Production Technology Intermediate

Technology Education

A Curriculum Guide (Interim)

(September 2012)

Department of Education Mission Statement

By March 31, 2017, the Department of Education will have increased the ease of access and responsiveness of the provincial education system to improve opportunities for the people of Newfoundland and Labrador

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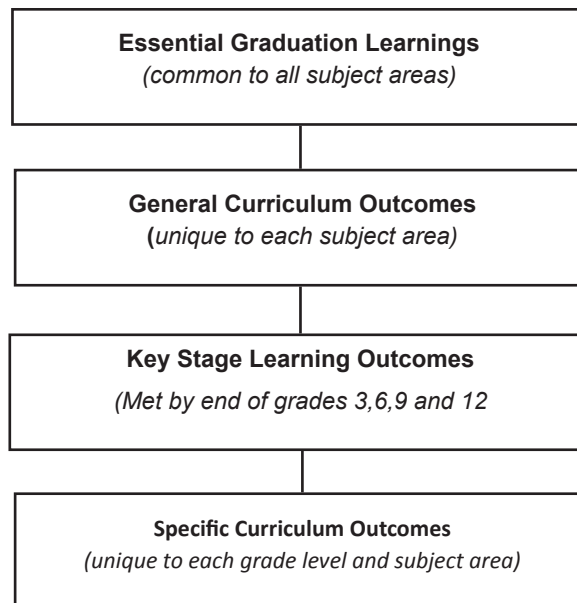
Curriculum Design

Outcomes Based Education

Introduction

K12 education in Newfoundland and Labrador is structured in outcomes based education. There are multiple factors that impact education; the information explosion, technological developments, the need for lifelong learners, increased emphasis on accountability, and globalization. These changes point to the need to consider carefully the education our children receive.

The Newfoundland and Labrador Department of Education believes that students' needs can be addressed if three conditions are met. Curriculum guides must clearly articulate what students are expected to know and be able to do by the time they graduate from high school, the curriculum must reflect these expectations, and there must be an accurate assessment of students' performance in relation to the curriculum outcomes. The Department of Education designs curriculum design to conform to these principles.

Curriculum is based on *The Atlantic Canada Framework for Essential Graduation Learning in Schools* (1997), and consists of Essential Graduation Learnings (EGLs), General Curriculum Outcomes (GCOs), and Specific Curriculum Outcomes (SCOs).

Essential Graduation Learnings
(common to all subject areas)

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General Curriculum Outcomes
(unique to each subject area)*

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Key Stage Learning Outcomes
(Met by end of grades 3,6,9 and 12

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Specific Curriculum Outcomes
(unique to each grade level and subject area)

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*Essential
Graduation
Learnings*

Essential Graduation Learnings (EGLs) provide vision for the development of a coherent and relevant curriculum. The EGLs are statements that offer students clear goals and a powerful rationale for education. They help ensure that our provincial education systems' mission is realized. The EGLs are supported by general, key stage and specific curriculum outcomes.

EGLs describe the knowledge, skills and attitudes expected of all students who graduate high school. Achievement of the EGLs will prepare students to continue to learn throughout their lives. EGLs describe expectations not in terms of individual subject areas but in terms of knowledge, skills and attitudes developed throughout the curriculum as a whole. They confirm that students need to make connections and develop abilities across subject areas if they are to be ready to meet the shifting and ongoing demands of life, work and study. EGLs serve as a guiding framework for the curriculum development process.
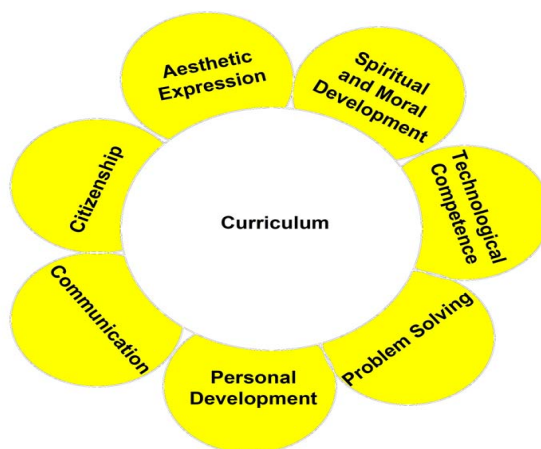
Aesthetic Expression - Graduates will be able to respond with critical awareness to various forms of the arts and be able to express themselves through the arts.

Citizenship - Graduates will be able to assess social, cultural, economic and environmental interdependence in a local and global context.

Communication - Graduates will be able to use the listening, viewing, speaking, reading and writing modes of language(s), and mathematical and scientific concepts and symbols, to think, learn and communicate effectively.

Problem Solving - Graduates will be able to use the strategies and processes needed to solve a wide variety of problems, including those requiring language, and mathematical and scientific concepts.

Personal Development - Graduates will be able to continue to learn and to pursue an active, healthy lifestyle.

Spiritual and Moral Development - Graduates will demonstrate understanding and appreciation for the place of belief systems in shaping the development of moral values and ethical conduct.

Technological Competence - Graduates will be able to use a variety of technologies, demonstrate an understanding of technological applications, and apply appropriate technologies for solving problems.

Curriculum Outcomes

Curriculum outcomes are unique to individual subject areas. Through the achievement of curriculum outcomes, students attain the Essential Graduation Learnings.

Curriculum outcomes are statements that articulate what students are expected to know and be able to do in each subject area and incorporate knowledge, skills, and attitudes.

Curriculum outcomes may be subdivided into General Curriculum Outcomes, Key Stage Curriculum Outcomes, and Specific Curriculum Outcomes.

General Curriculum Outcomes (GCOs)

Each program has a set of GCOs which describe what knowledge, skills and attitudes students are expected to demonstrate as a result of their cumulative learning experiences within a subject area. GCOs serve as conceptual organizers or frameworks which guide study within a subject area. Often, GCOs are further delineated into KSCOs.

Key Stage Curriculum Outcomes (KSCOs)

Key Stage Curriculum Outcomes (KSCO's) expand the intent of the GCO's and summarize what is expected of students at each of the four key stages of Grades Three, Six, Nine and Twelve.

Specific Curriculum Outcomes (SCOs)

SCOs elaborate the GCOs for a subject area. They set out, more specifically, what students are expected to know and be able to do as a result of their learning experiences in a course, at a specific grade level. SCOs are written to give defined information pertaining to student learning. Student performance is assessed on whether it meets pre-stated criteria rather than on the basis of rank or relative standing. In some subject areas, SCOs are further articulated into delineations.

It is expected that all SCOs will be addressed during each course of study. Evidence of student achievement is revealed through performance – when students demonstrate their understandings in observable and measurable ways.

The Nature of the Adolescent Learner

The adolescent learner in the intermediate grades is involved in a period of rapid and significant change with respect to physical, emotional, social, intellectual, spiritual and moral development. Because the nature of these changes is often intense and varied, they need to be acknowledged by the teacher. While some general characteristics of adolescents have been identified, there is a need to recognize that changing characteristics are on a continuum with many variations at each grade and for different ages. Each student is unique and any attempt to classify must be regarded as extremely general.

Cultural and social influences shape adolescence in many ways and such influences must be recognized in the learning and teaching context. Critical awareness of self and other influences is essential to the adolescent learner and this skill must be developed in the intermediate classroom.

The Characteristics of the Intermediate Learner

Adolescence "is a time of transition between dependence and independence, a time to explore new alternatives and try out new identities, a time to experiment with new points of view and a time to learn how to interact with others." (Knowles and Brown, 2002)

The intermediate learner:

- appears to fluctuate between independence and dependence.

- applies problem solving approaches to complex issues.

- asks questions and questions answers.

- attempts to define self, independent of the family.

- continues to develop reasoning skills.

- displays a multitude of emotions in varying degrees.

- grows physically and cognitively at varying rates.

- is developing the ability to handle abstract and hypothetical concepts.

- is enthusiastic about sharing ideas and experiences.

- is self-conscious.

- learns to interact cooperatively.

- may become more involved in risk taking behaviours.

- moves from morality based on convention to morality based on personal values.

- perceives peer relationships as more important than family relationships.

- refines his/her sense of humour.

- reflects on feelings, emotions, and responsibilities.

- responds best when expectations are clear.

- uses diverse communication skills.

- uses rigid definitions for right and wrong.

Context for Teaching and Learning

Inclusive Education

Valuing Equity and Diversity

Effective inclusive schools have the following characteristics: supportive environment, positive relationships, feelings of competence and opportunities to participate. (The Centre for Inclusive Education, 2009)

An inclusive classroom values the varied experiences, abilities, social and ethno-cultural backgrounds of all students while creating opportunities for community building. All students need to see their lives and experiences reflected in their school community. It is important that the curriculum reflect the experiences and values of both genders and that learning resources include and reflect the interests, achievements, and perspectives of all students. The promotion of inclusive attitudes builds respect for one another, creates positive interdependence and allows for varied perspectives. Students learn from the diverse backgrounds, experiences, and perspectives of their classmates in a community of learners where participants discuss and explore customs, histories, traditions, values, beliefs, and ways of seeing and making sense of the world. Students from different experiences and backgrounds can come to understand each other's perspectives; to realize that their ways of seeing and knowing are not the only ones possible; and to probe the complexity of the ideas and issues they are examining. Learning resources should include a range of materials that allows students to consider many viewpoints and to celebrate the diverse aspects of the school community.
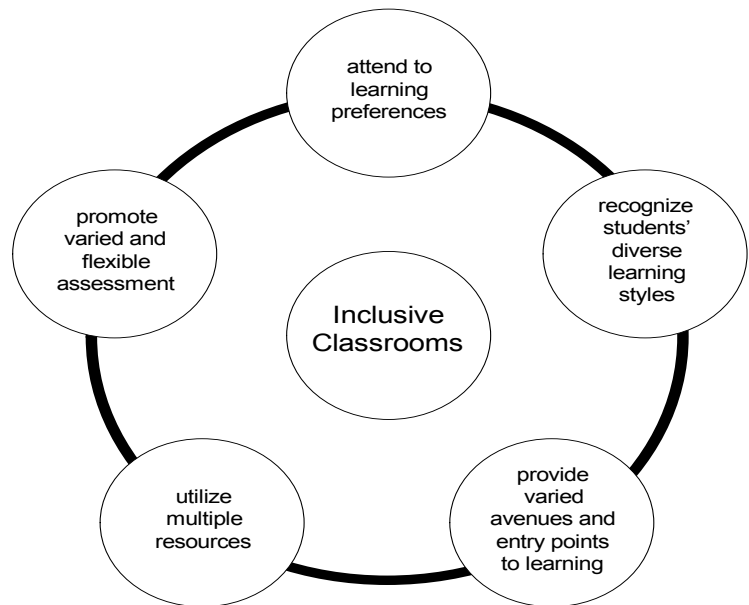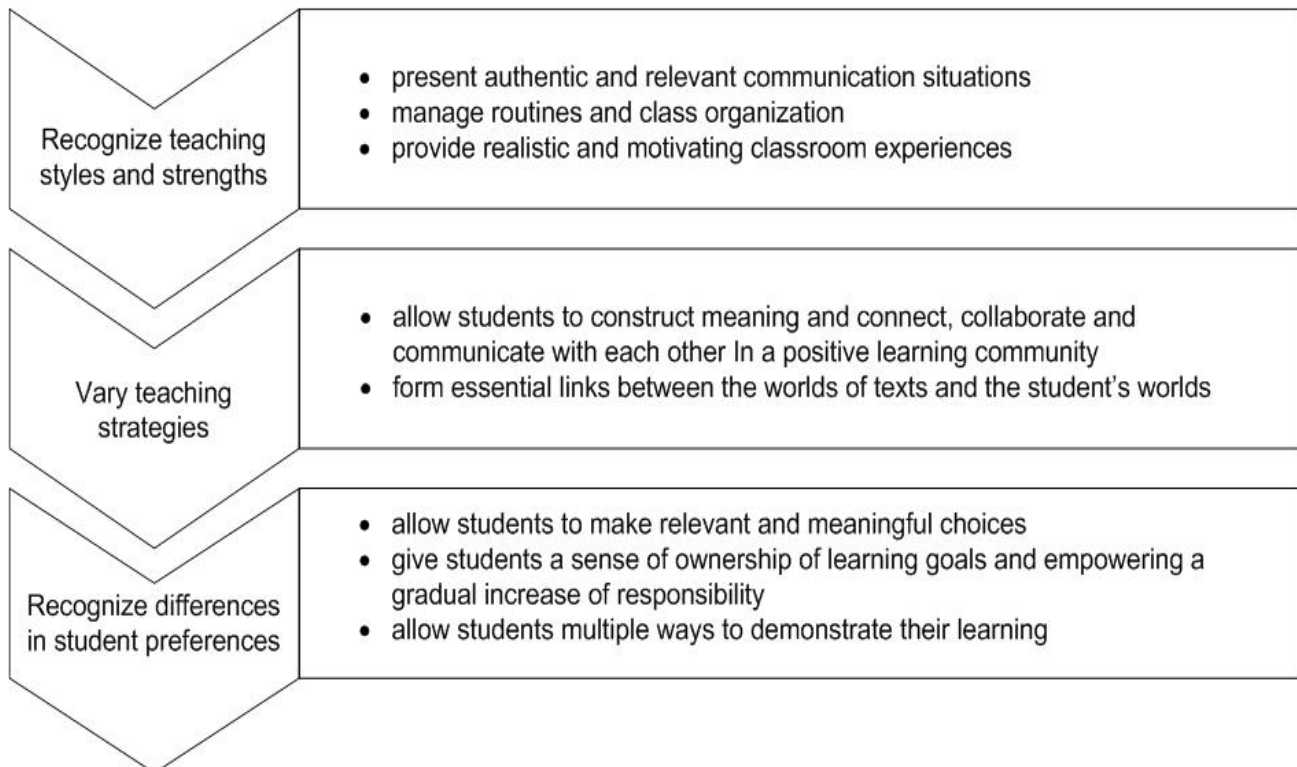
Differentiated Instruction

Differentiated Instruction is a teaching philosophy based on the premise that teachers should adapt instruction to student differences. Rather than marching students through the curriculum lockstep, teachers should modify their instruction to meet students' varying readiness levels, learning preferences, and interests. Therefore, the teacher proactively plans a variety of ways to 'get it' and express learning.- Carol Ann Tomlinson

Curriculum is designed and implemented to provide opportunities for all according to student abilities, needs, and interests. Teachers must be aware and responsive to the diverse range of learners in their classes. Differentiated instruction is a useful tool in addressing this diversity.

