

## SECTION 2: SUPPORTING PRINCIPLES

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The *Developmental Continuum for Literacy with ICT* is a matrix of descriptors that portray how students demonstrate their literacy with ICT. The following concepts, processes, and methodologies are embedded in the continuum and have become supporting principles for the implementation of *Literacy with ICT Across the Curriculum*:

- inquiry
- constructivist learning
- higher-level critical and creative thinking
- reaching deeper understanding
- gradual release of responsibility
- digital citizenship
- multiple literacies for the 21st century

### Inquiry

Inquiry is a powerful methodology that engages students in pursuing personal, active, and authentic learning in depth. For example, inquiry is embedded in language arts as inquiry-based learning, in mathematics as problem solving in the context of data analysis, in science as scientific inquiry and the design process, and in social studies as social studies skills. As they engage in inquiry, students develop questions to guide their learning, research sources of information, synthesize new ideas, and share evidence of their understanding, all while reflecting on their learning. Furthermore, inquiry processes enable students to learn how to learn, and to become self-directed learners.

Figure 3 shows how the inquiry processes, as described in several Manitoba curricula, are congruent with one another and with the Big Ideas outlined in the Cognitive and Affective Domains of the *Developmental Continuum for Literacy with ICT*.

## Literacy with ICT and Inquiry Processes Across the Curriculum

Literacy with ICT Big Ideas	ELA Inquiry Process	Math Problem-Solving	Science Scientific Inquiry/ Design Process	Social Studies Skills
<b>COGNITIVE DOMAIN</b>				
<b>Plan and Question</b>	3.1 Plan and Focus	Understands a given or a formulated question, task, or situation that introduces and applies mathematical ideas  Develops a plan	Initiating Researching  Planning Implementing a Plan	Plan topic and goals Formulate questions for research
	3.2 Select and Process	Carries out a plan <ul style="list-style-type: none"> <li>collects data, if applicable, and evaluates the collection process</li> <li>analyzes data or given information</li> </ul>	Observing, Measuring, Recording	Gather/Select information from oral, visual, material, print, or electronic sources  Revise ideas and opinions/ Interpret information and ideas
<b>Gather and Make Sense</b>	3.3 Organize, Record, and Assess			Sort/Categorize/Organize and record information using visual organizers/Reference
	4.1 Generate and Focus	Displays solution process or data. Interprets data, if applicable.	Analyzing and Interpreting	Select and use appropriate tools and technologies to accomplish tasks
<b>Produce to Show Understanding</b>	4.2 Enhance and Improve			Present information and ideas orally, visually, concretely, or electronically
	4.4 Present and Share	Communicates conclusion/solution	Concluding and Applying	
<b>Communicate</b>		Applies solutions to daily life and/or makes predictions based on data	Concluding and Applying	
<b>Reflect</b>				
<b>AFFECTIVE DOMAIN</b>				
<b>Ethics and Responsibility</b>		Describes the effect of bias, use of language, ethics, cost, time and timing, privacy, and cultural sensitivity if collecting data to answer a question	Demonstrating Scientific and Technological Attitudes	
<b>Collaboration</b>	5.2 Encourage, Support, and Work with Others		Demonstrating Scientific and Technological Attitudes	Cooperate/Collaborate with others
<b>Motivation and Confidence</b>			Demonstrating Scientific and Technological Attitudes	
<b>Social Implications</b>		Analyzes society's use of data, solution, representation	Reflecting on Science and Technology	

**Figure 3: Literacy with ICT and Inquiry Processes Across the Curriculum**

## Constructivist Learning

Learning theories, taxonomies, and instructional models have been articulated to explain cognitive development and to outline the needs of diverse learners. For example, constructivist learning theorists Piaget, Vygotsky, and Bruner explained learning as an interactive developmental process. Krathwohl, Bloom, and Masia developed a taxonomy that categorizes cognitive and affective learning into six levels of understanding: knowledge, comprehension, application, analysis, synthesis, and evaluation. Johnson and Johnson outlined a model for cooperative learning. These theories, taxonomies, and models were synthesized by Marzano and incorporated into a framework for constructivist teaching and learning.

Constructivist learning theorists view learning as a highly interactive process, where students construct personal meaning from new information and ideas that are presented in socially supportive contexts. Learning depends on making connections between new information and previous experiences stored in long-term memory. To be meaningful, learning must be integrated with what is already known, and then applied in new situations. The complexity of understandings that students construct depends on the stage of cognitive development they have reached. Conversely, as students mature, their understandings evolve and deepen as they move through stages of cognitive development.

