Technology As a Foundation Skill Area: A Journey Toward Information Technology Literacy

A Resource for Curriculum Developers, Teachers, and Administrators

Renewing Education:
New Directions

Manitoba Education and Training
Linda G. McIntosh, Minister

TECHNOLOGY AS A FOUNDATION SKILL AREA: A JOURNEY TOWARD INFORMATION TECHNOLOGY LITERACY

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INTRODUCTION

The Importance of Technology

Technology

Throughout history, technology has played a vital role in society. Technology may be regarded as

- a tool or machine
- a process, system, environment, epistemology, and ethic
- the systematic application of knowledge, materials, tools, and skills to extend human capabilities

Thus, technology includes not only tools and machines, but also their impact on processes and systems, on society, and on the way people think, perceive, and define their world.

Given the growing importance of technology, it is imperative that Manitoba students develop an informed awareness of technology in their lives. To this end, subject areas such as social studies, the sciences, mathematics, and language arts include the development of technology-related knowledge, skills, and attitudes. The importance of technology is also manifested through various Senior Years Technology Education Program subject areas (such as industrial arts, home economics, vocational industrial education, business education, and marketing education).

Information Technology

Over the past few decades, a particular dimension of technology has come to permeate nearly all aspects of human life: information technology. The information technologies, comprising computers and their peripherals, computer software, the Internet, and electronic multimedia, are becoming part of our daily existence at an ever-increasing rate. This reality also informs the need to integrate information technology into curricula for the various subject areas.

The Development of Information Technology Literacy

To prepare students for their roles in society, Manitoba Education and Training has identified technology,* along with literacy and communication, problem solving, and human relations, as a foundation skill area to be developed in every subject area and grade *(A Foundation for Excellence,* 1995). Development of technology as a foundation skill area will not only enable students to use technology to learn, but will also enhance their understanding of the connections between technology, society, and the environment.

* In the late 1980s and early 1990s, many educational stakeholders came to recognize the importance of information technology; however, many of these stakeholders initially referred to information technology simply as "technology." The use of the term "information technology" is increasing to avoid confusion with the wider, all-encompassing historical definition of technology.

The description of information technology literacy provided in this document builds on the definition provided in *A Foundation for Excellence* (1995), and includes aspects of literacy and communication, problem solving, and human relations. This illustrates the mutually supportive nature of all four foundation skill areas, and the important role of information technology in building on the other areas. The integration of information technology as a foundation skill area is an important step in students' journey toward information technology literacy.

PURPOSE OF THIS DOCUMENT

The purpose of *Technology As a Foundation Skill Area: A Journey Toward Information Technology Literacy* is to assist curriculum developers, teachers, and administrators in understanding the role of information technology as a foundation skill area in classroom teaching, learning, and assessment. This resource is also intended to assist in planning for and implementing information technology integration.

Document Overview

This document contains the following sections:

- **Transition to an Information Age** establishes a contextual framework for information technology by discussing the impact of technology in the development of human culture, education, and business and work.
- **Using Information Technology** provides a vision for the integrated use, management, and understanding of information technology to enhance teaching, learning, and assessment, and discusses categories of information technology.
- **Developing Information Technology Literacy** identifies the literacy outcomes that students achieve throughout various learning stages.
- **Enhancing Classrooms with Information Technology** describes characteristics of classrooms enhanced through effective interaction with information technology.
- **Integrating and Implementing Information Technology** discusses considerations for the integration and implementation of information technology in curriculum development and in classroom teaching, learning, and assessment.
- **Supporting Change** describes the support available to schools and school divisions/districts relating to this document.

In addition, this document contains appendices, a glossary, and a bibliography:

- **Appendix A: Information Technology Literacy Continuum** provides a framework for integrating information technology into all subject areas throughout the Early, Middle, and Senior Years. The continuum comprises three learning stages: exploration, skill development, and application and extension.
- **Appendix B: Projects Demonstrating Information Technology Integration** describes four projects that may serve as models for the integration of information technology as a foundation skill area.
- **Appendix C: Evaluation Form for Non-Print Learning Resources** may be adapted for individual use when evaluating and selecting multimedia learning resources, videotapes, and Web sites.
- The **Glossary** defines terms and acronyms related to information technology.
- The **Bibliography** cites resources used in the development of this document.

TRANSITION TO AN INFORMATION AGE

The Development and Impact of Technology

Understanding the historical development and impact of technology is important for all curriculum developers, teachers, and administrators. Few would dispute that the use and very presence of technology has determined the nature of life on Earth and continues to have a tremendous impact on our society, influencing cultural, educational, and business developments.

Technological development, often driven by the human search for a better way of life, has produced inventions and processes that have been described as both blessings and burdens. On the one hand, technology allows us to

- do tasks with greater speed, accuracy, efficiency, and reliability
- control information and influence social organizations and culture
- change our environment

But at what cost? Some technological developments have caused unforeseen problems and consequences for society and the environment.

Some of the effects of technology on human culture, schooling, and business and work are discussed below.

Culture

Throughout history, from the dawn of evolution to our modern society, technology has played a pivotal role in the development of human culture. In fact, the history of human development parallels the history of technological development. The very ages we use to refer to human progress and development are technology based: stone, bronze, iron, industrial, atomic, and information.

The development of new technology over the ages has not simply added new dimensions to human culture. New technology has actually altered human culture. Throughout the time that humans have used technology, from the early stone tools to the Hubble telescope, technology has affected and changed societies. Consider how writing and number systems, paper, and the printing press have influenced societies; how sailing ships, steam engines, automobiles, airplanes, and space craft have affected transportation. Reflect upon how gunpowder, crossbows, repeating rifles, dynamite, and atomic bombs have influenced combat and war; how the telegraph, radio, television, computer, and satellite have changed communication.

