APPLIED SKILLS K TO 7

TECHNOLOGY EDUCATION COMPONENT

(The first of three Applied Skills K to 7 Integrated Resource Packages)

Integrated Resource Package 1995

Province of
British Columbia
Ministry of
Education

IRP 012

Table of Contents

Preface: Applied Skills for Kindergarten to Grade 7

Preface III

Technology Education K to 7 Introduction

Introduction 1
Using this Integrated Resource Package 1
Overview 5
Curriculum Organizers 7
Instructional Strategies 13
Considerations for Instruction in Technology Education 15
Assessment and Evaluation 17
Learning Resources 18

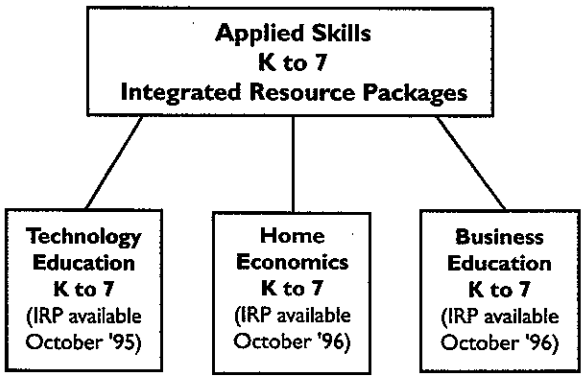
The Technology Education K to 7 Curriculum

Kindergarten to Grade 1 22
Grades 2 to 3 32
Grade 4 42
Grade 5 52
Grade 6 62
Grade 7 72

Technology Education K to 7 Appendices

Appendix A: Prescribed Learning Outcomes A-2
Appendix B: Learning Resources B-3
Appendix C: Cross-Curricular Outlines C-3
Appendix D: Assessment and Evaluation D-3
Appendix E: Acknowledgments E-3
Appendix F: Glossary F-3

Applied skills includes studies in technology education, business education, and home economics. Each of these subject areas will be phased in over a two-year period. Technology education will commence implementation in September 1996, with full implementation in September 1997. Business education and home economics will both commence implementation in September 1997, with full implementation in September 1998. Integrated resource packages, however, will be available in advance of these dates.



This Integrated Resource Package (IRP) provides some of the basic information that teachers will require to implement the technology education component. The information contained in this IRP is also available through the Internet. Contact the Ministry of Education's home page: http://www.educ.gov.bc.ca/

INTEGRATION OF APPLIED SKILLS

Teachers determine the best way to deliver the applied skills curriculum, including time allocation and the extent of integration with other curriculum areas.

The K to 12 Education Plan requires the integration of applied skills with other curriculum areas from Kindergarten to Grade 6. In Grade 7, students take one or more of the applied skills as a separate subject. Where possible, schools should offer all three of the applied skills subjects; where staff and facilities are limited it may be possible to offer only one or two.

REPORTING ON APPLIED SKILLS

As in all subject areas at the Kindergarten to Grade 7 level, teachers must use the prescribed learning outcomes as the basis for reporting to parents on student performance in the applied skills areas.

Technology Education is an integrated area of study at this level, and teachers do not need to report on it as a separate subject. However, teachers should include written comments specific to Technology Education when reporting on other relevant subject areas.

The prescribed learning outcomes for the Technology Education K to 7 curriculum are listed in the main body of this document. They are also collected together in a series of tables in Appendix A.

This Integrated Resource Package (IRP) contains learning outcomes and support materials for the Kindergarten to Grade 7 Technology Education curriculum. It has been designed to help teachers integrate technology education into other subjects to meet the requirements of the K to 12 Education Plan. It is organized to link the learning outcomes with the instruction and assessment strategies and learning resources.

USING THIS INTEGRATED RESOURCE PACKAGE

The provincially prescribed curriculum for technology education is structured in terms of *curriculum organizers*. The main body of this IRP consists of four columns of information for each organizer. These columns describe:

- provincially prescribed learning outcome statements for the area of study
- suggested instructional strategies for achieving the outcomes
- suggested assessment strategies for determining how well students are achieving the outcomes
- provincially recommended learning resources

A series of appendices provides additional information about the curriculum and further support for the teacher.

Prescribed Learning Outcomes

Learning outcome statements are content standards for the provincial education system. Learning outcomes set out the knowledge, enduring ideas, issues, concepts, skills, and attitudes for each subject. They are statements of what students are expected to know and do in each grade. Learning outcomes are clearly stated and expressed in measurable terms. All learning outcomes complete this stem: "It is expected that students will. . . ." Outcome statements have been written to enable teachers to use their experience and professional judgment when planning and evaluating. The outcomes are benchmarks that will permit the use of criterion-referenced performance standards. It is expected that actual student performance will vary. Evaluation, reporting, and student placement with respect to these outcomes depend on the professional judgment of teachers, guided by provincial policy.

Suggested Instructional Strategies

Instruction involves the selection of techniques, activities, and methods that can be used to meet diverse student needs and to deliver the prescribed curriculum. Teachers are free to adapt the suggested instructional strategies or substitute others that they think will enable their students to achieve the prescribed outcomes. These strategies have been developed by specialist and generalist teachers to assist their colleagues; they are suggestions only.

Suggested Assessment Strategies

The assessment strategies suggest a variety of ways to gather information about student performance. Some assessment strategies relate to specific activities; others are general. These strategies have been developed by specialist and generalist teachers to assist their colleagues; they are suggestions only.

Provincially Recommended Learning Resources

Provincially recommended learning resources are materials that have been reviewed and evaluated by British Columbia teachers in collaboration with the Ministry of

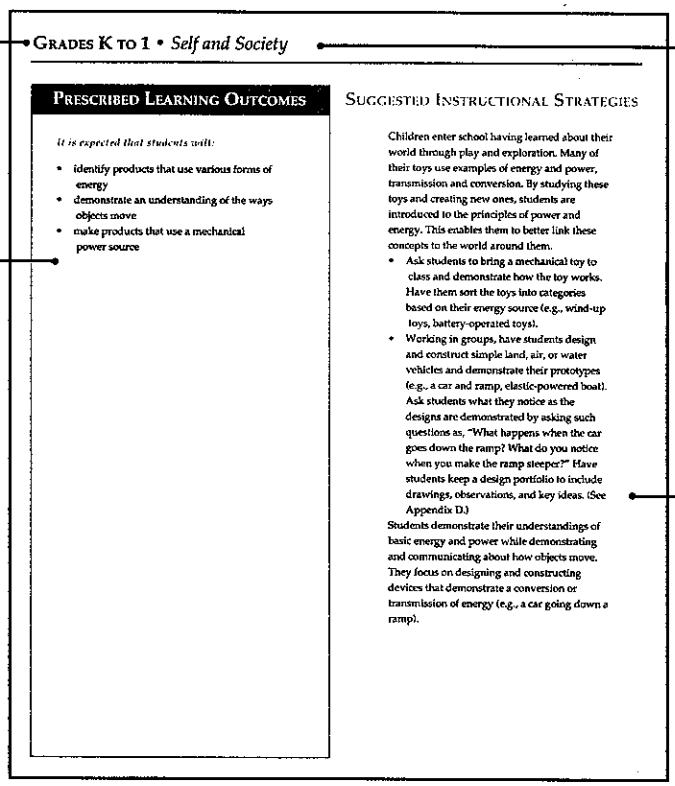
Education using a stringent set of criteria. They are typically materials suitable for student use, but they may also include information primarily intended for teachers. The *recommended* resources listed in the main body of this IRP are those that have a comprehensive coverage of significant portions of the curriculum, or those that provide unique support to a specific segment of the curriculum.

The Appendices

- ***Appendix A*** contains a listing of the prescribed learning outcomes for the curriculum arranged by curriculum organizer and by grade.
- ***Appendix B*** contains a comprehensive listing of the provincially recommended learning resources for this curriculum. As new resources are evaluated, this appendix will be updated.
- ***Appendix C*** outlines the cross-curricular screens used to ensure that concerns such as equity, access, and the inclusion of specific topics are addressed by all components of the IRP.
- ***Appendix D*** contains assistance for teachers related to provincial evaluation and reporting policy. Curriculum outcomes have been used as the source for examples of criterion-referenced evaluations.
- ***Appendix E*** acknowledges the many people and organizations that have been involved in the development of this IRP.
- ***Appendix F*** contains a glossary of terms specific to the Technology Education K to 7 curriculum.

Grade

Curriculum Organizer



GRADES K TO 1 • *Self and Society*

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- identify products that use various forms of energy
- demonstrate an understanding of the ways objects move
- make products that use a mechanical power source

SUGGESTED INSTRUCTIONAL STRATEGIES

Children enter school having learned about their world through play and exploration. Many of their toys use examples of energy and power, transmission and conversion. By studying these toys and creating new ones, students are introduced to the principles of power and energy. This enables them to better link these concepts to the world around them.

- Ask students to bring a mechanical toy to class and demonstrate how the toy works. Have them sort the toys into categories based on their energy source (e.g., wind-up toys, battery-operated toys).
- Working in groups, have students design and construct simple land, air, or water vehicles and demonstrate their prototypes (e.g., a car and ramp, elastic-powered boat). Ask students what they notice as the designs are demonstrated by asking such questions as, "What happens when the car goes down the ramp? What do you notice when you make the ramp steeper?" Have students keep a design portfolio to include drawings, observations, and key ideas. (See Appendix D.)

Students demonstrate their understandings of basic energy and power while demonstrating and communicating about how objects move. They focus on designing and constructing devices that demonstrate a conversion or transmission of energy (e.g., a car going down a ramp).

Prescribed Learning Outcomes

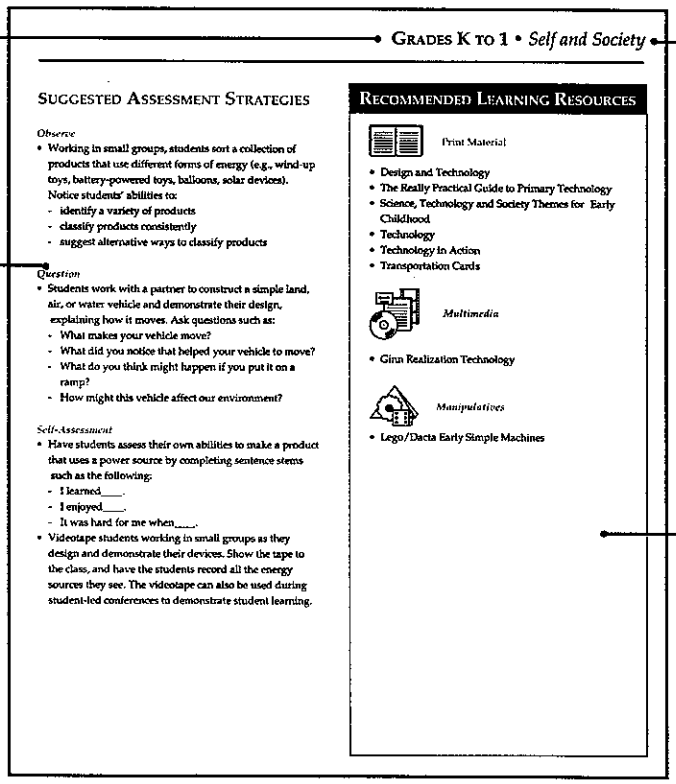
The Prescribed Learning Outcomes column of this IRP lists the specific learning outcomes for each curriculum organizer or sub-organizer. These aid the teacher in day-to-day planning.

Suggested Instructional Strategies

The Suggested Instructional Strategies column of this IRP suggests a variety of instructional approaches that include group work, problem solving, and the use of technology. Teachers should consider these as examples that they might modify to suit the developmental levels of their students.

Grade

Curriculum Organizer



GRADES K TO 1 • *Self and Society*

SUGGESTED ASSESSMENT STRATEGIES

Observe

- Working in small groups, students sort a collection of products that use different forms of energy (e.g., wind-up toys, battery-powered toys, balloons, solar devices). Notice students' abilities to:
  - identify a variety of products
  - classify products consistently
  - suggest alternative ways to classify products

Question

- Students work with a partner to construct a simple land, air, or water vehicle and demonstrate their design, explaining how it moves. Ask questions such as:
  - What makes your vehicle move?
  - What did you notice that helped your vehicle to move?
  - What do you think might happen if you put it on a ramp?
  - How might this vehicle affect our environment?

Self-Assessment

- Have students assess their own abilities to make a product that uses a power source by completing sentence stems such as the following:
  - I learned____.
  - I enjoyed____.
  - It was hard for me when____.
- Videotape students working in small groups as they design and demonstrate their devices. Show the tape to the class, and have the students record all the energy sources they see. The videotape can also be used during student-led conferences to demonstrate student learning.

RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Technology
- The Really Practical Guide to Primary Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action
- Transportation Cards

Multimedia

- Gizmo Realization Technology

Manipulatives

- Lego/Dacta Early Simple Machines

Suggested Assessment Strategies

The Suggested Assessment Strategies offer a wide range of different assessment approaches useful in evaluating the Prescribed Learning Outcomes. Teachers should consider these as examples they might modify to suit their own needs and the instructional goals.

Recommended Learning Resources

The Recommended Learning Resources component of this IRP is a compilation of provincially recommended resources that support the Prescribed Learning Outcomes. A complete list including a short description of the resource, its media type, and distributor are included in Appendix B of this IRP.

THE PRIMARY YEARS

This IRP includes curriculum outcomes and support materials that apply to learners in the Primary Years (K to 3). The K to 3 curriculum outcomes in this document comprise the prescribed curriculum. The instructional strategies, assessment strategies, and learning resources are intended to update or supplement many of the related support materials currently contained in the *Primary Program Foundation Document* and the *Primary Program Resource Document.*

Once all curriculum outcomes pertaining to the Primary Years have been updated, the *Primary Program Foundations Document* and the *Primary Program Resource Document* will be revised and combined with the updated curriculum to create a Primary Years Integrated Resource Package. Until the Primary Years IRP is available, teachers are encouraged to implement the new K to 7 curriculum and continue to use the other portions of the *Primary Program Foundation Document* and the *Primary Program Resource Document.*

RATIONALE

Technology is embodied in devices that extend human capabilities. It provides the tools to extend our vision, to send and receive sounds and images from around the world, and to improve health, personal relationships, lifestyle, economies, and ecosystems.

Technology is a dominant force in today's society. Technological literacy is as essential to participation in modern society as is numeracy and the ability to read and write. A technologically literate person uses tools, materials, systems, and processes in an informed, ethical, and responsible way. Technology education helps young people prepare to live and work in a technological world.

The Aim and Approach of The Curriculum

The aim of the Grades K to 12 Technology Education curriculum is to help students develop the technological literacy and lifelong learning patterns that they need to live and work effectively in a changing technological society. To achieve this, the curriculum provides a framework for students to learn how to design and make solutions to real-world problems.

Technology education should be guided by the principles of learning. These are:

- learning requires the active participation of the student
- people learn in a variety of ways and at different rates
- learning is both an individual and a group process

Preparing for the Workplace

To meet career challenges, students must be able to make independent decisions, solve problems, work independently and co-operatively with others, and become technically competent. Technology education helps students develop the types of learning patterns that are required in today's changing workplace.

Preparing the Citizen

To be responsible members of society, students must be aware of the ever-growing impacts of technology. They need to reflect critically on technology's role in society and consider its positive and negative effects. Technology education fosters the development of skills and attitudes that increase students' abilities to address the social and ethical issues of technological advancements.

Relevant to Everyone

The Grades K to 12 Technology Education curriculum is designed to provide learning opportunities for male and female students with a wide range of abilities. The instructional and assessment strategies described in this Integrated Resource Package encourage students to apply skills and knowledge gained in and out of the classroom to the design and making of solutions to real-life problems. As students study technology related to materials, tools, and processes used in their design and practical work, they develop research and communication skills and learn how to evaluate their work. Because of the changing nature of society and the workplace, the skills, knowledge, and attitudes developed in technology education are relevant to many other areas of life.

Preparing for Further Education

The technology education curriculum spans Kindergarten to Grade 12. It provides a framework for students to solve problems using a design process and make what they have designed. The aim of the curriculum is to develop technological literacy and lifelong learning patterns that will enable students to live and work effectively in a changing technological society. The following provides an overview of technology education, Kindergarten to Grade 12.

