an interactive chat component to compare life in several North Atlantic Island communities. Technology allows the

classroom to extend well beyond the boundaries of school walls.

Conclusion

Macdonald Drive is a fast paced, action packed school environment where technology has been infused into the curriculum. Teachers and students thrive in an atmosphere of change and challenge. The themes of cooperation and collaboration are demonstrated daily through the cooperative discipline program and through the collaborative teaching initiatives developed by the teachers. The expertise and experience of all staff enrich the learning environment.

The internship at Macdonald Drive Elementary provided valuable insights into the reality of the roles and responsibilities of the Learning Resource Teacher. This is a profession that requires commitment to lifelong learning, particularly in the areas of information literacy, children's literature, software, technology, learning theory, and curriculum. It requires competencies in leadership, interpersonal skills, time and financial management, and communication skills. Above all, a Learning Resource Teacher must be a good teacher with an understanding and appreciation of children and how they learn.

The range of experiences and the wealth of knowledge acquired during this period at Macdonald Drive would be difficult to obtain by any other means. The commitment, energy, enthusiasm, and vision of the Learning Resource Teacher / vice principal, Ms. Daphne Lilly and the principal, Ms. Beverley LeMoine enriched the internship experience

tremendously. Operating as a team they work with the staff to create a learning environment that infuses technology into the curriculum and provides an atmosphere of professionalism and growth.

Chapter 3

A Reflective Analysis of Specific Internship Projects

Introduction

The essential goal of this internship program is to explore the ways and means of integrating technology into the curriculum. Answering the fundamental question of how to integrate technology requires first and foremost an understanding what outcomes are identified across the curriculum and the levels of competency required. A central focus of this component of the internship experience therefore, is to collaborate on the development of an information skills continuum that reflects technological literacy within the larger framework of informational literacy.

Having identified these outcomes, the next goal to be addressed is the effective integration of these skills through the Stellar School Projects in place at Macdonald Drive Elementary School. The scope of these endeavours necessitated that only one Stellar Project be selected for inclusion in this study. This chapter will be organized into two sections, the first detailing the development of the continuum, and the second reporting on the ISLE-Net project, the Stellar Project chosen for development in this internship.

Information Literacy Continuum

Background

The most fundamental responsibility of the Resource Teacher is to help students develop information literacy skills, the cross curricular skills used for information problem solving (Association for Teacher-Librarianship in Canada, 1998). Students progress through increasing levels of competency in these skills to reach mastery. There are a variety of information processing models throughout the literature that can be applied to information problem solving tasks (Government of Newfoundland and Labrador, 1991; Johnson & Eisenberg, 1996; Kuhlthau, 1995).

In 1991, the Department of Education published the document Learning to Learn, outlining the philosophical framework for curriculum delivery in Newfoundland. The document reflects a resource based learning philosophy that emphasizes the need for students to become independent learners and problem solvers. The SUCCEED model for independent learning was the model chosen for inclusion in this document. Like many others, this model takes a systematic approach that can be applied to any information problem situation. The integrated, developmental approach to information literacy outlined in the Learning to Learn document, required the development of a skills continuum outlining the scope and sequence for the teaching of these skills.

The development of such a continuum was undertaken by the Learning Resources

Coordinator of the former Avalon Consolidated School Board. Current guide books were reviewed and a list of learning skills was compiled. Individual schools used this list as a foundation to develop a scope and sequence document appropriate to that school.

The information skills continuums developed in the early 1990's do not include many of the skills outlined in new curriculum documents. The technology skills included in these early continuums reflected only the technologies of the day. Changes in curriculum outcomes, and advances in information technologies have rendered these documents obsolete. These changes, and the infusion of technology into the required learning outcomes, necessitates the development of new documents with a revised and expanded scope. It is the development of such a document that is addressed in this internship program.

The process

The project was undertaken as a collaborative problem solving venture which included the Intern, the supervising Learning Resource Teacher, Ms. Daphne Lilly, and the Learning Resource Teacher from Vanier Elementary School, Ms. Gilda Parsons. A variety of continuums from local schools were collected, compared, and assessed. None of the documents reviewed were comprehensive enough to ensure that students would meet the outcomes reflected in the essential graduation learnings. When a new updated document could not be located, it was decided that this group would design and develop a

document reflecting the broader scope required.

A wide variety of information processing models were collected and compared. The Big Six Model for Informational Literacy, (Johnson & Eisenburg, 1996) was chosen as the organizational structure for several reasons. First of all, it is an internationally recognized model. Secondly, it provides clear and simple problem solving strategies that encompass those currently being taught which are identified in new curriculum documents. Finally, it includes a computer skills component that integrates the teaching of technology skills into an effective information problem solving model.

The next stage of development required that the most current curriculum guides available in all subject areas be collected and reviewed and a comprehensive list of information and technology objectives be extracted and compiled. Older continuums were also reviewed to ensure that no essential skills were missed. The skills extracted were then organized within the structure of the Big Six Model. The original wording of outcomes was retained where possible, but when meanings became unclear when taken out of the context of a guidebook, some rewording was done. This proved to be the most difficult stage of the project. Collaboration and discussion was essential to ensure that the skills described in the continuum, accurately reflected the outcomes identified in the guidebooks.

The outcomes from the Language Arts curriculum documents were of particular concern because of the very similar wording across grade levels. To avoid repetitiveness in the continuum, and to ensure that the highest level of competency required was

indicated, the wording used for the objective in the continuum was that of the highest grade level. To ensure clarity, each objective from the Language Arts guidebooks was identified as primary or elementary and a page reference for the outcome in that guidebook was provided directly on the continuum. In addition, a chart was developed which specified the page number in the guidebook for the wording of that particular outcome for each grade level (see Appendix B).

The subskills required to achieve information literacy objectives were detailed in a technology section included at the end of the continuum. For example, knowing how to use the cut and paste features of word processing software is a subskill required to achieve the information literacy objective of, "uses technology with increasing proficiency to create, revise, edit, and publish text". These subskills will require periodic modification as technologies evolve. The information literacy skills outlined in the main body of the document are more stable, reflecting lifelong, multi-disciplinary strategies for information problem solving.

The descriptors, *introduce, develop, master* and *maintain*, were used to identify levels of competency within the Big Six framework.. These clarify the teaching stage and the level of mastery expected for each skill at any particular grade level. Levels of competency can span more than one grade level and in some cases, mastery may not be expected until students are well beyond the elementary level.

Inservicing the staff

Initially there existed some confusion among staff about the type of skills that should be included in the continuum. Some teachers expressed the need for a document that listed and sequenced all learning outcomes across the curriculum. At a pre-inservice meeting, the impossibility of trying to create a document that included all learning skills was discussed. It was also explained to the staff that the purpose of the professional day was to clarify the concepts of information and technological literacy and to provide an opportunity for teachers to collaborate on a sequencing plan for the teaching of those skills. Staff was also informed that the scope of the continuum covered only the information and technology skills identified in their curriculum guide books.

In February, a full day inservice was held to present the proposed document to the staff for sequencing. Teachers from other schools within the cluster and parent representatives also attended. The concept of information literacy, its history and its significance to education, was introduced by Ms.Vicki Pennell, a nationally recognized leader in the field of Learning Resources and Information Literacy. The importance of technology to the concept of information literacy was also addressed.

Ms. Lilly next outlined the Big Six Model and the rationale for its selection. Teachers were then asked to work in groups to identify the objectives that would be introduced, developed, mastered or maintained at their grade level. There was a very positive response to the new continuum, and the list of subskills was the topic of much

discussion.

The skills sequencing activity was too intensive to be completed in a single day, so the afternoon session given by the Intern, was designed to build on the information skills of teachers. A brainstorming activity was used to generate criteria that could be used to evaluate information and sources of information found on the Internet. The results were compared and a comprehensive list of criteria was distributed for use in evaluating specific Internet sites (see Appendix C). The activity served to raise awareness of the need to look beyond the glitz and glitter of a web site and to consider issues such as the validity and reliability of the information presented.