Differentiated instruction responds to different readiness levels, abilities, and learning profiles of students. It involves actively planning for student differences in terms of the core concepts and skills being taught, the process by which the content is delivered; the resources used; and the product that students create. The learning environment is tailored to the individual needs of the student.

Teachers continuously make decisions about selecting teaching strategies and structuring learning activities to provide all students with a safe place to grow and succeed in a dynamic and personalized space.

Teachers should...

Recognize teaching styles and strengths
- present authentic and relevant communication situations
- manage routines and class organization
- provide realistic and motivating classroom experiences

Vary teaching strategies
- allow students to construct meaning and connect, collaborate and communicate with each other In a positive learning community
- form essential links between the worlds of texts and the student's worlds

Recognize differences in student preferences
- allow students to make relevant and meaningful choices
- give students a sense of ownership of learning goals and empowering a gradual increase of responsibility
- allow students multiple ways to demonstrate their learning

Differentiating the Content

Based on the specific curriculum outcomes (SCOs), the content can be described as the knowledge, skills and attitudes we want for students. Differentiating content requires teachers to pre-assess students. This will identify students who require pre-requisite instruction, as well as those who have already mastered the concept and may, therefore, move past the instruction and proceed to apply the concepts to problem solving. Another way to differentiate content is to permit an able student to accelerate their

rate of progress. They may work independently on projects to focus deeply on topics under consideration.

Teachers should consider the following examples of differentiating by content:

- using reading materials such as novels, web sites, and other reference materials at varying reading levels
- presenting ideas through auditory, visual and tactile means
- meeting with small groups to re-teach an idea or skill or to extend the thinking or skills when necessary

Differentiating the Process

Differentiating the process means varying learning activities or strategies to provide appropriate methods for students to explore and make sense of the concepts. A teacher might assign all students the same product (for examples giving a presentation) but the process students use to create the presentation may differ. Some students could work in groups and peer critique while others meet with the teacher alone. The same assessment criteria can be used for all students.

Teachers should consider flexible groupings of students such as whole class, small group or individual instruction. Students can be grouped according to their learning styles, readiness levels, interest areas, and the requirements of the content or activity presented. Groups should be formed for specific purposes and be flexible in composition and short-term in duration.

Teachers should consider the following examples of differentiating by process:

- using activities in which all learners work with the same learning outcomes, but proceed with different levels of support, challenge, or complexity
- providing activities and resources that encourage students to further explore a topic of particular interest to them
- providing students with activities that contain work, common to the whole class, and that address individual needs and interests of learners
- offering hands-on activities or other supports for students who need them
- varying the length of time a student may take to complete a task in order to provide additional support or to encourage an advanced learner to pursue a topic in greater depth

Differentiating the Product

Differentiating the product means varying the complexity and type of product that students create to demonstrate learning outcomes. Teachers provide a variety of opportunities for students to demonstrate and show evidence of what they have learned. When students have a choice in what the end product can be, they become more engaged in the activity.

Teachers should consider the following examples of differentiating by product:

- giving students options of how to express their learning (e.g., create an online presentation, write a letter, or develop a mural)
- using rubrics that match and extend students' varied skills levels
- allowing students to work alone or in small groups on their products
- encouraging students to create their own product assignments as long as the assignments meet required elements.
- allowing students to choose how they demonstrate their understanding is a powerful way to engage students. It is important to offer students learning activities that are appropriate to their learning needs, readiness, and interests.

Differentiating the Learning Environment

The learning environment includes the physical and affective tone or atmosphere in which teaching and learning take place, and can include the noise level in the room, whether student activities are static or mobile, and how the room is furnished and arranged. Classrooms may include tables of different shapes and sizes, space for quiet individual work, and areas for collaboration.

Teachers can divide the classroom into sections, create learning centres, or have students work both independently or in groups. The structure should allow students to move from whole group, to small group, pairs, and individual learning experiences and support a variety of ways to engage in learning. Teachers should be sensitive and alert to ways in which the classroom environment supports their ability to interact with students. Teachers should consider the following examples of differentiating the learning environment:

- ensuring there are places in the room for students to work quietly and without distraction, as well as places that invite student collaboration
- providing materials that reflect diversity of student background, interests and abilities
- establishing clear guidelines for independent work that matches individual needs
- developing routines that allow students to get help when teachers are with other students and cannot provide immediate attention.

The physical learning environment must be structured in such a way that all students can gain access to information while developing confidence and competence in applying their learning to real-life situations.

Meeting The Needs Of Students With Exceptionalities

All students have individual learning needs. Some students, however have exceptionalities (defined by the Department

of Education) which impact on their learning. Details of these exceptionalities are available at:

http://www.ed.gov.nl.ca/edu/k12/studentsupportservices/exceptionalities.html

Supports for these students range from accommodations such as adaptive equipment for students with physical exceptionalities to alternate curriculum for students with cognitive exceptionalities. Also included in this range are students who require modified or alternate programs or courses.

Teachers should adjust learning contexts to provide support and challenge for all students. If specific outcomes are not attainable or inappropriate for individual students, teachers can use statements of general curriculum outcomes, key-stage curriculum outcomes, and specific curriculum outcomes for previous and subsequent grade levels as reference points to setting learning goals. Classroom teachers should collaborate with instructional resource teachers to select and develop strategies which target specific learning needs.

Students With Advanced Abilities

Some students begin a course or topic with a great amount of prior experience and knowledge. They may know a large portion of the material before it is presented to the class or be capable of processing it at a rate much faster than their classmates. Teachers should pre-assess the students in order to identify strengths or weaknesses. All students are expected to move forward from their starting point. Some strategies for exceptionally able learners include:

- similar-ability grouping provides the opportunity for students to work with their intellectual peers and delve deeper into a particular topic.
- curriculum compacting allows for increased rate of content coverage commensurate with a student's ability or degree of prior knowledge
- independent study
- tiering of instruction to pursue a topic to a greater depth or to make connections between various spheres of knowledge
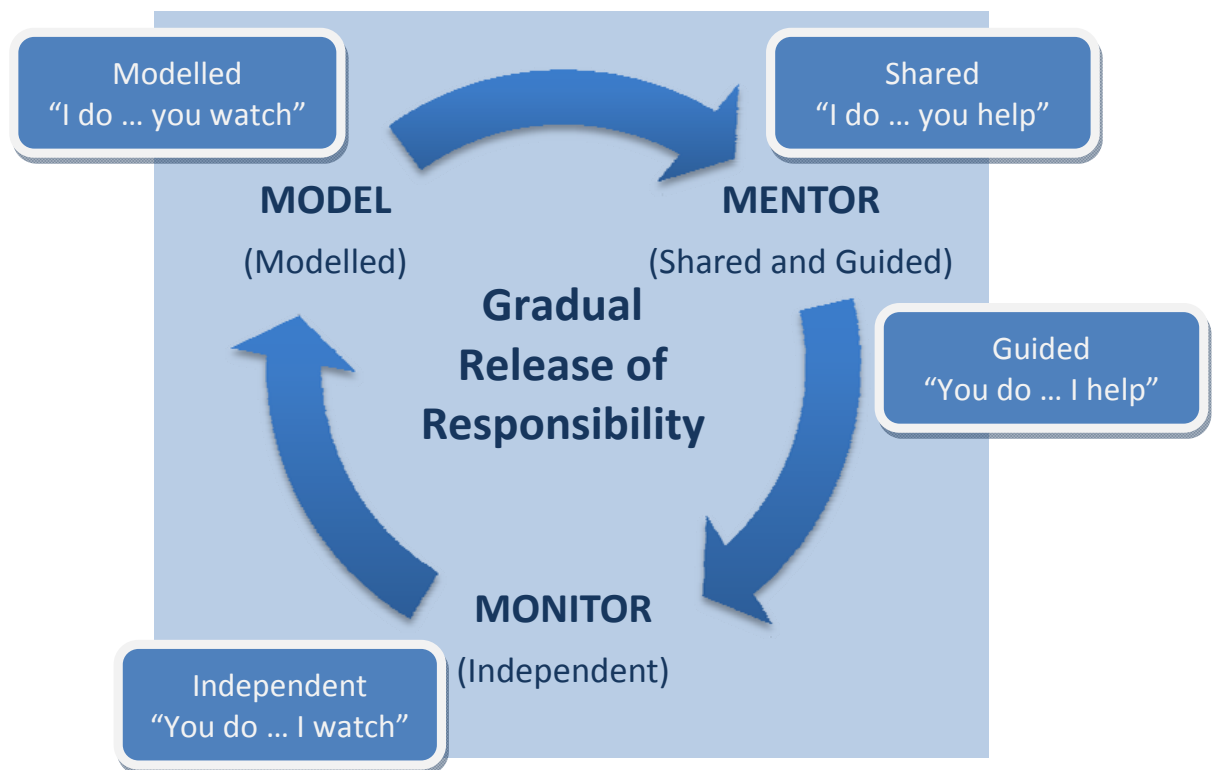
Exceptionally able students require the opportunity to do authentic investigation and become familiar with the tools and practices of the field of study. Authentic audiences and real world problems are vital for these learners.

Metacognition

When students monitor their learning, assess their strengths and needs, and set goals for improvement they become independent, lifelong learners. By reflecting on how they think and learn, students gain personal control over the strategies they use when engaged in learning activities. This control develops through metacognition, i.e., becoming aware of and more purposeful in using strategies for self-monitoring, self-correcting, reflecting and goal setting. Every student can develop metacognitive strategies and skills when teachers explain, model and help them practice talking and writing about their thinking.

Gradual Release of Responsibility

Teachers must determine when students can work independently and when they require assistance. In an effective learning environment, teachers choose their instructional activities to model and scaffold composition, comprehension and metacognition that is just beyond the students' independence level. In the gradual release of responsibility approach, students move from a high level of teacher support to independent work. If necessary, the teacher increases the level of support when students need assistance. The goal is to empower students with their own learning strategies, and to know how, when, and why to apply them to support their individual growth. Guided practice supports student independence. As a student demonstrates success, the teacher should gradually decrease his or her support.

Literacy

Literacy is a fundamental human right. It is the responsibility of educators to ensure that students graduate from the education system as literate members of society who are able to participate fully in their community.

To be literate is to possess an evolving supply of reading and writing skills, strategies and practices. Literacy enables one to achieve personal goals; participate fully in society; and build relationships. The demands for increasingly complex literacy understandings are escalating as definitions of text continue to expand.

Literacy is a process of making, receiving and negotiating meaning with self and others. Students engage in literacy experiences which will enable them to:

- decode, understand, evaluate and write through, and with, all forms of media
- read, evaluate and create text, images and sounds, or any combination of these elements

These expectations are identified in curriculum documents for specific subject areas as well as in supporting documents, such as *Cross-Curricular Reading Tools* (CAMET).

Literacy is not limited to the ability to read and write. Literacy is now viewed as a lifelong learning enterprise beginning at birth that involves many complex concepts and understandings. It includes the capacity to learn to communicate, read, write, think, explore and solve problems.

Literacy now consists of:

- comprehending and communicating meaning;
- making connections both personally and inter-textually;
- critically analyzing and problem solving;
- responding personally;
- creating a variety of texts;
- enjoying reading and viewing; and
- participating in the socio-cultural world of the community.

With modelling, support and practice, students' thinking and understandings are deepened as they work with engaging content and participate in focused conversations. When students engage in inquiry-based learning they use language and thinking skills to explore a range of topics and issues. Their identity and independence develop further, allowing exploration of issues such as identity, social responsibility, diversity and sustainability as creative and critical thinkers.

Adolescent Literacy (Grades 7-12)

Adolescent learners have unique learning needs that impact literacy development. Partnership and collaboration among families, schools and communities is critical to ensure sustaining support for literacy development. A high degree of the students' learning occurs in a social context. The opportunity for collaborative learning promotes critical thinking and problem solving; stimulates curiosity and imagination; and improves adaptability and analytical thinking. To support adolescent literacy development teachers should employ experiential teaching approaches; provide opportunities for self-assessment and focus on student issues and student voice. This encourages students to question and analyze situations, examine societal values, participate in discussions and communicate using available technology.

Reading in the content areas

The focus for reading in the content areas is not on teaching reading, but on teaching strategies for understanding content. Teaching strategies for reading comprehension benefits all students. Students develop transferable skills that apply across curriculum areas.

When interacting with different texts, students must read words, view and interpret text features and navigate through information. Information may be presented to them in a variety of ways including, but not limited to:

• Books	• Documentaries	• Speeches
• Magazine articles	• Student-created videos	• Online data bases and encyclopedias
• Poems	• Movies	• Podcasts
• Songs	• Music videos	• Plays
• Video games	• Advertisements	• Webpages
• Online games	• Commercials	• Blogs

Students should be able to interact with and comprehend different texts at different levels. There are three levels of text comprehension:

- Independent level – students are able to read, view and understand texts without assistance
- Instructional level – students are able to read, view and understand most texts but need assistance to fully comprehend some texts
- Frustration level – students are not able to read or view with understanding (i.e., texts may be beyond their current reading level)

Teachers should differentiate instruction to meet the needs of students who are working at each level. For example, print texts may be presented in audio form; physical movement may be associated with synthesizing new information with prior knowledge;

graphic organizers may be created to present large amounts of print text in a visual manner.

When interacting with information that is unfamiliar to students, it is important for teachers to monitor how effectively students are using strategies to read and view texts. Students will need to:

- use their prior knowledge
- be aware of their purpose
- problem solve using a variety of strategies
- make predictions

- visualize
- identify main ideas
- monitor and reflect on their own comprehension (metacognition)

21st Century Learning

21st Century Curriculum

A 21st century curriculum incorporates learning and innovation skills; literacy; and life and career skills. These three areas are addressed in the context of academic programs and across interdisciplinary themes. The diagram below illustrates the relationship between these areas and their specific components. A 21st century curriculum employs methods that integrate innovative and research-driven teaching strategies; modern learning technologies; and real world resources and contexts.