Understanding is much more than remembering new information. For understanding to develop, knowledge must be internalized, transformed, and applied in new contexts. Students develop deeper understanding when they restructure and reorganize new information by deliberately applying a variety of reasoning skills. Over-riding these skills is critical thinking, which involves the use of specific criteria and evidence to make reasoned judgements.

At the most sophisticated level, understanding means synthesizing information and ideas by combining higher-level, critical, and creative thinking processes. Students demonstrate their understanding by inventing, designing, and/or creating original products.

Marzano's framework for teaching and learning is particularly relevant to the *Developmental Continuum for Literacy with ICT* because it explains five dimensions of understanding and attitude:

1. developing positive attitudes and perceptions
2. acquiring knowledge and skills
3. extending and refining knowledge
4. using knowledge meaningfully
5. developing productive habits of mind

Dimensions two, three, and four are represented across three stages of thinking in the Cognitive Domain portion of the continuum. Dimensions one and five are represented in the Affective Domain portion of the continuum.

## Higher-Level Critical and Creative Thinking

In the process of constructing understanding, students acquire and store facts, data, details, procedures, formulas, algorithms, and definitions in long-term memory. Then, they compare, classify, recognize patterns, induce/inquire, deduce, formulate opinions, persuade, or argue pro/con to extend their understanding. Deeper learning occurs when students apply higher-level critical and creative thinking to invent, discover, design, and create (see Figure 4).

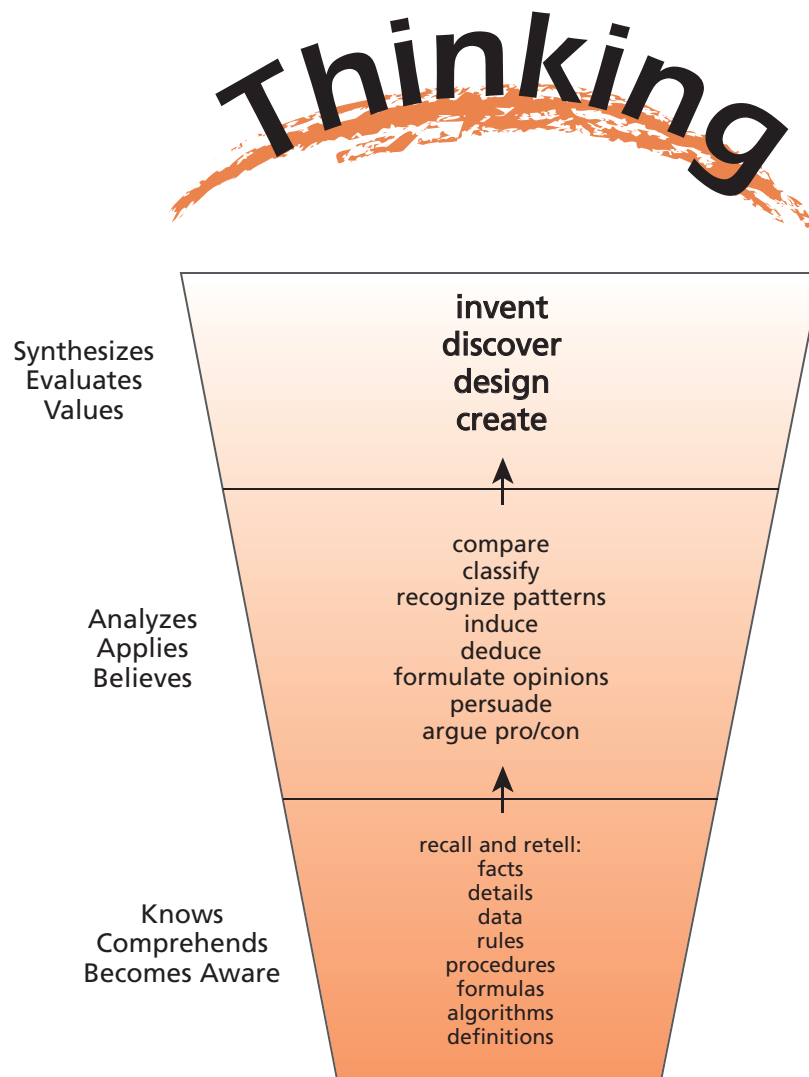
Critical thinking is convergent. It involves using criteria and evidence to assess the worth or validity of information and to make reasoned judgements. These judgements include distinguishing fact from opinion and interpretation, evaluating information and ideas, identifying perspective and bias, and considering the consequences of decisions and actions. In the *Developmental Continuum for Literacy with ICT*, the Big Ideas “Plan and Question” and “Gather and Make Sense” tend to require critical thinking.