Schooling

The nature of schooling tends to reflect the nature of the society in which it is found. In the latter part of the nineteenth century, life in North America was farm based, and schools mirrored that lifestyle. The one-room schoolhouse was sufficient to meet the needs of an agrarian society. School started late and ended early in the day to allow time for students to help their families with farm work. School dismissed entirely during the summer so that children could help their parents in the fields. Education was primarily didactic and learning was less book based than it is today. Controlled largely by the teacher, education focused predominantly on basic skills. Teachers taught reading, writing, and arithmetic to complement the skills students learned outside school. Since relatively few students progressed further than Grade 6 or 7, the need for higher levels of education was minimal.

By the beginning of the twentieth century, however, change was on the horizon. More people were living in cities and working in factories, and, as a consequence, new skills were needed. It was then that a great revolution in education took place: the model of school as a factory emerged. Students were taught the facts and skills they needed for industrial jobs, which they were likely to hold their entire lives. One-room schools were eventually replaced by large buildings. Students were sorted by grades and sat in straight rows, with a teacher at the front of the classroom in control of learning. The curriculum was compartmentalized and taught in separated bits and pieces — similar to the way that work is completed on an assembly line. Schools became efficient social institutions with the goal of turning out identical products.

Today, western society has evolved from a factory-based, industrial-style classroom to a post-industrial, information-based model. This evolution has been spurred by the mass appearance in the early 1970s of the microprocessor, while the 1980s and 1990s witnessed an explosive growth in the networking of information technologies. It is precisely this advancement in networking that has given us today's Internet. Multimedia innovations and the growth of the Internet have transformed our ability to access information. Despite all these factors, we are still educating many students (particularly Senior Years students) in factory-model schools. Many of the skills being taught are intended for jobs that will either no longer exist or will be radically different by the time students graduate.

Business and Work

In ever-increasing numbers, Canadians are working with, or being affected by, many technologies, including information technology. In fact, many businesses and industries would have great difficulty carrying out their enterprises without the full array of current technologies. In contrast, if technology systems were suddenly to disappear from schools, education would continue almost as usual.

A New Learning Environment

Our post-industrial society demands a post-industrial education. Curriculum developers, teachers, administrators, parents, and policymakers have begun to recognize the need for a new model of education. In the new model, education will be more personalized (i.e., education will be more differentiated to meet each student's learning requirements). Students will be challenged with higher expectations of learning, and encouraged to think creatively and critically as they solve problems. They will spend more time using information technology to learn independently. The knowledge they gain and the skills, strategies, and attitudes they learn in this way will support them throughout life.

USING INFORMATION TECHNOLOGY

The Vision

The use of information technology will help enable all students to solve problems, improve their personal performance, and gain the critical and abstract thinking skills necessary to become lifelong learners and contributing members of their communities.

To achieve this vision, all Manitoba students will

- **use** information technology to structure inquiries, solve problems, and gather, organize, validate, and communicate information on a local and global scale
- **manage** information technology by making creative, productive, and efficient technology choices for the tasks at hand
- **understand** information technology and reflect upon the ethics and impact of its use, synthesizing new insights and making reasoned decisions as information technology evolves

Skill development in this foundation area will be accomplished through the integrated use of information technology in all Manitoba curricula. The integration will be founded on

- an Information Technology Literacy Continuum (see Appendix A)
- current teaching, learning, and assessment philosophies
- sound pedagogical practices
- exemplary suggestions for grade-appropriate and subject area-appropriate information technology-based learning resources and instructional and assessment strategies

An Integrated Approach

The core function of schools is to educate students. Traditionally we have equated the achievement of this core function with the acquisition of certain key skills: reading, writing, and numeracy. Today, however, we require an enhanced set of skills that includes the old skills, but also reflects current skills related to the effective use of information technology. To be most effective, the acquisition of these new skills will be achieved through a curriculum-integrated approach that uses information technology to support teaching, learning, and assessment.

Teachers must continually make informed decisions about the appropriate use of information technology. For example, they need to consider whether its use adds another dimension to the resources already available to students. Information technology does not replace teachers, curricula, or other sources of information.

Manitoba Education and Training has undertaken several projects that demonstrate how the appropriate integration of information technology enhances teaching, learning, and assessment (see Appendix B).

Categories of Information Technology

For the purpose of simplification, information technologies are often grouped by categories such as those presented in the chart below. Some examples of the specific information technologies included in each category are also provided.

Information Technology

Category	Examples
Tool Hardware	▪ digital camera ▪ graphing calculator ▪ multimedia computer ▪ probes ▪ scanner ▪ video camera ▪ video capture card ▪ videodisc player
Tool Software	▪ computer-aided design (CAD) ▪ computer-aided manufacturing (CAM) ▪ concept mapping ▪ data mining ▪ database ▪ drafting ▪ spreadsheet ▪ word processor
Telecommunications	▪ audioconferencing ▪ e-mail ▪ fax ▪ Internet ▪ radio ▪ telephone ▪ television ▪ videoconferencing
Production/Presentation/ Authoring Applications	▪ animation ▪ desktop publishing ▪ graphics ▪ hypermedia ▪ hypertext markup language (HTML) ▪ musical instrument digital interface (MIDI) ▪ video
Interactive Multimedia	▪ computer-guided learning (CGL) ▪ multimedia books ▪ multimedia encyclopedias ▪ simulation ▪ virtual reality
Programming and Controlled Devices	▪ Logo ▪ robots

Note: Refer to the glossary for definitions of unfamiliar terms.

DEVELOPING INFORMATION TECHNOLOGY LITERACY

The goal of integrating information technology into curricula is to help students develop the abilities to use, manage, and understand information technology. It is important that students develop these abilities throughout the learning process in all curriculum areas.