OVERVIEW

Grades K to 3	
Students begin to appreciate that technology is everywhere. They become aware of the role of technology in their lives by exploring familiar devices. Through problem-solving activities, they develop group interaction and communication skills, and self-confidence in handling simple processes and products. Student activities are based on classroom themes and their own experiences and personal interests.	***In grades K to 3, students:*** • construct devices that are useful and relevant to them • explore materials, tools, and processes, independently and in groups • realize that there are several solutions to a single problem • learn the importance of using tools and materials safely
Grades 4 to 7	
Students consider the personal, community, and global consequences in the use of technology now and in the future, and develop a concern for its responsible application. They investigate the historical development of technology and begin to appreciate its impact on society and individuals. By investigating a product from its inception to its completion, students learn to research, create, and communicate solutions to problems involving design.	***In grades 4 to 7, students:*** • gain experience using a variety of communication tools (e.g., modem, CD-ROM, video, overhead projector) • identify problems involving design and investigate possible solutions • use an expanding variety of tools, materials, and production processes • use objective tests and feedback to refine and modify designs • become increasingly responsible for managing their time and resources, and for planning and organizing their activities within a specific task • begin to recognize that a system is made up of parts and devices that interact to achieve a purpose

Grades 8 to 10	
Students work in specialized environments to develop and use technological solutions to problems that they identify or that are identified for them. They continue to learn about the technical requirements of various careers. They consider the personal, local, and global consequences, and the cultural, ethical, and aesthetic implications of technology. They investigate the future applications of technology to improve the human condition.	*In grades 8 to 10, students:* • set goals, develop plans, and assess their own ability to design products (individually and in groups) • use graphic designs and oral and written language to convey technical ideas • learn about the safe use of specialized tools and machinery • consider how they will use technology in daily life and in the workplace • study the characteristics and uses of materials and information while solving problems involving design that occur in daily life and in the workplace • learn to create and manage systems that energize and control products
Grades 11 to 12	
Students work in a sophisticated technological learning environment designed to promote their skills, knowledge, and abilities to solve complex and varied problems. Students take advantage of opportunities to prepare for postsecondary training opportunities.	*In grades 11 to 12, students:* • develop skills appropriate to the workplace • produce products and systems that meet community standards • work in co-operative groups to develop solutions to real-life problems • develop detailed understanding of materials, processes, systems, and information gathering • select appropriate technologies to solve problems • evaluate possible solutions using models, simulations, and prototypes

The prescribed learning outcomes for technology education are grouped into the following five curriculum organizers:

- Self and Society
- Communications
- Production
- Control
- Energy and Power

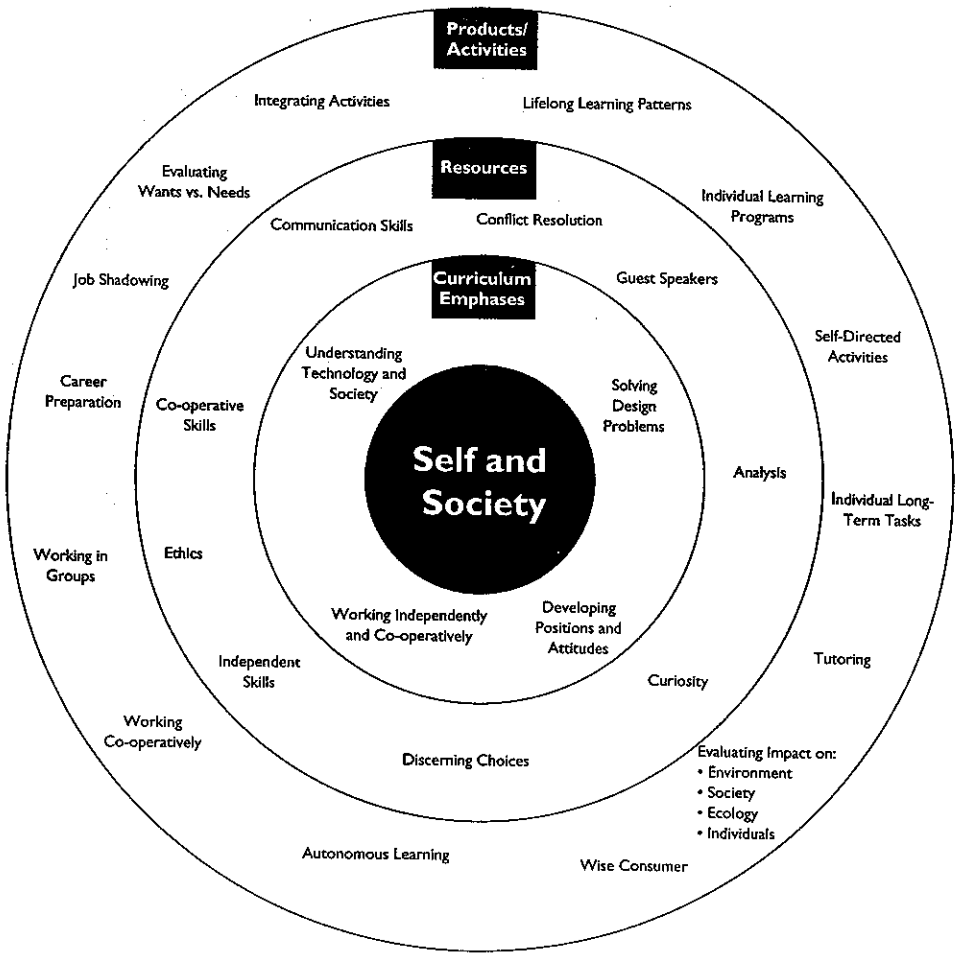
These five curriculum organizers are the key elements of technology education. They were developed to provide a framework for the learning outcomes—a way of organizing knowledge, skills and attitudes. Because of the dynamic nature of classroom learning, no one organizer should be used in isolation or as a basis for a lesson or unit of instruction, but should be used in combination.

Although all organizers work together in various ways, learning outcomes in Self and Society focus on career development and personal and social responsibility, making these learning outcomes central to all activities in technology education.

Self and Society

Technology touches our lives every day. Students need to understand how humans shape technology and the impact that current and future technologies will have on our society, culture, and environment. The prescribed learning outcomes emphasize:

- learning to solve problems involving technology
- the personal relevance of problems involving technology and the discovery that there may be several solutions to a problem
- developing positive attitudes toward lifelong learning and the integration and application of skills across areas of learning and technologies
- developing appropriate interpersonal skills and attitudes for working both independently and co-operatively within a group
- exploring careers and lifestyles associated with technology
- discovering how technology has changed society and the workplace

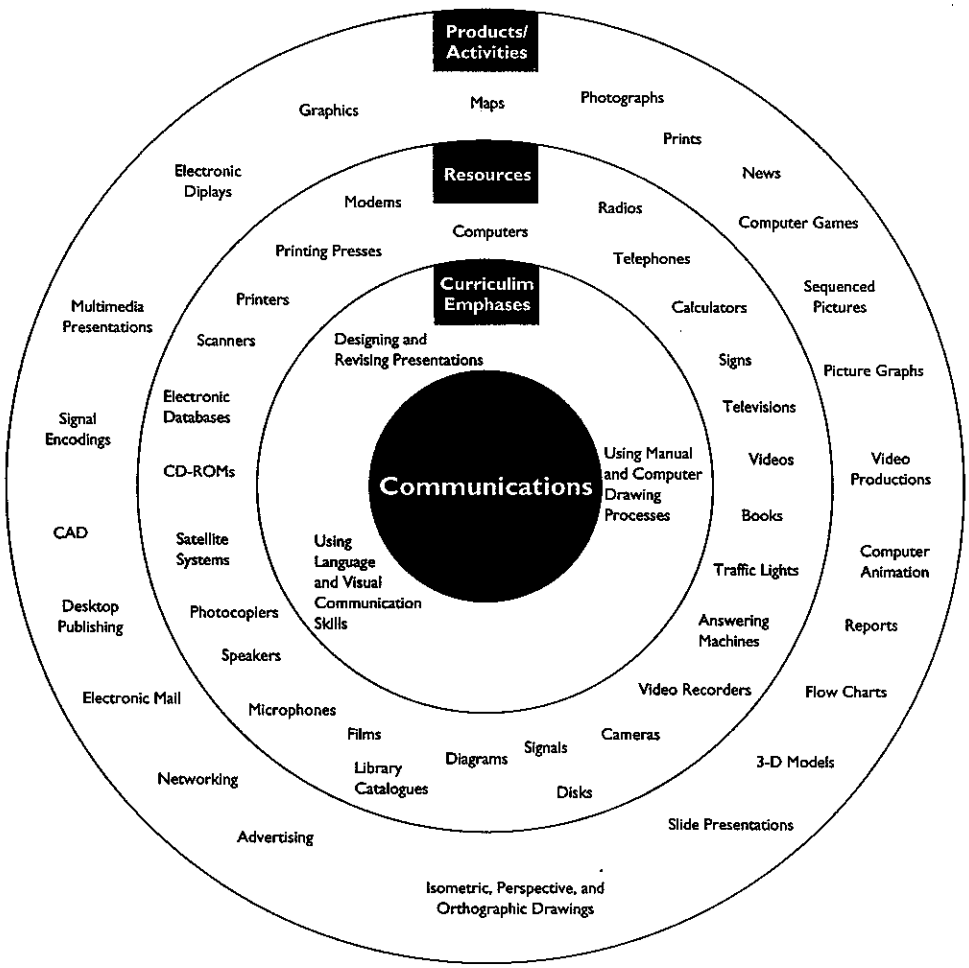


Together, the five curriculum organizers manage the content of technology education and are intended to provide direction for development of integrated units of study and the planning of instructional materials.

Communications

Images and messages can be sent instantly almost anywhere in the world, adding a global perspective to our lives. At home and in the workplace, students will need to use technology to process and share information and to communicate ideas using language and graphic forms. The prescribed learning outcomes emphasize:

- using technology to access, store, and retrieve information (although information technology is a separate curriculum, it is a major part of technology education)
- developing knowledge and skills related to accessing, storing, retrieving, and using information
- using manual and computer-assisted processes to present models and simulations in 2-D and 3-D forms to explain design ideas
- developing and using criteria to create and revise design presentations
- making use of skills, knowledge, and technologies from various curriculum areas to solve problems
- making responsible choices about the use of technology

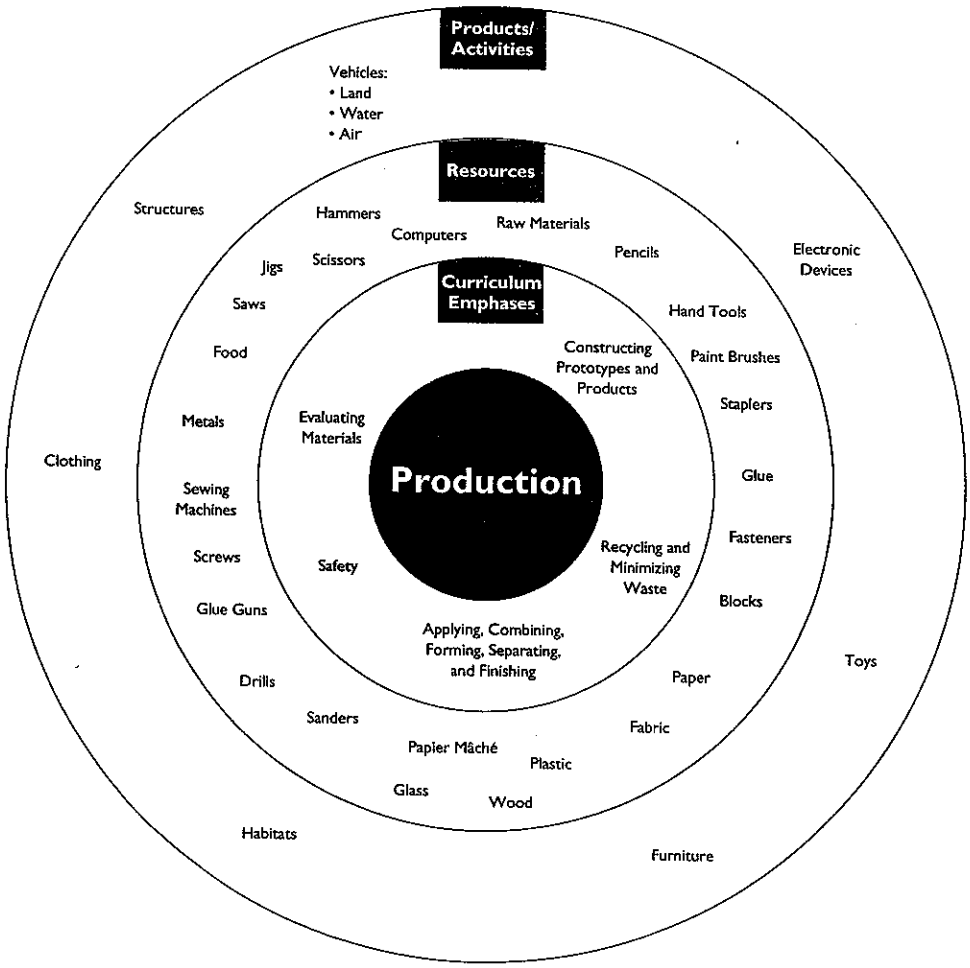


Together, the five curriculum organizers manage the content of technology education and are intended to provide direction for development of integrated units of study and the planning of instructional materials.

Production

The introduction of new technologies has influenced the way we create and make things. Students need to know about the safe use of tools and materials. They acquire skills by designing and developing products and systems that satisfy human needs and wants. The prescribed learning outcomes emphasize:

- applying the processes of combining, forming, separating, and finishing to the development and improvement of products at home and in the industrial world
- evaluating and selecting materials to meet specific design requirements
- constructing models, prototypes, and products to detailed specifications
- investigating the effects of technological changes on the production and use of materials
- examining processes and procedures used to minimize waste and to reuse products
- developing appropriate attitudes and practices about working safely, whether in the workplace, at home, or in the school laboratory

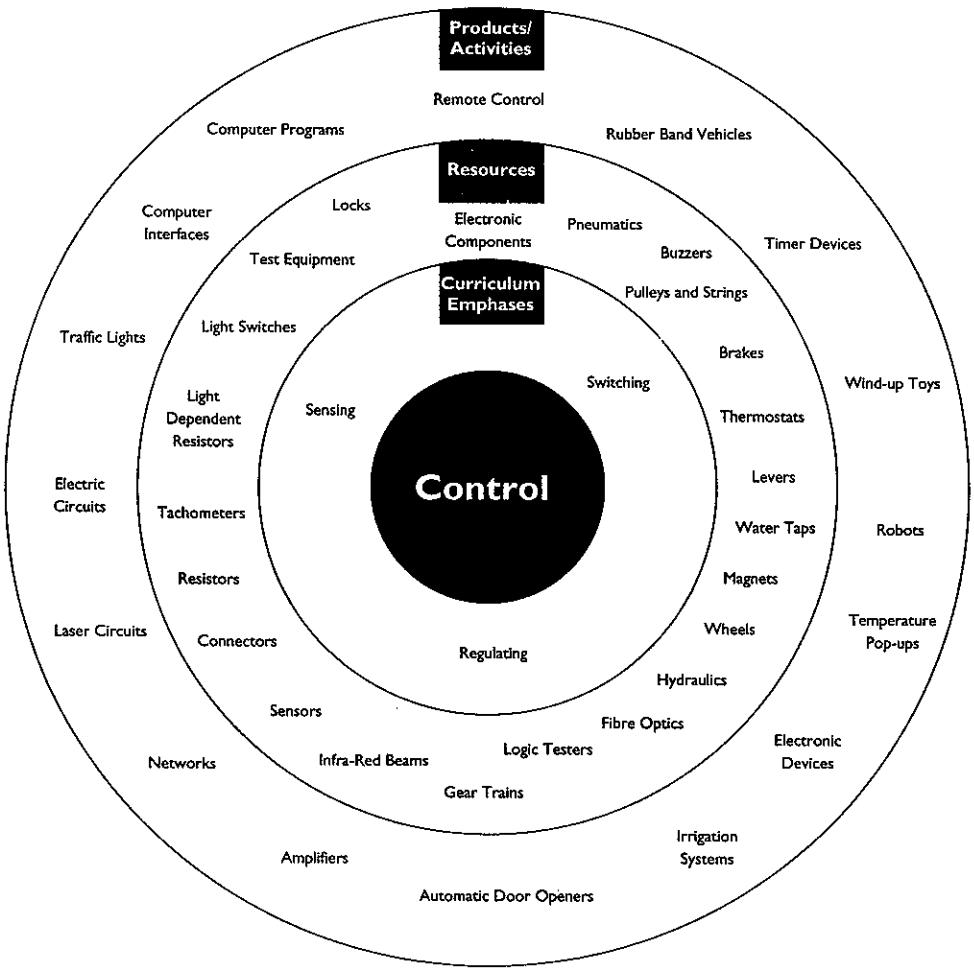


Together, the five curriculum organizers manage the content of technology education and are intended to provide direction for development of integrated units of study and the planning of instructional materials.

Control

Control addresses the application of devices and processes to manage, sort, control, and organize systems. The prescribed learning outcomes emphasize identifying and designing devices and processes in systems that integrate the following:

- *Sensing:* detecting, interpreting, and monitoring energy in a system using electric, electronic, fluid, or mechanical devices. Information is processed, and a decision is made that results in a specific outcome (e.g., the auto-stop function on a cassette player; an infra-red beam on a conveyor belt counts boxes as they pass).
- *Switching:* any method (e.g., mechanical, electronic) used to turn the flow of energy in a system off and on (e.g., a motion detector activates an alarm when an intruder is present; triggering the start of a model car on a ramp).
- *Regulating:* varying the flow, amount, and direction of all forms of energy (e.g., human, fluid, mechanical, electrical, heat).