Creative thinking is divergent. Creative thinking generates ideas and possibilities and explores diverse approaches, often by questioning accepted principles. (Manitoba Education, Citizenship and Youth, *Kindergarten to Grade 8 Social Studies...* TN-37). In the *Developmental Continuum for Literacy with ICT*, the Big Ideas “Produce to Show Understanding” and “Communicate” tend to require creative thinking. The goal of *Literacy with ICT Across the Curriculum* is for students to demonstrate increased levels of both critical and creative thinking, supported by ICT.

Both critical and creative thinking increase in complexity as students move across the levels of thinking in Bloom’s taxonomy. When constructing understanding at the knowledge and comprehension levels, students acquire information or discrete details and facts, then recall the information, or restate it in their own words. They may retrieve procedures, data, and formulas in order to apply the information at higher thinking levels. (Manitoba Education, Citizenship and Youth, *Rethinking Classroom Assessment...* 6)

As students mature in their ability to think, and as teachers gradually release responsibility to them, they are able to demonstrate behaviours in the analysis and application levels of Bloom’s taxonomy. When students apply their knowledge of methods or theories in new situations, they demonstrate their ability to use the information they have acquired. They may analyze a situation to determine the parts of the whole, or look for patterns to understand the relationship between the parts. When students apply their knowledge within a real life situation, this demonstration of learning is considered authentic. When applying and analyzing information, students begin to formulate opinions, make deductions, and prepare pro/con arguments.

At the synthesis and evaluation levels of thinking, students generate new ideas and form new patterns or ways of thinking as they extend their learning. This is the process of discovery and invention associated with divergent or creative thinking. Students also use criteria to critique new products or processes as they converge toward finding solutions and demonstrating their ability to think critically. Among other things, students distinguish fact from opinion, identify forms of bias, and consider the implications of decisions.



**Critical Thinking** involves applying criteria to judge the accuracy, relevance, credibility, fairness, and bias of information.  
**Creative Thinking** involves exploring diverse approaches and possibilities, and generating ideas.

**Figure 4: Stages of Thinking**

## Reaching Deeper Understanding

Learners can develop their literacy with ICT in more meaningful ways when they apply and extend their critical and creative thinking across the curriculum. To develop literacy with ICT, students need to learn how to decide whether or not to use ICT, which ICT to use, and when and how to use ICT to help meet their learning goals. Teachers also need to use their professional judgement to ask if and how ICT can help their students grasp essential concepts and construct personal understandings in language arts, mathematics, science, social studies, and other subject areas.

While literacy with ICT is important, a more fundamental educational goal is to strive for deeper understanding based on some central questions:

- What does deep understanding look like?
- What is worth learning and understanding in depth?
- How can students reach deeper understanding?
- How will teachers and students know when students have reached deeper understanding?

Learning for deeper understanding is not dependent on, but can be enhanced and extended with, the use of technology. For example, the use of ICT can

- extend students' access to worldwide educational resources and primary sources
- deepen students' understandings by making abstract concepts visible
- assist students in organizing, analyzing, and transforming information as they think critically to construct personal knowledge
- extend students' means and dimensions of creative expression
- promote students' collaborative and reflective learning
- motivate students to synthesize their knowledge into unique multidimensional products
- enable students to communicate with authentic audiences to show understanding
- allow students to transfer their knowledge to unfamiliar contexts
- enhance students' engagement with learning

Guided by the *Developmental Continuum for Literacy with ICT*, students and teachers together negotiate when and how to use ICT to help them reach deeper understanding.

## Gradual Release of Responsibility

Teachers provide scaffolding to help students develop higher-level critical and creative thinking and deeper understanding. As they support their learners, teachers believe that all students want to learn, and they provide a learning environment in which all students can gradually take on responsibility for their own learning (Manitoba Education, Citizenship and Youth, *Independent Together*, 2003).

Teachers enable this learning environment by

- becoming facilitators of learning
- providing real choices that accommodate a range of learning styles, recognizing that curricular outcomes can be met in a variety of ways
- inviting students to choose what they will do to demonstrate their learning, and to identify the steps they will take to accomplish the task
- emphasizing intrinsic motivation rather than external rewards

Teachers help students move across the *Developmental Continuum for Literacy with ICT* by following Pearson and Gallagher’s “Gradual Release of Responsibility” Model of Explicit Instruction (see Figure 5).

- **Modelling:** Teachers model learning behaviours such as building criteria, self-assessment, seeking feedback, making adjustments, goal setting, and reflection.
- **Sharing:** Teachers share exemplars of quality work and teach students to identify quality samples of their own work.
- **Guiding:** Students and teachers assume joint responsibility through guided practice.
- **Independent:** Students practise, demonstrate, and apply learning behaviours that help them become self-directed learners.