Information Technology Literacy Outcomes

Information technology-literate students are able to

- develop knowledge, ability, and responsibility in the use of information technology
- acquire, organize, analyze, evaluate, and present information using appropriate information technology
- use information technology to expand their range and effectiveness of communication
- solve problems, accomplish tasks, and express creativity, both individually and collaboratively, using information technology
- understand the role and impact of information technology and apply ethical, responsible, and legal standards in its use

The knowledge and skills of the information technology-literate student described above builds upon the definition of technology as a foundation skill area and includes the other mutually supportive foundation skill areas of literacy and communication, problem solving, and human relations. It is critical that the use of information technology support development of these skills.

Appendix A: Information Technology Literacy Continuum provides a framework for integrating information technology into all subject areas throughout the Early, Middle, and Senior Years.

ENHANCING CLASSROOMS WITH INFORMATION TECHNOLOGY

Effective Interaction with Information Technology

Careful consideration of the role of information technology will lead to new ways of teaching, learning, and assessing. However, the presence of information technology alone will not produce this transformation.

Effective interaction with information technology provides students with opportunities to

- utilize the rich, interactive capabilities of information technology, providing experiences traditionally unavailable within the school (i.e., computers used only for drill-and-practice or remedial work will not help reshape education)
- ask questions, identify problems, and seek multiple solutions to problems
- progress at their own rate and gain access to necessary learning resources
- work together, where the emphasis is on teamwork and critical and creative thinking
- act as peer tutors, helping classmates work through problems and challenges
- take responsibility for their own learning and strive to reach high expectations

The Teacher as Facilitator

In an information technology-enhanced classroom, the teacher's role is that of a facilitator, rather than expert. As facilitators, teachers

- assist students as they navigate through the information made available by information technology and other sources
- direct students as they gather, organize, analyze, and present their findings
- help students develop, focus, refine, consolidate, and extend their abilities

Information technology-enhanced classrooms provide teachers with additional resources and/or modes of delivery to differentiate instruction.*

* For an overview of strategies for differentiating instruction, see Manitoba Education and Training. *Success for All Learners: A Handbook on Differentiating Instruction: A Resource for Kindergarten to Senior 4 Schools.* Renewing Education: New Directions series. Winnipeg, MB: Manitoba Education and Training, 1996.

INTEGRATING AND IMPLEMENTING INFORMATION TECHNOLOGY

Considerations for Integrating Information Technology

In the process of integrating and implementing information technology as a foundation skill area and developing students' information technology literacy, curriculum developers, teachers, and administrators take into account various considerations. Overall, this process is based upon the content of the following two types of curriculum documents:

- ***Manitoba Curriculum Framework of Outcomes and Standards*** documents incorporate student learning outcomes prescribed for specific subject areas and grades for all Manitoba schools. Standards of performance for Grade 3, Grade 6, Senior 1, and Senior 4 are included where applicable.
- ***A Foundation for Implementation*** documents restate the prescribed student learning outcomes and assist teachers in implementing the outcomes by providing suggestions for instruction and assessment and by suggesting learning resources.

In developing and implementing these curriculum documents, educators in each subject area must

- address information technology as a tool to enhance teaching, learning, and assessment
- examine the implications of the use of information technology for society and the environment from within the context of their subject area, as well as their school and community

Some general considerations are offered below in the form of questions and answers to guide the integration and implementation of information technology.

Manitoba Curriculum Framework of Outcomes and Standards

- *Should the development of learning outcomes be determined by varying access to information technology in schools?*

  The current availability of information technology in schools varies greatly. Although this factor should be considered when developing student learning outcomes that integrate information technology, it should not limit outcome development. Learning outcomes should be designed in the best interests of students to help prepare them for present and future roles in society.

- *Can some learning outcomes be achieved only through the use of information technology?*

  It is likely that few learning outcomes can be achieved only through the use of information technology. These outcomes must be developed carefully to reflect both content goals and goals related to information technology literacy.

- *What learning outcomes can be enhanced through the application of information technology?*

  Many learning outcomes can be enhanced through the application of information technology, but the use of the information technology need not be prescribed in the outcomes. The application of information technology for these learning outcomes may be described as suggestions for instruction and/or assessment in *A Foundation for Implementation* documents.

- *Which competencies identified in the Information Technology Literacy Continuum can be developed within a curricular context?*

  Educators must help prepare students for future work and learning by addressing a variety of information technology skills ranging from basic procedural competencies to critical thinking. A starting point is offered in the Information Technology Literacy Continuum in Appendix A. The evolution of information technology, however, necessitates a dynamic continuum of skills and competencies that must be revisited over time.

A Foundation for Implementation

- *How and when is it appropriate to use information technology?*

  Information technology skills are best learned when integrated within a curricular context. Decisions about which information technologies to use and when and how to use them should be based on learning outcomes. (Does the information technology help students learn about science, mathematics, social studies, language arts, and other subject areas?) Learner-centred instructional philosophies and pedagogical practices (e.g., differentiated instruction) guide decisions about when and how to use information technology.

- *What process should be used when evaluating and selecting information technology?*

  Decisions about which information technologies to integrate are to be based on an evaluative process that includes

  — a preview and curriculum match of various information technologies

  — a testing/validation component

  — a mechanism for updating information technology as it evolves

  For a sample evaluation form, see Appendix C.*

* Also refer to the following Manitoba Education and Training documents:
- *Resource-Based Learning: An Educational Model.* Winnipeg, MB: Manitoba Education and Training, 1994.
- *Selection of Learning Resources: Policies and Procedures for Manitoba Schools.* Winnipeg, MB: Manitoba Education and Training, 1990.

- *How can information technology-based learning outcomes be assessed in the classroom?*

  Performance-based assessments that require students to use information technology to gather, organize, analyze, and communicate information can be used to assess information technology-based learning outcomes. A combination of self-assessment and peer and teacher assessment can be used.