The continuum sequencing activity was continued in two subsequent after school sessions. The first allowed teachers to finish the sequencing for their grade level, and the second involved comparing sequencing across grade levels and making necessary adjustments. Final modifications were made by the Learning Resource Teacher and the Intern and the revised document was then compiled and distributed to the staff.

Outcome

The value of the continuum was reaffirmed when a draft copy of the new report card was presented to the staff in June, 1998. The technology outcomes included on the report were not new to the staff and teachers felt confident in their ability to use the continuum not only as support for teaching specific skills, but as support for evaluation.

The document outlining the scope and sequencing of skills was shared with a number of different groups including other elementary school personnel and the feeder Junior High School, Macdonald Drive Junior High. This document will help these groups develop similar documents in their own schools and will provide teachers in junior high schools with insight into the competencies they can expect from students coming out of elementary school. A presentation introducing the continuum and outlining the rationale and process used to develop it, was also made at the School Board Office to members of the School Programming Committee and elected School Board officials. The last group to benefit from this project was a group of visiting Swedish educators, who took copies of the continuum back to Sweden with them.

In an age of increasing accountability, stakeholders want to know that the money spent putting technology into schools is a good investment. They also want to be sure that the time children spend using that technology is making a difference to their achievement. The document created in this project provides a rationale for the purchase of technology and provides direction for its use. It distinguishes between computer literacy and information literacy and is directly linked to the key stage outcomes identified by the Atlantic Provinces core curriculum documents.

Integrating Technology Skills Through A Stellar School Project - ISLE-Net

Background

The ISLE-Net project is intended to be an international information technology project involving students from several communities in Newfoundland, Prince Edward Island, and Iceland (see Appendix D). The objective is for students studying their own island communities through their social studies curriculum, to share information on a variety of themes with students in other North Atlantic island communities. This sharing will provide an opportunity for students to compare and contrast island communities and to critically reflect on what they discover. ISLE-Net objectives are directly linked to those of the Grade Three and Grade Five social studies curriculum in Newfoundland, and the Grade Six curriculum in Prince Edward Island. Language barriers prevent Icelandic students from participating until they begin to formally study English at ages 11-12, which is the age of students in grades six and seven here in Newfoundland.

The responsibilities of the intern with respect to the ISLE-Net project included ensuring that the infrastructures were in place to implement the project including the establishment of the links between schools and individuals. The intern's responsibilities also included collaborative development and implementation of an infostructure that enabled students to develop information and technological literacy skills through active engagement in directing and constructing their own learning.

ISLE-Net has the potential to be a powerful educational opportunity for students. However, attempting to bring the project to fruition has proven to be a valuable learning experience in itself. This portion of the report will include an outline of the planning and preparation procedures followed, a description and analysis of the implementation process, recommendations for the further development of the ISLE-Net project, and a discussion of its implications for future projects.

Planning & Preparation.

The preparation for the project began long before the internship experience was even considered. The ISLE-Net proposal aroused the interest of the North Atlantic Islands Research Programme, a project of the Institute of Island Studies at the University of Prince Edward Island. A component of this program involved a curriculum development initiative in which key educators who had already shown an interest in a study of islands, could be given an opportunity to get together and plan for student initiatives using information technologies. In May of 1997, Daphne Lilly of Newfoundland, founder of the ISLE-Net project, and Judy Davis from the Department of Education in Prince Edward Island, travelled to Iceland to meet educators there and discuss the possibilities of linking the study of community in their schools. Daphne and Judy met with educators and personnel involved in Iceland's educational network, Ismennt, who agreed to support a joint effort. The delegation returned home with a

selection of resources to support a study of Iceland and a list of names for e-mail contact.

The first challenge came in trying to make contact with teachers here in Newfoundland. There is no provincial directory of teacher names or e-mail addresses available to schools. Contacts must be made through School Boards and by telephone. This proved to be a tedious and trying process. Throughout the fall, numerous attempts were made to enlist participants from other schools across the province. Unfortunately few of the teachers contacted were interested in participating. Time pressures and technology access problems, were some of the reasons given for not participating.

Changes in teacher assignments created problems with establishing Icelandic contacts. The Learning Resources Teacher in Reykjavik who had planned to participate was reassigned and the project could not be incorporated into her new placement. The other Icelandic teachers on the list of contacts were notified that we were anxious to begin communications between students but there was little response.

A separate *Islands* e-mail account was set up on the network as an organizational measure, and to allow access to information to both Ms. Lilly and the Intern without compromising personal account confidentiality. Under this new account, mailing lists were created, with separate lists for Newfoundland, Prince Edward Island, and Iceland, and one list which included all names. In January, an introductory letter was sent to all contacts, outlining the project and encouraging participants to get their students to respond to messages that Newfoundland students would be sending shortly. A test message was also sent to ensure that the technology was working. Verification was

received from most of those contacted.

The Process

It was decided that participation by all students would not be feasible due to the lack of sufficient reliable contacts with other communities. The project would remain under the direction of the Intern who would work with Grade Three and Grade Five students selected by classroom teachers. E-mail accounts were checked, and in January a meeting was held with students to introduce the project and to provide a focus for the research. The themes in the Grade Five social studies book were examined and a list of possible questions about other island communities was generated. Students were each given an e-mail address for people in Newfoundland, Prince Edward Island, or Iceland. They composed messages identifying themselves and the project and asking some of the questions they had formulated. A log was kept of messages sent and replies received. The students generated good questions but the lack of response was not conducive to maintaining a focus of study. The few responses received were all from teachers, not from students and were, for the most part, brief answers to the questions posed with no effort made to initiate a dialogue.

The rapidly approaching deadline for the completion of the new Information Skills Continuum added a further obstacle to keeping the project active. The commitment to offer an inservice for teachers in February required that all time and energy be directed to

completing the continuum. Although intensive work with students became impossible, communication with Prince Edward Island educators continued, focusing on the process for linking students and information.

Prince Edward Island was very enthusiastic to begin collaboration, however they did not want to use e-mail as the basis for communication between students. Vernon River Elementary School was piloting a new software program, Zebu, that allows information to be typed directly onto web pages and features an interactive chat component. Educators in Prince Edward Island were anxious for Newfoundland to join their project using this new software. The time frames involved in learning a new program and teaching it to students, as well as the problems involved in acquiring and installing the software needed to run Zebu, made this form of collaboration difficult. Zebu, however, appeared to be the best opportunity to establish any meaningful communication between students so it was decided to attempt to get online with Zebu while persevering with efforts to make e-mail contacts with Iceland.

The Zebu site can only be accessed using the Internet browser Netscape Navigator 4.0. All computers in Macdonald Drive were running other browsers or earlier versions of Netscape which do not support the programming language used by Zebu. Another large program, Adobe Acrobat Reader, had to be downloaded in order to access the Zebu instruction manual. Attempts to download the correct software were hampered by hardware limitations. The school machines with only 8 MB of RAM, were having difficulty running Windows 95 through the Network. Downloading large software

programs placed too much strain on the system, causing extremely long downloading times and often causing computers to crash. Equipment upgrading was necessary.

The process of obtaining cost estimates, getting School Board approval, and arranging for installation was very expensive and time consuming. The upgrades were finally completed during the Easter break. The required software was immediately loaded onto thirteen computers spread over two pods and the Learning Resource Centre. The Intern worked with Zebu until a minimum comfort level was obtained.

Two members of a Swedish delegation visiting the school in May, expressed an interest in having students from their schools participate in the ISLE-Net project. These two delegates were principals of schools on the island of Gotland off the coast of Sweden. Their student access to communication technologies was in the developing stage, with full e-mail access expected in the Fall of 1998. It was arranged that limited access would be organized to allow a small group of Swedish children to participate during this school year.