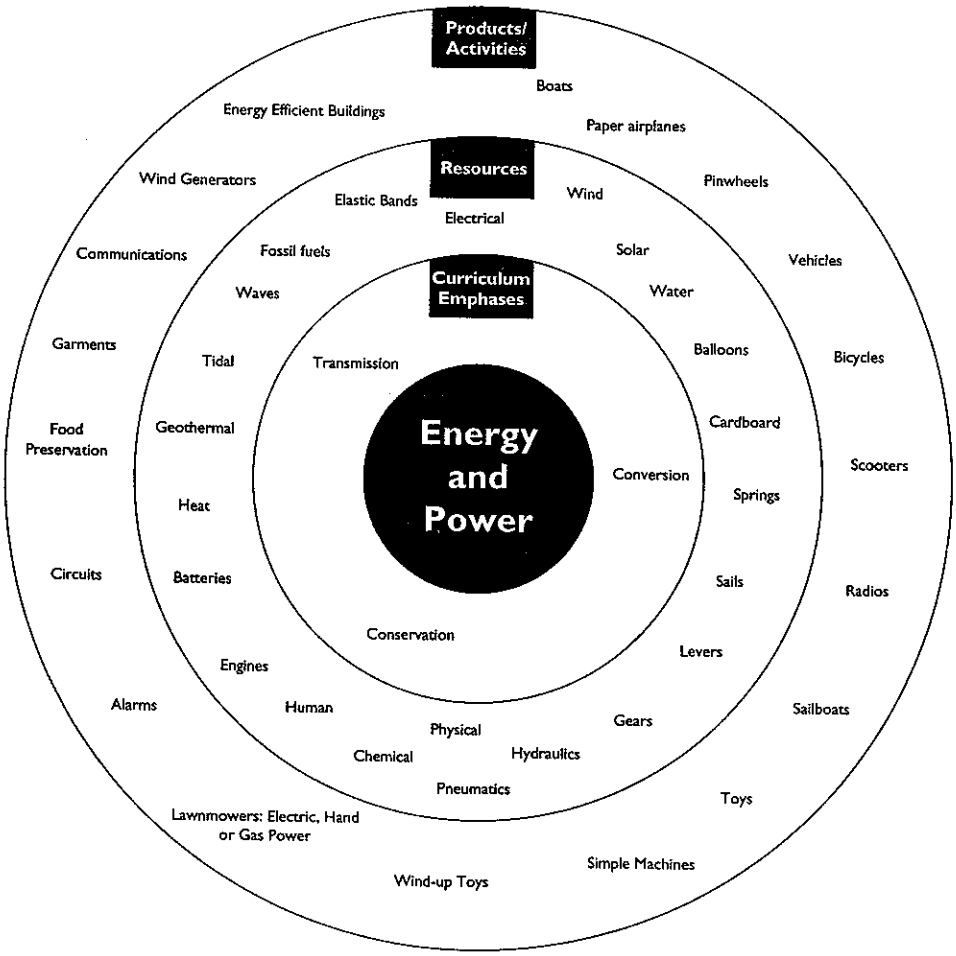


Together, the five curriculum organizers manage the content of technology education and are intended to provide direction for development of integrated units of study and the planning of instructional materials.

Energy and Power

Energy and Power refers to devices and processes that convert, transmit, and conserve forms of energy. The prescribed learning outcomes emphasize the analysis, design, and construction of systems that apply the following principles:

- *Conversion:* when energy is changed from one form to another (e.g., energy stored in a battery is converted into mechanical energy by an electric motor).
- *Transmission:* using devices and systems to transfer energy from one location to another (e.g., energy is transmitted from an electric motor through gears that turn the wheels of a model car, causing it to move).
- *Conservation:* using existing energy efficiently and finding alternative energy forms (e.g., aerodynamically designed vehicles; using solar energy to toast bread).



Together, the five curriculum organizers manage the content of technology education and are intended to provide direction for development of integrated units of study and the planning of instructional materials.

INSTRUCTIONAL STRATEGIES

The instructional strategies suggested in this IRP include techniques, ideas, and methods that illustrate a variety of approaches to the prescribed curriculum for a diverse population of students. Teachers determine the best instructional methods for their students, the best way to group students for particular studies, and the best way to present material to make it relevant and interesting.

Context Statements

Each set of instructional strategies in this IRP starts with a context statement, followed by several examples of instructional activities. The context statement links the prescribed learning outcomes with instruction. It states why these learning outcomes are important for the student's development and suggests some ways to integrate the learning outcomes into various subject areas.

Strategies

The suggested instructional strategies may be undertaken by individual students, partners, or small groups. Technology education emphasizes the skills needed in a continually changing workplace. Emphasis is given to the following:

- **Strategies that foster the development of individual and group skills.** The workplace requires that people work effectively, individually and with others, to solve problems and to complete tasks. Students need to experience the dynamics of group work to enhance their understanding of the problem-solving process. Group work focusses on such skills as collaboration, communication, leadership, and cooperation.

- **Strategies that develop applied skills.** In order to see technology education as relevant and useful, students must learn how it can be applied to a variety of real-world situations. Technology education helps students to understand and interpret their world, and to identify and solve problems that occur in their daily lives.

  As students access, synthesize, and present information, they apply their skills in various subject areas. They listen, read, write, and present ideas for various purposes, find specific information and summarize it graphically and in writing, and apply their knowledge of mathematics and science to the projects they develop.

- **Strategies that foster research and critical-thinking skills.** In order to make informed and responsible choices about the appropriate use of technology, students need to listen, view, and read critically.

- **Strategies that use technology.** The ability to use technology to solve problems is becoming a mandatory skill in the workplace and is an important "new basic" in postsecondary education. Students use technology to access information, to calculate, and to enhance the presentation of ideas.

- **Strategies that require the solving of problems involving design.** Students identify needs, pose real or invented problems of their own, and respond to problems presented by the teacher.

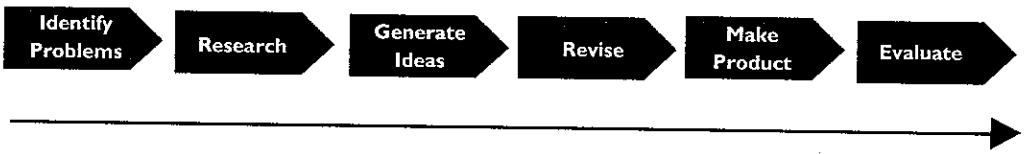
  To develop decision-making and problem-solving skills, students need to be challenged to identify problems and present appropriate design solutions. The problems students identify or are assigned in technology education involve the development of new or improved products and systems.

Problem-Solving Models

Models that describe problem-solving processes should be developed with students so they understand the recurring nature of solving real-world problems (as part of a problem is solved, new problems arise and some steps in the processes recur). The following diagrams present a variety of approaches to describe problem-solving in technology education. They are intended to provide teachers with ideas. They are not intended as prescribed models.

A Simple Linear Model

Some models suggest that problem-solving is a set of clearly defined and prescribed steps. This is rarely the case.



Designing, Troubleshooting, and Social Impact Models

Some specialized problems are approached in unique ways.

Troubleshooting

Troubleshooting is a method of solving problems used to isolate and diagnose a malfunction.

- Identify purpose of system (inputs and outputs)
- Identify purpose of subsystems (inputs and outputs)
- Test subsystems
- Identify cause and implement solution
- Test solution

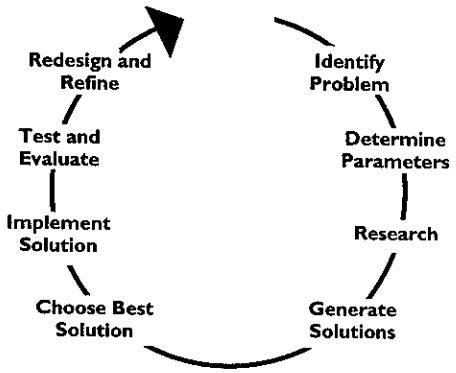
Social Impact

This is a method of solving problems used to appraise the social, environmental, and ethical implications of technological decisions.

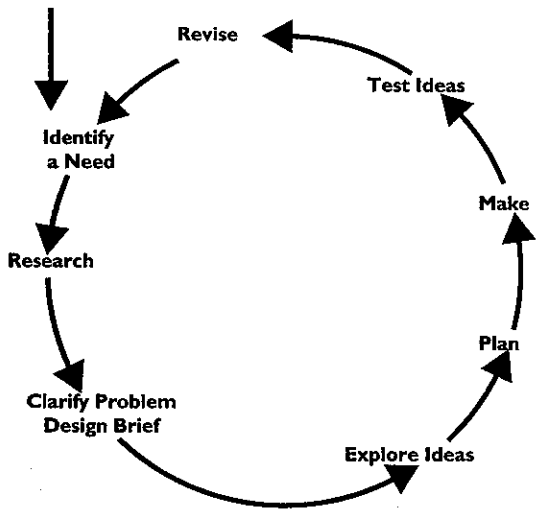
- Identify consequences and effects
- Develop a value system through critical thinking
- Judge benefits and disadvantages of technological applications
- Make ethical decisions

Designing

Designing is a problem-solving method used to develop solutions leading to the creation of articles, systems, or environments.

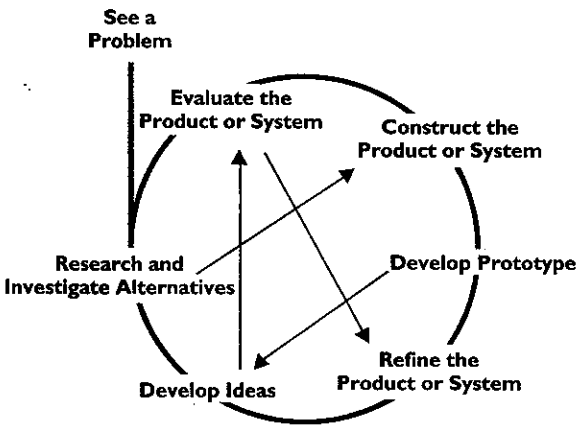


Action Model



Some models suggest a continuous flow of activity, from problem identification to the development of a refined product.

Interactive Model



Interactive models illustrate the complexity of a process, where at any time you might move to any point in the process in order to figure something out.

CONSIDERATIONS FOR INSTRUCTION IN TECHNOLOGY EDUCATION

When selecting and developing learning activities, consideration must be given to safety, gender equity, and diverse student needs.

Safety

The nature of technology education requires that correct safety practices be established as soon as students begin their studies. It is the responsibility of the teacher to ensure that students are aware of the hazards in facilities and that established safety procedures are followed. Safety education is a continuing experience. Teachers must use good judgment when instructing students in safety practices, remembering that the main objective is education.

It is essential that teachers address the following questions before, during, and after an activity:

- Has the instruction been sequenced progressively to ensure safety?
- Have students been given specific instruction about how to use and handle equipment and tools correctly?
- Are the tools and equipment in good repair and suitably arranged?
- Are students being properly supervised?
- Do the facilities provide adequate lighting and ventilation for the activity?
- Have students been made aware of hazards in the facility area?
- Have students been made aware of appropriate school-based and industrial safety standards?

Teachers should select safe activities, techniques, and projects, and ensure that the following safety practices are implemented.

This is not an all-inclusive list but a guide to help teachers establish a safe learning environment.

Students should:

- wear appropriate clothing and footwear
- follow established rules and routines
- select tasks that are within their ability
- demonstrate self control and show respect for the safety of others
- recognize hazards in work areas

Teachers should select activities, techniques, and projects that reflect safe practices.

Gender Equity

The education system is committed to helping all students succeed. This is particularly important in this area because female participation is low in technology education courses and women tend not to choose careers that require technical skills. Teaching, assessment materials, learning activities, and classroom environments should place value on the experiences and contributions of all people from all cultures. Teachers should consider the diversity of learning styles, gender bias in learning resources, and unintentional gender bias when teaching. The following instructional strategies are suggested to help teachers deliver a gender-sensitive technology education curriculum.

- Think about ways to feature female technologists or women who make extensive use of technology in their careers as guest speakers or subjects of study in the classroom.
- Design instruction to acknowledge differences in experiences and interests between girls and boys.
- Demonstrate the relevance of technology education to careers and to daily life in ways that may appeal to particular students in the class or school. Successful links include biology, environmental issues, architecture and design, computers, and current affairs.
- Explore not only the practical applications of technology education but also the human elements, such as the ways ideas have changed throughout history, and the social and moral implications of technology.
- Explore ways of teaching the uses of design and technology that will appeal to all students.
- Provide practical learning opportunities designed specifically to help girls develop confidence and interest in technology education and non-traditional roles.
- Emphasize that technology is used by people with various interests and responsibilities.
- Provide opportunities for visual and hands-on activities. Experiments, demonstrations, field trips, and exercises that provide opportunities to explore the relevance of technology education are important for both girls and boys.

Diverse Student Needs

Instruction and assessment methods should be adapted to meet the needs of all students. When students with special needs are expected to achieve or surpass the learning outcomes set out in the technology education curriculum, regular grading practices and reporting procedures are followed. However, when students are not expected to achieve the learning outcomes, modifications must be noted in their Individual Education Plans (IEPs).

The following strategies may help students with special needs succeed in technology education:

Adapt the environment:

- Change the student's classroom seat.
- Make use of co-operative grouping.

Adapt presentations:

- Provide students with advance organizers of key technology education concepts.
- Demonstrate or model new concepts.
- Adjust the pace of activities as required.
- Use bilingual peers or volunteers to help ESL students (e.g., to clarify safety rules).

Adapt materials:

- Use techniques to make the organization of activities more explicit (e.g., colour code the steps used to solve a problem).
- Use manipulatives or large-print charts.
- Use large print on activity sheets.
- Use opaque overlays on text pages to reduce the quantity of visible print.
- Highlight key points on activity sheets.
- Use translated material for information such as safety rules.

Adapt methods of assistance:

- Have peers or volunteers help students with special needs.
- Have students with special needs help younger students.
- Have teacher assistants work with individuals and small groups of students with special needs.
- Work with consultants and support teachers to develop appropriate problem-solving activities and strategies for students with special needs.

Adapt methods of assessment:

- Allow students to demonstrate their understanding of technology education concepts in a variety of ways (e.g., murals, displays, models, puzzles, game boards).
- Modify assessment tools to match student needs. For example, oral tests, open-book tests, and tests with no time limit may allow students to better demonstrate their learning than traditional tests.
- Set achievable goals.
- Use computer programs that allow students to practise word processing and to record and track their results.

Provide opportunities for extension and practice:

- Require the completion of only a small amount of work at any given time.
- Simplify the way questions are worded to match the students' levels of understanding.
- Provide functional, practical opportunities for students to practice skills.

ASSESSMENT AND EVALUATION

Assessment is the systematic process of gathering information about students' learning in order to describe what they know, are able to do, and are working toward. From the evidence and information collected in assessments, teachers describe each student's learning and performance. They use this information to provide students with ongoing feedback, plan further instructional and learning activities, set subsequent learning goals, and determine areas requiring diagnostic teaching and intervention.

Teachers determine the purpose, aspects, or attributes of learning on which to focus the assessment. They also decide when to collect the evidence and the assessment methods, tools, or techniques most appropriate to use. Assessment focusses on the critical or significant aspects of the learning students will be asked to demonstrate. Students benefit when they clearly understand the learning goals and learning expectations.

Assessment in Technology Education

The activities suggested in this IRP illustrate a variety of strategies for observing and interacting with students and for collecting their work. Each set of assessment strategies begins with a context statement that suggests an overall approach for the assessment of content, processes, and procedures.

Teachers may want to adapt some of the suggested activities to suit particular students or situations. While students perform activities, teachers use a variety of strategies to assess their levels of understanding in relation to outcomes. Possible strategies include performance assessment, oral and written reports, and student self-assessment. For further support, Appendix D of this IRP includes a more detailed discussion of assessment and evaluation.

The provincial reference sets are an additional resource that can be used to help teachers assess skills across curricular areas. The reference sets can help teachers establish criteria that focus assessments and provide a more complete picture of student development.

The reference sets include:

- *Evaluating Reading Across Curriculum* (RB 0034)
- *Evaluating Writing Across Curriculum* (RB 0020 & RB 0021)
- *Evaluating Problem Solving Across Curriculum* (RB 0053)
- *Evaluating Group Communication Skills Across Curriculum* (RB 0051)
- *Evaluating Mathematical Development Across Curriculum* (RB 0052)

A series of assessment handbooks have also been developed to provide guidance for teachers as they explore and expand their assessment repertoires.

- *Performance Assessment* (XX0246)
- *Portfolio Assessment* (XX0247)
- *Student-Centred Conferencing* (XX0248)
- *Student Self-Assessment* (XX0249)

LEARNING RESOURCES

The ministry promotes the establishment of a resource-rich learning environment through the evaluation of educationally appropriate materials in a variety of media and formats. This includes, but is not limited to, materials in print, video, and software formats, as well as a combination of these formats intended for use by teachers and students. Resources that support provincial curricula are identified through an evaluation process in which practising teachers act as evaluators. Resources not on the provincially recommended list must be evaluated through a local board-approved process. Teachers and school districts are encouraged to select those resources that they find most relevant and useful for their students, and to supplement these with locally approved materials and resources (such as locally available guest speakers or exhibits).

The use of the learning resources involves the teacher as a facilitator of learning. However, students may be expected to have some choice in materials for specific purposes such as independent reading or research. Teachers are expected to use a variety of resources to support learning outcomes at any particular level. A multimedia approach is encouraged.

Some selected resources have been identified to support cross-curricular integration. The ministry also considers students with special needs in the evaluation and annotation of learning resources. Special format versions of some selected resources (Braille and taped-book formats) are also available.

Learning resources for use in British Columbia schools fall into one of three categories:

- provincially recommended materials
- provincially authorized materials
- locally evaluated materials

All learning resources used in schools must have either *recommended* or *authorized* designation or be approved through district evaluation and approval policies.

Provincially Recommended Materials

Materials evaluated through the provincial evaluation process, approved through minister's order, and purchased using targeted learning resource funds are categorized as *recommended* materials. These resources are listed in the print and CD-ROM versions of the *Catalogue of Learning Resources*.

Appendix B of this IRP includes a list of *recommended* resources for technology education.

Provincially Authorized Materials

Materials selected prior to 1989 by curriculum committees and purchased through the Credit Allocation Plan are categorized as *authorized* materials. These resources are listed in the print and CD-ROM versions of the *Catalogue of Learning Resources*.

Locally Evaluated Materials

These are the materials evaluated through local (district and school) evaluation processes and approved for use according to district policy.

The Technology Education K to 7 Curriculum

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- solve problems that come up during the design process, independently and in groups
- demonstrate confidence and a positive attitude throughout the problem-solving process
- manage materials, time, and resources
- identify and describe the effects of technology on their lives, at home, and in the classroom
- identify occupations and role models in technological fields in their community, being sensitive to culture, gender, and physical ability

SUGGESTED INSTRUCTIONAL STRATEGIES

Students observe how technology is used and how it affects their daily lives. They become aware of technology-related occupations and cultural stereotyping that is associated with some occupations. Students are introduced to problem solving, individually and in groups.