- *What form of professional development will promote and support the integration of information technology?*

  The goal of professional development is to provide participants with opportunities to use information technology in teaching and assessing — to create lessons/topics/units/sequences using information technology to meet learning outcomes. The professional development activities should focus on helping teachers

  — make connections between curricula and the information technology available to them

  — make changes to their existing teaching and assessment practices to incorporate information technology appropriately

Conclusion

The goal of integrating and implementing information technology as a foundation skill area within all curricula is to help students on their journey toward information technology literacy through the use, management, and understanding of information technology. Curriculum developers, teachers, and administrators play a significant role in working toward achievement of this goal. Strategies for the integration and implementation of information technology, developed with an understanding of the use and historical impact of information technology, will help facilitate positive change in the classroom and lead to information technology-literate students.

SUPPORTING CHANGE

Many schools have created school- and/or division/district-based implementation teams to plan the implementation of new policies and curricula, and to organize and lead ongoing staff development and support activities within the school and/or school division/district. These teams can also help to inform the local community about the change taking place in schools as new policies and curricula are implemented.

Ideally, school- and/or division/district-based implementation teams include teachers, administrators, other school staff, parents or guardians, students, and members of the local community. It is critical that these teams have administrative support and leadership at both the school and divisional/district levels. Some divisions/districts have established implementation committees to help coordinate the work of the team.

Manitoba Education and Training supports the school-based implementation team concept and is committed to working with all educational partners to promote and support them.

Support to schools and school divisions/districts relating to the information in this resource is available by contacting

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APPENDICES

APPENDIX A: INFORMATION TECHNOLOGY LITERACY CONTINUUM

The purpose of the Information Technology Literacy Continuum on pages 20 to 24 is to provide a framework for the integration of information technology to achieve the vision of information technology as a foundation skill area. Effective integration of information technology into all curricula assists students in developing the abilities necessary to use, manage, and understand information technology. The development of these abilities guides students on their journey toward information technology literacy.

Information Technology Literacy Outcomes

The continuum identifies information technology literacy outcomes for all students. Information technology-literate learners will

1. develop knowledge, ability, and responsibility in the use of information technology
2. acquire, organize, analyze, evaluate, and present information using appropriate information technology
3. use information technology to expand their range and effectiveness of communication
4. solve problems, accomplish tasks, and express creativity, both individually and collaboratively, using information technology
5. understand the role and impact of information technology, and apply ethical, responsible, and legal standards in its use

The continuum further identifies skills and competencies to be developed within each of these five outcome areas.

Learning Stages

The Information Technology Literacy Continuum is based upon knowledge of child development and upon the use of sound teaching and assessment strategies. The continuum is divided into three learning stages:

- **Exploratory Stage:** The Early Years stage is characterized by exploratory learning experiences that focus on the use of educational software in the context of subject area content. During this stage, students are expected to have a general exposure to, and experience with, a variety of information technologies as learning tools.
- **Skill Development Stage:** Middle Years students are expected to acquire specific information technology skills and knowledge in the context of core subject areas. Students at this stage of development continue to make subject-specific use of a range of educational software. Grade 4 is considered a transition period between the Early and Middle Years stages. The transition phase is characterized by a range of learning experiences, some of which continue to be exploratory while others are more focused on skill acquisition.

- **Application and Extension Stage:** The application and extension of skills and knowledge occurs in the Senior Years. Senior 1 is intended to serve as the transition phase between the skill acquisition stage occurring at Middle Years and the application and extension stage which occurs during the Senior Years. During the transition phase, the emphasis on skill acquisition diminishes while the emphasis on application increases. In the final stage, Senior Years students apply, consolidate, and extend the skills, knowledge, and experiences acquired earlier across the full range of subject areas.

Development Processes

The appropriate and full integration of information technology into all curricula will require adjustments to structures and processes. This applies to both Department-based and field-based development processes.

In forming departmental curriculum development teams and identifying development processes, Manitoba Education and Training considers

- including on development teams practising subject area teachers who are integrating information technology into their current classroom practices
- assigning an information technology resource person to development teams
- ensuring liaison between the information technology resource person and development teams
- identifying aspects of the Information Technology Literacy Continuum that best fit within the grade(s) and subject area curriculum under development

Within the curriculum development process there is a strong need for

- coordinating efforts to ensure that, over time and through all curricula, all aspects of the Information Technology Literacy Continuum are adequately and appropriately addressed
- guiding curriculum developers in the many skills that must be addressed to achieve the competencies identified on the continuum
- ensuring that emerging information technologies are adequately and appropriately reflected on the continuum and in curricula

In planning, designing, and implementing local curricula and projects (e.g., locally developed/acquired Department-approved curricula,* student-initiated projects, and school-initiated courses), school divisions/districts need to ensure that information technology is incorporated as a foundation skill area.

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* Refer to Manitoba Education and Training. *Locally Developed/Acquired Department-Approved Curricula: A Handbook for Senior Years Schools.* Renewing Education: New Directions series. Winnipeg, MB: Manitoba Education and Training, 1998.

The Continuum

In reading the Information Technology Literacy Continuum on pages 20 to 24, note the following:

- Students working at any learning stage should be proficient in the competencies identified for the previous stage, where it exists:
  - — By the end of the **exploratory stage**, students will engage in the information technology experiences identified for that stage.
  - — At the **skill development stage**, students will be proficient in the exploratory competencies, and then develop the information technology competencies identified for the skill development stage.
  - — At the **application and extension stage**, students will be proficient in the skill development stage competencies, and then continue to apply, consolidate, and extend information technology skills in all subject areas.
- When specific information technologies are identified on the continuum, they are to be viewed as examples and not as exhaustive lists that exclude all other similar types of information technologies.
- Italicized words and terms are defined in the glossary following the appendices.