Re-evaluating

With the school year growing shorter, it was necessary to re-evaluate what could be accomplished in the remaining time and which students could quickly learn and use the new software. The Grade Three students were finished their class unit on Islands and had moved on to other projects. A group of twelve Grade Five children were chosen to work

on ISLE-Net for two to three afternoons per week instead of attending regular afternoon classes. A letter was written to parents outlining the need to have participating students make up missed classroom work at home, and requesting permission for students to use the Internet.

At the first meeting with this new group collaborating communities were located using atlases, and predictions were made about what those communities might be like based on location and any other information evident from the maps. Students were introduced to Zebu and spent some time exploring the site developed by the Prince Edward Island group. Attention was directed to the organization of the site and the themes developed. The Newfoundland students responded to the Prince Edward Island students through the on-line discussion boxes. Students were paired to work on specific themes including climate, transportation, attractions, physical features, folklore, culture, and government. The research was to focus initially on Iceland, and then move on to Newfoundland.

Understanding Zebu

The Zebu software allows students to create web pages using only their Internet Browser. Anyone can view published projects on the Zebu site, http://zebu.edu.pe.ca, but only registered users can create or edit work. The teacher administrator, sets up accounts for students and assigns passwords. Students log on to work on their web pages.

Zebu is organized into projects and project collections. For example, ISLE-Net is a project collection that is composed of two projects, Iceland, and Newfoundland. The project is a collaborative creation consisting of a number of pages created by different students. The Iceland project has pages on physical features, transportation, climate, etc.

Pages can be created with, or without templates. A template is the blank form used to organize the information. Creating a template involves choosing the number of desired columns and the ratio of boxes, or objects, per column. Objects are then assigned a media format, such as text, graphic, link, discussion, video, or sound. Each object has different attributes, depending on the format selected. Choices include labels, text appearance, content, picture gallery, or URL. These attributes can be locked to prevent editing, or they can be left flexible to allow students the option to change them.

Once the objects in a template are defined, the document must be saved as a template or as a page. Templates are used to impose organization on students work. One template can be used multiple times to create pages. Once students input information into the template they must save it as a page or they will lose all data entered. Students then continue to work using the page rather than the template.

Analysis of the Process

The method used by Prince Edward Island to develop the project was considerably more structured than that used in Newfoundland. The Prince Edward Island project was

developed as a Resource Centre unit where students worked in small groups on a single topic. Resources to be used were pre-selected and the structure and headings for each Zebu page were pre-determined on templates created by teachers prior to the start of the project. Suggestions to students for improvements and corrections were made on-line through the discussion boxes.

The ISLE-Net project was developed to allow students to engage in all parts of the research processes in a guided but reasonably independent manner. The Iceland resources were placed in a central area and several appropriate Internet sites were supplied to get students started. Templates were created incorporating basic headings and several empty objects, but attributes were not 'locked', and students could modify them as they wished. The creation of templates requires a great deal of teacher time and thought. Pre-organizing the information for students essentially pre-defines information needs and limits the research task. Task definition and the organization of information are two major processes in the problem solving model. To maximize the application of the model, students were encouraged to modify or add to the templates provided to define their own organizational structure.

The government of Prince Edward Island and the distributors of Zebu, worked together to ensure that the correct technology was in place and that teachers were trained in the software. Technical support was also provided to assist with the infusion of the new technology. In Newfoundland however, none of these things were accessible and little time was available to practise using the software before getting students on-line.

Using Zebu was very much a learning experience for the Intern as well as the students.

Although the software did make web publishing possible without learning hyper-text mark-up language (HTML), the program had several weaknesses that hindered project development. The initial plan was for students to take jot notes using a word processor, do a first draft, e-mail it to the Intern for comments, then copy and paste the final copy into their Zebu page. Unfortunately, text cannot be copied and pasted into Zebu even from within the program itself. This raised student awareness of the value of basic text editing features that can be applied across software programs. One student, discovering that he could not type the Icelandic alphabet directly into the Zebu page, or copy and paste it from a word processor, came up with an alternate strategy to print it from the word processor, scan it, and add it as a graphic. In this instance, program limitations were overcome through creative problem solving.

Templates also hampered progress in two ways. First of all, each time an attribute on a template was defined or edited, the entire page had to reload before the next block could be modified. This made the process of creating templates very slow and tedious. Secondly, additional object boxes could not be added to pages or templates once they were created. Adding objects to incorporate additional information meant re-creating the entire page and re-entering data.

The other major difficulty encountered involved the use of discussion boxes. Once discussion boxes were added to a page, changes could not be made to them. Questions posed for discussion could not be edited, even for spelling. This meant publishing a page

with errors or re-creating the entire page. Comments added by others could not be edited for inappropriate or inaccurate comments.

Unfortunately, the students from Prince Edward Island were finished their project before Newfoundland could get online with Zebu. Although Macdonald Drive students did respond to the discussion boxes created by their counterparts in Vernon River. those students had moved on to other activities and no correspondence was received back from them. Although technology problems and incompatible time frames prevented students from collaborating on a project this year, the infrastructure is now in place for future initiatives.

The project extended beyond anticipated time frames, stretching from the beginning of May through to the last week of school in mid June. This was primarily the result of the amount of time used in the research process. Students were using resources that were not written for children and some found it difficult to locate and extract main ideas from very detailed text. In some cases information could only be obtained through personal contact and responses to e-mails were very unreliable. Time was also lost due to testing, and special events such as guest speakers, field trips, sports day, and choir commitments. The need to learn many new technology skills in addition to learning the Zebu software also impacted time frames.

The ISLE-Net project gave students the opportunity to solve real information problems by applying and extending the technology skills introduced and developed in resource-based units. When using the Internet in units, students always used only pre-

selected sites. In this project they experimented with a variety of search strategies and learned first hand which search engines provided the best results. Students also discovered for themselves that Internet addresses are case sensitive and that blank spaces are not accepted.

Even with reminders about the importance of citing references, many forgot to copy the URL of each site used, often having to repeat a search to find the required bibliographic information. Students more experienced with the Internet taught others how to check the Browser's history to locate a previously visited site. Skills learned in Learning Resource Centre units such as bookmarking, and copying and pasting URL's into jot notes, were eventually applied and found to be the most reliable methods of keeping track of Internet sources.

Incorporating pictures into the web pages led to a discussion of copyright issues. Students were disappointed that they could not simply scan pictures and include them on their pages. Language barriers and time frames prevented contact with publishers for necessary permissions. Students resolved the problem of graphics by incorporating links to web sites with appropriate pictures.

Using Eudora to read and send mail had not been included as part of any resource based units and therefore was new to some students. Even though access was available to students all year, many had never used it. E-mail opened new doors of communication that extended beyond the ISLE-Net project. Many of the information skills students practised and developed through ISLE-Net were extended beyond the project as they

were shared with classmates and applied in other learning situations.

Recommendations for Project Development

An understanding of the history and culture of Newfoundland is enhanced by an exploration of the concept of island life. ISLE-Net can be used effectively in a Grade Five classroom situation to integrate technology within and across the curriculum. As each theme is developed, a different group of students could be responsible for corresponding with individuals in other island communities. Research activities could be divided among groups then compiled through incorporation into the corresponding project pages. The published information would become an information resource on the World Wide Web.

The project could be expanded each year to include new communities. On June 8, 1998, students from Sweden contacted Macdonald Drive expressing interest in participating in ISLE-Net next term. Swedish schools closed on June 10, and will reopen on August 18, 1998. Replies were made on June 9 confirming a commitment to establish a link in September. A request for information was also received in May from a teacher in Great Britain. Although several attempts were made by the Intern to initiate correspondence, there has been no further contact from that teacher. Contact in the Fall may be more successful.