21st Century Learning
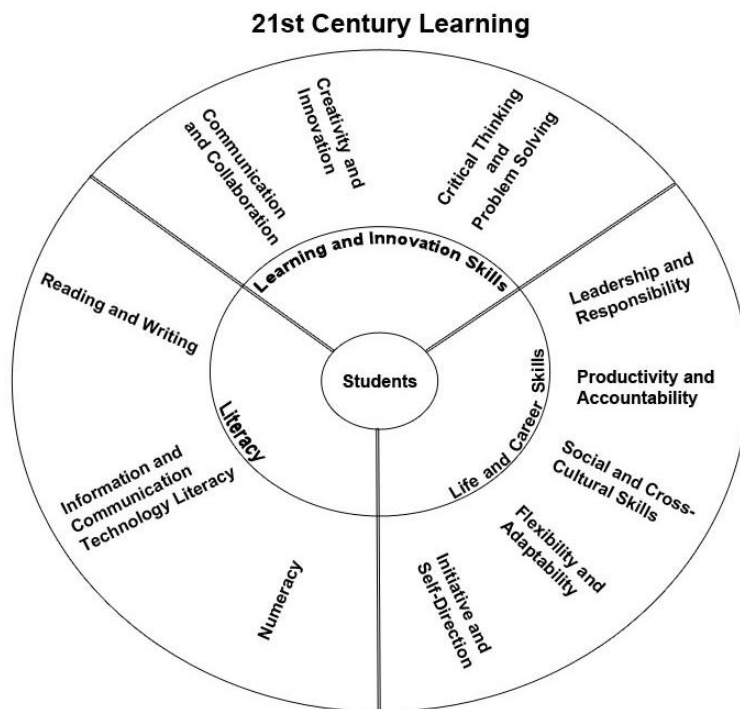
The acquisition of literacy and skills is important across curriculum areas and should be integrated into teaching, learning and assessment strategies. Opportunities within the curriculum for integration of these skills exist and should be planned with rich, engaging, experiential activities that support gradual release of responsibility. For example, lessons in a variety of subject areas can be infused with 21st century skills by using open-ended questioning, inquiry approaches, self-directed learning, student role rotation, internet-based technologies, student as teacher, and role plays.

Literacy

In addition to the literacy aspects outlined in the previous section, students in the 21st century must be skilled consumers of information, critical readers, writers and creators, and critically aware of the world in which they live.

Reading and writing, while not the only elements that constitute the concept of literacy in its various and complex facets, are in many ways the literate emphases used in school based literacies and the language of the workplace. It is often through reading and writing that students receive and communicate information. Traditionally developing reading and writing skills (learning to read and write) is associated with the early years of formal school while using reading and writing skills (reading and writing to learn) happens in the later years. As students progress, they are expected to be able to read and understand a wide range of material. They are also asked to create texts in response to what they read, view and hear. Therefore, the development of reading and writing skills within various school subjects continues throughout students' educational careers.

Another important component of literacy is Information and Communication Technology Literacy. Students need to be prepared to understand, use and apply Information and Communication Technology (ICT) in an effective, efficient and ethical manner.

Activities, projects and problems that replicate real life situations are the best methods for attaining ICT skills. It should be integrated within subject areas.

In the context of other programs, students using ICT will learn:
- about the impact of technologies on daily life
- how to determine which processes, tools and techniques to use, and when to use them
- how to use and apply a variety of information and communication technologies for problem solving, decision making, inquiry and research

The final component of Literacy in the broad context is numeracy. Numeracy is a collection of skills, knowledge, beliefs, communication capabilities, and problem solving skills needed to engage effectively in quantitative situations arising in life. A numerate individual has the ability to identify and understand the role mathematics plays in the world, to make well-founded judgements, and to use mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen.

Learning and Innovation Skills

Teachers are preparing students for the jobs of the future, some of which do not even exist yet. The one commonality for those job paths will be the ability to learn, create new ideas, problem solve and collaborate. These are learning and innovations skills.

- Creativity and Innovation - Developing, implementing and communicating new ideas to others. Being open and responsive to new and diverse perspectives within learning.
- Critical Thinking and Problem Solving - Understanding the interconnections among systems. Identifying and asking significant questions that clarify various points of view and lead to better solutions.
- Communication and Collaboration - Demonstrating ability to work effectively with diverse teams. Assuming shared responsibility for collaborative work.

Life and Career Skills

The one constant of the job market is that it is not constant. Students will require skills that allow them to adapt, be self-reliant, deal with many cultures, be productive and show leadership. These are the new employability skills for the 21st century.

- Flexibility & Adaptability – Ability to adapt to change, to continue to function in a variety of situations
- Initiative & Self-Direction – Working without supervision, completing tasks that are not necessarily assigned but are required to be completed
- Social & Cross-Cultural Skills – The ability to work well with others, being cognizant of cultural mores and differences
- Productivity & Accountability – Completing work assigned in time required, to the skill level required, and taking responsibility for your own actions and work
- Leadership & Responsibility – Being able to enlist the aid of others in completion of a task, and being dependable enough to complete that task

Impact of 21st Century Learning

Consideration of the following factors will support 21st century learning:

- Physical organization within classrooms (e.g., access to resources, flexible seating arrangements for collaboration)
- Emphasis on teaching and learning strategies that include differentiated instruction
- Inquiry-based learning
- Elements of sustainable development present in all activities
- Professional learning opportunities for teachers
- Integration of technologies

Integrated Teaching and Learning

Integrated teaching and learning occurs when connections are made among program areas. Students recognize the relevance and the interrelatedness of curricula. Skills in problem solving, organization, thinking, and writing are transferable. Teams of teachers can design cross-curricular units based on concepts, issues, or essential questions that are integrated across the

curriculum and involve skills and content from several academic areas.

When there are common concepts, processes, and skills among the programs, students begin to sense a new meaning for the word integration. Cooperation, collaboration and community building is enhanced when students and teachers work together. The challenge in effective integration is to ensure that the skills, strategies, and knowledge components of each discipline are respected.

Inquiry

With inquiry-based learning, the focus is on the development of questions by teachers and students to guide the inquiry, problems and issues related to the curriculum outcomes. The questions guide student research so they can create their own knowledge and understanding.
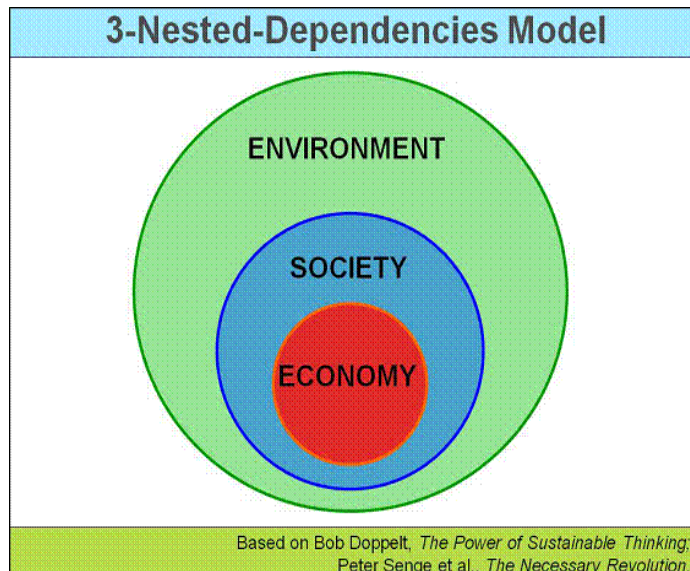
Students take more responsibility for
- determining what they need to learn.
- identifying resources and how to best to learn from them.
- using resources and reporting their learning.
- assessing their progress in learning.

Student self- reflection of their learning and their documentation of the inquiry process are important components of this learning.

Education for Sustainable Development

Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development).

The diagram below, the 3-Nested-Dependencies Model, illustrates that sustainable development is comprised of three integrally connected areas: economy, environment, and society.

3-Nested-Dependencies Model

ENVIRONMENT

SOCIETY

ECONOMY

Based on Bob Doppelt, *The Power of Sustainable Thinking*; Peter Senge et al., *The Necessary Revolution*.

As conceived by the United Nations Educational, Scientific and Cultural Organization (UNESCO) the overall goal of Education for Sustainable Development (ESD) is to integrate the knowledge, skills, values and perspectives of sustainable development into all aspects of education and learning. Changes in human behavior should create a more sustainable future – a future that provides for environmental integrity, economic viability, and results in a just society for both the present and future generations.

ESD is not teaching about sustainable development. Rather, ESD involves teaching for sustainable development – helping students develop the skills, attitudes, and perspectives to meet their present needs without compromising the ability of future generations to meet their needs.

Within ESD, the knowledge component spans such things as understanding the interconnectedness of our political, economic, environmental, and social worlds, to the role of science/ technology in the development of societies and their impact on the environment. The skills necessary include such things as being able to assess bias, analyze consequences of choices, ask the right questions, and problem solve. The values and perspectives include an appreciation for the interdependence of all life forms and the importance of individual responsibility and action. ESD values and perspectives also include an understanding of global issues as well as local issues in a global context, the fact that every issue has a history, and that many global issues are linked.

Assessment and Evaluation

Purposes of Assessment

What learning is assessed and evaluated, how it is assessed and evaluated, and how results are communicated send clear messages to students and others about what is really valued.

Assessment techniques are used to gather information for evaluation. Information gathered through assessment helps teachers determine students' strengths and needs and guides future instructional approaches.

Teachers are encouraged to be flexible in assessing the learning success of all students and to seek diverse ways in which students might demonstrate what they know and are able to do.

Evaluation involves the weighing of the assessment information against a standard in order to make an evaluation or judgment about student achievement.

Assessment can be used for different purposes:

- assessment for learning to guide and inform instruction;
- assessment as learning to involve students in self-assessment and setting goals for their own learning; and
- assessment of learning to make judgments about student performance in relation to curriculum outcomes.

Assessment for Learning

Assessment for learning involves frequent, interactive assessments designed to make student understanding visible. This enables teachers to identify learning needs and adjust teaching accordingly. It is an ongoing process of teaching and learning.

Assessment for learning:

- includes pre-assessments that provides teachers with information of what students already know and can do
- requires the collection of data, during the learning process, from a range of tools to learn as much as possible about what students know
- provides descriptive and specific feedback to students and parents regarding the next stage of learning
- is not about a score or mark
- engages students in their own learning as they assess themselves and understand how to improve performance
- focuses on what students are doing well, what they are struggling with, where the areas of challenge are, and what to do next
- is used to inform student learning

Assessment as Learning

Assessment as learning actively involves students' reflection on their learning and monitoring of their own progress. It focuses on the role of the student developing and supporting metacognition.

Assessment as learning:

- supports students in analyzing their learning related to learning outcomes
- prompts students to consider how they can continue to improve their learning
- enables students to use information gathered to make adaptations to their learning processes and to develop new understandings.

Assessment of Learning

Assessment of learning involves strategies to confirm what students know, demonstrate whether or not they have met curriculum outcomes, or to certify proficiency and make decisions about students' future learning needs. Assessment of learning occurs at the end of a learning experience that contributes directly to reported results.

Traditionally, teachers relied on this type of assessment to make judgments about student performance by measuring learning after the fact and then reporting it to others. Used in conjunction with the other assessment processes previously outlined, however, assessment of learning is strengthened.

Assessment of learning:

- provides opportunities to report evidence to date of student achievement in relation to learning outcomes, to parents/guardians and other stakeholders
- confirms what students know and can do
- occurs at the end of a learning experience using a variety of tools.
- reports student learning accurately and fairly, based on evidence obtained from a variety of contexts and sources.

Involving Students in the Assessment Process

Students should know what they are expected to learn as designated by learning outcomes, and the criteria that will be used to determine the quality of their achievement. This information allows students to make informed choices about the most effective ways to demonstrate what they know and are able to do.

It is important that students participate actively in assessment by co-creating criteria and standards which can be used to make judgments about their own learning. Students may benefit from examining various scoring criteria, rubrics, and student exemplars.

Students are more likely to perceive learning as its own reward when they have opportunities to assess their own progress. Rather than asking teachers, "What do you want?", students should be asking themselves questions such as, "What have I learned? What can I do now that I couldn't do before? What do I need to learn

next?" Assessment must provide opportunities for students to reflect on their own progress, evaluate their learning, and set goals for future learning.

Assessment Tools

In planning assessment, teachers should use a broad range of tools to give students multiple opportunities to demonstrate their knowledge, skills, and attitudes. The different levels of achievement or performance may be expressed as written or oral comments, ratings, categorizations, letters, numbers, or as some combination of these forms.

The grade level and the activity being assessed will inform the types of assessment teachers will choose.

Types of Assessment Tools

- Documentation using photographs
- Graphic Organizers
- Self Assessments
- Observations
- Presentations
- Demonstrations
- Rubrics
- Anecdotal Records

- Audio/video clips
- Literacy Profiles
- Portfolio
- Questioning
- Conferences
- Checklists
- Journals
- Role Play

- Debates
- Tests
- Exemplars
- Wikis
- Quizzes
- Case Studies
- Podcasts
- Projects

Assessment Guidelines

It is important that students know the purpose of an assessment, the type, and the marking scheme being used. The following criteria should be considered:

- collection of evidence of student learning through a variety of methods
- rationale for undertaking a particular assessment of learning at a particular point in time
- the collection of assessments should be balanced and not solely be weighted on tests and paper and pencil activities
- criteria that will be used in the assessment will be shared with student so that they know the expectations
- assessments measure what they intend to measure
- feedback that is descriptive and specific to students
- learning outcomes and assessment criteria together should provide a clear target for students to work towards
- provide all students with the opportunity to demonstrate the extent and depth of their learning

Evaluation

Evaluation is the process of analyzing, reflecting upon and summarizing assessment information, making judgements or decisions based on the information gathered. Evaluation is conducted within the context of the outcomes, which should be clearly understood by learners before teaching and evaluation take place. Students must understand the basis on which they will be evaluated and what teachers expect of them.

During evaluation, the teacher
- interprets the assessment information and makes judgments about student progress
- makes decisions about student learning programs

Section Two
Curriculum Area and
Course Overview

Curriculum Area and Course Overview

Rationale

The Production Technology Module for Grade 8 is based, on the Atlantic Canada Foundation for Technology Education Curriculum (2001). The teacher is directed to the Foundation document for specific information that forms the basis for this and other technology education curricula in the province of Newfoundland and Labrador.