Information Technology Literacy Continuum

Students will:

1. Develop knowledge, ability, and responsibility in the use of information technology.

Exploratory Stage

Students will:

1.1.1 Use *information technology* to assist learning.

1.1.2 Demonstrate *ergonomic* practices while using information technology.

1.1.3 Use information technology-related vocabulary in context.

1.1.4 Use a variety of input devices such as a keyboard, mouse, *touch screen,* and *joystick* to complete tasks.

1.1.5 Start, stop, navigate, and interact with software.

1.1.6 Access *peripherals* such as printers and *CD-ROM drives*.

Skill Development Stage

Students will:

1.2.1 Select appropriate software to complete a defined task.

1.2.2 Select appropriate input and output devices or media, such as a mouse, *scanner,* touch screen, voice, joystick, video camera, track pad, and printer to complete a defined task.

1.2.3 Use appropriate keyboarding techniques.

1.2.4 Use an *operating system* to load software and conduct regular data management functions such as deleting, copying, moving, renaming, and grouping of files.

1.2.5 Use *removable media* such as CD-ROMs and *cartridges,* demonstrating proper handling, insertion, ejection, and accessing of data contained on the media.

1.2.6 Connect to networks and *upload* and/or *download* data to and from networks, including navigating the *Internet*.

1.2.7 Describe the *compatibility* issues related to the integration of various software programs and their files.

1.2.8 Solve information technology-related challenges and assist others to do so.

Application and Extension Stage

Students will:

1.3.1 Select the most appropriate information technology to complete tasks and to assist in the attainment of student learning outcomes.

1.3.2 Use information technology to conduct research, share information, and work in collaboration with others.

1.3.3 Resolve common compatibility issues related to the integration of various software programs and their files.

1.3.4 Develop specific solutions to information technology-related problems.

Continued

Information Technology Literacy Continuum

Students will:

2. Acquire, organize, analyze, evaluate, and present information using appropriate information technology.

Exploratory Stage

Students will:

2.1.1 Acquire information from electronic sources such as CD-ROMs and the Internet.

2.1.2 Manipulate electronic information using symbols, letters, and words.

2.1.3 Organize information obtained from electronic sources.

2.1.4 Create electronic or other presentations using software appropriate for a given grade.

Skill Development Stage

Students will:

2.2.1 Acquire information from *network,* electronic, and *online* resources and databases in a variety of formats, such as text, audio, video, and graphics, while limiting extraneous data, and implement appropriate search and selection strategies, including *Boolean, keyword,* or natural language *searches.*

2.2.2 Analyze and evaluate information and data obtained from electronic sources by considering their currency, usefulness, and reliability.

2.2.3 Plan for and produce a project or report by synthesizing information acquired from a variety of electronic and other resources.

2.2.4 Create presentations using *multimedia* and integrated software packages for a variety of audiences.

2.2.5 Develop information resources available through an *intranet* or the Internet.

Application and Extension Stage

Students will:

2.3.1 Synthesize new information from data gathered from a wide variety of electronic and telecommunication sources to create a new product.

2.3.2 Plan, implement, and produce projects based on appropriate technological choices.

2.3.3 Develop information resources for an intranet or the Internet and assume responsibility for their timeliness, relevance, and accuracy.

Continued

Information Technology Literacy Continuum

Students will:

3. Use information technology to expand their range and effectiveness of communication.

Exploratory Stage

Students will:

3.1.1 Communicate and share information electronically using information technologies such as the telephone, fax, and *local area network*-based *e-mail* facilities.

3.1.2 Explore the capabilities of Internet-based e-mail.

3.1.3 Participate in teacher-guided online activities.

Skill Development Stage

Students will:

3.2.1 Use a variety of *productivity tools* to create documents that communicate effectively with a variety of audiences.

3.2.2 Publish and present documents in a variety of media, including hard copy, electronic projection, and the Internet.

3.2.3 Use *telecommunications tools*, such as e-mail and desktop videoconferencing, for communication and participation in interactive projects with other learners.

3.2.4 Participate in *electronic communities* as learners, initiators, contributors, and mentors.

3.2.5 Accomplish tasks through collaboration facilitated by the appropriate use of information technologies, such as *groupware* products that function on *local* and *wide area networks*.

3.2.6 Use multimedia technology to create presentations appropriate for a given grade and a variety of audiences.

Application and Extension Stage

Students will:

3.3.1 Apply information technology regularly in the preparation of assignments, reports, and other projects.

3.3.2 Publish information using a variety of information technologies.

3.3.3 Use local and wide area network resources, including the Internet, in a self-directed manner to participate in local and global initiatives.

3.3.4 Use information technology to become contributing members of local and global communities.

Continued

Information Technology Literacy Continuum

Students will:

4. Solve problems, accomplish tasks, and express creativity, both individually and collaboratively, using information technology.

Exploratory Stage

Students will:

4.1.1 Complete tasks individually and collaboratively using information technologies such as word processors, graphics and drawing applications, and *educational software*.

4.1.2 Express creativity by using a drawing application.

Skill Development Stage

Students will:

4.2.1 Solve subject-specific learning problems using a combination of information technologies.

4.2.2 Plan, create, and edit projects and reports using a word processor.

4.2.3 Collect, manipulate, and analyze data by using a spreadsheet application and by writing formulas and functions and identifying various label types to chart and graph information.

4.2.4 Plan, create, edit, and evaluate databases with fields and layouts appropriate for the desired reports and specific purposes.

4.2.5 Format projects and reports for publication by applying the principles and concepts associated with *desktop publishing*.

4.2.6 Use *multimedia authoring tools* to plan, create, and edit projects or reports that incorporate graphics, *digital images,* video, and sound.

4.2.7 Examine projects or reports, created with the use of information technology, for reasonableness or relevance and accuracy.

Application and Extension Stage

Students will:

4.3.1 Use a variety of information technologies, in an integrated manner, to solve problems and to assist in the attainment of learning outcomes, both individually and collaboratively.