- In a whole-class discussion, help students to generate a list of products and associated occupations in technological fields (e.g., telephone—operator; lights—electrician; faucet—plumber). Record the responses on a chart divided into occupations and products. Working with a partner, the students create a mime or drama to represent one of the occupations in action. Invite other students to guess the occupation and the product.
- Using a list of occupations, ask students ques-

SUGGESTED ASSESSMENT STRATEGIES

Early primary students begin to investigate technology-related occupations and the direct role of technology in their lives. Through play, discussions, and problem-solving activities, they develop group interaction and communication skills. Assessment strategies emphasize group processes as well as the development of knowledge about technology and jobs that use technology.

Observe

- As students brainstorm examples of occupations they know about from home, school, and the community, notice the extent to which they are able to:
  - identify a variety of occupations
  - describe how people in different occupation use technology
  - identify non-traditional occupational roles
- Listen to students' conversations as they work in groups. Notice the extent to which students are able to:
  - take turns communicating
  - share materials
  - incorporate the ideas of others
  - manage materials, time, and resources

Collect

- Have students role play various jobs using props from home or the drama centre. Invite other students to guess the occupations the students are demonstrating. Look for evidence of:
  - accuracy of their perceptions of an occupation
  - stereotypes and preconceptions of gender and cultural roles
  - knowledge of a variety of occupations in their community

Self-Assessment

- Lead a class discussion about what a co-operative group looks like and sounds like. As students work in their groups, ask them to collect evidence of their group working co-operatively. Ask them to think about whether individuals had certain roles within the group and if these roles were independent of gender, culture, and physical abilities. After the activity, record and discuss their findings.

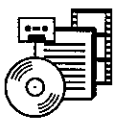
RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action
- Transportation Cards

Video

- Fixing The Fence



Multimedia

- Ginn Realization Technology

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3
- Lego/Dacta Early Simple Machines

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- follow instructions to construct a product
- communicate ideas for creating a product
- make a drawing to communicate solutions to problems that come up during the design process
- identify different ways to communicate using technology

SUGGESTED INSTRUCTIONAL STRATEGIES

Young children learn communication skills by discussing, demonstrating, and drawing their ideas about solving a problem. As these skills improve, students are able to use precise vocabulary and create clear drawings that communicate their thoughts as they solve problems.

- Present students with pictures of common household items (e.g., can opener, television) and discuss how these items solve problems using technology. Students can draw pictures representing the problem being solved (e.g., before—unopened can; during—can opener in use; after—opened can).
- To build vocabulary and develop shape recognition, show pictures or models of basic shapes (e.g., circle, square), and ask students to name them. When students can identify shapes, present objects or pictures (e.g., bicycle, television), and ask them to find and name the basic shapes within each object. Have students create a shape booklet, including the technology that demonstrates each shape.
- Working in pairs, have students design an object using geometric shapes made from paper, wood, or plastic. Students discover different shapes that can be created by combining objects in a variety of ways (e.g., two triangles form a rectangle).
- On a visit to the playground, encourage students to investigate the concepts of balance and levers using a teeter-totter. In the classroom, provide Lego pieces for the students to use to build a model teeter-totter following pictorial and verbal instructions.
- Using pictures cut from magazines, have students create a representation of the various ways people use technology to communicate.

SUGGESTED ASSESSMENT STRATEGIES

Young children communicate their solutions to technological problems in a variety of ways, including drawing and talking. Students demonstrate their abilities to communicate in a technological manner by creating and developing lists of possible solutions to a problem (e.g., identify circles, squares, and rectangles in objects they encounter daily), by following instructions, and by drawing solutions to problems that come up during the design process.

Observe

- Students collaborate to develop solutions to technological problems. Look for evidence that students are able to:
  - follow directions
  - focus on the main purpose of the task
  - ask questions and listen for answers
  - add to suggestions that others offer

Question

- Have students demonstrate their knowledge by making a collage or poster using pictures based on a theme (e.g., transportation, communications). For example, if the theme is communications, have students create a representation using pictures that show ways people communicate. Ask questions such as:
  - Have you ever used any of these ways to communicate?
  - Which pictures on your poster are of things you have at home?
  - Who do you know who has used these ways to communicate?
  - Can you think of people you know who use this technology at work?

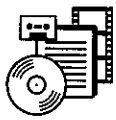
Collect

- Have students draw their solutions to a technical problem such as opening a can or turning on a television. Examine each drawing for evidence that it:
  - illustrates a solution to the problem
  - is easily understood
  - is an appropriate solution

RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action
- Transportation Cards



Multimedia

- Ginn Realization Technology

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3
- Lego/Dacta Early Simple Machines

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- solve problems involving technology using various tools, materials, and processes
- modify familiar products by experimenting with ways of combining, separating, forming, and finishing materials
- compare the properties and uses of familiar materials
- identify common tools, and compare their characteristics and intended uses
- recognize the potential safety hazards presented by tools, and identify safety equipment and procedures
- recognize and suggest ways to reduce, reuse, and recycle materials and products to control waste

SUGGESTED INSTRUCTIONAL STRATEGIES

By using tools and materials, students become aware of how products are manufactured. Students are given opportunities to increase their understanding of the function of tools and the properties of materials that they encounter daily (e.g., Plasticene, pencils, screwdrivers). Through observation, manipulation, and classification of tools and materials, they identify the similarities, differences, and potential hazards.

- Demonstrate a variety of familiar tools and their processes, such as scissors cutting paper (separating), a stapler joining two pieces of paper (combining), sandpaper smoothing a piece of wood (finishing), and a garlic press shaping Plasticene (forming). Encourage students to use a variety of tools and materials to create examples of these processes; then display them in the classroom as a source of information.
- Set out a variety of magazines and books for students to use to find pictures of tools. Ask students to categorize the pictures by processes (combining, forming, separating, finishing) and make a scrapbook.
- Provide a woodworking centre with a variety of familiar materials, and allow students to experiment with production processes. Keep a class chart to record ideas (e.g., joining two pieces of wood with nails or glue). Ask students to evaluate the success of each idea using symbols.

Wood			
Combining	Separating	Forming	Finishing
glue	scissors	carving tool	fine sandpaper
stapler	saw	file	coarse sandpaper
nails	hammer claw		tempera paint
pins			crayons

- Provide set routines for students to follow for organizing tools and recycling materials. Encourage students to suggest alternative ways the class can organize tools and control waste of materials.

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their understandings of the safe use of tools and the properties of materials through practical activities. Look for evidence of students' skills and knowledge of the production process.

Observe

- As students use different tools, look for evidence of:
  - appropriate choice of tools for the task
  - proper safety procedures when using tools and equipment (e.g., safety goggles when using hammer, passing scissors handles first)
  - appropriate care and storage of tools
- As students engage in various production activities, look for evidence of:
  - appropriate choice of materials for the task
  - appropriate choice of processes for the task
  - ability to reduce and reuse materials

Question

- Ask students to use a variety of provided materials to demonstrate the processes of combining, separating, forming, and finishing. (e.g., "Choose two materials, and show me how you could combine them.") Ask questions such as:
  - What other processes could you have used with these materials?
  - What other materials could you have used for this process?
  - What could you create that would use two of the processes?

Collect

- Conference with students and collect their projects, noticing the extent to which they are able to:
  - identify safe ways of using tools
  - identify the proper use of tools
  - sort and classify materials according to classroom or community recycling routines

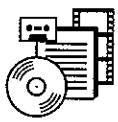
RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Technology
- The Really Practical Guide to Primary Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action

Video

- Fixing The Fence



Multimedia

- Ginn Realization Technology

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3
- Lego/Dacta Early Simple Machines

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- identify common control devices in their homes and at school
- operate familiar control devices
- identify methods to control a device manually
- make a manual control device

SUGGESTED INSTRUCTIONAL STRATEGIES

Before entering school, children learn to operate many mechanical, electric, and electronic devices. Students formalize their knowledge by identifying common devices in the classroom and at home, and by exploring control methods.

- Encourage students to identify devices in their homes that use buttons, switches, or dials as control mechanisms (e.g., light switch, toilet lever, door lock). Lead a discussion about these operations, and make a large wall chart to list and illustrate class findings.
- Ask students to collect data by drawing or collecting pictures of common manual and automatic control devices that they discover in their homes. In class, have them sort and classify the devices by cutting out drawings or pictures and gluing them into categories (e.g., buttons, dials, switches). Ask students to name the categories and explain the connection.
- Set up a centre with a variety of mechanical devices (e.g., latches, doorknobs, pegs, push buttons, switches) where students can explore the operation of control devices. Ask questions to help them understand that the operation of these control devices should result in a change in the environment (e.g., turning on a light).
- Demonstrate how to turn on a computer, launch a program, quit the program, and shut down the computer. Provide each student with a "learner's permit" to be used until they consistently demonstrate responsible operation. On completion of the "driver's training," award a computer "driver's licence" for independent operation.
- Ask students to create a waterproof plug using Plasticene and foil to control the flow of water down a drain.

SUGGESTED ASSESSMENT STRATEGIES

Children learn about controls and begin to understand systems by observing, playing, experimenting, and remembering sequences. They demonstrate their emerging skills and knowledge by relating past experiences to new situations, by explaining how they and other people use control devices, and by playing with control devices.

Observe

- Students sort and classify control devices from home and school using the actual devices, pictures, or drawings. Observe the extent to which the students are able to:
  - identify devices that have control mechanisms
  - sort and classify them in a variety of ways
  - connect the operation of a device with its control

Question

- Ask individual students to describe how to operate the computer. Record evidence of their abilities to:
  - turn the computer on and off
  - log-on and log-off
  - manipulate a specific program
  - save their work

Collect

- After working with control devices in a centre, have students present three control devices (e.g., using clay, building materials, drama, drawings) that they have seen outside the classroom. Look for evidence that students are able to:
  - identify control devices
  - make connections between the devices in the centre and devices found outside the classroom

Self-Assessment

- Students assess the control devices they have made by completing prompts such as the following:
  - I know my control device works because____.
  - One thing I learned about control devices is____.
  - One piece of advice I would give someone about building control devices is____.

RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Technology
- The Really Practical Guide to Primary Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- identify products that use various forms of energy
- demonstrate an understanding of the ways objects move
- make products that use a mechanical power source

SUGGESTED INSTRUCTIONAL STRATEGIES

Children enter school having learned about their world through play and exploration. Many of their toys use examples of energy and power, transmission and conversion. By studying these toys and creating new ones, students are introduced to the principles of power and energy. This enables them to better link these concepts to the world around them.

- Ask students to bring a mechanical toy to class and demonstrate how the toy works. Have them sort the toys into categories based on their energy source (e.g., wind-up toys, battery-operated toys).
- Working in groups, have students design and construct simple land, air, or water vehicles and demonstrate their prototypes (e.g., a car and ramp, elastic-powered boat). Ask students what they notice as the designs are demonstrated by asking such questions as, "What happens when the car goes down the ramp? What do you notice when you make the ramp steeper?" Have students keep a design portfolio to include drawings, observations, and key ideas. (See Appendix D.)

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their understandings of basic energy and power while demonstrating and communicating about how objects move. They focus on designing and constructing devices that demonstrate a conversion or transmission of energy (e.g., a car going down a ramp).

Observe

- Working in small groups, students sort a collection of products that use different forms of energy (e.g., wind-up toys, battery-powered toys, balloons, solar devices). Notice students' abilities to:
  - identify a variety of products
  - classify products consistently
  - suggest alternative ways to classify products

Question

- Students work with a partner to construct a simple land, air, or water vehicle and demonstrate their design, explaining how it moves. Ask questions such as:
  - What makes your vehicle move?
  - What did you notice that helped your vehicle to move?
  - What do you think might happen if you put it on a ramp?
  - How might this vehicle affect our environment?

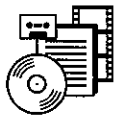
Self-Assessment

- Have students assess their own abilities to make a product that uses a power source by completing sentence stems such as the following:
  - I learned____.
  - I enjoyed____.
  - It was hard for me when____.
- Videotape students working in small groups as they design and demonstrate their devices. Show the tape to the class, and have the students record all the energy sources they see. The videotape can also be used during student-led conferences to demonstrate student learning.

RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Technology
- The Really Practical Guide to Primary Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action
- Transportation Cards



Multimedia

- Ginn Realization Technology

Manipulatives

- Lego/Dacta Early Simple Machines

PRESCRIBED LEARNING OUTCOMES

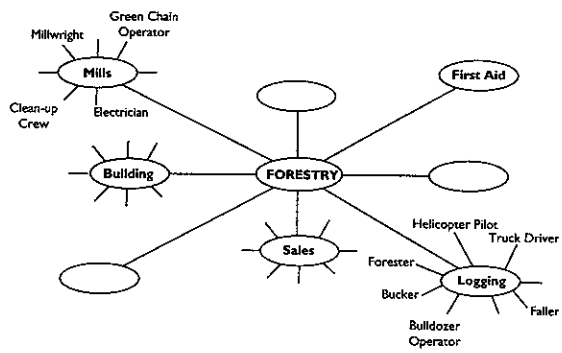
It is expected that students will:

- solve problems that come up during the design process, independently and in groups
- demonstrate confidence and a positive attitude throughout the problem-solving process
- use a variety of classroom resources when looking for answers to problems involving design
- manage materials, time, and resources
- identify the effects of technology on their lives, at home, and in the classroom
- identify occupations and role models in technological fields in their community, being sensitive to culture, gender, and physical ability

SUGGESTED INSTRUCTIONAL STRATEGIES

By working in groups, students begin to understand and appreciate the contributions of others. They develop skills to solve problems involving design and become aware of the various occupations connected with technology.

- Have students in small groups brainstorm methods to transport their group across a field without touching the ground, using only a board, a rope, and two car tires. All members of the group are included in the activity, and all ideas are accepted and valued.
- Ask each group to select one transportation method to present to the class. The presentation should include how the group worked together. In a class discussion, the group and the rest of the class could suggest ways to improve the design.
- Have students work in groups to create large wall webs on a particular technology field (e.g., forestry, manufacturing), and to connect their field to other occupations or workers. To assist students, provide an additional poster that connects occupations with career titles. Ask students to share their wall webs with the class. Lead a discussion of culture, gender, and physical ability in relation to their chosen field.



SUGGESTED ASSESSMENT STRATEGIES

By creating situations where students succeed by working together as a group, teachers foster an environment where all students realize their own self-worth and the benefits of working co-operatively.

Observe

- Invite a community guest with an occupation familiar to the students to visit the classroom and talk about how workplace problems are solved. Ask students to compare their problem solving with that of the community guest. Look for evidence that students:
  - know problem-solving strategies
  - understand the benefits of solving problems co-operatively
  - recognize group strategies and behaviours that help a group work effectively

Question

- During a brainstorming session, look for evidence that student are able to accept the ideas of others. Discuss their reactions. Ask questions such as:
  - How did you feel when you shared your ideas?
  - How does it help you when the group offers many ideas?
  - Think of one idea you heard that you had trouble accepting. Why do you think you had trouble accepting it?

Self-Assessment

- Videotape groups of students as they solve a problem involving design. Show the videotape, and have students look for evidence of working co-operatively. Have them focus on:
  - adopting group roles and responsibilities
  - remaining on-task
  - equal participation by gender, culture, and physical ability

RECOMMENDED LEARNING RESOURCES

Print Material

- Challenging Artstraws
- Design and Technology
- Investigating Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action
- Transportation Cards

Multimedia

- Ginn Realization Technology

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3
- Lego/Dacta Early Simple Machines

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- describe the purpose of technical communications used in the home
- describe a problem involving design using their own words
- describe a solution to a problem involving design
- present ideas about products they have made, and show how they work
- identify ways of enhancing technical communications

SUGGESTED INSTRUCTIONAL STRATEGIES

Improving hand-eye co-ordination and fine motor skills gives students an opportunity to use a greater number of communication tools more effectively. Students are able to do their own sequencing in pictorial form and incorporate short captions to explain the operation of an item in solving problems involving technology. They develop a greater understanding of component parts, spatial relationships, and interrelationships by exploring how shapes are formed and combined in drawings and pictures. They use these skills to explain more complex ideas, plans, and products.

- Review the basic shapes students learned about in mathematics (e.g., circles, squares, rectangles), and create a drawing using these shapes. Introduce techniques for improving the drawing (e.g., templates, rulers, grid paper), and have students recreate their original drawing.
- Provide an image and ask students to identify the basic shapes that make up the whole picture. Have students cut out and assemble basic shapes to reproduce the given image. Ask students to compare and contrast this form of technical communication with communicating by drawing.
- Ask students to select an object at home that is used for technical communications (e.g., telephone, fax, television, computer). Have students work individually to prepare a presentation for the class that includes a poster illustrating the chosen technology and a written description of its purpose.

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their abilities to communicate using technology by completing a design portfolio. (See Appendix D.) Look for evidence that students are able to explain their solution to a problem involving design, present ideas on how the design works, and define changes or alterations that would improve their final design.

Observe

- Students demonstrate their knowledge of technical communications in the home by identifying different communication devices and explaining their operation. Note the degree to which they are able to:
  - use technical language
  - incorporate ideas from others
  - use diagrams, sketches, and manipulatives to enhance their presentations

Collect

- Students complete a simple design task using basic pre-cut shapes or manipulatives and develop a design portfolio. In their portfolios, look for evidence of students' abilities to communicate by:
  - stating the problem in their own words
  - generating several possible solutions orally, with manipulatives, with sketches, and with or without a computer
  - justifying the solution they chose in terms of ease of production, aesthetics, and the incorporation of shapes

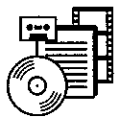
Self-Assessment

- Listen to students' conversations during collaborative problem solving. Provide students with the opportunity to analyse their work, evaluate themselves, and set goals by completing the following statements:
  - I had some trouble when____.
  - I solved this by____.
  - I would like someone to have noticed____.
  - Next time I would____.