Teaching the necessary computer skills and sharing information could be done

more efficiently in a computer lab setting. Having students dispersed over three areas meant that time was lost in repeating instructions. It also meant that students could not learn from each other's mistakes because they were not physically near each other. Discussion with students about problems had to be done individually to avoid disrupting the three classes in each Pod. Group conferences had to be conducted in a small room with no computers located behind the Learning Resource Centre. Implementing the project as a class effort would allow for group activity and instruction within the Pod. An additional network hub could allow mini labs to be temporarily set up for group work or technology training.

Expanding the project to a larger group means providing support for students at different levels of competency with respect to information skills. Consideration should be given to providing additional structure within the templates for students who need it. An optional set of guiding questions could also be developed to help those experiencing difficulty in defining their information needs and in locating and organizing information.

Web publishing by students demands that they have an understanding of copyright laws. The project should incorporate an investigation of copyright issues and the processes involved in gaining permissions to use published work.

Teachers working with the ISLE-Net project should be inserviced in the technologies to be used. Total proficiency is not necessary but teachers should have basic computer skills and some familiarity with the software. With support from the Learning Resource Teacher, classroom teachers will share the learning experience with students.

promise for future development. When e-mail communications broke down, the Zebu software was a digression that allowed Newfoundland students to use information technology in a meaningful way, but in a way that differed from the original plan. Success in this project was measured by what was gained through the process rather than through the evaluation of a product.

Conclusion

The development of this type of initiative requires leadership, tenacity, and the ability to work well with others on curriculum development initiatives. Successfully taking a project from the theoretical to the practical requires leadership in establishing contacts and organizing time lines. The ability to focus on long term goals, allows short term frustrations to be kept in perspective, and the motivation to persist to be maintained. Collaboration between Learning Resources Teachers, classroom teachers, and teachers from around the globe, delivers a combination of energy, expertise, experience and imagination that can lead to the development of exceptional educational experiences for both students and teachers.

Communication technologies allow students to participate in a global educational community. Projects like ISLE-Net inspire students to think in new ways about the way we live and about their place in the world. Students discover that they can not only learn through and with technology, but that they can contribute to an important body of

knowledge and make that contribution available to the world. Technology becomes the instrument of education rather than its driving force.

Technology infused into the curriculum opens the door to a new vision of teaching and learning where teachers and students are a team sharing in the continuous search for knowledge and new understandings.

> In a context where new technologies play an important role, teachers begin to view knowledge less and less as a series of facts to be transferred and more and more as a process of continuous research in which they share the difficulties and results with their students. (Grégoire, Bracewell, & Laferrière, 1996)

Technological literacy is only empowering when it is embraced as a component of information literacy. Information literacy skills allow students to make the connections across the curriculum that demonstrate the knowledge, skills, and attitudes that indicate successful attainment of the essential graduation learnings. A curriculum based, information literacy continuum that includes a technology component and its subskills, clearly articulates key stage outcomes in this area and provides direction for the sequential development of these critical thinking skills. Theoretically sound and curriculum based projects, like ISLE-Net, demonstrate how technological literacy can be infused into curriculum implementation, thereby realising the vision presented through the TILE document.

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APPENDIX A

The Benefits of Technology Integration

The Benefits of Technology Integration

The following list was compiled for the Regional Educational Laboratory, by Réginald Grégoire, Robert Bracewell, and Thérèse Laferrière (1996). This list documents the advantages of technology that is supported by research and in the literature. The record of supporting research can be obtained from the website at: http://www.tact.fse.ulaval.ca/fr/html/impactnt.html

1. **The development of various intellectual skills**

   New technologies have the power to stimulate the development of intellectual skills such as reasoning and problem solving ability, learning how to learn, and creativity.

2. **Specificity of what is learned using the new technologies**

   The new technologies can contribute in several ways to better learning in various subjects and to the development of various skills and attitudes. The nature and breadth of learning depends on previously acquired knowledge, and on the type of the learning activities using technology. Most students show greater spontaneous interest in a learning activity that uses a new technology than in the traditional approaches in class.

4. **The time and attention devoted to learning activities**

   The attention span or concentration that the majority of students are willing to devote to learning activities is greater when they use a new technology than when

they are in a traditional setting using traditional resources.

5. **Developing research spirit**

The new technologies have the power to stimulate the search for more extensive information on a subject, a more satisfying solution to a problem, and more generally, a greater number of relationships among various pieces of knowledge or data.

6. **Broader cooperation among individuals**

The use of new technologies promotes cooperation among students in the same class and among students or classes in different schools, near or far, for the purpose of making them more aware of other realities, accessing relevant knowledge not strictly defined in advance, and executing projects with a genuine relevance for the students themselves, and possibly for other people.

7. **More integrated and better assimilated learning**

The potential for simulation, virtual manipulation, rapid merging of a wide variety of data, graphic representation and other functions provided by the new technologies contributes to a linkage of knowledge with various aspects of the person, thereby ensuring more thorough assimilation of the many things learned.

8. **Information on new instructional resources and availability of support for their use**

Through the new technologies, teachers quickly obtain information on the availability and value of a very diverse selection of instructional resources, and also

often benefit from support for their use.

9. **Teacher cooperation with other people**

The new technologies facilitate the teacher's cooperation with colleagues as well as other people inside or outside the school system for planning or development of learning activities intended for students.

10. **The orientation of planning**

The teacher's planning for teaching requires great harmony between his or her orientation towards teaching, expected learning outcomes, and the characteristics of the technologies he or she utilizes. Hence, the likelihood of positive results is enhanced when the teacher places great importance on the development and arrangement of activities whose execution requires students to perform real work and cooperate with other students.

11. **Different relationships between teachers and students**

If the new technologies are used in such a way as to exploit their potential, the teacher interacts with students much more than in a traditional classroom, as a facilitator, a mentor, a guide to the discovery and gradual mastery of knowledge, skills and attitudes.

12. **A different vision of teaching and learning**

In a context where new technologies play an important role, teachers begin to view knowledge less and less as a series of facts to be transferred and more and more as a process of continuous research in which they share the difficulties and results

with their students.

13. **Assessment of learning**

The new technologies foster a positive, close association of students with the assessment of their own learning, and uses and manages much more demanding assessment methods than is generally the case at present.

14. **Diagnosing specific difficulties**

By permitting rapid retracing of the various learning paths taken by a student, the new technologies facilitate detection by the teacher of this student's strong points as well as the specific difficulties the student encounters or prior incorrect or poorly assimilated learning.

APPENDIX B

Information Literacy Continuum

INFORMATION SKILLS CONTINUUM

KEY

GUIDEBOOK INDICATORS

P Atlantic Canada English Language Arts Curiculum Guide Grades Entry-3
E Atlantic Canada English Language Arts Curiculum Guide Grades 4-6

GRADE LEVELS

To identify the grade level of each objective use the following codes:

EM..... Emergent (K-1)
E..... Early (1-2)
T..... *Transitional (2-3)*
4..... Grade 4
5..... Grade 5
6..... Grade 6

PROGRESS LEVELS

Introduce.....Initial exposure to requirements of the objective.
Develop..... Frequent opportunity to develop understandings and practice skills. Continued teaching and guidance required.
Master..... Demonstrates complete understanding. Teacher assistance not generally required.
Maintain.....Opportunity for student to demonstrate mastery and sustain performance.