4.3.2 Use information technology-related vocabulary to document and articulate problems related to own use of information technology.

4.3.3 Use *telecommunications* individually and collaboratively to extend the resources available for problem solving.

4.3.4 Use information technology to facilitate aesthetic expression, decision making, and critical thinking.

4.3.5 Critique projects or reports that have been created with the use of information technology.

Note: In addition to the above, students should have opportunities to explore various programming languages and computer-controlled devices and systems through specialized Senior Years courses.

Continued

Information Technology Literacy Continuum

Students will:

5. Understand the role and impact of information technology and apply ethical, responsible, and legal standards in its use.

Exploratory Stage

Students will:

5.1.1 Use acceptable etiquette in electronic communication.

5.1.2 Explore the use of information technology in an appropriate, safe, and responsible manner.

Skill Development Stage

Students will:

5.2.1 Recognize and avoid gender, age, and cultural stereotypes of information technology users.

5.2.2 Examine the need for information technology competency in relation to performance in various jobs and careers.

5.2.3 Investigate the impact of information technology on society, the economy, and the environment.

5.2.4 Investigate the impact of a variety of information technologies on learning, working, and playing, and explore how they can be used to support research, learning, decision making, critical thinking, and communication.

5.2.5 Recognize the value of privacy and *intellectual property* rights as they apply to information technology

5.2.6 Cite sources of information and, where necessary, obtain permission to use the electronic representation of others' work.

5.2.7 Demonstrate responsible behaviour regarding privacy rights, *piracy,* dissemination of misinformation, and plagiarism when using information technology to complete tasks.

Application and Extension Stage

Students will:

5.3.1 Analyze the societal impact of gender, age, and cultural stereotypes of information technology users.

5.3.2 Analyze the impact on society of inequitable access to information technology.

5.3.3 Analyze the legal, ethical, and societal impacts of *hacking,* piracy, *viruses,* and plagiarism.

5.3.4 Contrast the right to information access with the right to individual privacy.

5.3.5 Investigate the role of information technology in lifelong learning.

5.3.6 Correlate personal information technology skills with the skills required in personal career choices.

APPENDIX B: PROJECTS DEMONSTRATING INFORMATION TECHNOLOGY INTEGRATION

Manitoba Education and Training has undertaken information technology projects that may serve as models for the integration of information technology as a foundation skill area. These projects include the following:

- **Senior 2 to Senior 4 Applied Mathematics Project**

  Information technology is an integral component of Senior 2 to Senior 4 Applied Mathematics curricula. In these curricula, information technology is used to learn new mathematical content. It is used as a tool to support teaching, learning, and assessment, as a focus of instruction, and as a medium of instruction.

- **Curriculum/Multimedia Integration Project**

  This project identifies multimedia learning resources that are matched to subject area learning outcomes and develops instructional and assessment strategies based on the various multimedia modalities. The resulting multimedia-enhanced *A Foundation for Implementation* documents support teachers in the integration of information technology. The initial focus of the project has been Senior Years science curricula.

- **Interdisciplinary Middle Years Multimedia Project**

  This research and development project is designed to create an interdisciplinary instructional model that effectively integrates information technology into curricula. Pilot schools are provided with hardware, software, and professional development. Thematic, interdisciplinary, multimedia-based teaching units facilitate the integration of information technology with the various subject area learning outcomes.

- **Western Canadian Protocol (WCP) Computer Guided Learning (CGL) Mathematics Project**

  The four western provinces undertook this project to develop curriculum-based Senior 1 Mathematics CGL software. This courseware matches the learning outcomes and content of both *The Common Curriculum Framework for K-12 Mathematics* (1995), developed through the WCP process, and *Senior 1 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 1 Standards* (1997). The aim of the CGL software is to enhance the delivery of mathematics and to encourage the use of information technology within mathematics. CGL software in the classroom has the potential to change the teacher's role to that of a facilitator and allow students to have more control over their own learning.

Additional information about any of these projects may be obtained by contacting the Learning Technologies Unit of the Program Development Branch via Internet < tfs@mbnet.mb.ca >, by telephone 204-945-5259, or by fax 204-945-1704.

*APPENDIX C: EVALUATION FORM FOR NON-PRINT LEARNING RESOURCES**

Bibliographic Information

Descriptors

Title _____

Series title _____Number _____ of _____

Copyright date _____ Edition/Version _____ Running time _____

Date Web site updated _____ Date Web site visited _____

Author/Producer _____ ISBN _____

Publisher _____

Distributor _____

Distributor's address_____

E-mail address_____

Web site address_____

Components

Check 3 all components that apply to this learning resource.

- q CD-ROM Macintosh
- q CD-ROM Win 3.1/Win 95
- q CD-ROM Win 98
- q CD-ROM dual platform
- q disk 3.5" Macintosh
- q disk 3.5" Windows 95
- q disk 3.5" Win 3.1/Win 95
- q disk 3.5" Win 98
- q audio CD
- q audiocassette
- q cable(s)
- q electronic text/publisher's disk
- q lab interface box
- q probe(s)
- q VHS videocassette
- q videodisc CAV
- q videodisc CLV
- q student's workbook
- q teacher's guide
- q textbook
- q user's manual
- q Web site
- q other print materials
- q other _____

Continued

Note: Where information is not applicable, use N/A.

* This evaluation form will need to be reviewed and updated periodically as applicable/required.

Hardware and Software Requirements

Descriptive Information

Target Audience q stated or q inferred by evaluator

Circle all audiences that apply to this learning resource.

K 1 2 3 4 5 6 7 8 S1 S2 S3 S4 Post-Sec. Teachers Parents

Range of Classroom Use

Check 3 all classroom uses that apply to this learning resource.

q regular q struggling learner q other _____

q English as a second language (ESL) q highly able learner

Content Summary

Specify the purpose of this learning resource and provide an overview of its content, including the scope, sequence, depth, and breadth of coverage.