The Production Technology Module is the second of four modules to be delivered at the Intermediate level. It is recommended students complete the Production Technology Module first at the grade 8 level. The delivery order of modules is: Grade 7 Communications Technology Module, Grade 8 Production and Control Technology Modules, and Grade 9 Energy & Power Module.

Technology education is defined by outcomes in modular curriculum components. It encompasses all technological systems, processes, resources, and consequences, in areas such as construction, manufacturing, communications, and power systems. This curriculum enables students to work across a much broader range of problems and technological systems which encompass the four intermediate modules.

The focus of this curriculum is the development of students' technological literacy, capability, and responsibility (International Technology Education Association, 1996). Students engage in the design, development, management, and evaluation of technological systems as solutions to problems.

The Grade 8 Production Technology Module, consists of three units: big ideas, basic skills and design activity. Teachers are encouraged to carefully examine the student expectations outlined in the three units and plan lessons that accommodate the achievement of each of them.

Technology education curriculum in Atlantic Canada adheres to principles that guide the design and implementation of the curriculum and include:
- Authenticity
- Unity
- Constructivism
- Collaboration
- Autonomy
- Continuous Inquiry
- Continuous Improvement

- Continuous Learning

Teachers are encouraged to refer to the *Foundation for the Atlantic Canada Technology Education Curriculum* document (Contexts for Learning and Teaching section) for further elaboration.

Representation of Curriculum Guide Framework
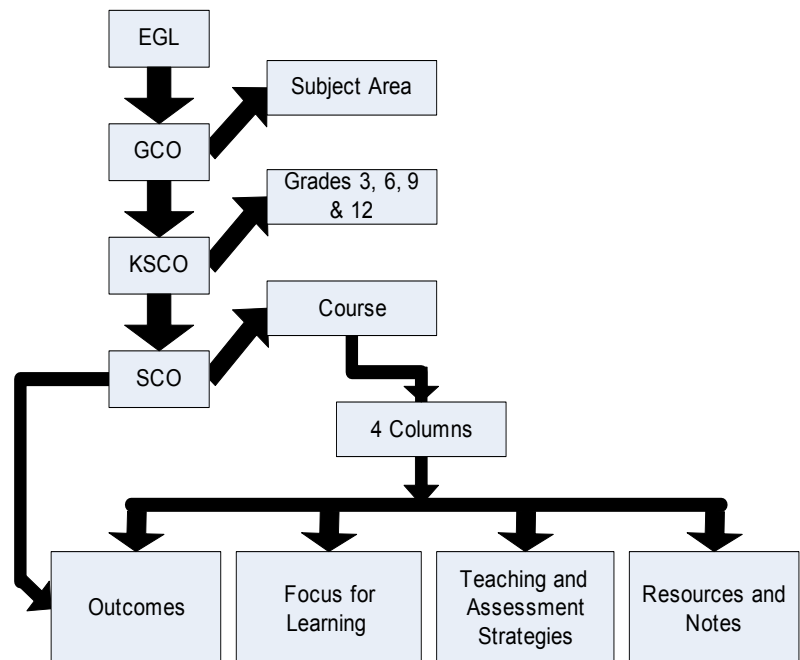
Curriculum Framework

Technology Education curriculum in the Atlantic Provinces is defined in terms of five General Curriculum Outcomes (GCO's). These define the intent and focus of the Technology Education Program and apply from Kindergarten to Grade 12. They are:

General Curriculum Outcomes (GCO's)

GCO 1: Technological Problem Solving: Students will be expected to design, develop, evaluate, and articulate technological solutions.

GCO 2: Technological Systems: Students will be expected to evaluate and manage technological systems.

GCO 3: History and Evolution of Technology: Students will be expected to demonstrate an understanding of the history and evolution of technology, and of its social and cultural implications.

GCO 4: Technology and Careers: Students will be expected to demonstrate an understanding of current and evolving careers and of the influence of technology on the nature of work.

GCO 5: Technological Responsibility: Students will be expected to demonstrate an understanding of the consequences of their technological choices.

Key Stage Curriculum Outcomes (KSCO's)

The Key Stage Curriculum Outcomes for Technology Education are listed in the Outcomes section of the *Foundation for the Atlantic Canada Technology Education Curriculum (2001)* document. Key Stage Curriculum Outcomes (KSCO's) expand the intent of the GCO's and summarize what is expected of students during each of the four Key Stages. The Grade 8 Production Technology Module adheres to the KSCO's at the Key Stage 3 level (Grades 7-9).

By the end of grade 9, students will have achieved the outcomes for entry to grade 6 (Key Stage 1 and Key Stage 2) and will also be expected to:

GCO 1
Technological Problem Solving

1.301 articulate problems that may be solved through technological means

1.302 conduct design studies to identify a technological solution to a problem

1.303 develop (prototype, fabricate, make) technological solutions to problems

1.304 critically evaluate technological solutions and report their findings

1.305 communicate ideas and information about technological solutions through appropriate technical means

GCO 2
Technological Systems

By the end of grade 12, students will have achieved the outcomes for entry to grade 9 (Key Stage 1, Key Stage 2 and Key Stage 3) and will also be expected to:

2.301 operate, monitor, and adjust a representative range of technological systems

2.302 manage a representative range of technological systems

2.303 employ programming logic and control systems to sense, switch, and regulate events and processes

2.304 classify technological systems, using one or more schema, and determine their operational components and parameters (e.g., schema include general make-up, underlying principles and purposes, and sub-systems)

2.305 diagnose and repair malfunctioning systems

GCO 3
History and Evolution of Technology

3.301 examine the historical evolution of technologies and predict future developments

3.302 investigate ways that science activities depend on technology and that inventions in technology depend on science

3.303 examine technological literacy and capability in modern society and their effects on citizenship and education

3.304 evaluate the effects of rapid change in technological systems on people in their schools and communities

3.305 account for effects of cultural diversity on technological solutions

GCO 4
Technology and Careers

4.301 examine the technologies of specific careers and workplaces, including the organizational structures of work environments and the effects of newer technologies

4.302 examine the roles of design and invention in business growth and economic development

4.303   develop strategies to assess their technological literacy/capability and plan for continuous personal growth, using xternal criteria

GCO 5
   Technological Responsibility

By the end of grade 12, students will have achieved the outcomes for entry to grade 9 (Key Stage 1, Key Stage 2 and Key Stage 3) and will also be expected to:

5.301   demonstrate an understanding of the nature and purpose of legal and ethical rules and principles

5.302   develop personal rules of conduct that ensure healthy and safe practices

5.303   develop and demonstrate risk-management strategies for a variety of technological activities

Section Three

Specific Curriculum Outcomes

Unit 1- Big Ideas

Overview

Focus

This unit introduces the concept of production technology as a purposeful activity that employs a broad range of tools and methodologies. Specific tools and methods will be introduced as examples. In particular, students will be introduced to basic production technology concepts, processes and strategies.

The purpose of the big ideas section is to provide students with an introduction to the ideas, terminology and concepts covered in the module.
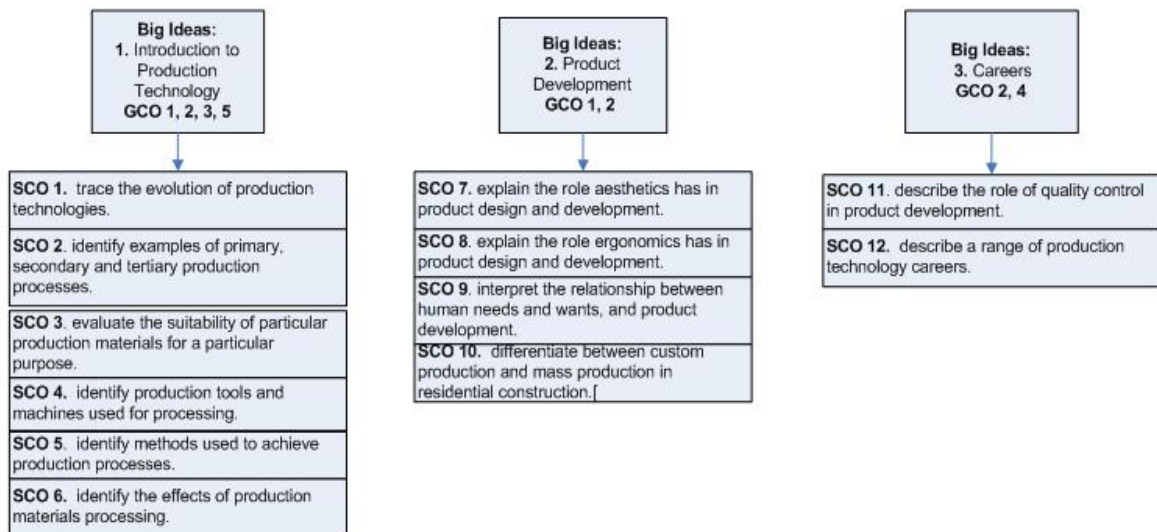
Outcomes Framework

GCO 1: Technological Problem Solving:
design, develop, evaluate, and articulate technological solutions.
GCO 2: Technological Systems:
evaluate and manage technological systems
GCO 3: History and Evolution of Technology:
demonstrate an understanding of the history and evolution of technology, and of its social and cultural implications.
GCO 4: Technology and Careers:
demonstrate an understanding of current and evolving careers and of the influence of technology on the nature of work.
GCO 5: Technological Responsibility:
demonstrate an understanding of the consequences of their technological choices.

Big Ideas:
1. Introduction to Production Technology
GCO 1, 2, 3, 5

Big Ideas:
2. Product Development
GCO 1, 2

Big Ideas:
3. Careers
GCO 2, 4

SCO 1. trace the evolution of production technologies.

SCO 2. identify examples of primary, secondary and tertiary production processes.

SCO 3. evaluate the suitability of particular production materials for a particular purpose.

SCO 4. identify production tools and machines used for processing.

SCO 5. identify methods used to achieve production processes.

SCO 6. identify the effects of production materials processing.

SCO 7. explain the role aesthetics has in product design and development.

SCO 8. explain the role ergonomics has in product design and development.

SCO 9. interpret the relationship between human needs and wants, and product development.

SCO 10. differentiate between custom production and mass production in residential construction.[

SCO 11. describe the role of quality control in product development.

SCO 12. describe a range of production technology careers.

Module Plan

This unit is introductory in nature, and will set the stage for the remainder of the module.

This material constitutes approximately 20% of the module time allotted. That understood, much of this material can be integrated with hands-on work to follow.

SCO Continuum

Grade 7 Communication	Grade 8 Production	Grade 8 Control
1.01 trace the evolution of communications technologies	1.0 trace the evolution of production technologies.	1.01 trace the evolution of control technologies
	2.0 identify examples of primary, secondary and tertiary production processes.	
	3.0 evaluate the suitability of particular production materials for a particular purpose.	
1.04 identify information and communications tools, systems and networks in daily use at home and in school	4.0 identify production tools and machines used for processing.	
	5.0 identify methods used to achieve production processes.	
	6.0 identify the effects of production materials processing.	
	7.0 explain the role aesthetics has in product design and development.	
	8.0 explain the role ergonomics has in product design and development.	
	9.0 interpret the relationship between human needs and wants, and product development.	
	10.0 differentiate between custom production and mass production in residential construction.	
	11.0 describe the role of quality control in product development.	
	12.0 describe a range of production technology careers.	1.23 identify and describe a range of control technology careers

Big Ideas: 1. Introduction to Production Technology

Outcomes	Focus for Learning
Students will be expected to	
1.0 trace the evolution of production technologies. [GCO 3 KSCO 1]	Students may be less familiar with the term "production technologies" but they will be more familiar with the terms manufacturing or building. Production technology is the process of using the design process to produce an object. In this instance, the intention is to focus towards the specific topic of residential construction. The discussion could begin around the evolution of the various aspects of construction, starting with the sod houses of the Vikings, and evolving into the modular houses being constructed today.
	This topic is introductory in nature and the depth of treatment is intended to be minimal. Certain types of houses in history should be used as examples with more emphasis on the evolution over the last few decades. Starting with the sod houses, mud huts, adobe and mainly rough wood construction of the earlier ages, and following up with stone constructed residences of the middle ages, specific housing types can can be tied to specific ages of history.
	Later ages see advances based on advances in materials with milled wood products and brick coming from the Renaissance or the Industrial Age. The recent changes come from the development of concrete, composite materials, and modular construction.
2.0 identify examples of primary, secondary and tertiary production processes. [GCO 1 KSCO 3, GCO 2 KSCO 4]	Students may be familiar with the terms introduced in this outcome. A short explanation of each of the processes may be necessary. This can be accomplished through direct instruction. The use of examples would be an effective strategy. Wood is one example, identified in the performance indicator, but nickel also has applicability to this province.
	• the primary process is mining (Voisey's Bay),
	• the secondary process is smelting (Long Harbour), and
	• the tertiary process is manufacturing using the processed nickel.
	Performance Indicator:
	Students could identify a particular material used in house construction and explain how it was produced at the primary, secondary and tertiary levels. A good example would be wood products:
	• Primary Processing: Wood is harvested
	• Secondary Processing: Logs are cut into board at a saw mill
	• Tertiary Processing: Board is used for construction of a partition in a house

Sample Teaching and Assessment Strategies	**Resources and Notes**
Activation	

Teachers may

- identify some of the local, regional or provincial production industries and companies dealing with house construction. Teachers could also highlight some of the production businesses in their area dealing with house construction (e.g., social housing, Habitat for Humanity)

- as an introduction to the module teachers could provide examples of housing in history with specific reference to Newfoundland and Labrador. Soddies could be the starting point but thatch houses/stone all the way to composite building materials could be used.

Students may

- discuss some of the impacts of production technology at the home and at the school (e.g., house construction).

Connection

Students may

- define the three levels of production process and create a chart of simple objects that are present in the class. This chart would list the object and in each instance the three production processes undertaken in its production.