RECOMMENDED LEARNING RESOURCES

Print Material

- Challenging Artstraws
- Design and Technology
- Investigating Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action
- Transportation Cards



Multimedia

- Ginn Realization Technology

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3
- Lego/Dacta Early Simple Machines

PRESCRIBED LEARNING OUTCOMES

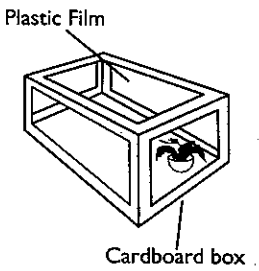
It is expected that students will:

- solve problems involving technology using appropriate tools and materials
- identify natural and manufactured materials
- follow given steps in making a product
- modify a variety of materials by combining, separating, forming, and finishing
- identify ways to reduce, reuse, and recycle materials and products to control waste
- identify the potential safety hazards presented by tools in the classroom, and use appropriate safety equipment and procedures

SUGGESTED INSTRUCTIONAL STRATEGIES

Tools have practical applications for modifying materials. Through the exploration and use of a variety of tools and materials, students learn to create products safely and accurately. Students develop a greater understanding of manufacturing processes that affect the community and the environment.

- Have students work with a partner to design and create an environment for growing seeds using a limited amount of plastic wrap, popsicle sticks, and other recycled materials. In producing the structure, students will experiment with different methods of combining, separating, forming, and finishing materials. Ensure that the students understand how to use tools and materials safely. Ask students to include concept sketches in their design portfolios. (See Appendix D.)



- Have teams of students create a chart identifying products found at home and at school, listing the type of material (e.g., natural, synthetic, composite) and the tools and processes used in its production, and identifying potential environmental hazards.
- Lead a class discussion on the visual cues given in Lego construction plans (e.g., highlight colours for new pieces, symbols show required movement). Have students construct a Lego vehicle using the assembly instructions.
- Display tools that are available for student use. Have each student create a two-column chart using the headings Do and Don't to identify safety issues associated with a tool. After sharing their charts with the class, students could use them for future reference.

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their knowledge of problem-solving processes, follow sequential steps, and use appropriate tools and materials safely when creating products.

Observe

- As students participate in design and production activities, look for evidence of their abilities to:
  - follow a given sequence of steps in the construction of a product
  - make appropriate choices of materials and tools for the construction of a product
  - use tools and materials safely
  - demonstrate innovation and creativity
  - sort and classify materials according to classroom or community recycling routines
  - reduce, reuse, and recycle materials and products

Question

- After students have worked on a problem involving design, ask questions such as:
  - What problems did you encounter in the construction of your product?
  - What would you do differently next time to improve its design?
  - What other materials could you have used in its construction?
  - What potential impacts could there be on the environment?

Collect

- Have students keep records (e.g., photographs, sketches) of the construction of the products in their portfolios. Examine their records to assess their abilities to:
  - accurately represent their construction designs
  - identify steps in construction

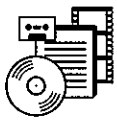
Self-Assessment

- Have students discuss the criteria for a specific product they have constructed (e.g., practicality, use of materials, innovation), and rate the effectiveness of their products according to the criteria they developed.

RECOMMENDED LEARNING RESOURCES

Print Material

- Challenging Artstraws
- Design and Technology
- Investigating Technology
- The Really Practical Guide to Primary Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action



Multimedia

- Ginn Realization Technology

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3
- Lego/Dacta Early Simple Machines

PRESCRIBED LEARNING OUTCOMES

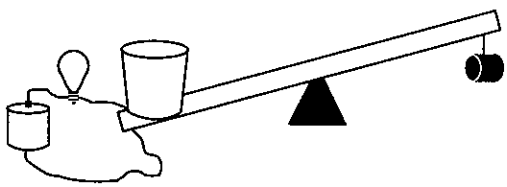
It is expected that students will:

- identify common control devices in their home and school environments that sense, switch, and regulate
- design and make products that use control devices

SUGGESTED INSTRUCTIONAL STRATEGIES

All control systems, from the simplest to the most complex, operate on the principles of sensing, switching, or regulating. When students begin thinking in these terms, they begin to understand the control aspect of technology. This is reinforced by activities that produce a functioning control device.

- Have students collect pictures of a variety of control devices and sort them into three categories: sensing (e.g., smoke alarm), switching (e.g., light switch), and regulating (e.g., TV volume). Some items will fit into more than one category.
- Have teams of students design and construct a first-class lever using a meter stick with a styrofoam cup attached to one end and a rock on the other. Ask students to place a fulcrum so that when the cup is filled with sand, the rock is lifted. As an extension, have students create a simple electric circuit (using a dry cell, wires, a bulb) that turns a light on or off when the cup is filled. Have students enter their ideas, solutions, and sketches into a design portfolio.



SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their understandings of control devices in their explanations and demonstrations.

Question

- As students share and explain their work samples (e.g., drawings, photographs, descriptions, models) of control devices, ask the following questions:
  - What category do you think this control device belongs to: sense, switch, or regulate?
  - How else could this control device be used?
  - Where else have you seen this control device used?
  - What is different about how it is used?

Collect

- Collect the sequences of pictures students have drawn of control devices at home and at school. Notice the extent to which students are able to:
  - accurately identify a control device
  - correctly sequence input, process, and output
  - identify cause-and-effect relationships

Self-Assessment

- Have students assess the manual control device they made by completing prompts such as:
  - I know my control device works because____.
  - One thing I learned about control devices is____.
  - One piece of advice I would give someone about building a control device is____.

RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Technology
- Investigating Technology
- Lego/Dacta Science and Technology Activities Collection
- The Really Practical Guide to Primary Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action

PRESCRIBED LEARNING OUTCOMES

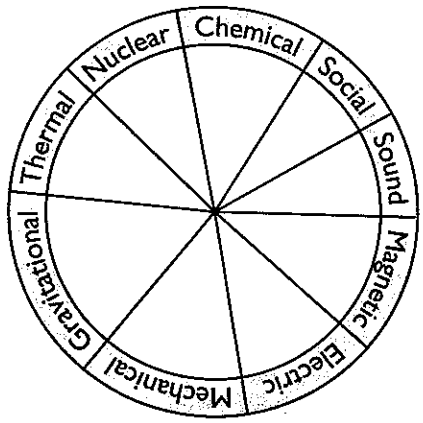
It is expected that students will:

- identify a variety of energy sources
- identify how energy can be transferred and converted to make devices function
- design and make a device that is powered by an energy source

SUGGESTED INSTRUCTIONAL STRATEGIES

Exploring energy and power helps students to understand the important role they play in our world. Through design and construction, students begin to develop an understanding of energy sources and power. They are introduced to a range of energy sources and discover how energy can be used to drive machines.

- Ask students to survey their homes and list energy-powered devices used in daily activities (e.g., lawnmower, refrigerator, microwave). Have students produce classroom charts categorizing the form of energy used (e.g., electric, mechanical, chemical). Some devices will fit into more than one category. Provide students unfamiliar with common household items with an illustrated list to take home.



- Have students design and construct several devices powered by a variety of energy sources (e.g., elastic band, fan, battery) and share their design discoveries in a class discussion. Post ideas and results for future reference.
- Lead a discussion of energy conversion and transmission using familiar materials (e.g., rubber band, wind-up toy, waterwheel). Have students design and construct a device that will perform a specific task (e.g., move an object a specified distance). Have students identify how their device converts or transmits energy, and record their ideas and construction plans in a design portfolio.

SUGGESTED ASSESSMENT STRATEGIES

Assessment focusses on the students' abilities to recognize that all energy has the potential to make a device function. Students demonstrate their understandings of energy sources and power by designing and constructing simple devices and explaining to others how they work.

Observe

- As students design and construct toys driven by an energy source, note:
  - the students' abilities to connect sources of energy with devices that they operate
  - the degree of creativity and sophistication in the ideas presented
  - the extent to which the students can relate their prior knowledge of energy sources

Collect

- Students individually collect pictures of devices that use energy, and sort and classify the pictures according to their energy source. Look for evidence that students:
  - correctly identify the energy source
  - recognize the sorting categories
  - classify accurately

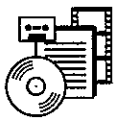
Self-Assessment

- Teams of students demonstrate their devices, and peers provide feedback by completing a peer assessment sheet:
  - I think the group made a good choice of an energy source because____.
  - I saw evidence of a design plan when____.
  - I saw evidence that the group accurately designed their device to perform the task of ____ (e.g., fly the furthest, fly the highest) when____.
  - One question I have for the group is____.

RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Technology
- Investigating Technology
- Lego/Dacta Science and Technology Activities Collection
- The Really Practical Guide to Primary Technology
- Science, Technology and Society Themes for Early Childhood
- Technology
- Technology in Action
- Transportation Cards



Multimedia

- Ginn Realization Technology

Manipulatives

- Lego/Dacta Early Simple Machines

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- demonstrate risk taking and perseverance throughout the problem-solving process
- organize their work to improve the management of materials, time, and resources
- express personal thoughts and feelings about the effects of technology in their lives, at home, and in the classroom
- identify past and current technological occupations and role models, being sensitive to culture, gender, and physical ability

SUGGESTED INSTRUCTIONAL STRATEGIES

Technological changes affect the lives of students at home and at school. Students learn to work independently and in groups to plan and execute tasks to solve problems. In doing so, they become better able to adapt to a technological society.

- Have students work independently to design a timeline representing the development of a household appliance, from its early stages to the modern version (e.g., washing machine). At each point in the timeline, have students write a paragraph from the user's point of view. To prompt critical thinking, ask students to explain why it was created and who developed it.
- Ask students in groups to design and construct a board game about the life of BC First Nations people, emphasizing tools and techniques and those who made and used them. Give each group a budget to develop their abilities to organize and manage materials and time. Students could incorporate a spinning wheel, cards, and dice. Ask them to write clear directions for playing the game. A work plan such as the following could be included:

WORK PLAN			
Job	Change	When	Done

- Have students investigate transportation technologies at the time of the explorers and compare them to current transportation technologies, particularly technologies related to trade (e.g., canoe—freighter). Ask students to present their findings to the class.

SUGGESTED ASSESSMENT STRATEGIES

Observing students as they work individually and in small groups provides opportunities to note the extent to which they can discuss the impact of technology on themselves and society. Assessment practices can be used to encourage risk taking and perseverance when problem solving.

Question

- Conference with students about their group processes. Look for evidence of group problem-solving strategies and behaviours. Ask questions such as the following:
  - How did your group solve a problem you encountered? Provide an example.
  - How did you contribute to your group?
  - How would you change the way your group worked?

Collect

- Have students research the lifestyles of First Nations people before European settlement and list occupations within those traditional communities. Invite a First Nations guest to discuss modern First Nations communities. Ask students to create a Venn diagram to illustrate the similarities and differences between historical and modern occupations. Collect the Venn diagrams, and look for evidence of students' abilities to:
  - understand how technological occupations and roles have changed over time
  - identify historical First Nations occupations

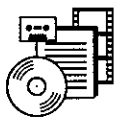
Self-Assessment

- Students design and play their own board game. Have students complete both a self-assessment and a group assessment by completing the following stems in written or pictorial form:
  - A time I contributed ideas to my group was____.
  - Two ideas I learned from others were____.
  - I noticed our group members being respectful of each other when____.
  - Our group members shared jobs such as____.

RECOMMENDED LEARNING RESOURCES

Print Material

- Challenging Artstraws
- Folens Technology
- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Light Magic
- The Resources and Projects Book
- Technology
- Technology in Action
- Transportation Cards
- Visual Guides Series



Multimedia

- Ginn Realization Technology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- describe a solution to a problem involving technology
- use established criteria for designing presentations of ideas
- develop a plan and clearly communicate ideas for creating a product or system
- use appropriate tools in the presentation of ideas

SUGGESTED INSTRUCTIONAL STRATEGIES

Students explore a variety of ways to present information and refine their technical communication skills by using established criteria for presentations. They create written plans and diagrams to outline a construction process for others to follow, and use feedback to improve their skills.

- Have students collect examples of plans and assembly instructions (e.g., model, toy, garden shed), and have a class discussion about how these instructions help the assembly process. Using appropriate drawing tools (e.g., CAD programs, rulers, templates, protractors), ask students, with a partner or in small groups, to design a set of sequential plans to explain the assembly process of a model of their own design. Ask students to build a model from their own plans, adding details to clarify the assembly process for others, and present it to the class for analysis. In their design portfolio, have students include the research, concept sketches, prototype, and final drawing. (See Appendix D.)
- Have students exchange plans, replicate the models, compare them to the original model, identify strengths and weaknesses, and suggest modifications to the plans.

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their abilities to successfully use a variety of tools to develop, design, and construct a model. Through the use of a design portfolio, students keep records of their thinking during the design process.

Observe

- Students design a model with established design parameters. Look for evidence that students can:
  - use design tools (e.g., rulers, templates, protractors) appropriately to develop a scale drawing
  - develop a set of sequenced plans for constructing a model
  - incorporate ideas from others into their existing design plan
- Videotape the students' design presentations. Look for evidence that students are able to:
  - communicate their ideas clearly to others
  - answer questions of clarification
  - describe their design process

Collect

- Students solve a problem involving specified design parameters. (e.g., Build a tower 20 cm tall that can support 100g.) Examine the design portfolios for evidence that students are able to:
  - state the parameters and problem in their own words
  - generate several possible solutions
  - justify the solution they chose
  - complete an accurate representation (drawing) of their solution
  - accurately communicate a sequence of assembly steps to their peers

Self-Assessment

- When students have completed a model or product, ask questions such as:
  - How would you teach someone else?
  - How do you feel about your work?
  - What did you find easy or hard when you were explaining your work to others?

RECOMMENDED LEARNING RESOURCES

Print Material

- Challenging Artstraws
- Investigating Technology
- Light Magic
- The Resources and Projects Book
- Technology
- Technology in Action
- Transportation Cards
- Visual Guides Series

Multimedia

- Ginn Realization Technology

Software

- The Way Things Work - CD-ROM

Manupulitives

- Artstraws
- Brio-Mec Educational Set 3

PRESCRIBED LEARNING OUTCOMES

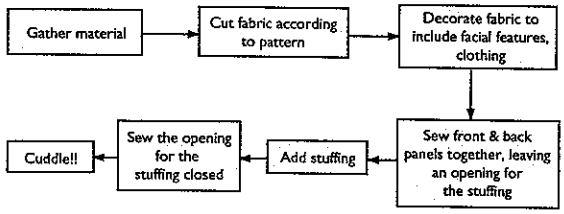
It is expected that students will:

- choose appropriate tools and materials for the construction of a product or system
- develop a design, make a product or system, and determine the steps for its construction
- determine ways to reduce, reuse, and recycle waste materials
- identify natural and manufactured materials used in the manufacture of a product or system
- modify a variety of materials by combining, separating, forming, and finishing to construct products or systems
- identify the potential hazards of classroom tools, and use appropriate safety equipment and procedures

SUGGESTED INSTRUCTIONAL STRATEGIES

Students demonstrate their technical knowledge, skills, and safety procedures in the design and construction of products or systems using natural and manufactured materials. They become more proficient using tools and gain confidence in solving problems.

- Have students work in small groups to research the steps used in the construction of a product. Ask them to create a flow chart of the steps and present it to the class. Projects could include how pencils are manufactured, or how a teddy bear is sewn together.



- Encourage students to design and construct a puppet of their favourite literary or cartoon character using recycled materials. Ask them to collect related ideas, drawings, and documentation in a design portfolio.
- Have students research the advantages and disadvantages of natural (e.g., wood, cotton) and manufactured (e.g., particle board, synthetics) materials used in common household products. Ask them to identify the strength, durability, environmental implications, and safety of these materials. Have students design and construct models (e.g., doll furniture, boat, toy) using both natural and manufactured materials.
- Ask students in pairs to design and construct a card game matching the safe use of tools, processes, and materials with situations requiring their use.

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their abilities to work confidently and safely on a variety of design and production problems using the processes of combining, separating, forming, and finishing.

Observe

- Students demonstrate construction of a product they have designed. Look for evidence that students are able to identify
  - a sequence of construction steps
  - necessary tools and materials
  - processes used
  - ways the design could be modified or alternative materials used
  - impacts on the individual, community, and global society

Question

- While students work on the design of their products, ask individual students questions such as:
  - Why did you select these materials?
  - What other materials could you use?
  - Describe a problem that came up during the design process and how you solved it.
  - How would you teach someone to use your product?

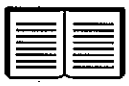
Collect

- Collect the products and examine them for evidence of:
  - innovation and creativity
  - a variety of possibilities for the use of tools, processes, and materials

Self-Assessment

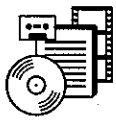
- Have students assess their own safety procedures by completing statements such as:
  - Two things I have done to prevent injuries to myself are_____.
  - One potentially dangerous situation I saw was____.
  - To stop it from happening I____.
  - One piece of advice I have for others using this equipment is____.

RECOMMENDED LEARNING RESOURCES



Print Material

- Challenging Artstraws
- Folens Technology
- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Light Magic
- Machines At Work
- The Really Practical Guide to Primary Technology
- The Resources and Projects Book
- Technology
- Technology in Action



Multimedia

- Ginn Realization Technology

Software

- The Factory
- The Way Things Work - CD-ROM

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3
- Capsela
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- describe the function of control devices used in the community
- describe a method to control a device
- design and construct a control device

SUGGESTED INSTRUCTIONAL STRATEGIES

Awareness and understanding of control devices allows students to realize the effects these devices have on daily life. Students use a variety of materials and equipment to explore the concept of control, and they design and construct a simple control device.

- Take students on a field trip within the school or community. In class, ask students to list the control devices they saw and experienced and to create an information chart categorizing the control devices (e.g., sensors—infra-red beam in a store door; switches—stereo button; regulators—water tap). Lead a class discussion on the function of these control devices.