Instructional Design

Check 3 all methodologies and features that apply to this learning resource.

q direct instruction	q documentary	q animation	q educational game
q drill-and-practice	q dramatization	q archival footage	q e-mail links
q hypermedia	q interactive evaluation	q graphics	q reference
q problem solving	q interactive feedback	q music	q search engine
q simulation	q interviews	q paintings	q site map
q tutorial	q live action	q still photography	q Web site links
q utility/tool	q storytelling	q other _____	q other _____
q other _____	q other _____		

Continued

Manitoba Curriculum Match

Specify the subject area(s) and student learning outcomes from *A Foundation for Implementation* documents that this learning resource addresses. (Attach pages if necessary.)

Supporting Print Materials

Describe the supporting print materials that accompany this learning resource (e.g., teacher's guide, workbook).

Title _____ Description _____ ISBN _____

Title _____ Description _____ ISBN _____

Check 3 all components found in the supporting print materials.

- q background information
- q bibliography
- q classroom organization suggestions
- q content summary
- q discussion questions
- q objectives
- q script
- q suggested learning activities
- q test/quiz
- q vocabulary list
- q other _____

Assessment Information

Curriculum Content and Philosophy

1. Comment on how well this learning resource addresses the student learning outcomes specified above, under Manitoba Curriculum Match.

Continued

2. Comment on the congruency of this learning resource with Manitoba curricula and with policy documents.

3. Comment on the extent to which the content of this learning resource is current, accurate, and presented from a Canadian perspective.

4. To what extent is this learning resource authoritative? (Consider the extent to which the learning resource is consistent with current educational research and pedagogical practice, and comment on the reliability of the source.)

Foundation Skill Areas and Integrated Elements

1. Comment on how well this learning resource addresses each of the following foundation skill areas. (Check 3 all areas that apply to this learning resource and give examples.)

   q human relations

   q literacy and communication

Continued

q problem solving

q technology

2. Comment on how well this learning resource integrates each of the following elements. (Check 3 all elements that apply to this learning resource and give examples.)

q Aboriginal perspectives (addresses accomplishments, history, culture, and contemporary experiences)

q anti-racist/anti-bias education (promotes practices that celebrate diversity and challenge bias and discrimination)

q appropriate age portrayals (supports contributions of all age groups; avoids stereotypes and discriminatory practices and attitudes related to age)

Continued

- q curriculum integration (links student learning outcomes with various subject areas or community/home experiences)

- q differentiated instruction (promotes use of a wide range of strategies, techniques, and approaches to meet various learning requirements)

- q gender fairness (focuses on educational opportunities that are equally accessible, relevant, interesting, appropriate, inclusive, and challenging for both female and male students)

- q human diversity (promotes recognition, acceptance, and celebration of the diversity of cultures, languages, and religions in Manitoba)

- q resource-based learning (promotes meaningful use of a wide range of appropriate print, non-print, and human resources)

Continued

- sustainable development (promotes balancing of the economy, the environment, and society)

Social Considerations

1. From the perspective of the diversity of Canadian society, is there any objectionable content, bias, or stereotyping in this learning resource? Does the learning resource promote/reinforce tolerance and diversity? (Give specific examples, with location references).

2. To what extent does this learning resource present a balanced point of view? (Consider political, religious, and cultural contexts, potential controversial topics, and significant omissions.)

3. Does this learning resource require a cautionary note? (If so, state suggested wording).

Instructional Design

1. Comment on the suitability of the instructional design for the target audience. (Consider factors such as conceptual level, vocabulary, reading level, organization, and variety of teaching, learning, and assessment approaches.)

Continued

2. Are the instructional goals and learning outcomes clearly stated and achievable through the use of this learning resource?

3. Comment on the appropriateness of the assessment and evaluation strategies used in this learning resource.

Technical Design

1. Comment on the ease of use of this learning resource. Did you encounter technical problems? (Consider software installation and navigability.)

2. Rate the quality of the visuals, sound, layout, and supporting print materials for this learning resource.

Continued

Learning Resource Type

Check 3 all resource classifications that apply to this learning resource.

- q student breadth
- q student depth
- q student breadth and depth
- q teacher professional reference (theory and practice)
- q teacher content reference
- q teacher's guide

Other Evaluations

Cite source(s) in which this learning resource is reviewed. (Attach a copy of review, if available.)

Recommendation

- q I recommend this learning resource.
- q I do NOT recommend this learning resource.

General Comments

Evaluator _____ Date _____

School/Department _____

Address _____

E-mail address _____

Subject area _____ Grade _____

GLOSSARY

GLOSSARY

acceptable use policy — A policy developed by an organization for the appropriate use of information technology, including the Internet.

assessment — The systematic process of gathering information about what a student knows, is able to do, and is learning to do. A variety of forms can be used, including tests, observations, interviews, portfolios, daily work, self-assessment, and peer assessment.

audioconferencing — Audio (or sound) communication between two or more people at different locations.

Boolean search — The use of *and, or,* and *not* connectors to expand the search capabilities of an electronic online resource.

CAD software — Software used in **c**omputer-**a**ided **d**esign (e.g., architecture, graphics).

CAM software — Software used in **c**omputer-**a**ided **m**anufacturing (e.g., furniture making, automobile assembly).

cartridge drive — A storage device that uses re-writeable removable media such as Zip™ and Jaz™ drives.

CD-ROM — **C**ompact **d**isc **r**ead-**o**nly **m**emory. A medium capable of storing large amounts of digital data representing text, sound, animation, graphics, and video.

CD-ROM drive — A computer peripheral designed to access the data contained on a CD-ROM.