Big Ideas: 1. Introduction to Production Technology

Outcomes	Focus for Learning
Students will be expected to	
3.0 evaluate the suitability of particular production materials for a particular purpose. [GCO 1 KSCO 3, GCO 2 KSCO 4]	The suitability of a material for the production process in which it is used is based on the physical properties of that material. Students may be familiar with physical properties from other subject areas, but physical examples may be the most effective method of instruction. Listing the properties of materials is integral to evaluating the material for suitability.
	Students may not be familiar with all the material types used in house construction but would most likely have experience with wood.
	The properties of wood from a construction perspective would include:
	• tensile strength,
	• compression strength,
	• shear strength,
	• permeability,
	• durability,
	• density,
	• shaping/forming/conditioning potential,
	• and decorative/aesthetic features.
	These factors impact why wood is still used as a common house construction material, as well as the renewable aspect of the resource as a whole.
	Outcomes 3.0, 4.0 and 5.0 can be taught together such that the properties of materials, their method of processing and the tools used in the process have links. Some of the activities described will attempt to make those links clear. Teachers need to be able to identify the relationship between properties of particular production materials and the tools and techniques used to process them.
	Performance Indicator:
	As part of teams, students could identify and select a collection of objects from a particular production material and present a profile of their properties to the class. This should include materials commonly used in house construction.

Sample Teaching and Assessment Strategies	Resources and Notes
Activation Teachers may • Collect examples of each of the various material types (e.g., wood, metal, plastics, asphalt shingles etc.) and demonstrate/display their properties to the class • Provide a collection of examples of material types for students to examine and describe. Students may • from a chart of simple items in the classroom. expand the chart to include the type of material and a brief discussion of the suitability for the current use in the product in question. **Consolidation** Students may • Develop a checklist of criteria, individually or in groups, to determine the suitability of various materials for the variety of uses it has in the construction of a house (e.g., What properties of materials and what materials are best suited for use on the roof of a house? - Develop a checklist of the requirements for the roof and the type of materials that would be suitable).	

Big Ideas: 1. Introduction to Production Technology

Outcomes	Focus for Learning
Students will be expected to	
4.0 identify production tools and machines used for processing. [GCO 1 KSCO 3, GCO 2 KSCO 4]	A brainstorming session or class discussion around the topic of house construction may lead to students identifying their personal experiences in this area. This can then lead to identification of personal experience with tools and machines.

The industry-specific tools used in house construction should be included in the discussion. These may include but are not limited to:

- hammers
- saws (table, circular, hand)
- drills
- screwdrivers
- measuring tapes
- levels
- framing nailers
- roofing nailers

This will be students' introduction to carpentry tools in a schools setting. Demonstration of the various tools should occur at this point. Safe use of tools will be covered at a later time before activities begin but proper modelling of tool use is required at all times by the instructor.

The discussion could also revolve around how some of these tools have evolved from their antecedents.

Performance Indicator:

Students could develop a timeline that highlights the major time periods in the evolution of house construction. On the timeline they should highlight the periods when specific tools were introduced into the process.

Sample Teaching and Assessment Strategies	**Resources and Notes**

Activation

Students may

- develop of a list of commonly used production tools and processes employed within the home (e.g., scissors, sewing machines, mixers, simple hand tools, tape, etc.).

Connection

Students may

- As a new addition to the chart described in the previous outcome, a new column could be added that will allow for examples of tools that could have been used to create the object keeping in mind the properties for the particular type of material.

Consolidation

Students may

- Choose a single material that is used in house construction and identify its properties in relation to the tools used to modify it.

Big Ideas: 1. Introduction to Production Technology

Outcomes	Focus for Learning
Students will be expected to	
5.0 identify methods used to achieve production processes. [GCO 1 KSCO 3, GCO 2 KSCO 4]	The basic production processes that are common to residential construction would include: • combining, • separating, • forming/shaping, • conditioning and • finishing Teachers could provide students with a basic list of methods for these basic methods through the utilization of wood and the associated tools that are used. Examples could include: • Use of a nail, screw, staple, or glue to combine wood, • Use of a knife or saw to cut (separate) wood, • Use of heat and steam to form/shape wood, • Use of a wood conditioner to prepare for stain, and • Use of sandpaper or paint to finish wood. Students may be familiar with most of these from personal experience but not from any formal study. A series of samples demonstrating each of the production processes would be effective. **Performance Indicator:** Students could develop a presentation for the class, individually or in groups, that demonstrates the tools and methods used for the listed production processes for wood with specific references to the tools and processes used in residential construction.
6.0 identify the effects of production materials processing. [GCO 3, KSCO 5, GCO 5 KSCO 2 and 3]	Teachers could identify and describe local, regional, provincial, national or international environmental issues related to house construction. Focus should be on people, the economy and the environment. Housing starts are often used as a measure of how well the economy is doing, a quick discussion of why this is the case would be useful. When considering people, a discussion about or demonstration of the various personal protective equipment (PPE) that workers wear while constructing a house could be used as an introduction. Such things as: • Dust masks (airborne dust/fibers) • Eye protection (airborne particulates) • Gloves (glass fibers from insulation/paint) • Full body protective gear (blown in insulation) For the environment, the topic of recycling can be used as a catalyst. **Performance Indicator:** Students could develop a chart which shows the benefits and consequences of the processing of wood (e.g., the processing of wood leads to air and water pollution. The benefits are the products created and the consequences are related to the pollution created.).

Sample Teaching and Assessment Strategies	Resources and Notes

Activation

Teachers may

- Provide a series of examples of items that have been modified or created from separating, combining, forming, conditioning or finishing.

Students may

- As in the previous outcome, use a chart of objects within the classroom or conversely use the existing chart, and identify the variety of ways separating, combining, forming, conditioning or finishing were used in the production of the item.

Activation

Teachers may

- Introduce this topic by describing some of the issues and challenges around the once common building material, Asbestos. A quick description of the properties that lead it to be used so widely should be included.

Students may

- identify some of the environmental impacts in the use of some common building materials. A material should be identified and the possible impact outlined.

Big Ideas: 2. Product Development

Outcomes	Focus for Learning
Students will be expected to	
7.0 explain the role aesthetics has in product design and development [GCO 1 KSCO 4]	Aesthetics is an important factor in house design and construction. This may be the first time students are introduced to this idea. A brainstorming session to establish elements of aesthetics would be an effective starting point.
	Focus on how aesthetics will influence house design and the materials choice. A discussion of cultural differences and access to certain materials could also be included here. Discuss the choice of materials that are used in residential construction within this province. This will also link to the previous outcome dealing with materials selection and properties of materials (4.0),
	Later in the module, as the design process is introduced, aesthetics will be considered as one of the design constraints.
	Performance Indicator:
	• Students could search magazines, web sites, and building photos for house designs that they can analyze in terms of the elements of aesthetics. Students could comment on whether the house designs may fail in the marketplace because of their aesthetic characteristics. Alternatively a series of images of different house designs could be presented and aesthetics of each specified.
8.0 explain the role ergonomics has in product design and development. [GCO 1 KSCO 4]	Ergonomic principles have applicability in a variety of products. For these outcomes, the focus will be on ergonomics in the home. Students may not be familiar with the concept, but may be familiar with the resulting design elements. One method of introducing the topic is to provide examples of products and discuss the ergonomic principles of interior systems for residential construction (kitchen counter height 900 mm (36 inches), hand rail height for stairs minimum height of 800 mm (32 inches).
	Present basic information on health and safety issues in the contexts of product design and development. Why are they important, and what happens in the home when the principles of ergonomics are ignored or unknown?
	Performance Indicator:
	Students could develop a list and detailed description of the ergonomic factors that should be considered in the design of a residence. This can be extended by considering a wheelchair accessible house.

Sample Teaching and Assessment Strategies	Resources and Notes

Activation

Teachers may

- establish the key elements of aesthetics using a concept map.

Students may

- comment on the elements or aesthetics and describe how it has changed from their parents generation to now and how it changes as style changes.

Connection

Students may

- compare and contrast the term aesthetics and style.

Activation/Connection

Teachers may

- introduce ergonomics from the example of student desks and what principles were used in the design. With this introduction a brief discussion of how ergonomics is based on the one size fits all principle generally and why this presents design challenges in residential construction.

Students may

- examine common objects within the class to determine how ergonomics was or should have been used in their design.

- measure common heights in their home and compare them to the norm. Counter height, stair height and door width would be the three most common. A commentary on what these norm measurements constitute could also be included.

Extension

Students may

- compare and contract ergonomics and aesthetics.

Big Ideas: 2. Product Development

Outcomes	Focus for Learning
Students will be expected to	
9.0 interpret the relationship between human needs and wants, and product development. [GCO 1 KSCO 1 and 2]	This outcome deals specifically with the differences in house design and construction, and how house design may be more responsive to wants than needs. Mazlov's hierarchy of needs can also be introduced at this point. The need is to have shelter that can be kept warm in winter and cooler in summer. This is another consideration for the design process starting later in the module.
	Market force is responsive to wants and needs. An example is the need for affordable housing across the province, while the desire for upscale homes is also increasing. Students may have been introduced to the idea of human needs and wants before in other subjects. Market force as it is presented here may be a new topic for them, but one which they may have an understanding from their personal lives.
	Performance Indicator:
	In a classroom discussion generate a list of common residential features. Students could indicate next to each of the features whether it was created by a market force and whether that force was a result of a need or a want.
10.0 differentiate between custom production and mass production in residential construction. [GCO 2 KSCO 4]	Custom production and mass production can be introduced by using examples of products
	• Made as one of a kind or in limited release (e.g., hand-knitted clothing, a house, designer jewellery, boats),
	• Mass produced (e.g., cars, clothing, boots, appliances, treats, food, books, computers)
	Mass production in residential construction is done in an assembly line similar to those products listed above. Modular housing units are available from this province and others. Another element of residential construction that is often mass-produced is trusses. The truss is rarely made on site but rather created elsewhere in assembly-line fashion and shipped. Other elements of residential construction are custom produced and created on site. Such as: electrical wiring and plumbing, wall partitions and drywall.
	There are advantages and disadvantages to all types of production, but common ones would include:
	• uniformity (lack of/too much)
	• time (too much on site)
	• fit (tolerance important for mass, can be "made to fit" for custom)
	• availability (workers/materials/just in time economics)
	Performance Indicator:
	Students could analyze several common products to determine if they were custom produced or mass produced. Students could share and discuss their findings with each other.

Sample Teaching and Assessment Strategies	Resources and Notes

Activation

Teachers may

- link this instruction to the concept of aesthetics and ergonomics.

- introduce market force though a brainstorming session, using concrete examples of how market force affects product design. One simple example is the car industry, market force has moved car companies to more fuel economic vehicles, but the development of the crossover has allowed the market force for suvs to be met.

Connection

Students may

- use a two column list describe elements of their house and classify those elements as wants or needs. In the classification justify why aspects were placed in each category, for instance, although hardwood floor may be considered a want, people with allergies may see it as a need.

- identify objects and design elements within the classroom that are needed and those which are more of a want.

Consolidation

Students may

- expand the the two column list they created earlier to include a designation of wants and needs as market force. Each of their entries should then be further classified considering this concept.

Connection

Students may

- discuss the advantages and disadvantages of using custom production or mass production in house construction. Some areas that could be discussed could include:
  - One of a kind selling point;
  - Cheaper labour costs; and
  - Consistent quality of modules for house construction.

Big Ideas: 3. Careers

Outcomes	Focus for Learning
Students will be expected to	
11.0 describe the role of quality control in product development. [GCO 2 KSCO 4]	There will be an emphasis on quality control in the design and production element later in this module. The concept of quality control has relevance for the previous outcomes dealing with custom and mass production. In mass production, quality control is easier to implement through the assembly line process, but is also more critical for creation of modular housing off-site. For custom production, quality control is more challenging and often left to inspectors from outside the organization. The importance of quality control may be new to students, but it should be emphasized at this introductory stage so that the hands-on experience will be more effective. Quality control-based careers can be introduced here as a link to the next outcome. **Performance Indicator:** Students could develop a list of reasons why quality control is important for house construction. Within this list, the possible consequences of a lack of quality control should be included.
12.0 describe a range of production technology careers [GCO 4 KSCO 1]	Throughout the province of Newfoundland and Labrador there are many companies and industries involved with residential construction. Teachers could develop and present a list of local or regional industries to the students that will provide a basis for identifying residential construction careers. Teachers could consult career development teachers, guidance counsellors and materials from the Intermediate Module for Career Development for information related to current career opportunities in the field of production and related technologies. **Performance Indicator:** Students could compile a list that includes short descriptions of the characteristics and requirements for residential construction careers. A list of careers could include:

• Carpenter	• Inspector
• Electrician	• Lather
• Plumber	• Bricklayer
• Painter Decorator	• Landscaper

Sample Teaching and Assessment Strategies	Resources and Notes

Activation

Teachers may

- introduce this concept by defining what quality control is and how it is used in the manufacturing and construction world.

Connection

Students may

- create a brochure outlining the importance of quality control in the workplace. Within the brochure they should describe the concept and what role it has within the manufacturing and construction sectors.

Consolidation

Students may

- develop a checklist of the things that should be checked for quality control in the production of a particular product or group of products. This can be directed to the residential construction field.

Activation

Teachers may

- using a website or a guest speaker, outline for students the number of jobs/careers are engaged in the construction of a house. These should be organized by specific trades areas.

Consolidation

Students may

- in their groups, develop and present information on a particular trades career to their classmates. The presentation could utilize a single medium or a variety of media (e.g., electronic presentation, poster, web site, brochure, demonstration).

Unit 2 - Basic Skills

Overview

Focus

The purpose of the basic skills section is to provide students with an introduction to the basic tools and techniques to be employed throughout the remainder of the module's implementation. Students will develop basic skills related to:

- interpretation and development of technical drawings
- selection of materials for production
- usage of simple tools and/or machines for the purpose of production
- preparation of materials and facilities for the purpose of production

Outcomes Framework

GCO 1: Technological Problem Solving:
design, develop, evaluate, and articulate technological solutions.

GCO 2: Technological Systems:
evaluate and manage technological systems

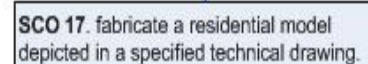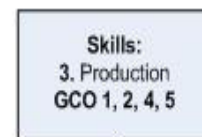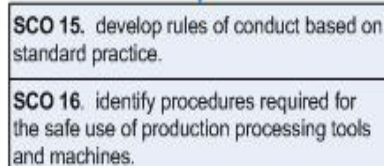**GCO 3: History and Evolution of Technology:**
demonstrate an understanding of the history and evolution of technology, and of its social and cultural implications.