Control Devices		
Sense	Switch	Regulate

- Have students work in small groups to create a "steady hands" game—an electric circuit consisting of a conductor, a power supply, and a buzzer. The object of the game is to pass an insulated wire wand with a bare wire loop on the end through the conductor wire, which is connected to a power supply and a buzzer. If the wand touches the wire, the circuit will be completed and the buzzer activated.
- Provide students with materials to make a variety of simple electric circuits. Have students incorporate switches to control lighting a bulb under several conditions (e.g., series, parallel circuits, more than one bulb).

SUGGESTED ASSESSMENT STRATEGIES

By observing the operation of control devices in their environment, students assess the effects of technological devices on their lives. By constructing products using control devices, students demonstrate their understanding of the role of control devices in the design and operation of various products and processes.

Observe

- As students participate in a field trip to record control devices, watch and listen for evidence that they are able to:
  - identify the purpose and function of control devices
  - make connections between control devices they find on the field trip and past experiences
  - assess the effects on the user and the environment

Collect

- Students record the design and construction of their products in a design portfolio. Look for evidence of their abilities to:
  - identify the purpose of control devices in their product
  - explore alternative methods for controlling a product
  - categorize two types of control devices
  - choose appropriate control devices
  - identify and solve problems related to control

Self-Assessment

- After a field trip to record control devices, ask students to complete the following sentence stems:
  - Some of the control devices that I knew about before our trip were____.
  - Two new control devices I know about are____.
  - I found it____(easy, hard) to identify control devices because____.
  - The way this device affects my life is____.

RECOMMENDED LEARNING RESOURCES

Print Material

- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Lego/Dacta Science and Technology Activities Collection
- Light Magic
- Machines At Work
- The Really Practical Guide to Primary Technology
- Technology
- Technology in Action

Software

- The Factory
- The Way Things Work - CD-ROM

Manipulatives

- Capsela
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- identify simple machines
- identify various forms of energy and how energy can be stored
- identify devices that are used to convert, store, and transmit energy
- design and construct devices that use simple machines

SUGGESTED INSTRUCTIONAL STRATEGIES

Simple machines help people do work by increasing speed or force or by changing the direction of a force. Students work with and replicate a variety of everyday items incorporating simple machines. They increase their understanding of how energy is stored, converted, and transmitted, and realize how simple machines affect their lives.

- Encourage students to work with a partner or in small groups to design and create simple elastic-powered cars using common materials (e.g., balsa wood, cardboard, glue). Students present their explanation of how the device converts, stores, and transmits energy.
- Have students work in small groups to survey the playground. Ask them to observe and record evidence of types of simple machines (e.g., swing, teeter-totter) and share their findings with the class using lists, webs, or charts.
- In a drama-based activity, have students work in groups to create a machine that uses each person as a working, integrated part. Have them name the machine, give its purpose, and explain how it works (e.g., car wash).
- Ask students to design and build a device (e.g., automatic book opener, backscratcher) using popsicle sticks, rubber bands, spools, doorknobs, string, and so forth. Have them describe their steps in making the device, and record their ideas and construction plans in a design portfolio.
- Create centres where students can explore household items that incorporate six simple machines (wedge, inclined plane, pulley, lever, wheel and axle, screw). Provide materials for students to use to construct a household item of their choice.

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their knowledge of energy forms, energy storage, and simple machines through representations such as charts, journals, drama activities, building devices, and demonstrations.

Observe

- Observe students as they work in small groups to design and construct devices that use simple machines. Have students develop a design portfolio that includes research, recorded descriptions, prototypes, documentation, and final products. Look for evidence that students are able to:
  - use simple machines effectively to solve problems involving design
  - identify a wide variety of energy sources
  - make connections between the energy source and the problem involving design

Collect

- Have students videotape themselves planning and presenting their dramatized machine. While watching the tape, ask other students questions using prompts such as:
  - Who is the energy source?
  - Who is storing the energy?
  - Who is transmitting the energy?

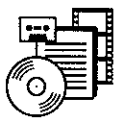
Self-Assessment

- Help students to develop criteria for designing and constructing devices that use simple machines by listing what a good device would look like.
  - Record their responses on a chart, and display it in the classroom so students can refer to the criteria as they design and construct their device.
  - As the devices are completed, have students assess one another's projects, looking for evidence of the listed criteria. Have students collect evidence as they observe, talk, and interact with others.
  - Notice the extent to which students are able to observe and comment on the progress of other students.

RECOMMENDED LEARNING RESOURCES

Print Material

- Folens Technology
- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Lego/Dacta Science and Technology Activities Collection
- Light Magic
- The Really Practical Guide to Primary Technology
- The Resources and Projects Book
- Technology
- Technology in Action
- Transportation Cards
- Visual Guides Series



Multimedia

- Ginn Realization Technology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Capsela
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- solve problems that come up during the design process, independently and in groups
- manage their work and resources during design activities
- analyse the positive and negative effects of technology in their lives
- categorize and compare various occupations in technological fields, and discuss how some have been the subject of culture, ability, and gender stereotyping

SUGGESTED INSTRUCTIONAL STRATEGIES

Knowledge of the relationship between people and technology helps us to discover our own place in the world. When students investigate occupations in technological fields, they become aware of and discuss their thoughts about gender, cultural, and ability stereotyping. They also consider the positive and negative effects of technology on society and the environment. Students explore these ideas through writing, interviews, and class discussions.

- Have students create a questionnaire for interviewing people who work in various technological fields. Lead a class discussion about what makes a good interview, and help them to generate questions that will provide material for comparing occupations. Have students role play to practise interviewing techniques. Ask each group to develop a schedule for their interviews, including who they will interview, the date, and time. As an extension, students could create an audiotape or video presentation of an interview for the class.
- Ask each student to maintain a learning log evaluating the impact of technological products on their lives (e.g., computer, television, satellite). The log could include associated occupations and discuss the positive and negative effects of each product.
- Encourage students to work in small groups to solve a variety of problems involving the design of structures (e.g., crossing a river, transporting water to buildings within a community, sheltering a canoe). As students work to solve these problems, have them identify and record in a learning log the specific tasks they have chosen to work on that day, the resources required, and a description of the day's progress.

SUGGESTED ASSESSMENT STRATEGIES

Students can understand the importance of their roles in groups by thinking about how others perceive them in group situations. Receiving feedback from their peers helps students to become aware of how they affect the process. Students develop their abilities to analyse group functioning when they have opportunities to engage in peer and self-assessment in a non-threatening atmosphere.

Observe

- While students work in small groups to develop interview questions, observe their abilities to work co-operatively. Look for evidence of:
  - the adoption of group roles and responsibilities
  - the ability to remain on-task
  - the ability to respect the ideas and feelings of others

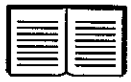
Question

- During class presentations on technological careers, assess students' abilities to discuss a variety of careers using prompts such as:
  - What are two things you learned that you did not know before?
  - Name one thing you used to think about a career but now think differently.
  - What would you have to know or be able to do in order to do this job?
  - Name two careers for which you would need similar knowledge and skills.
  - What careers are gender or ability specific? How might that affect your life?

Self-Assessment

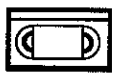
- After interviewing people who work in various technological fields, students analyse their experiences in their journals. To focus their thinking, provide students with sentence starters such as:
  - The most important thing I learned was____.
  - Something that surprised me was____.
  - Careers that interest me include____.

RECOMMENDED LEARNING RESOURCES



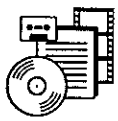
Print Material

- Challenging Artstraws
- Design and Make Folios
- Folens Technology
- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Light Magic
- The Resources and Projects Book
- Technology
- Technology in Action
- Transportation Cards
- Visual Guides Series



Video

- Parking Places



Multimedia

- Ginn Realization Technology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- gather information from available resources to solve problems involving technology
- describe a solution to a problem involving technology
- determine appropriate criteria for the presentation of ideas
- choose appropriate tools for the presentation of ideas
- develop a plan and communicate ideas for creating products and systems

SUGGESTED INSTRUCTIONAL STRATEGIES

The skills developed in communications provide students with the abilities to access and process information. Students make presentations about design and construction ideas to develop effective communication skills. They learn to use a variety of technological devices (e.g., overhead, video, computer) to communicate ideas according to specified criteria.

- Ask students to undertake a research project on a specific topic (e.g., forests) that requires them to use various technological resources, such as a computer card catalogue, CD-ROM, or videotape. Have students complete a research information sheet that includes:
  - the type of information sources used (e.g., CD-ROM)
  - topics for title, subject, and word searches, with examples of articles and the number of resources found in each search
  - key words identified from search information that could be used in subsequent searches
  - a flow chart demonstrating an understanding of the general-to-specific organization of their search
- Ask students to work in groups to create a scale drawing using grid paper for the design of a piece of jewellery or a door plate for their rooms with their initials on it. Encourage students to use lines to create various shapes and patterns (e.g., circle, square, spiral) and to develop several different examples from which to design the final products. A computer graphic or CAD program may be used to create the scale drawing.

SUGGESTED ASSESSMENT STRATEGIES

As students gain experience using a variety of communication tools to research topics (e.g., CD-ROM, Internet, card catalogue, video), their inquiries become more focussed and refined. Projects involving design provide opportunities for students to demonstrate their abilities to access information. Students' abilities to use technological tools to help plan and communicate ideas can be assessed by asking them to document solutions in a design portfolio. (See Appendix D.)

Observe

- Students use a CD-ROM-based encyclopedia to research a problem involving design. Note their abilities to:
  - use key words to search for information on a given topic
  - streamline their search from a general heading to a specific topic
  - use on-line help functions for assistance

Collect

- Examine students' scale drawings of a product (e.g., jewellery with their initials), and observe their abilities to:
  - choose a reasonable scale
  - create an accurate drawing with the required dimensions
  - incorporate initials effectively into the design
  - use basic shapes in the design
  - use design tools appropriately to create drawings

Self-Assessment

- After completing research on a problem involving design, students assess their learning experience by answering such questions as:
  - Where could you go if you wanted more information on this topic?
  - Who else could you have asked?
  - Can you identify someone who works in this area who could give you information?
  - What are three things you found out that you want other people to know?

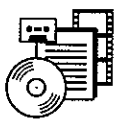
RECOMMENDED LEARNING RESOURCES

Print Material

- Challenging Artstraws
- Investigating Technology
- Light Magic
- The Resources and Projects Book
- The Sky's the Limit with Math and Science
- Technology
- Technology in Action
- Technology I.D.E.A.S.: A Teaching Resource Book
- Transportation Cards
- Visual Guides Series

Video

- Parking Places



Multimedia

- Ginn Realization Technology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- choose appropriate tools and materials for the design and construction of products or systems
- identify the potential hazards of tools, and use appropriate safety equipment and procedures
- demonstrate ways to reduce, reuse, and recycle materials and products to control waste
- modify a variety of materials by combining, separating, forming, and finishing to construct products or systems
- develop a design for a product or system, and determine the steps for its construction

SUGGESTED INSTRUCTIONAL STRATEGIES

As students explore familiar products and materials used in their daily lives, they begin to understand how technology extends natural human abilities to make life easier. In order to produce a useful product, students learn how to design from different viewpoints, determine the steps taken in construction, and select the appropriate tools and materials to improve strength, durability, flexibility, and functionality, and lessen the environmental impact.

- Introduce a model of an elastic-powered mechanical device (e.g., boat, vehicle, airplane), and ask students to create a replica. Have students work in small groups to determine and record the steps taken in its construction. Ask them to list the materials and their properties (e.g., twisting an elastic band for torsion) and the tools used. Have each group make a presentation to the class, and rate their own design and procedures. Encourage students to use group discussion to refine and modify the original product before its final construction. As a follow-up, students could create a video presentation of the steps involved in the production of their product, or demonstrate it for parents during an open house.
- Review the fundamental principles of production (combining, separating, forming, finishing) by displaying a variety of tools and materials and discussing their functions. Have students collect pictures and work in small groups to create a web or chart representing the four principles. Encourage each group to share their work with another group, and post their findings around the classroom.

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their technical skills and knowledge of safety procedures and production processes when they use a variety of tools and materials in different problem-solving situations. Teachers can help students to clarify and communicate what they know by asking questions about the processes and strategies that students are using.

Observe

- As students design and construct products, observe their abilities to:
  - use appropriate safety equipment and procedures
  - use production processes to create a quality product (e.g., edges evenly matched, sound structure)

Collect

- Collect student work samples to assess the depth of their use of production processes (combining, separating, forming, finishing), materials, tools, and products. Record these findings on a web or chart.
- Students list the steps required to construct a mechanical device. Look for evidence of their abilities to:
  - identify all necessary steps
  - order a sequence of steps logically
  - use correct terminology

Self-Assessment

- After completing a replica of a mechanical device, students may use a Venn diagram to compare their construction to the original. Provide prompts such as:
  - What is the most successful part of your construction?
  - How does your construction compare to the original?
  - What would you do differently next time?
  - What effect will it have on the user, the community, and global society?

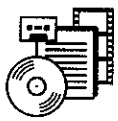
RECOMMENDED LEARNING RESOURCES

Print Material

- Challenging Artstraws
- Design and Make Folios
- Folens Technology
- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Light Magic
- Machines At Work
- The Really Practical Guide to Primary Technology
- The Resources and Projects Book
- The Sky's the Limit with Math and Science
- Technology
- Technology in Action

Video

- Parking Places



Multimedia

- Ginn Realization Technology

Software

- The Factory
- The Way Things Work - CD-ROM

Manipulatives

- Artstraws
- Brio-Mec Educational Set 3
- Capsela
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

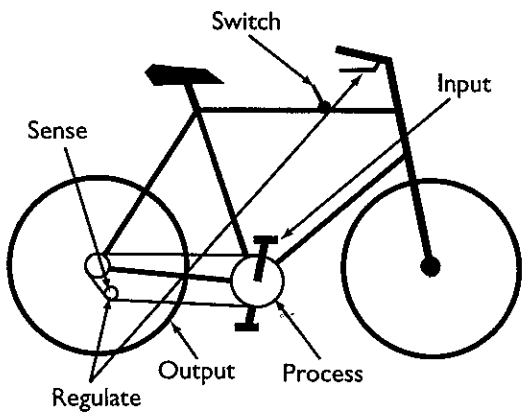
It is expected that students will:

- describe familiar control systems and the devices that control them
- describe a sequence of steps to control a device
- design and construct a control device that senses, switches, or regulates

SUGGESTED INSTRUCTIONAL STRATEGIES

As students investigate control systems, they expand their awareness of increasingly complex sensing, switching, and regulating devices. They develop an understanding of systems as they become aware that control devices involve input, process, and output. Students learn that with appropriate tools and materials, they can control the environment to meet their needs.

- Provide students with criteria for control devices or systems. Ask them to list as many common control devices or systems as they can think of based on the criteria. Have students work in small groups to compare their lists. After sharing their findings with the whole class, send small groups of students to look for control devices or systems within the school.
- Present a common control device or system (e.g., thermostat) to students. Take it apart and explain how it works, showing each part of the system. Have students sequentially list or draw the steps necessary for the control device or system to function.
- Have students work in small groups to disassemble an old operating system (e.g., a bicycle) and identify sensing, switching, and regulating devices. Ask students to replicate the devices they identified using a variety of tools and materials (e.g., Lego).



SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their understandings of control devices as they learn to define, categorize, and relate the operation of devices within a system. Assessment focusses on the students' abilities to connect the function of a control device to its role in a system and to explain these concepts using a device they have designed and constructed.

Observe

- Have students create and present skits to the class representing a sequence of steps or components required to control a device. (e.g., Simulate an electric circuit.) While students are presenting, look for evidence that:
  - all necessary steps are included
  - the steps are presented in a logical order
  - cause-and-effect relationships are understood

Question

- Conference with students about their understandings of input, process, and output. Ask students to:
  - show possible connections between input, process, and output
  - suggest a way to change a control device keeping the same output
  - distinguish between devices that sense (e.g., motion detector), switch (e.g., light switch), and regulate (e.g., thermostat)

Collect

- Using students' three-column charts (input, process, output), notice the extent to which they can:
  - accurately identify control devices (e.g., thermostat, brain, light switch)
  - logically categorize input, process, and output statements

Self-Assessment

- Have students review their design portfolios by providing prompts such as:
  - The most important thing I learned is____.
  - I struggled with____.
  - I used to think____ but now I know____.

RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Make Folios
- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Lego/Dacta Science and Technology Activities Collection
- Light Magic
- Machines At Work
- The Really Practical Guide to Primary Technology
- Technology
- Technology I.D.E.A.S.: A Teaching Resource Book
- Technology in Action

Software

- The Factory
- The Way Things Work - CD-ROM

Manipulatives

- Capsela
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

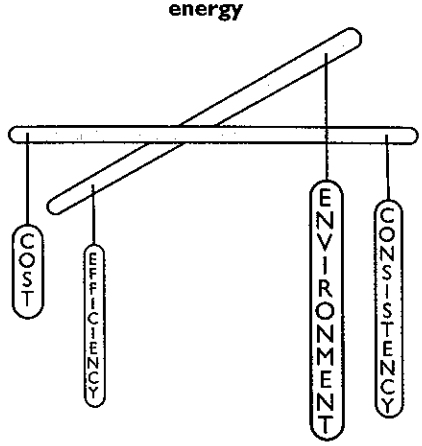
- describe ways to conserve energy
- identify alternative ways to make an existing product or system function
- identify various forms of energy and power
- design and construct devices that use simple machines

SUGGESTED INSTRUCTIONAL STRATEGIES

The depletion of non-renewable energy reserves is a worldwide concern. Conservation and the search for alternative energy sources have become part of daily life. Students pursue creative solutions to the consumption of non-renewable energy resources by identifying various power sources, applying those sources in different ways, and seeking energy and power alternatives.