INFORMATION SKILLS CONTINUUM

REFERENCE CHART

TASK DEFINITION
Page 1

Reference	Emergent	Early	Grade 4 objective	Grade 5 objective
E 88			E 48	E 68
P 136	P 108	P 122		
P 52	P 40	P 46		
P 94	P 68	P 80		
P94	P 68	P 80		

INFORMATION SEEKING
Page 2

Reference	Emergent	Early	Grade 4 objective	Grade 5 objective
P 94	P 68	P 80		
E 74			E 34	E 54
E 76			E 36	E 56
P 86	P 62	P 74		
P 86	P 62	P 74		
P 86	P 62	P 74		
P 94	P 68	P 80		
P 94	P 68	P 80		

LOCATION & ACCESS
Page 4

Reference	Emergent	Early	Grade 4 objective	Grade 5 objective
E 82			E 42	E 62
P 140	P 116	P 128		
P 56	P 42	P 48		
P 56	P 42	P 48		
P 54	P 40	P 46		

INFORMATION USE
Page 7

Reference	Emergent	Early	Grade 4 objective	Grade 5 objective
E 88			E 48	E 68
E 74			E 34	E 54
E 78			E 38	E 58
E 86			E 36	E 66
E 86			E 36	E 66
E 86			E 36	E 66

SYNTHESIS

Page 9

Reference	Emergent	Early	Grade 4 objective	Grade 5 objective
P 183/184	P 183/184	P 183/184		
E 76			E 36	E 56
P 142	P 116	P 128		
E 92			E 52	E 72
E 74			E 34	E 54

Page 10

Reference	Emergent	Early	Grade 4 objective	Grade 5 objective
E 90			E 50	E 70
E 90			E 50	E 70
E 90			E 50	E 70
E 88			E 48	E 68
E 92			E 52	E 72
E 92			E 52	E 72

Page 11

Reference	Emergent	Early	Grade 4 objective	Grade 5 objective
P 132	P 106	P 120	E 48	E 68

EVALUATION
Page 12

Reference	Emergent	Early	Grade 4 objective	Grade 5 objective
P 94	P 68	P 80		
P 56	P 42	P 48		
E 76			E 36	E 56
E 90			E 50	E 70
E 90			E 50	E 70
E 90			E 50	E 70
P 58	P 44	P 50		
P 134	P 106	P 120		
P 134	P 106	P 120		

INFORMATION SKILLS CONTINUUM

TASK DEFINITION	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Frames questions and designs investigations to answer their questions	E	88	E	3 4 5	6	
2. Uses brainstorming techniques to determine information needs			E M	E 3 4 5	6	
3. Uses a web	P	13 6	E M	E	3	4+
4. Shows beginning knowledge base through free-writing			E M	E	4	5+
5. Responds to story readings with literal questions and comments			E M	E	T	4+
6. Responds to story readings with inferential and critical questions and comments			E M	E	3 4 5 6	
7. Recognizes that differences in organizational structures between print and media text can affect their understanding of what they read and view.			E	3 4 5 6		
8. Selects own books to read			E M	E / E M	3	4+
9. Analyzes and evaluates information requirements			E	3 4 5 6		
10. Asks and responds to questions to clarify information and to explore possibilities or solutions to problems	P	52	E M	E 3 4 5 6		
11. Identifies their own personal and learning needs for information;	P	94	E M	E 3 4 5 6		

TASK DEFINITION (CONTINUED)

	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
12. Generates their own questions as a guide for research	P	94	E M		6	

INFORMATION SEEKING	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Answers, with assistance, their own questions and those of others by seeking information from a variety of texts	P	94	E M	E	3	4+
2. Asks and responds to questions to seek clarification or explanation of ideas and concepts	E	74	E M	E 3 4 5 6		
3. Contributes to and responds constructively in conversation, small group and whole group discussion	E	76	E M	E 3 4 5 6		
4. Distinguishes front, back, and spine of a book			E M	E	E	T+
5. Exercises proper care and handling of resources			E M	E	T	4+
6. Is aware of publishing date			E M	3	4	5+
7. Selects independently, texts appropriate to their range of interests and learning needs	P	86	E M	E	T	4+
8. Selects, with teacher assistance, texts appropriate to their interests and needs	P	86	E M	E	T	4+
9. Uses a range of reference texts [children's magazine guide] and a database [OPAC]or an electronic search [Internet/ERIC] to facilitate the selection process			E	4 5	6	
10. Is aware of a range of forms and genres			E M	E T	4	5+
11. Selects, reads, and views with understanding a range of literature, information, media , and visual texts	P	86	E M	E	T	4+

INFORMATION SEEKING (CONTINUED)	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
12. Locates and selects a range of print and non-print materials to meet their needs	P	94	E M	E	T	4+
13. Demonstrates understanding of the purpose of classification systems.			E	3 4	5	6
14. Uses basic reference materials and/or database or electronic search			1	2	3	4+
15. Recognizes some basic types of texts (videos, poems, posters, letters, true and imaginary texts)			E M	E	E	T+
16. Develops guide questions			E	T 4 5 6		
17. Is aware that information is available in a variety of forms and is used for a variety of purposes (eg. labels , captions, stories, letters)			E M	T 3 4 5 6		
18. Assesses the value of various types of electronic resources (eg. CD-ROM resources, community and government electronic information resources)			4	5 6		
19. Accesses OPAC			1	2	3	4+
20. Uses OPAC to search by subject			1	2	3	4+
21. Is aware of copyright laws			T	4	5	6

LOCATION & ACCESS

	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Asks and responds to questions to gather further information			E M	E T 4 5 6		
2. With increasing independence, answers their own questions and those of others by selecting relevant information from a variety of texts	E	82	T	4 5	6	
3. Uses a database, CD-ROM, and Internet as resources for finding information	P	140	E	T	T	4+
4. Gives and follows instructions	P	56	E M	E	T	4+
5. Responds to a variety of questions and directions	P	56	E M	E	T	4+
6. Uses a wide range of children's literature for information (i.e. fiction, non-fiction, poetry)			E M	E T 4 5	6	
7. Uses diverse print forms to obtain information (eg. posters, pamphlets, newspapers, forms, messages, recipes, signs)			E M	E T 4 5	6	
8. Uses a dictionary to choose appropriate spelling			E	T	4	5+
9. Uses a dictionary to choose appropriate meaning			E	T	4	5+
10. Puts words into alphabetical order			E	T	T	4+
11. Alphabetizes to the second and third letter			E	T	4	5+
12. Uses guide words			E	T	4	5+
13. Uses pronunciation symbols (including syllables and accents)			4	5	6	

LOCATION & ACCESS (Continued)	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
14. Uses spell checkers			T	4 5	6	
15. Uses a print and an electronic thesaurus			4	5	6	
16. Skims to obtain information			E	T 4 5	6	
17. Listens critically to the ideas and opinions of others	P	54	E M	E	T	4
18. Uses text features (keywords, titles, paragraphs, headings, subheadings, font, bolding, italics) to locate information			E	T 4 5	6	
19. Uses an index to locate information (text, periodical, electronic)			E	T 4 5	6	
20. Uses a table of contents to locate information			1	2	3	4+
21. Uses pictures/ illustrations to locate information			E M	E	T	4+
22. Uses graphs to locate information (bar graphs, pictographs, and broken-line graphs)			E M	E T 4 5 6		
23. Uses an atlas to locate information			E	T 3 4 5	6	
24. Uses maps to locate information			E	T 4 5	6	
25. Uses symbols and legends to read simple maps			E	E	T	4+
26. Understands that a globe is the only true map of the earth			E	T	4	5+
27. Identifies oceans, land masses, countries, poles, equator and hemispheres on a globe			E	T	4	5+