GCO 4: Technology and Careers:
demonstrate an understanding of current and evolving careers and of the influence of technology on the nature of work.

GCO 5: Technological Responsibility:
demonstrate an understanding of the consequences of their technological choices.

Skills:	Skills:	Skills:
1. Technical Drawings	2. Safety	3. Production
GCO 1, 2	GCO 1, 5	GCO 1, 2, 4, 5

SCO 13. interpret the basic components of simple 2-dimensional and 3-dimensional technical drawings	**SCO 15.** develop rules of conduct based on standard practice.	**SCO 17.** fabricate a residential model depicted in a specified technical drawing.
SCO 14. develop simple 2-dimensional and 3-dimensional representations	**SCO 16.** identify procedures required for the safe use of production processing tools and machines.	
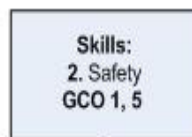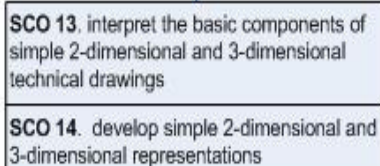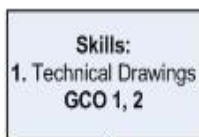
Module Plan

This section should be completed in not more than 6 hours maximum class time. Consideration should be given to integrating parts of this section with *Unit 1: Big Ideas* and *Unit 3: Design Activity*.

The *Basic Skills* unit should account for 20% of the evaluation for the Production Technology Module.

SCO Continuum

Grade 7 Communication	Grade 8 Production	Grade 8 Control
1.12 demonstrate understanding of the purpose of technical drawings	13.0 interpret the basic components of simple 2-dimensional and 3-dimensional technical drawings	
1.13 identify specific examples of isometric (pictorial) and orthographic drawings	14.0 develop simple 2-dimensional and 3-dimensional representations	2.04 Create simple schematic drawings
	15.0 develop rules of conduct based on standard practice.	1.22 demonstrate an understanding of health and safety procedures to be employed when working with control technology systems
	16.0 identify the procedures required for the safe use of production processing tools and machines.	2.12 identify and implement safe procedures when configuring control technology systems and components
	17.0 fabricate a residential model depicted in a specified technical drawing.	2.13 safely employ control technology systems fabrication techniques

Skills: 1. Technical Drawings

Outcomes	Focus for Learning
Students will be expected to	
13.0 interpret the basic components of simple 2-dimensional and 3-dimensional technical drawings [GCO 1 KSCO 3 and 5, GCO 2 KSCO 4]	It is important to note that some of the outcomes listed in this unit can be achieved as separate skill building activities or combined with the outcomes in *Unit 3: Design Activity*.
	The technical drawings will be detailed floor plans, elevation drawings and isometric views of house plans for residential construction. Students may not have been introduced to this information before, so it will be important to give sufficient examples for understanding.
	This treatment is introductory in nature, involving mostly the basic components, including construction symbols, simple lines and dimensions.
	Dimensions, the use of residential construction symbols and the alphabet of lines also need to be emphasized in the diagrams. Although more detailed drawings are used at each stage of construction, these simple drawings are used for decision making at various stages.
	Performance Indicator:
	Students could compare the contents of a technical drawing to the physical object(s) it depicts (e.g., study the technical drawing of a simple house and compare it to the physical image of that house, noting how the drawing conveys the various properties).

Sample Teaching and Assessment Strategies	Resources and Notes
Activation Teachers may • introduce this topic through the use of sample floorplan diagrams. Each of the diagrams should incorporate dimensioning, the alphabet of lines and some symbols. Keep in mind the depth of treatment when selecting sample floorplans. For the purposes of this outcome only visible, hidden, section, center and dimension lines should be included. 2-dimensional drawings are simple floorplans while three dimensions are incorporated into elevation views. Students may • discuss and record the uses for 2-dimensional and 3-dimensional drawings in house construction. **Connection** Students may • describe the uses for the five basic lines introduced outcome. **Consolidation** Students may • from a sample drawing, identify basic components, what specific symbols mean, where dimensions are recorded and the five basic types of lines used in the drawing.	

Skills: 1. Technical Drawings

Outcomes	Focus for Learning

Students will be expected to
 	
14.0 develop simple 2-dimensional and 3-dimensional representations [GCO 1 KSCO 3 and 5, GCO 2 KSCO 4]
	Students may further develop this skill as part of the design activity in *Unit 3 - Design Activity*. The completion of the module's major design activity will involve students working with floorplans to adapt them in guided discovery.
	
	As an introduction, teachers could model appropriate isometric and orthographic drawing development techniques with students. This may involve preparing and/or introducing students to a sequential set of technical drawing tutorials that employ the basic principles of technical drawings (e.g., alphabet of lines, dimensioning and symbols). Floorplans and house construction should be the main focus.
	
	Time constraints would make it impossible for each student to develop their own floorplan from scratch, and consideration of teaching this outcome with the previous two outcomes would be an effective way to integrate the topic.
	
	Students will not have developed such drawings in the intermediate curriculum, but they will be engaged with this skill if they pursue courses in the Skilled Trades and Technology Program.
	
	Performance Indicator
	
	Students could complete a series of sequenced sketching exercises that incorporate the principles of technical drawings. Such a drawing should include:
	    • horizontal lines
	    • vertical lines
	    • angular lines
	    • 45 degree lines
	    • 30 degree lines

Sample Teaching and Assessment Strategies	Resources and Notes
Activation Teachers may • want to start with simple sketch exercises with students. Starting with isometric faces of an object, have students sketch each side creating 2-dimensional drawings. From this, simple 3-dimensional drawings can be extrapolated and proper isometric drawings created. Students may • create simple sketch drawings of objects in the classroom. At this stage they should keep it to the basics of form and shape. **Connection** Students may • create representations of objects in the classroom. Concentration on representation of shape, size and 3-dimensional likeness should be the main focus. **Consolidation** Students may • create a sample drawing of an object in the classroom. This drawing may be either 2-dimensional or 3-dimensional and should include dimensioning, the simple alphabet of lines and symbols as appropriate.	

Skills: 2. Safety

Outcomes	Focus for Learning
Students will be expected to 15.0 develop rules of conduct based on standard practice. [GCO 5 KSCO 1, 2, and 3]	This topic forms the basis for the safe and orderly operation of the technology education classroom. Rules and regulations that govern individual and group behaviour need to be emphasized. In the world of work Occupational Heath and Safety rules clearly state that employees and employers have rights and responsibilities. It is the responsibility of employers to provide a safe work environment, and the responsibility of employees to maintain that environment. Students will have limited exposure to this topic before this module, as this is the first time they would have been involved in fabrication. There are certain key points that teachers need to focus on during this section. These include but are not limited to: • Safety is not just a set of rules. Safety is a way of life. It is a set of ideas, attitudes, behaviours and practices that are essential to the workplace. Safe practice does not eliminate risk, but it reduces risk. • All students must use Personal Protective Equipment (PPE) at all times in the technology classroom. • A Student Safety Pledge Sheet is an integral part of the process. Teachers should emphasize the main points for students to base their own behaviour on. These include but are not limited to: • following safety rules, • qualifying for tool use, • listening to the instructor, • proper demeanor at all times, • respect for tools, and • respect for others. Teachers are reminded to explicit and comprehensive when it comes to safety for students. **Performance Indicator:** Students could create a contract concerning appropriate behaviour in the technology education classroom. This contract will provide details of appropriate behaviour and consequences. Students should sign a Student Safety Pledge Form agreeing to acceptable behaviours, and ask their parent/guardian to sign as well. A copy should be given to the teacher and one placed in their portfolio.

Sample Teaching and Assessment Strategies	Resources and Notes

This is the first topic in the safety section. How a student behaves in the technology education classroom will dictate aspects of safety for the remainder of the module.

Activation

Teachers may

- as in introduction to this outcome and safety in general, teachers could make links to real world work places. In the world of work Occupational Health and Safety rules clearly state that employees and employers have rights and responsibilities. It is the responsibility of employers to provide a safe work environment, and the responsibility of employees to maintain that environment. Establishing a personal code of conduct will allow students to take ownership of their OH&S rights and responsibilities, and will also serve to establish the baseline for safety within the lab.

Students may

- develop personal rules of conduct for a technology education classroom.

Connection

Students may

- compare and contrast their own rules of conduct with the accepted list provided by the instructor.

Consolidation

Students may

- complete a safety checklist (resource) of the classroom and insert into their portfolio.
    - The exit route in case of a fire
    - The location of the eye wash station
    - The location of the fire extinguishers
    - Type of extinguisher (rating) should be noted on the checklist
    - Identify potentially dangerous situations that can exist in a technology education classroom.

At this stage a parental permission form, signed and returned, would be advisable.

Skills: 2. Safety

Outcomes

Students will be expected to

16.0 identify procedures required for the safe use of production processing tools and machines. [GCO 5 KSCO 2 and 3]

Focus for Learning

Students may have limited experience with tools prior to this module and even those with some experience may not have been using the tools in the proper and safe manner.

Focus on the tools which are appropriate for the tasks involved in this module.

Students must be certified to use power tools. Normal practice is to use a combination of written and performance testing for each student for each tool. It is a good idea to maintain a chart of who is qualified for which tools. Accurate record keeping will be very important.

Provide class wide instruction on tools followed by individual testing.

- Demonstrate the proper tool for the material to be processed. Emphasize that using the proper tool is an important aspect of safety.
- Demonstrate proper order of operations at all times
- Demonstrate proper and safe production tool/machine care and maintenance.
- Demonstrate proper and safe configuration of tools/machines.
- Set up a series of workstations to expose students to the skills and procedures required for safely separating, combining, forming, conditioning and finishing specific production materials.

Points to emphasize

- Safe use of tools is primarily using them in the prescribed manner, with the proper adjustments and usage procedures. It is also avoidance of clearly understood unsafe practices. In particular shortcuts often increase risk. Students should have a plan for production before engaging the tools.
- Only students who are qualified will be allowed to use a particular tool. Tool qualification can occur on an as-needed basis.
- Point out the commonalities with other tools when demonstrating a tool's function, adjustments and operating procedures.
- Tool qualification has no margin of error. Only 100% on written/verbal/performance tests are acceptable for qualification.

Performance Indicator:

Students must complete the written safety test for the tools they will be using at 100% level. As well, students must pass a demonstration/observed use of the tools to the same level.

Safety must be constantly emphasized and demonstrated.

Sample Teaching and Assessment Strategies	Resources and Notes

Activation

Students may

- develop a list of all the tools they will be required to use in the fabrication part of the module.

Connection

Students may

- develop a short presentation on what is important to note when using this tool. These presentations could be used in addition to the teacher-led demonstration of each tool.

- make an individual checklist to keep track of those tools they have qualified for. This checklist could include space to indicate whether their partner is also qualified for the tool. In this manner, one of the two students at each station could be able to operate the tool, enabling fabrication activities to continue while some testing continues.

Consolidation

Students may

- complete a written safety test (passing grade is 100%) and complete a practical safety demonstration for each of the hand, portable power, and stationary power tools to be used in the fabrication space.

- complete a test (passing grade 100%) on the general fabrication space safety requirements.

- report in course portfolio each tool they are qualified to use, and the date and time of the qualification.

Skills: 3. Production

Outcomes	Focus for Learning
Students will be expected to	

Outcomes

Students will be expected to

17.0 fabricate a residential model depicted in a specified technical drawing.
[GCO 1 KSCO 3, GCO 2 KSCO 1, GCO 5 KSCO 3]

  17.1 employ materials processing techniques and production tools/ machines to finish production materials.
[GCO 1 KSCO 3, GCO 5 KSCO 3]

Focus for Learning

The planning stage would be the first step to production, and could easily be incorporated with the main design activity to follow. Students may not have much experience with fabrication and hence planning for fabrication will be important.

When planning for constructing the model according to the technical drawing and plan of action, students will perform activities suggested within the categories listed below.

- **Layout**
  - Review of plans
  - Identification of production materials required
  - Development of an optimal sequence of steps for fabrication
  - Marking and preparation of the processing materials
  - Evaluation of the layout plan by peers and the teacher
- **Separating - Initial Cutout**
  - Identification of tools and cutting sequences
  - Safe separating of the processing materials
- **Forming**
  - Identification of components, if any, that need to be altered by bending or other forming procedures
  - Identification and selection of a forming jig, if required
  - Understanding of safety practices associated with particular production tool/machine usage and safe forming of production materials
- **Combining**
  - Testing of processing materials for fit by doing a "dry" (trial) assembly, and then incorporating the required adjustments, if necessary
  - Identification and selection of appropriate combining techniques and materials to be utilized
  - Identification and selection of proper production materials assembly sequence
  - Safe combining and assembling of the processing materials

Performance Indicator

Students could itemize the steps necessary to fabricate the residential model they have drawn. They could elaborate on materials, tools, and skills that will be necessary as well as when they will be required in the process.

Sample Teaching and Assessment Strategies	Resources and Notes

Activation

Teachers may

- introduce the main idea of the design project. The question or problem to be solved will have implications for planning but the general layout of the residential model should be established by this point. Getting students' input in previous activities will make this part of the process more real for them.

Students may

- assist in the development of the technical drawing (floorplan) to be used as the general template for the main design project to follow.

Connection

Students may

- describe the processes required to fabricate individual components of an object specified in a technical drawing.

- specify a list of production tools/machines required to fabricate individual components of an object specified in a technical drawing.

- identify skills (in general terms such as 'saw to length', or 'combine wood pieces') required to fabricate the components of a specified product and to determine if the required skills will have to be acquired.

Consolidation

Students may

- complete a representative series of production activities that safely employ separating, combining, forming, conditioning and finishing production processes, utilizing specified materials. These activities should have some reference to the main design project being undertaken in the class.

- create a modified concept web that will outline what is necessary for each section of the project depicted.

Unit 3- Design Activity

Overview

Focus

Purpose

The purpose of the Design Activity unit is to provide students with experience designing and fabricating a complete product by employing technological problem solving strategies. Students will develop capability with the design process for developing technical solutions by employing the fundamental processes associated with production technology.