- At the beginning of the school day, have students fill three pop cans with cold tap water or refrigerated water. One can has no insulation, the second is wrapped in paper, and the third is encased in a foam insulator. At regular intervals, ask students to measure, record, and graph the temperature of the water in each can. At the end of the day, help students develop conclusions and relate the concepts of insulation and the conservation of energy to heating or air-conditioning a house.
- Have students use three different sources of energy (e.g., wind, water, solar) to generate electricity to illuminate a bulb.
- Set up a small DC generator to be driven by a stream of water from a tap. Hook the output wires to the bulb. Caution students about the mix of electricity and water.
- Set up a generator to be driven by wind, either from a fan or breath.
- Hook up a solar cell to a bulb.
- In a group discussion, have students evaluate each of the energy sources for efficiency, consistency, cost, and environmental impact.

Finding a balance for energy



SUGGESTED ASSESSMENT STRATEGIES

The design and construction of simple machine systems provides students with the opportunity to extend and demonstrate their knowledge of energy sources and their abilities to convert energy. Assessment focusses on their understanding of—and commitment to—energy conservation from a global perspective.

Observe

- As students prepare a plan for energy conservation in their homes, listen to their conversations, and look for evidence that students are able to:
  - identify products that are major users of energy in their homes
  - recognize and articulate the impact of their behaviour on energy consumption
  - use correct terminology

Question

- As students investigate insulation as a heat-saving device (e.g., pop can activity), invite them to discuss their ideas about heat conservation. Pose questions such as:
  - How do you predict the temperature will change in each can?
  - What do you know about insulation that helps you to make these predictions?
- After examining the results of the experiment, assess students' abilities to apply their knowledge. Ask questions such as:
  - What do you think would happen if you used hot water in this experiment?
  - Think of two ways you use insulation in your life.
  - How could you use this information to make your home more energy efficient?

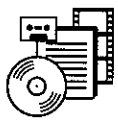
Self-Assessment

- After completing a design project, students assess their learning by responding to the following stems:
  - I think my plan would work because____.
  - The most important thing I learned about energy conservation is____.
  - One connection my plan has to global energy conservation is____.

RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Make Folios
- Folens Technology
- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Lego/Dacta Science and Technology Activities Collection
- Light Magic
- The Really Practical Guide to Primary Technology
- The Resources and Projects Book
- The Sky's the Limit with Math and Science
- Technology
- Technology I.D.E.A.S.: A Teaching Resource Book
- Technology in Action
- Transportation Cards
- Visual Guides Series



Multimedia

- Ginn Realization Technology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Capsela
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- demonstrate, independently and in groups, confidence and a positive attitude when solving problems involving technology
- compare and contrast solutions to problems involving design and technology in other cultures
- describe how technological change affects their quality of life at home, in the community, and in society
- identify career paths in technological fields, and examine possible career directions
- investigate the traditional roles of people of different cultures and gender in technological fields

SUGGESTED INSTRUCTIONAL STRATEGIES

Students use knowledge gained from past problem-solving experiences to compare and contrast technical solutions in Canadian society to those in other cultures. Awareness of varying cultural approaches to design solutions highlights the idea that there are several effective solutions to a single technological problem.

- In a small group have students design and make a prototype of a system for collecting and purifying drinking water that could be used in a developing country using common household materials (e.g., coffee filter, cheesecloth, colander). Ask them to describe their design, materials, and production processes, and present a picture of their prototype. To facilitate understanding of the importance of working effectively in a group, brainstorm reasons to work co-operatively.

- Have students work with a partner to design and construct a model of a shelter that will withstand the climatic problems of a particular area (e.g., hurricanes in the Caribbean, severe winters in the Arctic). In a class presentation, students outline the unique design features of their prototype (e.g., the processes and materials they used).
- Ask students to create a chart comparing solutions to a technological problem (e.g., obtaining purified water, shelter) in several different cultures. Have students work with others to suggest reasons for the differences in the solutions (e.g., technical knowledge, contact with other cultures, physical environment). Provide students with a set of discussion questions on how levels of technology affect quality of life.

SUGGESTED ASSESSMENT STRATEGIES

Students extend their thinking to include a global and historical perspective of technology. This allows students to examine their role in and recognize their impact on a technological society. Having them analyse their interactions during group activities makes it possible to assess the extent to which they

RECOMMENDED LEARNING RESOURCES

Print Material

- Challenging Artstraws
- The Car
- Design and Make Folios

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- use appropriate research strategies to solve problems involving technology
- develop a plan and clearly communicate ideas for creating products or systems
- choose appropriate tools to represent ideas to others
- determine appropriate criteria for the presentation of ideas
- select appropriate methods to convey information

SUGGESTED INSTRUCTIONAL STRATEGIES

Students continue to develop their communication skills by working collaboratively to solve problems involving technology. By investigating a product from its inception to its completion, students learn to research, communicate, and present solutions to problems that come up during the design process.

- Lead a class discussion to formulate a set of criteria to design a plan for a space station or an underwater marine-research station of a specific size and population. Divide the class into teams, and delegate one of the following jobs to each team:
  - communication systems
  - environment systems
  - transportation systems
  - resource management
  - emergency systems
- Have each team submit design requirements for class review and approval. Have students incorporate the revised design into a scaled drawing, then place it on a master plan mounted for display.
- Ask each team to create an audio-visual presentation demonstrating how its component operates and fits into the master plan. Help students generate a list of presentation requirements and criteria for an effective presentation.

SUGGESTED ASSESSMENT STRATEGIES

Students gain proficiency in solving problems involving technology and in communicating their ideas. As the class works in teams to solve a single problem involving design, the students' abilities to communicate effectively can be assessed.

Observe

- Have students create an audio-visual presentation demonstrating their solution to a problem involving design, and present it to audiences other than their peers. Look for evidence of:
  - effective use of voice and body language
  - effective use of a variety of presentation tools
  - appropriate sequencing of information
  - presentation tailored to the specific audience

Collect

- Students complete the team project and produce design portfolios. (See Appendix D.) Examine the portfolios for evidence that students are able to:
  - identify and address all design parameters
  - use a variety of resources to research relevant information relating to problems involving design (e.g., CD-ROM encyclopedia, NASA hook-up via modem)
  - create concept sketches examining potential solutions
  - complete a scale drawing of their solution and show how it will be integrated into the total system

Self-Assessment

- Students complete a design plan and assess their abilities to communicate their plan by completing sentence stems such as:
  - I made it easy for people to understand my plans when I____.
  - Three examples that show when I used technical language correctly are____.
  - One thing I would change if I could communicate my plan again is____.

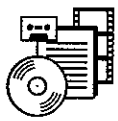
RECOMMENDED LEARNING RESOURCES

Print Material

- The Car
- Challenging Artstraws
- Investigating Technology
- Light Magic
- Q Science Series
- The Resources and Projects Book
- The Sky's the Limit with Math and Science
- Technology
- Technology Craft Topics
- Technology I.D.E.A.S.: A Teaching Resource Book
- Technology in Action
- Transportation Cards
- Visual Guides Series

Video

- Parking Places



Multimedia

- Experience Technology: Communication, Production, Transportation, Biotechnology
- Ginn Realization Technology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Artstraws

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- determine a sequence of steps before making a product or system based on a design
- identify and use suitable tools, processes, and materials for combining, separating, forming, and finishing to construct products or systems
- use appropriate hand and portable power tools in the safe manufacture of products or systems
- describe ways to reduce, reuse, and recycle materials and products to control waste

SUGGESTED INSTRUCTIONAL STRATEGIES

As students explore methods of production and materials used in manufacturing, they begin to understand how technological advancements affect society. In determining the steps taken in production, students consider the planning and design aspects of a product. By producing their own products or systems, they not only become more skilled at using tools but also become discerning users of materials, products, and services.

- Have students work in small groups to create a flow chart illustrating the sequence of steps needed to construct a product. Ask students to use the steps to design and construct a product or system using appropriate tools and materials. As an extension, students could assess the product's impact on society. Possible products or systems include:
  - a scale model of the solar system, using recycled and common household materials
  - a model of a space probe landing device, using recycled and household materials
  - a working sundial, using a clock to check its accuracy
  - a scale model of a longhouse that provides proper smoke ventilation
- During the design and construction stage, have students gather materials for a design portfolio (see Appendix D), including a statement of the problem, possible solution ideas, sketches, final drawings, and a photograph of their final product or system.

SUGGESTED ASSESSMENT STRATEGIES

As students study the processes of production, they gain a more realistic understanding of manufacturing. Assessment strategies focus on the students' abilities to plan effectively for construction and to use a variety of tools safely.

Observe

- While students work with hand and portable power tools, look for evidence that safety procedures are being followed. For example:
  - blade guards in place
  - electric tools unplugged when not in use
  - safety equipment worn where necessary (e.g., glasses, gloves)
  - extension cords safely stored

Question

- Students review the process of planning and creating a product (e.g., steps on a flow chart). Assess their abilities to sequence production steps by asking questions such as:
  - How did you decide where to start?
  - How does this step relate to the last or next steps?
- Discuss students' design portfolios individually. Look for evidence of student learning by asking questions such as:
  - What materials and tools did you use?
  - Why did you choose them?
  - How did you reduce waste during construction?
  - How did your plans help you during construction?

Self-Assessment

- Work with students to develop criteria for a finished product or system, and help them to use the criteria to evaluate their own work. Criteria might include:
  - the ability to incorporate reused materials
  - the effectiveness of the product
  - the creativity of the design

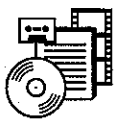
RECOMMENDED LEARNING RESOURCES

Print Material

- Challenging Artstraws
- Design and Make Folios
- Folens Technology
- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Light Magic
- Machines At Work
- Q Science Series
- The Random House Book of How Things Were Built
- The Resources and Projects Book
- The Sky's the Limit with Math and Science
- Technology
- Technology Craft Topics
- Technology in Action

Video

- Making the Most of Things
- Parking Places



Multimedia

- Experience Technology: Communication, Production, Transportation, Biotechnology
- Ginn Realization Technology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Artstraws
- Capsela
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

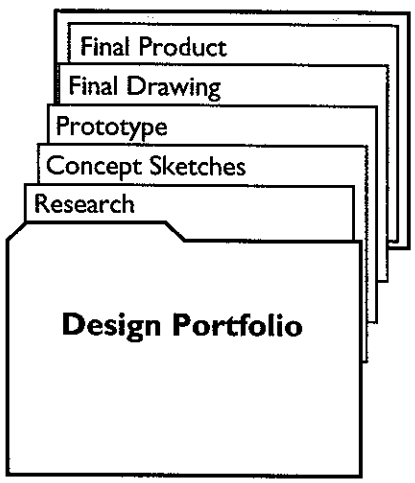
It is expected that students will:

- describe and use control devices that sense, switch, and regulate
- design and construct a mechanical control device that senses, switches, or regulates

SUGGESTED INSTRUCTIONAL STRATEGIES

By identifying how devices sense, switch, and regulate, students increase their understanding of control. They design and construct mechanical control devices using a given set of criteria to gain hands-on experience. Through a variety of activities (e.g., field trips, interviews), students become aware of other types of control systems (e.g., hydraulic, pneumatic, electric, electronic).

- On a field trip to several industrial sites, ask students to sketch, photograph, or videotape control devices that are mechanical, electric, hydraulic, and pneumatic. Have students interview technical personnel and use this information to prepare an explanation of how each observed device senses, switches, or regulates. In class, have students compile a master list of devices, compare and contrast the control mechanisms, and identify the devices that use a combination of control systems.
- Have students design and build a model car with the ability to descend an inclined plane at different speeds. The design should include a braking system that is variable, consistent, and that allows the car to descend the ramp as close as possible to three preset times.
- Ask students to design and sketch three other possible solutions for braking their car, which could include electric, hydraulic, or pneumatic systems. Ask students to include their ideas, solutions, sketches, and a photograph of the system in their design portfolio.



SUGGESTED ASSESSMENT STRATEGIES

Students expand their knowledge of control through a variety of practical experiences and written activities. They demonstrate their abilities to apply their knowledge when they design and construct mechanical control devices. Students are able to demonstrate their levels of understanding by explaining their thinking orally or by making presentations.

Observe

- Students collect and explain various control devices that sense, switch, and regulate. Look for evidence that students are able to accurately:
  - identify and explain a wide variety of control devices (e.g., toggle switch, auto-stop function, volume control)
  - distinguish between devices that sense, switch, and regulate

Question

- To assess students' thinking during the design and construction of a mechanical control device, ask:
  - Which type of control device do you think will be effective?
  - What other control device would do the same job?
  - What other strategies could you use to solve this problem?
  - What are the environmental implications?
  - How will the user feel about your control device?

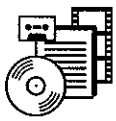
Self-Assessment

- After designing and constructing a mechanical control device, have students reflect on their learning by asking questions such as:
  - How does your work on this assignment reflect what you know about control devices?
  - What was the most difficult challenge for you as you worked on this task?
  - How did you deal with the challenges?

RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Make Folios
- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Light Magic
- Machines At Work
- Q Science Series
- Technology
- Technology Craft Topics
- Technology I.D.E.A.S.: A Teaching Resource Book
- Technology in Action



Multimedia

- Experience Technology: Communication, Production, Transportation, Biotechnology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Capsela
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- identify systems that convert and transmit energy
- design a device that converts and transmits energy
- design and construct a product or system that uses simple machines

SUGGESTED INSTRUCTIONAL STRATEGIES

Problems posed by increasing power needs and decreasing energy resources require unique solutions. By constructing systems using simple machines, students become more cognizant of efficient power applications and problems related to the conversion and transfer of energy. Students realize that even the most complex tools are often combinations of simple machines.

- Ask students to work in groups or with a partner and discuss what life was like before the invention of labour-saving devices (e.g., washer, dryer, dishwasher, Velcro). Have students brainstorm all the labour-intensive things they and their family members do at home and at school, and list strategies or machines to save labour and reduce energy consumption.
- Present students with the challenge to design an original labour-saving device using a combination of simple machines. Ask them to develop a plan that includes the purpose of the device, a labelled diagram, and the steps involved in the construction. Have students construct a model using common household materials and demonstrate its operation to the class. Examples could include a device to turn off a light switch from a distance, or a series of pulleys and levers to open and shut a door. Their research, ideas, concept sketches, prototype, and final drawing are included in their design portfolio.
- Ask students to brainstorm ways to use different forms of energy (e.g., solar, wind) to power devices that accomplish practical functions.

SUGGESTED ASSESSMENT STRATEGIES

Students can demonstrate their understandings of global energy problems and the need for more efficient power applications by talking, drawing, writing, designing, and creating original labour-saving devices. The emphasis is on applying components of simple machines and designing and building powered devices.

Observe

- Students work in small groups to design and construct a device using a simple machine. While they present the device to the class, notice the extent of their abilities to:
  - provide a detailed explanation of energy transmission
  - use correct terminology (e.g., force, lift, load)

Collect

- Focus the attention of students on the way the devices convert and transmit energy. Have them summarize what they know about transmission and conversion. Assess their understandings by looking for the extent to which they are able to:
  - use accurate terminology
  - include advantages (e.g., requires less work, saves time) and disadvantages (e.g., friction, increased power use) of energy conversion
  - provide and explain specific examples of machines that transmit and convert energy

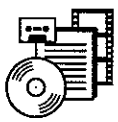
Self-Assessment

- Students record their learning about the efficient application of energy and power in their design portfolios. To help students focus their critical thinking, provide prompts such as:
  - Three important things I learned about energy conversion and transmission are____.
  - They are important because_____.
  - A question I have is____.

RECOMMENDED LEARNING RESOURCES

Print Material

- The Car
- Design and Make Folios
- Folens Technology
- Investigating Technology
- Investigating the World of Science, Math and Real Technology
- Light Magic
- Q Science Series
- The Resources and Projects Book
- The Sky's the Limit with Math and Science
- Technology
- Technology Craft Topics
- Technology I.D.E.A.S.: A Teaching Resource Book
- Technology in Action
- Transportation Cards
- Visual Guides Series



Multimedia

- Experience Technology: Communication, Production, Transportation, Biotechnology
- Ginn Realization Technology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Capsela
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- apply innovative thoughts and actions when solving problems involving technology, independently and in groups
- organize activities to make the best use of time, materials, and resources
- investigate career paths in technological fields, and examine possible career directions
- describe how societal pressures influence technological change and how technological change influences society

SUGGESTED INSTRUCTIONAL STRATEGIES

Students gain an understanding of the relationship between society and technology to prepare them for a changing technological world. Career paths in technological fields are further explored for students to consider. They apply innovative thoughts and actions to solve problems involving technology, independently and in groups.

- Using a class simulation from the social studies unit "The Bronze Axes" (available from the Ministry of Education), have students work in groups to explore the interrelationship of food production, labour availability, raw materials, and the technological knowledge needed for the survival of a tribe. As part of the problem-solving process, ask each group to:
  - make a plan
  - negotiate trades
  - ensure they have enough food and raw materials (e.g., tin and copper)
  - negotiate the services of bronze-making specialists to make axes to defend their tribe
- Provide students with an opportunity to become research and design contractors. Have students work in groups to brainstorm ideas for a product they could create or improve by modifying or improving its form or function. The students' design portfolios list all ideas and include research, concept sketches, final drawings, and a prototype. (See Appendix D.)
- Have students investigate a variety of occupations in technological fields and choose one they are especially interested in to research in detail. Ask students to interview someone in the field about the education and special training required, and job expectations.

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their understandings of the effect that technology has on society (e.g., resources, labour force, gender equity) when they engage in simulation activities or apply their knowledge to analyse current issues. As students realize that the possession of technological knowledge has a powerful effect on society, they develop an awareness of the importance of risk taking and creative problem solving.