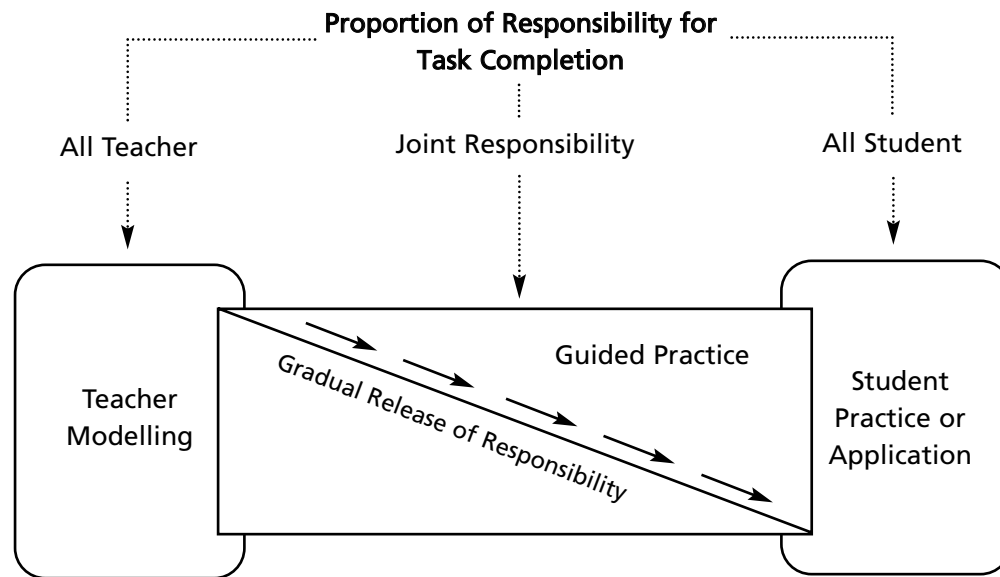


Figure 5: “Gradual Release of Responsibility” Model of Explicit Instruction

## Digital Citizenship

The concept of digital citizenship relates to the responsible, ethical, and safe use of ICT by students as members of society and citizens of the global community.

The International Society for Technology in Education (ISTE) has identified standards for students, teachers, and administrators called the National Educational Technology Standards (NETS). Standard 2 for Students addresses social responsibility and ethical issues related to digital citizenship:

- Students understand the ethical, cultural, and societal issues related to technology.
- Students practise responsible use of technology systems, information, and software.
- Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity. (International Society for Technology in Education 14)

“Gradual Release of Responsibility” Model of Explicit Instruction: Reprinted from *Contemporary Educational Psychology*, 8, P. David Pearson and Margaret C. Gallagher, “The Instruction of Reading Comprehension,” page 337, under the terms of the *Access Copyright* licence agreement, renewed in 2004.

The Affective Domain of the *Developmental Continuum for Literacy with ICT* contains four Big Ideas that encompass digital citizenship:

- ethics and responsibility
- social implications
- collaboration
- motivation and confidence

## Multiple Literacies for the 21st Century

In the 21st century, the Internet instantly makes available vast amounts and types of unfiltered information. Most of this information is no longer filtered by textbook publishers, librarians, and teachers, so students need to extend their literacy skills to include the following:

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*New literacies build upon the foundational literacies we have always taught in schools to prepare students for the effective use of books, paper, and pencils. However, the new literacies go beyond these foundational literacies to include new reading, writing, viewing, and communication skills required by the many new ICTs that continue to appear in our lives.*

(Leu et al. 496)

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- identifying appropriate inquiry questions
- navigating multiple information networks to locate relevant information (print, images, data, video, music, talk, et cetera)
- applying critical thinking skills to evaluate information sources and content
- synthesizing information and ideas from multiple sources and networks
- crediting and referencing sources of information and intellectual property
- communicating new understandings to others, both face to face and over distance

The Conference Board of Canada has compiled a list of essential skills for lifelong learning in the 21st century. They include broad literacy skills that will be required as today's students graduate and enter the workforce. These same skills are also embedded in the continuum.

- **Managing Data:** identifying what needs to be measured or calculated, estimating and verifying, and observing and recording primary data using appropriate technology
- **Managing Information:** locating, collecting, assessing, analyzing, and applying knowledge from various disciplines and electronic sources
- **Communicating Ideas:** reading a variety of media formats, writing and speaking clearly, and communicating using a range of technologies (Conference Board of Canada)