LOCATION & ACCESS (Continued)	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
28. Identifies longitude and latitude			4	5	6	
29. Uses globes and maps to access information on location, distance, climate, population, travel routes, natural resources, products, and areas in the news			4	5 6		
30. Compares maps which give different facts about the same region (eg: vegetation, population, land use etc.)			4	5 6		
31. Chooses the correct map for a particular purpose			4	5	6	
32. Uses key, scale, legends, compass direction, symbols, labels			4	5	6	
33. Uses a glossary to locate information			E	T	4	5+
34. Uses a vertical file to locate information			3	4 5 6		
35. Uses charts, posters, time lines to gather information			E	4 5	6	
36. Obtains information from Venn diagrams and concept maps			E M	E	3	4+
37. Uses electronic mail (E-mail, listservs, newsgroups)			T	5	6	
38. Uses appropriate software such as, electronic encyclopedias, biographical reference sources, atlases, and dictionaries.			E	3	4	5+
39. Uses appropriate computer resources and technologies (online catalogue, periodical indexes, full text sources)			T	4	5	6
40. Uses search tools and commands for Internet use (Boolean logic, icons, hypertext links, URL's)			4	5	6	
41. Uses the Dewey Decimal System to locate resources			E	3	4	5+

LOCATION & ACCESS (Continued)	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
42. Learns the location and organization of Easy Fiction Books			E M	E	T	4+
43. Learns the location and organization of Fiction Books			E	T	4	5+
44. Learns the location and organization of Non Fiction Books			E	T	4	5+
45. Learns the location and organization of Reference Materials			E M	E	3	4+
46. Understands borrowing procedures of the Resource Centre			E M	E	3	4+
47. Scans to locate detail			E	T 4 5	6	
48. Conducts an effective interview			E	T 4 5 6		
49. Uses keyboarding skills to access appropriate resources and technologies			E	3	4	5+
50. Is familiar with database structure and conventions as well as the processes of selecting fields to be displayed, organizing columns, and sorting fields.			4	5 6		
51. Selects appropriate Internet search engines (eg: Yahoo, Lycos, WebCrawler)			5	6		

INFORMATION USE

	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Identifies in order beginning, middle, and end			E M	E	T	4+
2. Sequences events through retelling			E M	E	T	4+
3. Summarizes orally what has been heard			E M	E	T	4+
4. Participates in jot noting on experience charts through recall of information			E M	E	T	4+
5. Selects appropriate note-making strategies (jot notes, matrix, webs, charts, databases, story maps etc.)	E	88	4	5	6	
6. Listens critically to others' ideas or opinions and points of view	E	74	4	5	6	
7. Detects examples of prejudice, stereotyping and bias	E	78	4	5	6	
8. Uses background knowledge to recognize that information can be presented to suit an author's purpose and point of view	E	86	4	5	6	
9. Responds critically to texts by applying a growing range of strategies to analyze and evaluate a text	E	86	4	5	6	
10. Recognizes when language is being used to manipulate, persuade or control	E	86	4	5	6	
11. Understands relationships between ideas (cause-effect, problem-solution)			E	T 4 5	6	
12. Comprehends at different levels (literal, interpretive, critical)			E	T 4 5	6	
13. Differentiates fact and opinion			E	T	4	5+

INFORMATION USE (continued)	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
14. Identifies main idea and supporting details of a text			E	T 4 5	6	
15. Summarizes information using major points			T	4 5	6	
16. Identifies, and suggests explanations for discrepancies in information/data			3	4 5 6		
17. Identifies patterns in information/data			E M	E T 4 5 6		
18. Classifies according to several attributes			E M	E T 4 5 6		
19. Uses strategies such as colour coding or numbering etc, to organize notes			4	5	6	
20. Derives relevant information from pictures, graphs, and charts			E M	E T 4 5	6	
21. Applies critical thinking to understanding how the mass media (T.V., film, radio, magazines)produce meanings			4	5 6		
22. Uses electronic bookmarks to record relevant Internet sites			T	4	4	5+

SYNTHESIS	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Creates a word book to present information			E M	E T	4	5+
2. Produces a table of contents			T	4	5	6
3. Produces pictures/ illustrations/diagrams			E M	E T 4 5	6	
4. Produces graphs (bar graphs, pictographs, and broken line graphs)			E M	E T 4 5	6	
5. Constructs simple maps			E	T 4	5	6
6. Produces a glossary			E	T	4	5+
7. Produces a Venn diagram, concept maps (non-fiction)	P	183/ 184	E M	E	3	4+
8. Contributes thoughts, ideas, and questions to discussions and compares their own ideas with those of peers			E	T 4 5	6	
9. Presents information through dramatization			E M	E T	4	5+
10. Presents information orally			E M	E T	4	5+
11. In an oral presentation, uses word choice, and emphasis, such as projection, tone of voice, facial expression and gestures appropriate to the speaking occasion making a conscious attempt to produce a desired effect	E	76	4	5	6	
12. Constructs a paragraph using a topic sentence and supporting details			T	4 5	6	

SYNTHESIS (Continued)	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
13. Selects, organizes, and combines relevant information with assistance from at least two sources, without copying verbatim to construct and communicate meaning	P	142	E	E	T	4+
14. Selects, organizes, and combines relevant information from two to five sources to construct and communicate meaning	E	92	4	5	6	
15. Explains/defends and/or supports their opinions with evidence	E	74	4	5	6	
16. Demonstrates effective use of poetic writing (songs, plays, poems)			E	T 4 5	6	
17. Demonstrates effective use of expressive (personal) writing (journals, diaries)			E M	E T 4 5	6	
18. Demonstrates effective use of transactional (or informational) writing (lists, classifications, comparisons, diagrams, maps, reports, advertisements, observations, categories, surveys)			E M	E T 4 5	6	
19. Creates written and media texts using an increasing variety of forms (brochures, book jackets, cartoons, collages, and computer graphics)	E	90	4	5	6	
20. Demonstrates understanding that particular forms of written and media texts require the use of specific features, structures, and patterns	E	90	4	5	6	
21. Makes informed choices of form, style and content for specific audiences and purposes	E	90	4	5	6	
22. Makes language choices to enhance meaning and achieve interesting effects in imaginative writing and other ways of representing	E	88	4	5	6	

SYNTHESIS (Continued)	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
23. Selects from a range of prewriting, drafting, revising, editing, proofreading, and presentation strategies to develop effective pieces of writing and other presentations	E	92	4	5	6	
24. Uses technology with increasing proficiency to create, revise, edit, and publish texts	E	92	4	5	6	
25. Creates and uses computer generated graphics and art in various print and electronic presentations			4	5 6		
26. Uses electronic spreadsheet software to create original spreadsheets			4	5 6		
27. Generates charts, tables, and graphs, using electronic spreadsheets and other graphing programs			5	6		
28. Demonstrates progress in keyboarding skills			T	4 5 6		
29. Publishes using hypertext and hypermedia			4	5	6	
30. Uses database/file management software to create original databases			4	5 6		
31. Uses presentation software (eg: PowerPoint) to create electronic slide shows and/or to generate overheads			4	5 6		
32. Uses word processing software in each stage of the writing process (eg: keyboarding skills, drafting, editing, proofreading, formatting)			T	4 5 6		
33. Uses specialized computer applications such as music composition software, computer-assisted drawing and drafting programs to enhance the quality, precision and effectiveness of their presentations			4	5 6		

SYNTHESIS (Continued)	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
34. Properly cites and credits electronic sources of information in bibliographies			4	5 6		
35. Organizes material using graphic organizers (eg: semantic mapping)			T	4 5 6		
36. Expresses and supports an opinion about an author's point of view			T	4 5 6		
37. Begins to develop a "voice" as a writer			T	4 5 6		
38. Writes sufficient relevant ideas to produce a complete and logical sequence			E	T 4 5 6		
39. Writes in more complex narrative and non-narrative forms			T	4 5 6		
40. Produces writing that is unified, well-organized, and elaborated			T	4 5 6		
41. Uses electronic information management strategies for personal evaluation (eg: electronic portfolios, databases)			4	5 6		
42. Makes judgements about the appropriateness of a technology in a given situation			T	4 5 6		
43. Creates texts collaboratively and independently, using a variety of forms for a range of audiences and purposes.	P	132	E M	E	T	4+
44. Uses relevant terminology appropriately			E	4	5	6