Typical activities/processes include:
- Participation in design teams
- Usage and maintenance of design portfolios
- Application of the design process to the fabrication of products
- Identification of useful problems which students are capable of solving
- Identification of resources, including tools and materials
- Identification of possible solutions to production design problems
- Investigation and research of possible solutions to production design problems
- Selection of the most appropriate solution to an identified production problem
- Development of the solution through the construction of the product
- Evaluation and/or testing of the product, the solution
- Presentation of a report on the design problem, the process, and the solution
- Relationship building to other subject areas

Note: The Grade 8 Production Technology Module's *Unit 3 - Design Activity* is based on the structure and content of the Grade 7 Communication's Technology Module's *Unit 3 - Design Activity*. The design activity is a major component of all Technology Education curricula and its implementation will employ similar strategies throughout the entire Technology Education Program.

Outcomes Framework

GCO 1: Technological Problem Solving:
design, develop, evaluate, and articulate technological solutions.
GCO 2: Technological Systems:
evaluate and manage technological systems
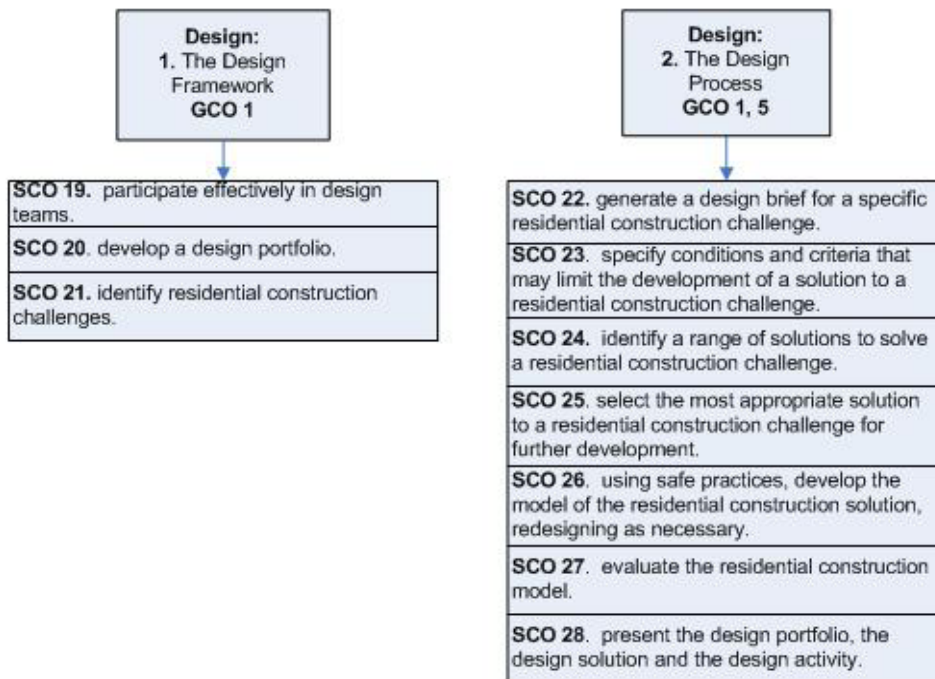GCO 3: History and Evolution of Technology:
demonstrate an understanding of the history and evolution of technology, and of its social and cultural implications.
GCO 4: Technology and Careers:
demonstrate an understanding of current and evolving careers and of the influence of technology on the nature of work.
GCO 5: Technological Responsibility:
demonstrate an understanding of the consequences of their technological choices.

Design:
1. The Design Framework
GCO 1

SCO 19. participate effectively in design teams.

SCO 20. develop a design portfolio.

SCO 21. identify residential construction challenges.

Design:
2. The Design Process
GCO 1, 5

SCO 22. generate a design brief for a specific residential construction challenge.

SCO 23. specify conditions and criteria that may limit the development of a solution to a residential construction challenge.

SCO 24. identify a range of solutions to solve a residential construction challenge.

SCO 25. select the most appropriate solution to a residential construction challenge for further development.

SCO 26. using safe practices, develop the model of the residential construction solution, redesigning as necessary.

SCO 27. evaluate the residential construction model.

SCO 28. present the design portfolio, the design solution and the design activity.

Module Plan

Unit 3 - Design Activity should account for the largest time allotment of all three units in the Production Technology Module. Fully 60% of the class time, or 15 hours shoudl result. It should also account for the largest percentage of the Module's evaluation, a total value of 60% broken down further as:

- Design Process   10%
- Design Portfolio   40%
- Solution   30%
- Report   20%

SCO Continuum

Grade 7 Communication	Grade 8 Production	Grade 8 Control
3.01 work cooperatively and collaboratively in design teams	19.0 participate effectively in design teams.	3.01 work cooperatively and collaboratively in design teams
3.02 maintain a complete design portfolio of the design process and the design activity	20.0 develop a design portfolio.	3.02 maintain a complete design portfolio of the design process and design activity
3.03 identify real life communication problem situations and opportunities, and select one for further development	21.0 identify residential construction challenges.	3.03 identify real life control technology problem situations and opportunities, and select one for further development
3.07 generate a design brief for a specific problem	22.0 generate a design brief for a specific residential construction problem.	3.07 generate a design brief for a specific problem
3.10 engage in idea generating strategies to identify a range of alternative solutions	24.0 identify a range of solutions to solve a residential construction challenge.	3.10 engage in idea generating strategies to identify a range of alternative solutions to solve the control technology problem presented/identified
3.12 using established criteria, examine the solution options and select the most appropriate	25.0 select the most appropriate solution to a residential construction challenge for further development.	3.12 using established criteria, examine the solution options and select the most appropriate
3.16 using safe practices, develop the solution, redesigning as necessary	26.0 using safe practices, develop the model of the residential construction solution, redesigning as necessary.	3.16 using safe practices, develop the solution, redesigning as necessary
3.18 evaluate the solution, based on predetermined criteria	26.0 evaluate the residential construction model.	3.18 evaluate the solution, based on established criteria
3.21 present the design portfolio, the design solution and the design activity report to the class	27.0 present the design portfolio, the design solution and the design activity.	3.21 present the design portfolio, the design solution and the design activity report to the class

Design: 1. The Design Framework

Outcomes	Focus for Learning
Students will be expected to	
19.0 participate effectively in design teams. [GCO 1 KSCO 1, 2, 3, 4, and 5.]	Design is a real-world process that depends significantly on the effective team work for success. Students will be working in these groups through the design process and the project creation for the remainder of the course. An important element of effective team work is collaboration. Assessment of this outcome will be an ongoing process and success of group work will need constant supervision such that all members of the group are engaged. Capitalize on student strengths and consider inclusion at all times when constituting groups. Review group processes to enhance efficiency. **Performance Indicator:** At this point, establishment of design team structure, determination of roles and responsibilities, and development of an initial plan of action would be sufficient.
20.0 develop a design portfolio [GCO 1 KSCO 1, 2, 3, 4, and 5.]	Students may have been engaged with design portfolios before this module. Design portfolios are like diaries and they need to be constantly updated to have meaning. Students should track all ideas, decisions, actions and activities. Whether this is done digitally or in a file is the decision of the teacher and determined by their situation with regards to access to technology. If the design portfolios are digital in nature (recommended) skill development/competency with the tools/software may be required. Teachers could also demonstrate how the information obtained should be documented in the design portfolio. This is an ongoing assessment activity as the design portfolio forms the basis for the development of the design activity report later in the module. Maintenance of the design portfolio throughout the completion of *Unit 3 - Design Activity* must be a priority with students. **Performance Indicator:** Students will develop a format for individual design portfolios and determine individual roles for the group design portfolios.

Sample Teaching and Assessment Strategies	Resources and Notes

These outcomes are intended to be assessed as work progresses through the remainder of this unit. It should be noted that a significant number of instances of assessment may be required to accurately gauge the level at which students accomplish these outcomes.

Activation

Students may

- list the attributes of a good group member and justify example selections of prospective group mates through these attributes. Some examples could include that group members will:
    - Allow others to take the lead when necessary
    - Assume leadership in the area of expertise-interest when called upon to do so
    - Compromise on some issues
    - Participate
    - Share ideas
    - Share responsibilities

Activation

Teachers may

- introduce design portfolios as diaries of the work students will accomplish for the remainder of the module. A rubric of assessment expectations could be introduced to students at this point.

Students may

- create an outline of what will be placed in the design portfolio. This outline could include but is not limited to:
    - information/documentation/research,
    - reflection on design decisions,
    - all information related to the various steps of the design process.

Design: 1. The Design Framework

Outcomes	Focus for Learning
Students will be expected to 21.0 identify residential construction challenges [GCO 1 KSCO 1]	Many students will be entering the Grade 8 Production Technology Module with an introduction to design completed as part of their participation in the Grade 7 Communications Technology Module. A review of that introduction could be completed and a discussion of the application of the design process to residential construction problems could be discussed. It would be most useful if a sample analysis of one or two problem situations were presented to the class. One of those should result in the identification of the specific problem students will be attempting to solve as part of the module's major design activity. It would be useful to conduct part of the analysis of problem situations with the class. Some students might benefit from conducting the analysis as an independent exercise, but time and student capability should be considered. Some examples might include: • House construction for alternative energy • Wheelchair accessibility • Layout for best use of space This is the first step for the remainder of the design process and a guided nature for the selection would be indicated. Students could develop a ranked list of residential construction problems associated with everyday living according to their level of impact on individuals and society. From this list some choice could be introduced but certain aspects are preset. Including but not limited to: • floor size • number of stories **Performance Indicator:** Students could select a residential construction problem or opportunity that could then be further developed throughout the design process.

Sample Teaching and Assessment Strategies	Resources and Notes

Activation

Teachers may

- brainstorm with the class a series of challenges or issues that can be dealt with as a residential construction question.
- present a range of specific challenges that could be used for the class design work. These can either be used as examples or as guiding challenge statements for students to engage in.

Students may

- identify challenges that can be solved through a residential construction solution. These could include but are not limited to:
    - environmental
    - social housing
    - proper use of space within a residence
- These challenges should all be recorded in the Design Portfolio.

Extension

Students may

- develop a residential construction challenge that could be further developed in the design process.
- If students do identify their own specific production technology challenges to solve, teachers could assess the students on the basis of clarity of their design challenge statement.

Design: 1. The Design Framework

Outcomes	Focus for Learning
Students will be expected to 22.0 generate a design brief for a specific residential construction challenge. [GCO 1 KSCO 1 and 5]	Students may have limited experience with design briefs before this module. This material was presented in the Communication Module frequently offered in Grade 7. This is the first step in the recording process. All that transpires from this point forward in the design process will be recorded as an aspect of the design brief. The design brief, accompanying rationale, conditions and criteria will form the basis of the portfolio started in the previous outcome. There are three approaches to developing a design brief: 1. **Provision of a Design Brief.** Teachers could use this approach if developing a design brief for the first time, or if time does not permit other approaches. This will require preparation by the teacher of one or even several design briefs for the class. A single design brief will likely result in all student design teams solving the same problem. If several design briefs are provided, multiple problems could be solved by different design teams. 2. **Development of a Design Brief with the Class.** This may be the preferred approach. Teachers could supply a situation and develop a design brief through a collaborative approach with the entire class. As with the first approach, it may be possible to develop several design briefs to provide student design teams with a choice. 3. **Students Development of their own Design Brief.** This approach is recommended when students have a strong background in design brief development, or if there is time to provide individual/group guidance. With this approach each design team could develop its own design brief and solve its own unique problem. Time may be an issue for completion of the main project for this module so the most guided method may prove to be the most prudent. **Performance Indicator:** Students will develop a design brief that will be completed by the end of this module.

Sample Teaching and Assessment Strategies	Resources and Notes
Activation Teachers may - provide in whole or in part a design brief to students. It is possible to do this in sections, but essentially a design brief will include: - short description of the challenge situation - statement of a specific challenge - criteria (conditions and limitations) affecting the solution - expectations for the solutions - information about the tasks the designers are expected to do or deliver - One or more of these elements will have to be provided to the students for the project to move forward and be complete in the time provided. Students may - write a short explanation of why a design brief is used and why it is important. **Connection** Students may - from a series of example design solutions develop rationale for why they were chosen. **Consolidation** Students may - practice developing individual parts of the design brief after being provided with another element of the brief.	

Design: 2. The Design Process

Outcomes	Focus for Learning
Students will be expected to 23.0 specify conditions and criteria that may limit the development of a solution to a residential construction challenge. [GCO 1 KSCO 1]	This activity can be done as a whole class sharing and discussion or established by the teacher if time is an issue. The conditions and criteria will set limits to the design so that the solution which is chosen can be undertaken with existing materials and tools. These also establish criteria that can then be used as part of the evaluation process after the model is completed. Students may have some experience with this activity from the Grade 7 Communication Module or the Control Module. As discussed in outcome 21.0, there are some limiting factors to the challenges that can be considered for development within this module. These conditions are preset by you the instructor and should be introduced early on so that the selection of possible solutions is partly guided by them. Students can be engaged in helping to establish criteria beyond the limitations provided but this should remain a guided activity. Some of the conditions may include but are not limited to: • Floor size • Number of storeys • Number of windows/doors **Performance Indicator** Students could brainstorm a series of limiting conditions and criteria for the residential construction model. Considerations could include limitations of facilities and materials.

Sample Teaching and Assessment Strategies	Resources and Notes

Sample Teaching and Assessment Strategies

Activation

Students may

- examine a series of residential construction projects in their area and establish what some of the conditions and criteria may have been to result in the final product.

Connection

Students may

- set conditions and criteria that may have determined further development of a design solution.

Consolidation

Students may

- develop a series of conditions and criteria that would allow student groups to develop their solutions using the least amount of material available. To do this students would have to consider standard produced size of material and costs of non-standard sized materials.

Design: 2. The Design Process

Outcomes	Focus for Learning
Students will be expected to 24.0 identify a range of solutions to solve a residential construction challenge. [GCO 1 KSCO 2]	A brainstorming session is an effective strategy for dealing with this topic. Students design teams can brainstorm within their groups and then share their alternative solutions with the class as a whole. The number of alternatives from each design team should reflect the number of students in each group. Students will need to be made aware of the dual components of this step: • idea generating strategies, • research of similar problems and related solutions. Strict timelines will have to be applied to keep this step of the design activity from becoming too extensive. Teachers could provide design teams with guidelines and strategies for organizing their design work so the various design activity tasks get evenly shared/distributed among design team members. An initial review of the student design portfolios could be completed at this point in the design process to ensure students are properly maintaining them. The design portfolios should be assessed early to allow students opportunity to adjust any procedural issues. Alternative solutions may serve as a basis of choice for the student design teams, the selected solution is one element but viable solutions could be introduced. This is an idea generating activity. Assessment needs to focus on quantity of ideas generated by the student, the level of divergent thinking exhibited, and on the willingness of the student to be innovative. **Performance Indicator:** Students could undertake an investigation of alternate solutions to the one proposed to be followed by the class. This investigation could include research into similar problems and how this was solved as well as coming up with their own unique alternate solutions. Such research is recorded in the design portfolio.