CGL — **C**omputer-**g**uided **l**earning. Interactive software that allows students to have more control over the pace of their own learning.

compatibility — Data created in one application is directly useable by another application.

computer-controlled devices — Computer-controlled devices include robots, probes, and electronic switches.

concept mapping software — Software that allows a user to create concept or mind maps.

data mining software — Software that assists in searches for correlations in large databases.

database software	Software that allows a user to enter, access, and manage data.
desktop publishing	Computer-aided creation and layout of text and graphics.
digital camera	A device that produces digitized photographic images for use in a computer.
digital image	An image that may be accessed and manipulated from within a computer program.
downloading	Receiving a file from an outside source using telecommunications. (See also uploading.)
drafting software	Software used in computer-aided creation of diagrams representing scale drawings of physical structures.
educational software	Software that supports the attainment of specific learning outcomes.
electronic communities	Individuals with a common purpose or goal who are linked by telecommunications.
e-mail	Electronic messages sent and received through a computer network. The network may be local or cover a wide area such as the Internet.
ergonomics	The scientific study of the interaction between people and their work environment. Ergonomic considerations include keyboard height, lighting conditions, and body position and posture in relation to the computer.
graphing calculator	A hand-held computer that allows a user to input a variety of equations to produce graphs. This device may also have spreadsheet and statistical analysis capabilities.
groupware	Software that facilitates collaboration over a network for the purpose of completing a product or task.
hacking	The unauthorized access to a computer system.
hardware	The physical equipment of a computer system, including the monitor, keyboard, central processing unit, and storage devices.
HTML	**H**yper**t**ext **m**arkup **l**anguage. A computer-based language that facilitates graphic communications on the Internet.
hypermedia	Software used to link networks of text, graphics, and audio and video files.

hypertext	A linking feature that allows a user to access supplementary text by selecting a specifically marked word or image on the screen.
information technologies	Tools such as computers, software, printers, the Internet, automated library systems, scanners, projection devices, and a variety of support materials (e.g., software) used by teachers and students to enhance teaching and learning.
intellectual property	The presentation of ideas that may be protected by copyright or patent.
Internet	A worldwide electronic network connecting many separate personal computers.
intranet	The application of Internet technology within an organization.
keyword search	The use of descriptive terms to locate information electronically. (See also Boolean search.)
liquid crystal display (LCD)	Technology that displays or projects computer images.
local area network (LAN)	A group of computers and peripheral devices linked within a limited area for the purpose of sharing information and resources.
Logo	A simple, but powerful computer programming language designed for use by young students.
MIDI	**M**usical **i**nstrument **d**igital **i**nterface. Software that allows a user to compose digital music and to reproduce the sound of musical instruments.
multimedia	Using or combining several media such as text, sound, images, and video files. Multimedia include hypertext concepts.
multimedia computer	A computer that allows a user to access, control, and analyze information in a variety of ways (accommodating text, hypertext, graphics, animation, audio files, and video files).
multimedia encyclopedia	An electronic encyclopedia that includes text, hypertext, graphics, animation, audio files, and video files.
natural language search	A database text search using common language without any predetermined rules.
navigating	Moving through and exploring software and various sites on the Internet or other networks.
netiquette	Network etiquette. The rules of etiquette governing communication on a network.

network	A group of computers and peripheral devices linked for the purpose of sharing information and resources. Networks are often described by their geographical extent (e.g., local area networks [LANs], wide area networks [WANs], and the Internet), their protocol (e.g., ethernet), and the operating system (e.g., Novell, Windows NT) being used.
network resources	The programs, files, and computer peripherals existing on a network.
online	Connected to a computer or telecommunications system for the purpose of access and/or sharing.
online resources	Information or peripheral devices that are connected to a computer or network for the purpose of access and/or sharing.
operating system	The interface between the user and the computer.
peripheral	A device connected to a computer or network that is used to perform a specific task.
piracy	The unauthorized use, duplication, or distribution of copyrighted resources.
probes	Electronic devices that measure environmental conditions such as temperature, pH, and light intensity. These devices are usually connected to computers for accurate data collection and analysis.
productivity tool	Software used to enhance personal productivity when managing data and producing information.
removable media	Storage media that can be taken out of a drive and replaced, thereby allowing many disks to be used in the same drive.
robotics	The design and use of computerized robots to perform tasks.
safe use of the Internet	Procedures used to safeguard self and others from dangerous or inappropriate behaviour on the Internet.
scanner	A device that uses light to read and digitally encode text, pictures, and graphs, and then sends the information to the computer to be stored on disk.
simulation	A representation of a real event or process.
spreadsheet software	Software that can generate tables and charts that record and analyze data.
storage device	A peripheral used to retain and retrieve electronic data.

technological literacy	The ability to use, manage, and understand information technology.
telecommunication	Communication over a distance by telephone, television, radio, cable, satellite, computer modem, or other similar means.
telecommunications tools	Software and hardware used to communicate.
touch screen	An input device that allows a user to interact with the computer by touching the screen.
uploading	Sending a file to an outside source using telecommunications. (See also downloading.)
video camera	A device for recording and playing back motion video.
video capture card	A computer-driven device that allows for the conversion and storage of video images to computer files.
videoconferencing	Communication among people at different locations by means of transmitted audio and video signals. May involve a computer as the interface.
videodisc	An optical disc capable of storing and playing back still frames, motion video, and/or audio files. Both constant angular velocity (CAV) and constant linear velocity (CLV) videodiscs are available; however, CAV videodiscs are preferred because they can be controlled by computer.
videodisc player	A device for playing back videodiscs.
virtual reality	The computerized display and control of a simulated environment into which a user enters and simulates movement and interaction with objects.
virus	Software designed to cause damage to a computer system.
wide area network (WAN)	A group of computers or local area networks linked by telecommunications, over a large area, for the purpose of sharing information and resources.
word processing software	Software that allows a user to enter, edit, save, and print text.

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