EVALUATION	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Reflects on their own research process	P	94	E	E	T	4+
2. Assesses the ethical and social impact of technologies			T	4 5 6		
3. Expresses opinions and responds to the questions and reactions of others			E M	E T 4 5 6		
4. Engages in and responds to a variety of oral presentations and other texts	P	56	E M	E	T	4+
5. Engages in, responds to, and evaluates a variety of oral presentations and other texts	E	76	4	5	6	
6. Invites responses to early drafts of their writing/media productions	E	90	4	5	6	
7. Uses audience reaction to help shape subsequent drafts	E	90	4	5	6	
8. Reflects on their final drafts from a readers'/ viewers'/listeners' point of view	E	90	4	5	6	
9. Values and seeks out feedback on writing			E M	E T 4	5	6
10. Interacts with sensitivity and respect, considering the situation, audience and purpose	P	58	E M	E	T	4+
11. Considers their readers'/listeners'/viewers' questions/comments and other responses about their work	P	134	E	E	T	4+
12. Begins to use such responses to assess and extend their learning	P	134	E	E	T	4+

EVALUATION (Continued)

	GUIDEBOOK	PAGE	INTRODUCE	DEVELOP	MASTER	MAINTAIN
13. Understands and complies with school's computer network acceptable use policy			E M	E	T	4+
14. Uses checklists or rubrics to evaluate their own products			E	T 4 5	6	
15. Creates portfolios of research skills and strategies and their products for use as a self assessment tool			T	4 5 6		

TECHNOLOGY SKILLS CONTINUUM

GENERAL KNOWLEDGE (WINDOWS)	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Identifies parts of a computer system (mouse, keyboard, monitor, printer)	EM	E	E	4+
2. Knows and uses appropriate computer terminology	EM	E	T	4+
3. Operates various pieces of hardware and software	E	E	T	4+
4. Accesses programs/files using desktop icons	EM	E	T	4+
5. Understands the purpose of a screensaver	E	E	T	4+
6. Accesses programs/files using START menu in Windows '95	E	E	T	4+
7. Closes programs properly	E	E	T	4+
8. Can close programs using both "X" and "FILE / EXIT" options	E	E	T	4+
9. Understands the multitasking capabilities afforded by a windows environment	4	5	6	
10. Opens more than one window at a time and moves information/data from one document to another	4	5	6	
11. Uses cut, copy and paste features	3	4	5	6+
12. Understands the difference between SAVE and SAVE AS and uses appropriately	E	T	4	5+
13. Saves to a floppy disk or to the hard drive (where available)	E	T	4	5+
14. Inserts and opens a floppy disk	E	T	4	5+

GENERAL KNOWLEDGE (WINDOWS)
(Continued)

	INTRODUCE	DEVELOP	MASTER	MAINTAIN
15. Understands the differences between different drives (A, C, & D)	E	T	4	5+
16. Inserts and uses CD-ROM software	E	E	3	4+
17. Uses HELP features as a problem solving strategy	E	T	4	5+
18. Creates directories	5	5	6	
19. Empties trash bin regularly	2	3	4	5+
20. Works cooperatively using information tools	E	T	4	5+
21. Identifies technology tools that communicate information in their home and school	EM	E	3	4+
22. Follows a sequence of steps to perform a task using information technology tools	EM	E	T	4+
23. Demonstrates the proper use and handling of equipment	EM	E	T	4+
24. Identifies occupations in their community that use information technology	E	T	4	5+
25. Demonstrate a willingness to be self-reliant when using information technology tools	E	T	4	5+
26. Discusses the uses of technology in society	E	4 5 6		

KEYBOARD

	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Demonstrates increasing proficiency in keyboarding	E	T 4 5	6	
2. Understands and uses specialized keys such as esc, backspace, insert, delete, tab, caps lock, shift, control, alt, page up, page down, home, end, num lock	E	3 4	5	6
3. Uses function keys appropriately	E	3 4 5 6		

OTHER DEVICES

	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Demonstrates proficiency using a mouse	EM	E	T	4
2. Uses a digital camera to capture and save images (OPTIONAL)	5	6		
3. Uses a scanner to convert print images and text to digital format	4	5	6	
4. Prints documents from a shared and/or local printer	E	T	4	5+
5. Uses a video camera (OPTIONAL)	5	6		
6. Uses an audio recorder (tape recorder or computer application)	E	T	4	5+

WORD PROCESSING	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Composes and edits on screen	E	T	4	5+
2. Selects text	E	T	4	5+
3. Uses a mouse to point, select and drag	EM	E T	4	5+
4. Selects and resizes shapes	E	T	4	5+
5. Uses basic tool bar features including open, print, print preview, cut, copy, paste, undo, redo, zoom, bold, italics, underline, justification, bullets, font, font size, select all	E	T	4	5+
6. Uses some advanced menu bar features including table of contents, columns, tables, borders and shading, find, replace, page numbering, insert symbols , insert picture (and frame if appropriate), hanging indent, drop case, change case, split windows	E	T	4	5+
7. Imports and includes a graphic into a document	4	5	6	
8. Demonstrates an awareness of layout and design	4	5	6	
9. Organizes files using directories and appropriate file names	4	5	6	
10. Opens and uses a template	5	6		
11. Creates and publishes newspapers	5	6		

GRAPHICS PROGRAMS

	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Uses simple drawing/paint software	EM	E	T	4+
2. Produces an original graphic	EM	E	T	4+
3. Demonstrates an awareness of layout and design	4	5	6	
4. Modifies an existing graphic	T	4 5	6	
5. Exports a graphic to a paint or word processing program	4	5	6	

DATABASE/SPREADSHEET

	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Uses different forms of databases/spreadsheets	4	5	6	
2. Enters data in fields/cells	4	5	6	
3. Manipulates data in fields/cells	4	5	6	
4. Uses electronic spreadsheets, databases and statistical software to process and analyze statistical data	5	5	6	

NETWORK	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Uses proper logon / logoff procedures	EM	E	T	4+
2. Is aware of, and adheres to network acceptable use policy	EM	E	T	4+
3. Accesses and saves to 'P' drive	E	E	T	4+

PRESENTATION PROGRAMS	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Accesses and create simple presentations using software such as PowerPoint	4	5	6	
2. Uses appropriate slide layout features	4	5	6	
3. Uses a variety of transition features	4	5	6	
4. Uses a variety of effects features	4	5	6	
5. Inserts a simple chart	4	5	6	
6. Inserts appropriate graphics to enhance information	4	5	6	
7. Uses text in concise manner	4	5	6	
8. Uses organizational strategies to enhance clarity (eg: keyword, titles, subtitles)	4	5	6	

ELECTRONIC MAIL	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Accesses E-mail account using EURDORA or other software	3	4 5	6	
2. Checks mail	3	4 5	6	
3. Composes and sends or queues new messages	3	4 5	6	
4. Uses nicknames to facilitate sending mail	3	4 5	6	
5. Creates and uses mailboxes and folders to organize and save mail	3	4 5	6	
6. Uses features such as forward, cc, reply, and redirect	3	4 5	6	
7. Checks and replies to mail in a timely and polite manner	3	4 5	6	
8. Adheres to netiquette	3	4 5	6	
9. Uses trash to delete mail	3	3	3	4+

INTERNET	INTRODUCE	DEVELOP	MASTER	MAINTAIN
1. Locates an Internet site given the correct URL (Universal Resource Locator)	3	4	4	5+
2. Evaluates internet sites/sources/content using appropriate criteria	5	6		
3. Uses the Internet to search for information on specific topics	5	5 6		
4. Uses simple Boolean search strategies	5	6		
5. Uses favorites or bookmarks to save the addresses of particular Internet cites	3	4	4	5+
6. Accesses bookmarks or favorites	3	4	4	5+
7. Uses BACK and FORWARD features of tool bar	3	4	4	5+
8. Uses taskbar to monitor progress and speed of loading	3	4	4	5+
9. Uses STOP to terminate loading	3	4	4	5+
10. Sets new home page for their browser	5	6		
11. Understands terms **Browsers** (Netscape Navigator vs Internet Explorer) and **Search Engines** (Yahoo, Excite, Altavista, WebCrawler)	3	4	4	5+
12. Understands the nature of search engines and the differences between them	5	6		
13. Uses *view document source* and *view document information*	5	6		
14. Decompresses and opens documents from Internet sites	5	6		
15. Creates hypertext/hypermedia documents for presentation on school web page	5	6		

APPENDIX C

Thinking Critically About Information on the World Wide Web

Thinking Critically About Information on the Web

Criteria for the evaluation of information and sites on the Internet.