Sample Teaching and Assessment Strategies	**Resources and Notes**

Activation

Teachers may

- establish the following sequence. Develop a preferred solution. Identify and research alternate solutions (This can either prove as a method of enriching the original solution or replacing it with one which is more suitable). Once this is complete and the best solution is identified students will begin to engage in the actual model making. This will allow a series of outcomes to be taught in tandem.

Students may

- actively participate in an idea generating activity.
- develop a series of alternate solutions for their design challenge.

Connection

Students may

- identify resources to solve the identified challenge. This may prove a limiting factor for the solution presented, as only classroom resources are available.
- champion one of the ideas generated as an alternate and develop arguments, based on the design, for why this idea is the best choice. This can be accomplished in a mini-debate format or presentation within their design teams.
- submit their design portfolio for a periodic to ensure that they are properly recording and organizing the appropriate information.

Design: 2. The Design Process

Outcomes	Focus for Learning
Students will be expected to	
25.0 select the most appropriate solution to a residential construction challenge for further development. [GCO 1 KSCO 2]	Teachers could prepare a sample evaluation of one solution idea with the assistance of the entire class. A solution evaluation checklist should be required of each student or design team member. This will permit greater scrutiny of the solutions and lead to a sound selection of the "best" solution by the design team.
	Teachers could ensure that students understand the importance of selecting one solution at this stage of design. There must be sound reasons provided by the students for selecting a specific design solution.
	Performance Indicator:
	Students could develop a method to effectively evaluate the possible design solutions, including: • Development of a rating scale • Completion of an accurate evaluation of each possible solution based on the criteria-based rating scale • Determination of the "best" solution, based upon the results produced by the criteria-based rating scale • Maintenance of accurate record-keeping in the design portfolio of the chosen solution and the reasons for its selection

Sample Teaching and Assessment Strategies	Resources and Notes

Activation

Teachers may

- supply the criteria for evaluation for the students. There are some instances though where students may wish to create their own set of criteria. In either case, the solution selection process should be documented in the design portfolio.

Students may

- develop a list of questions to address the challenge trying to be solved. These questions should help in the evolution of the solution as well as alternate solutions. How well each of the proposed solutions answer the questions should assist in the final decision of which solution to choose.

- establish criteria, starting from the originally developed preferred solution, for why they chose that solution first.

Connection

Students may

- develop a series of alternate solutions for their design challenge. Each solution should then be evaluated using the constraints established.

Design: 2. The Design Process

Outcomes

Students will be expected to

26.0 using safe practices, develop the model of the residential construction solution, redesigning as necessary.
[GCO 1 KSCO 3 and 5, GCO 5 KSCO 2 and 3]

Focus for Learning

This activity is the first stage of the culminating work students will be engaged in for this module and as such will require significant time for instruction and completion. As discussed in previous outcomes, skills acquisition, safe use of tools, job identification, group work and elements of the design process can all be taught in this section. Preparation of materials for student work is necessary at this point.

This is the point when students implement their residential model. It is expected that this portion of the module will take between 10 to 15 hours of class time. To ensure that all student groups finish their product during this phase there is significant preparation required. This will include:

- Identification and preparation of appropriate workspaces for the design teams;
- Collection of resources, including consumables, for the design activities;
- Development of a strategy to keep work progressing smoothly, especially when tools and workstations need to be shared (workstation is the location of a tool or process setup); and
- Development of a strategy that ensures work is shared equitably among the design team membership.

Teachers should ensure that design portfolios are maintained. Teachers will need to inspect and assess students' solutions and design portfolio development periodically. Documentation should be an equally shared responsibility among the design team membership.

The most important cautionary note is to make sure groups stay on task for their development. The timeline for creation of the model can be very tight.

Teachers may either wish to review tool safety at this point or wait until this point to introduce it and qualify students for tool use.

Scaled board for use in the activity will need to ripped and laid out for students to access.

Performance Indicator:

- Students will develop a fully functional prototype of the design solution.
- Students will document all aspects of the design solution development in the design portfolio. All steps of the design process, including tests of ideas, things that worked and things that did not work, all sketches and plans, all problems that arose and had to be solved, and new tools/skills that had to be learned must be included.

Sample Teaching and Assessment Strategies	Resources and Notes

Activation

Teachers may

- assign student groups their house model base for their main design project. These bases will be used by the individual groups for the remainder of the module. Appropriate storage and labeling should be used for continuity of student work.
- showcase a finished project of the model house shell, indicating the exterior wall locations and salient features. This model can be left in the Technology Classroom for student reference. It is is not suggested that the project include anything more than the shell as this may detract from student solutions and creativity.
- take students through the process in much the same way that it would be done on a real work site, floor and foundation first, exterior walls, interior walls etc.

Students may

- begin the process of fabrication through sketching wall positions on an overlay from their provided work piece.
- start with the fabrication of their exterior walls, laying the walls out un-combined on the bench. This should be checked by the teacher before the next stage, combining, occurs.

Connection

Students may

- establish another plan of action, such as an assembly line, where common wall types can be all completed first by the whole class and then distributed to the groups equitably. This could be tested against the time taken for individual groups to complete common walls and comparisons made. A discussion of the benefits of both methods could ensue.

Consolidation

Students may

- compare their completed model to the prototype supplied by the instructor. Comparisons between the two could be made and differences noted. Reasons for the differences could be discussed and recorded in the design portfolio.

Design: 2. The Design Process

Outcomes	Focus for Learning
Students will be expected to 27.0 evaluate the residential construction model. [GCO 1 KSCO 4]	A class discussion about criteria for assessment would be an effective introduction to this section. Students may have limited experience with this topic before the module but will have experiences some aspects when working on the varied solutions in the previous unit. Providing samples of evaluation criteria may be necessary and working from the samples within the class to develop common criteria. The key elements of evaluating the solution may simply mean determining if the solution meets the conditions stipulated in the design brief. Establishing criteria has already been undertaken in a previous outcome while evaluating alternate solutions. Linking this activity with that one may help in developing the final criteria. Some if not all of the criteria established earlier will still have relevance and should be included. The evaluation should include more than comparison to an accepted model but also the rationale for the decisions being made. Once again this can be a whole class activity, and the appropriateness of such will have been dictated by earlier instructional choices. The entire process of establishing criteria and evaluating the solution should not take more than a single class. Each group should be engaged in this separately to some degree. This evaluation of the solution will require analysis and a reasoned judgment by the students. Their evaluation will need to include referencing the criteria used to select the solution option, including all recorded responses that have been recorded in the design portfolio. This is the first step of the culminating activity for the this module, and depends heavily on the design portfolio. **Performance Indicator:** Design teams will evaluate their solution by applying appropriate criteria to assess it, and/or by testing it under actual working conditions. Design team members will record the results and the decisions made in their design portfolios.

Sample Teaching and Assessment Strategies	Resources and Notes

Activation

Students may

- develop a rubric as an evaluation guideline. A starting point could be the comparison between the established prototype and their own finished product.
- differentiate between design constraints, limitations, and criteria for assessment. In the differentiation, they should draw upon the relations between the three.

Connection

Students may

- outline all of the design constraints, limitations and criteria that have been established for the design project in their design portfolio.
- develop an evaluation sheet for their design project. This will incorporate all of the evaluation elements established earlier in the process. The evaluation should be in checklist form such that questions about the design are answered either in the affirmative or negative.

Consolidation

Students may

- compare and contrast their evaluation processes with those used by the class as a whole or those used by other groups. The comparison should establish whether their process is consistent with those in use.

Design: 2. The Design Process

Outcomes	Focus for Learning
Students will be expected to	
28.0 present the design portfolio, the design solution and the design activity. [GCO 1 KSCO 5]	This may be a challenging task for many students. Teachers should provide explicit and comprehensive directions to ensure that everyone is attentive to and respectful of others.
	The design portfolio should include all aspects of the design brief and the solution students created. As such, a variety of methods will be available beyond the formal classroom presentation. Consideration of time constraints may factor into the inevitable choice of presentation. No matter what the final choice of style, the focus of this presentation should be the residential model that students have been engaged in designing and building.
	Engagement of all members of the design group should be evident in the final product and method of presenting. The focus should be on the material being presented rather than on the method or type of presentation. This can be considered a culminating activity for this module. Students will have experience with presenting results through a variety of subjects in the intermediate curriculum.
	The presentation, in whichever form it is created, should include:
	• a summary of the design brief.
	• a summary of how the design process enabled the design team to achieve the solution, including successes and challenges encountered and an explanation of how the challenges were resolved.
	• a demonstration/exhibition of the solution, and
	• an evaluation of the solution, including evidence of any improvements made to the design based on the evaluation.
	The presentation structure should be based on the structure of the design team's design portfolio. The portfolio will contain evidence of all aspects of the design activity and will prove to be both informative and comprehensive. If the design portfolio is in electronic form (e.g., web site or slide show) the presentation of it will be easier to deliver.
	Performance Indicator:
	Students will present the design team report.

Sample Teaching and Assessment Strategies	Resources and Notes
Activation Teachers may • introduce this as an activity that will pull together all of the elements into a whole, making the connections necessary for learning. Students may • develop an outline of what a presentation on the design process they followed could look like. The outline could include a simple storyboard. • create a plan for presenting the design brief and model to the class. The plan should include fair division of responsibilities, list or resources to be used and format of the presentation. **Connection** Students may • investigate a presentation format that does not include a formal, oral presentation in front of the class. The format (poster/video/ photo-story) should effectively present the information required. **Consolidation** Students may • create a presentation on the design brief that is digital in nature and form with multiple media types included/	

Evaluation of Unit 3 - Design Activity (Summary)

Portfolios and Design Solution Collection

Portfolio Collection

Portfolios should be collected just prior to, or just after, the design report has been presented to the class.

Design Solution Collection

Student solutions should be collected at the conclusion of the design team's presentation. Where possible, solutions can be displayed for a period of time to elicit feedback from other students. It may be an idea to showcase solutions as examples for future course use.

Evaluation of Design Activities

Purpose

Evaluation of design is cumulative and occurs at each stage of the design process.

Evaluation of students' design activities at the intermediate level has several purposes:

- It is used to determine how well students understand and employ design as a technological problem solving process.
- It is used to assess the students' design capability. Design capability is defined as the ability to develop useful technological solutions to problems.
- It is used to assess the students' ability to engage in divergent thinking and to develop effective solutions to identified problems. Effective design tends to not just solve the problem but to provide an elegant solution. Elegance is considered to be simple, uses minimal resources and energy, may be novel, is not always obvious, is reliable, is cost effective, and is of high quality.
- It is used to determine how well the solution addresses the problem as stated in the design brief.

Evaluation of the Design Process

To be effective, evaluation of the design process has to address each stage and specific issues at each stage. There are three primary pieces of evidence which can be used to assess students'

capability with the process - the design portfolio, the design solution, and the in-class report. The report may have oral, written, or resource material/presentation components. Additional evidence may be gathered from observation and interaction with students. Evaluation needs to address each stage of the process:

Step 1 - Identification of the Problem Situation

In the Grade 8 Production Technology Module, the *Problem Situation* step may be completed for the students, depending on how the module is managed, or the may be identified by the students. Students will have gained experience identifying the *Problem Situation* through their completion of the Grade 7 Communications Technology Module. If the *Problem Situation* is provided to the students it would not be included in the overall evaluation of the student's design work.

Step 2 - Development of the Design Brief

The Design Brief may be provided to the students in whole or in part. However, students may have the necessary skills and knowledge at the Grade 8 level to develop their own design briefs. If the design brief is to be evaluated in its entirety, the following components are required:

- Short description of problem situation
- Statement of a specific problem
- Criteria (conditions and limitations) affecting the solution
- Expectations for the solution
- What the designers are expected to do or deliver

Step 3 - Demonstration of Investigation and Research

This step has 2 components and each requires evaluation:

- **Research into similar problems and their solutions.** This will be a very simple element with not a lot of detail.
- **Resources to solve this problem.** This element will have little detail. Much of the information may be provided by the teacher.

Step 4 - Identification of Possible Solutions

This is an idea generating activity. Evaluation needs to focus on quantity of ideas, on divergent thinking, and on student willingness to be innovative and spontaneous. Evaluation may be done during or after the process.

Step 5 - Selection of the Best Solution

This is a more deductive, analytical activity. Students will assess each idea against a set of pre-determined criteria. Typically, the teacher will supply the criteria for this class. Some students may wish to create their own criteria. Evaluation has to reflect how well students can perform the task.

Step 6 - Development of the Solution

This activity will have a planning component, a trial and error component, and will require that students know when to discard an idea or method and when to move forward. This is the point in the design process where the solution gets constructed - the product gets made. Modelling and Prototyping are components of this step. Evaluation will have to consider how students engage in the process, including their ability to synthesize information and reach reasonable conclusions. Evidence of technical skill may also be used as an evaluation component.

Step 7 - Evaluation of the Solution

This activity requires that students evaluate their own solution using a set of pre-determined criteria. Evaluation of their work will assess how well they employed the process and understood the criteria. Evaluation objectivity should be emphasized and students must understand that the solution must be evaluated based on specific criteria and not influenced by personal biases toward the design.

Step 8 - Presentation of the Report

The report is the student's opportunity to summarize and present information on the design brief, the solution, and reasons for making particular choices. Evaluation should consider how well students synthesize the material and how well they present it to the class.

The Design Portfolio

Evaluation of the Design Portfolio should consider
- Completeness of items
- Level of detail
- Conciseness
- Evidence of decisions and reasons for them
- Inclusion of authentic information, like sketches, drawings, photos, video, etc.
- Inclusion of components that failed
- Organization according to design process headings

The Solution

Evaluation has to consider how well the solution addresses the problem. Some consideration should also be given to the execution of the solution - technical quality, workability, fit and finish.