Access

- Is it easy to access?
- Does it load quickly with essential information coming on screen first?
- Are the hardware/software/multimedia requirements greater than those available to you?

Design

- Is the site well arranged and easy to use? (Logical use of headings and hot links/ convenient navigational buttons)
- Are charts and graphs clearly labelled and easy to read?
- Is it appealing to students?
- Is it appropriate for your grade level? (Will they stay on task?)
- Does it make use of the web capabilities to offer something unique or just to add "glitter"?
- Does the page lead to other good information sources or sites?

Purpose

- Is the purpose of the site clear? (Scholarly vs general public, sell / persuade / inform / entertain / personal)

Authority

- Is the source/author clearly identified? (Individual/organization/business/news agency)
- Are they qualified to write about this topic? (Educational or occupational background)
- Is contact information provided? (Is there a phone number or mailing address or just an e-mail address?)
- Is copyright information provided?

Accuracy

- Are sources or references listed?
- Does the information provided compare with related sources? (Verifiable?)
- Are there links to other organizations or outside sources?
- Is this site offered as a *link* from a reputable source such as NASA or the Smithsonian?
- Are there errors in information or in typing or grammar?

Coverage (scope)

- Who is the intended audience? (Expert vs Novice)
- Is there stated criteria for inclusion of information?
- What topics are included?
- Are topics explored in depth?

Objectivity

- Is information clearly distinguished from advertising?
- Is information presented with a minimum of bias?
- Does the author acknowledge his/her bias up front?
- Are different viewpoints represented either within the information provided or through links to other organizations ?
- Does the author's affiliation with the organization sponsoring the page appear to bias the information provided?

Currency

- Are dates provided?
- Do they clearly identify whether they represent the date the information was first written, the date they were placed on the web, or the date of the last revision?
- Is the site updated regularly?

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APPENDIX D

ISLE-Net

ISLE-NET
General Information
School:
Macdonald Drive Elementary School
150 Macdonald drive
St. John's, NF, A1A 2K9
Phone: (709) 753-6020
Fax: (709) 753-3809

Principal:
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Lead Teacher:
Daphne Lilly
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Project Overview

Originally developed as a STELLAR School Project to integrated use of information technology into the Grade Four school curriculum, this project has been selected to participate n a joint resource-based learning effort with students in Prince Edward Island and Iceland. The study has two components:
-students will be actively engaged in researching their own "island" community and sharing this information with participating schools.
-students will be expected to reflect, compare and contrast the essential elements of their community, ie. The culture, economy, history, ecosystem, government, etc. with "how it is"in other North Atlantic communities of the project.

The involvement of Iceland was precipitated by interest expressed by the North Atlantic Islands Research Programme in ISLE-Net. Their major focus is on comparative research and exchange, with a mandate to engage public policy and business communities in seven jurisdictions, and encourage positive development initiatives. The seven islands are Aland, the Faroes, Greenland, Iceland, Isle of Man, Newfoundland and Prince Edward Island. While the Research Programme is a project of the Institute of Island Studies at the University of Prince Edward Island, it is closely associated with the Nordic Institute of Regional Policy Research (NordREFO) in Stockholm. The four main research sectors are small-scale manufacturing, tourism, resource-based industries, and export of knowledge-based services.

A second element of the Programme is a Public Engagement strategy, of which one area is

involvement in the school curriculum. Their strategy was to identify key educators who had already shown interest in an analysis of islands, and provide opportunities for them to plan together for student initiatives such as projects involving electronic communications, exchanges, and other areas of curriculum development. Their support enabled educators from Newfoundland and Prince Edward Island to travel to Iceland to meet colleagues who would be interested in linking the study of community in elementary schools there with our students' projects.

Grade Level

In Iceland, students begin formal instruction in English at age 11-12, which is equivalent in Newfoundland schools to Grades 6-7. The Newfoundland grade Five Social Studies curriculum is focused solely on the history and culture of Newfoundland, whereas in Grade Six, students expand their study to all the provinces and territories of Canada. Therefore, in the interests of compatibility of topic and learner, Icelandic schools will be communicating with Grade Five and Six students in Newfoundland.

Prince Edward Island will be incorporating this project into the elementary curriculum or Social Studies, Language Arts and Science for Grades Four, Five and Six. The Department of Education for Prince Edward Island is also providing support for resources and technical assistance. Since language is not a barrier, students from a wider range of age and grade levels may share information between the two Canadian provinces.

Curriculum Connections

This project has benefits for the Newfoundland elementary Social Studies and Language Arts curriculum. For example, the Social Studies curriculum goals include:

1. developing an understanding of the elements of the physical environment; the land, its location, its surface features, resources, particularly water, and the use and conservation of natural resources, weather (climate).
2. Investigating people's material culture and economic systems: the effect of geographic systems on people's way of living, how people in turn modify and change their environment; the basic needs of people in any community such as shelter, clothing, work, and ways of making a living from resources production; transportation; communication; technological change
3. understanding how people live together: their social structure; political organization for accomplishing social objectives; institutions for education and religion; attitudes, values and ideology; the changes that occur over time, past, present, and future.

The provincial Language Arts Learning Outcomes develop skills in the following areas:

reading/interpreting/analysing
- online and oral communication
- interviewing/discussing
- writing summaries/reports (accessing/retrieving/analysing/synthesizing/presenting)
- presentation a variety of formats

In addition, Newfoundland's Department of Education has endorsed resource-based learning as the underlying philosophical framework for the achievement of all learning outcomes - active engagement of the student using a variety of print, non-print, electronic and human resources. This project is process-oriented, and will require of students greater concentration in higher level thinking skills.

The General Learning Outcomes for Technology Education are widely addressed in this project. As part of their study of various island communities, they will develop an understanding of modern technology activities, processes, resource utilization, tools and systems applicable to different communities. The impact of technology and technological change on self, society and the environment will also be addressed.

Information literacy skills will be focus of the project in the various curriculum areas. Critical thinking about the role and value of information and about communications technology in particular will be emphasized.

Resource Connections

Macdonald Drive Elementary is equipped with a Windows NT computer network with computers installed in each classroom area and a high-speed connection to the Internet. The resource Centre has a collection of approximately 12,000 print/video/film resources for classroom use.
In addition, the North Atlantic Islands research Programme provided funds for the purchase of print and video resources on Iceland specifically targeted to the elementary school student. These resources will be circulated to those schools in Newfoundland and Labrador who become members of the project.

Evaluation

The value of this project lies in the opportunity it provides to students to build knowledge and develop skills and attitudes in relation to the "island" experience they share with others in their own province and beyond. The Learning Outcomes and general curriculum goals previously mentioned will be used to determine the level of student achievement. Teachers will also use observation and anecdotal records to assess student performance. Students will be required to maintain a current record of the extent of their communication

and findings and will also be evaluated on their teamwork and group decision-making strategies.