Observe

- As students work in design teams, observe their abilities to:
  - monitor their own progress
  - break down and sequence tasks effectively
  - show flexibility in the management of time and resources (e.g., switching tasks if resources are unavailable)
  - work respectfully and co-operatively

Question

- Students present their research (e.g., written report, oral presentation, skit) about occupations in technological fields. Conference with students to determine their levels of awareness regarding possible career directions. Pose questions such as:
  - Which of your personal qualities and skills could you use if you chose this career?
  - What other knowledge and skills would you need for this career?
  - Who do you know who has pursued this career or a similar one?
  - How could you gather more information about this career?

Collect

- Examine the design portfolios that students developed while operating as research and design contractors. Look for evidence of:
  - originality
  - consideration of the intended users
  - openness to design modifications
  - incorporation of the ideas of others

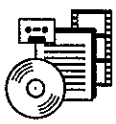
RECOMMENDED LEARNING RESOURCES

Print Material

- The Car
- Design and Make Folios
- Folens Technology
- Investigating Technology
- Light Magic
- Q Science Series
- The Resources and Projects Book
- Technology
- Technology Craft Topics
- Transportation Cards
- Visual Guides Series

Video

- Alternative Energies: Fuels for the Future
- How to Make Great Videos - With Just a Camcorder
- In the Kitchen
- Making the Most of Things
- Parking Places
- Robots at Work



Multimedia

- Experience Technology: Communication, Production, Transportation, Biotechnology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Artstraws
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- communicate ideas for designing products or systems using different kinds of drawings
- choose appropriate tools to transmit ideas to others
- develop a plan and clearly communicate ideas to create a product or system
- use appropriate research techniques to help solve problems involving technology

SUGGESTED INSTRUCTIONAL STRATEGIES

The design and construction of products and systems requires students to research, design, and present a technical device in such a way that it can be easily understood and manufactured. As students' ideas about design and construction become more sophisticated, they integrate a wider variety of communication skills and presentation techniques such as market research, working drawings, planning a construction path, and constructing a prototype.

- Lead a class discussion about how ideas or projects evolve from a concept into a manufactured product (e.g., new car, new clothing style).
- Have students examine this process more closely by forming their own companies and designing a product or system (e.g., game, toy) following these steps:
  - identify the type of product they wish to produce
  - design a market research questionnaire to gather information for their proposal
  - interview students in the target age group using the questionnaire, and include interviews in their presentation package
  - decide on a game or toy to produce using the information gathered
  - explore ideas for design and production
  - produce a set of working drawings and a construction path for manufacturing the game or toy
  - construct a prototype
  - test and modify the prototype
- Have students produce a marketing plan for selling their product. Their plan should include:
  - a budget for manufacturing the product
  - an example of packaging
  - examples of advertising that use appropriate communication technologies

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their abilities to solve a problem involving technology by researching, designing, presenting, and marketing a given product or system and communicating a marketing plan to others. Teachers can assess their understandings by inviting students to discuss the processes and strategies they used to solve problems involving technology and to present their solutions.

Question

- Students present their products to the class. Conference with individuals or small groups, asking the following questions:
  - What methods did you use to collect information?
  - How did you make the information useful to you?
  - Explain your decision to use a particular method of graphic representation.

Collect

- Students develop and implement a market research questionnaire relevant to the problem involving design. Examine the questionnaires for evidence of students' abilities to:
  - select a representative sample from the target population
  - deal with different aspects of the product or service (e.g., packaging, ease of use, safety)
  - clarify design parameters by comparing products or services of a similar type

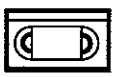
Self-Assessment

- As a whole class, students develop criteria for effective marketing presentations. Teachers may choose to have peers assess the presentations. Criteria may include:
  - effective use of a variety of communication tools (e.g., models, charts, drawings)
  - effective use of voice
  - relevance of information presented
  - accurate use of technical terms

RECOMMENDED LEARNING RESOURCES

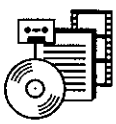
Print Material

- The Car
- Investigating Technology
- Light Magic
- Q Science Series
- The Resources and Projects Book
- The Sky's the Limit with Math and Science
- Technology
- Technology Craft Topics
- Technology I.D.E.A.S.: A Teaching Resource Book
- Transportation Cards
- Visual Guides Series



Video

- Alternative Energies: Fuels for the Future
- How to Make Great Videos - With Just a Camcorder
- In the Kitchen
- Parking Places



Multimedia

- Experience Technology: Communication, Production, Transportation, Biotechnology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Artstraws

PRESCRIBED LEARNING OUTCOMES

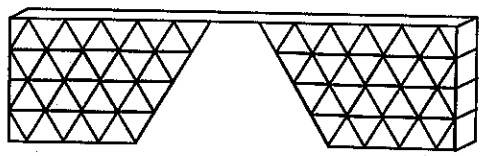
It is expected that students will:

- describe production processes involved in the development of products
- identify and use suitable tools, processes, and materials for combining, separating, forming, and finishing to construct products or systems
- modify designs to improve the appearance, usefulness, and function of a product or system
- use hand and portable power tools for their intended function in the safe manufacture of products or systems
- reuse and recycle materials and products to reduce waste

SUGGESTED INSTRUCTIONAL STRATEGIES

Through the safe use of hand and power tools, students design and construct a product or system using suitable materials. Students evaluate the procedures leading to the manufacture of a product or system that satisfies design specifications. By taking into account the views and needs of other users, they examine the implications for producing a better quality product or system.

- Have students in small groups design and construct products or systems, emphasizing the safe use of tools and materials. As part of the process, students modify their design based on peer feedback. Possible products or systems include:
  - a greenhouse incorporating manual heat and humidity controls for testing the effects of fertilizers, different soils, pollution, and CO_2 injections on plants. Ask students to consider potential users and make recommendations that would result in the development of a more effective system
  - a truss design for a bridge that will withstand a specified weight



- Have students use a computer graphic or CAD program to design an automated animal feeder with interconnecting mechanical systems (e.g., a bird feeder with a built-in sensor that dispenses food when a bird lands on the perch).
- During the construction of these products, have students gather material for their design portfolios, including a statement of the problem, possible solution ideas, sketches, final drawings, and a photograph of their final product or system. A detailed outline of the production steps necessary to complete this product should be included.

SUGGESTED ASSESSMENT STRATEGIES

Students expand their understanding of production to include the aspects of critical analysis and design modification. By analysing and communicating their choices of materials, tools, and processes, students provide evidence of their knowledge of the development and manufacture of products.

Observe

- While students are involved in the construction process, observe the ways they reduce, reuse, and recycle products to manage waste. For example:
  - Do students use leftover pieces of material before cutting into a fresh piece?
  - Are students conscious of waste and able to plan for its reuse or disposal?

Question

- Students create a presentation (e.g., visual, oral) outlining the materials used and the steps involved in the development of a product. Look for evidence that students are able to:
  - justify their design and choice of materials
  - identify the strengths and limitations of their design, and suggest possible modifications

Collect

- Examine students' design portfolios. Note their abilities to describe production processes and to identify suitable materials and tools. Look for evidence of design evolution, from concept ideas to a solution.
  - Have several design ideas been generated?
  - Are production processes described in detail?
  - Were design modifications made along the way?
  - How were potential implications taken into consideration?

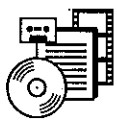
RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Make Folios
- Folens Technology
- Investigating Technology
- Light Magic
- Machines At Work
- Q Science Series
- The Random House Book of How Things Were Built
- The Resources and Projects Book
- The Sky's the Limit with Math and Science
- Technology
- Technology Craft Topics
- Tracktronics: Opportunities for Design Using Electronics

Video

- How to Make Great Videos - With Just a Camcorder
- In the Kitchen
- Making the Most of Things
- Parking Places
- Robots at Work



Multimedia

- Experience Technology: Communication, Production, Transportation, Biotechnology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Artstraws
- Capsela
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

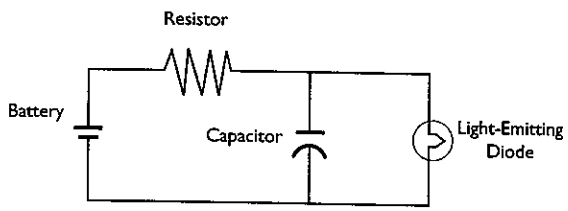
It is expected that students will:

- explain the operation of control devices that sense, switch, or regulate
- design and construct a control device that operates a system

SUGGESTED INSTRUCTIONAL STRATEGIES

Students deepen their understanding of devices that sense, switch, or regulate by explaining their operation to others. By designing and constructing a variety of control systems, students extend their knowledge of mechanical controls to include other systems, such as electric, hydraulic, and pneumatic.

- Have students experiment with syringes, tubes, pumps, and water to learn about hydraulic systems (fluid pressure pushed in a cylinder) and pneumatic systems (compressed air pushed in a cylinder). Students review their findings and identify the basic principles of each system through small group and class discussions.
- Ask students to design, construct, and operate two robotic arms using a wooden armature, syringes, clear tubing, and coloured water. Explain that one arm is to be operated by a hydraulic system and one by a pneumatic system. Have students test the two systems in a competition to see which arm can move a specific material faster and with more accurate control. This exercise demonstrates the mechanical advantages of each system.
- Have students design and construct an electronic winking face, which is a simple capacitor-charged circuit that switches electronically between two light-emitting diodes and allows students to control a system electronically. Their design portfolio should include their ideas, solutions, sketches, and a photograph of the system.



SUGGESTED ASSESSMENT STRATEGIES

Students build on their understandings of different types of control devices when they incorporate them in the design and modification of systems. Requiring students to present these devices to others provides an opportunity to assess how well students understand the function and potential use of different control devices and their abilities to communicate these ideas.

Observe

- Students list two kinds of questions requiring (1) recall of information, and (2) higher-level thinking (e.g., inferring, analysing). The questions provide evidence of their understanding of the concepts, relationships, and applications of the material. These questions may be used formally in quizzes or tests, or informally to create games modelled on Jeopardy or Pictionary.

Question

- Students select one of their projects to explain in detail. Have them create a flow chart to represent their knowledge of the operation of the control devices in their system. Conference with them, and ask questions such as:
  - Explain the input, process, and output of your system.
  - How did you decide where to begin and end the flow chart?
  - What might be another way to create the same system?

Collect

- Before beginning control activities, have students complete the first two columns in a chart headed I know, I wonder, I learned. When the third column is complete, collect and record evidence of the extent to which students:
  - increased their knowledge of control devices
  - corrected misconceptions recorded initially
  - sought answers to their own questions

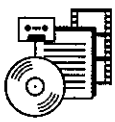
RECOMMENDED LEARNING RESOURCES

Print Material

- Design and Make Folios
- Investigating Technology
- Light Magic
- Machines At Work
- Q Science Series
- Techniques For Technology
- Technology
- Technology Craft Topics
- Technology I.D.E.A.S.: A Teaching Resource Book
- Tracktronics: Opportunities for Design Using Electronics

Video

- Robots at Work



Multimedia

- Experience Technology: Communication, Production, Transportation, Biotechnology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Capsela
- Discovery Kits: Pumping it up with Pneumatics
- Lego/Dacta Simple Control Activities

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

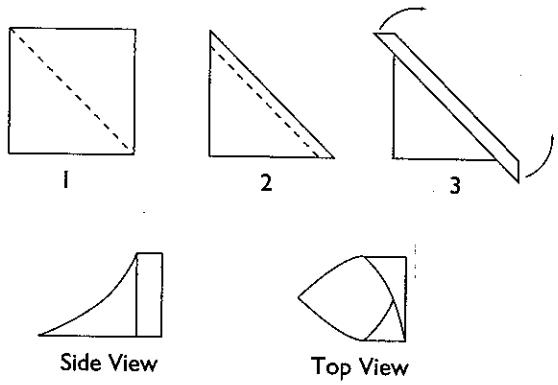
- design a system that converts energy into power
- identify various forms of energy and their applications
- design and construct devices that use different forms of energy to operate

SUGGESTED INSTRUCTIONAL STRATEGIES

Concepts of energy and power are consolidated and related to the fundamental concepts of conversion, transmission, and conservation. Students apply design and problem-solving skills to recognize the limitations of energy sources used in their daily lives.

- Have students, individually or in small groups, design and build a complicated device that performs a simple task (Rube Goldberg machine) involving as many energy conversions as possible. (e.g., A marble rolls down a ramp and strikes a switch that opens a trapdoor.)
- Encourage students to work in groups to design and build a vehicle that operates by a different form of energy (e.g., fan-driven sailboat, paper car, or paper airplane). In a competition, students determine which vehicle operates the most efficiently. Friction can be introduced as a criteria in the design.

Paper Glider



- As a connection to science concepts, have students simulate street lights in a model village or lights in a model car using simple electric circuits, batteries, wires, switches, and bulbs or light-emitting diodes.

SUGGESTED ASSESSMENT STRATEGIES

Students demonstrate their problem-solving skills as they research, document, construct, and modify devices and systems. Assessment emphasizes the students' abilities to apply their knowledge and skills to develop energy-efficient products.

Question

- Select a vehicle for students to design and construct. Invite individuals or small groups to choose a form of energy (e.g., electric, mechanical, gravitational) to power the vehicle. After students demonstrate the vehicles, assess their understanding by asking questions such as:
  - What are the advantages and disadvantages of each form of energy?
  - Which design is most efficient with respect to cost, resource use, and duration?

Collect

- Before investigating energy and power, students create a web, cartoon, illustration, or other visual representation to show their current levels of understanding. At the end of these learning experiences, students create a similar representation and compare the two. Collect and observe the extent to which:
  - their understanding shows growth over time
  - energy conversion and transmission are explained
  - they are able to make connections with the use of energy and power in their lives

Self-Assessment

- Students keep an on-going energy and power journal where they reflect on what they have learned and make suggestions about how they could apply and extend their knowledge. Possible prompts are:
  - Three things I learned about energy and power are____.
  - I could use this information in my life when____.
  - I still wonder about____.

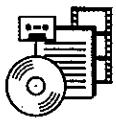
RECOMMENDED LEARNING RESOURCES

Print Material

- The Car
- Design and Make Folios
- Folens Technology
- Investigating Technology
- Light Magic
- Q Science Series
- The Resources and Projects Book
- The Sky's the Limit with Math and Science
- Techniques For Technology
- Technology
- Technology Craft Topics
- Technology I.D.E.A.S.: A Teaching Resource Book
- Tracktronics: Opportunities for Design Using Electronics
- Transportation Cards
- Visual Guides Series

Video

- Alternative Energies: Fuels for the Future



Multimedia

- Experience Technology: Communication, Production, Transportation, Biotechnology

Software

- The Way Things Work - CD-ROM

Manipulatives

- Capsela
- Discovery Kits: Pumping it up with Pneumatics
- Lego/Dacta Simple Control Activities

TECHNOLOGY EDUCATION K TO 7
APPENDICES

Appendix A
Prescribed Learning Outcomes

Appendix A: Prescribed Learning Outcomes

Self and Society

Students need to understand how humans shape technology and the impact that current and future technological advances have on our society, culture, and environment.

It is expected that students will:

Grades K to 1	Grades 2 to 3	Grade 4
• solve problems that come up during the design process, independently and in groups • demonstrate confidence and a positive attitude throughout the problem-solving process • manage materials, time, and resources • identify and describe the effects of technology on their lives, at home, and in the classroom • identify occupations and role models in technological fields in their community, being sensitive to culture, gender, and physical ability	• solve problems the come up during the design process, independently and in groups • demonstrate confidence and a positive attitude throughout the problem-solving process • use a variety of classroom resources when looking for answers to problems involving design • manage materials, time, and resources • identify the effects of technology on their lives, at home, and in the classroom • identify occupations and role models in technological fields in their community, being sensitive to culture, gender, and physical ability	• demonstrate risk taking and perseverance throughout the problem-solving process • organize their work to improve the management of materials, time, and resources • express personal thoughts and feelings about the effects of technology in their lives, at home, and in the classroom • identify past and current technological occupations and role models, being sensitive to culture, gender, and physical ability

SELF AND SOCIETY

Students need to understand how humans shape technology and the impact that current and future technological advances have on our society, culture, and environment.

It is expected that students will:

Grade 5	Grade 6	Grade 7
• solve problems that come up during the design process, independently and in groups • manage their work and resources during design activities • analyse the positive and negative effects of technology in their lives. • categorize and compare various occupations in technological fields, and discuss how some have been the subject of culture, ability, and gender stereotyping.	• demonstrate, independently and in groups, confidence and a positive attitude when solving problems involving technology • compare and contrast solutions to problems involving design and technology in other cultures • describe how technological change affects their quality of life at home, in the community, and in society • identify career paths in technological fields, and examine possible career directions • investigate the traditional roles of people of different cultures and gender in technological fields	• apply innovative thought and actions when solving problems involving technology, independently and in groups • organize activities to make the best use of time, materials, and resources • investigate career paths in technological fields, and examine possible career directions • describe how societal pressures influence technological change and how technological change influences society

Appendix A: Prescribed Learning Outcomes

Self and Society

Students need to understand how humans shape technology and the impact that current and future technological advances have on our society, culture, and environment.

It is expected that students will:

Grade 8	Grade 9	Grade 10
• demonstrate confidence and positive attitudes when solving problems that arise during the design process • identify practical problems involving technology in a variety of contexts • work with others to solve problems that come up during the design process • list career paths in technological fields, and examine potential career opportunities • demonstrate a willingness to express thoughts and feelings about the effects of technology on their personal lives, society, and the environment	• contribute to group success by encouraging others to fulfil their responsibilities • identify role models in technological occupations, including those that are sensitive to culture, gender, and physical ability • explain relationships between technological advancements and changes in the workplace, including the changing roles of workers • evaluate design ideas based on assessments by others • demonstrate a willingness to look for and develop improved solutions to problems that arise during the design process • express personal thoughts and feelings about how societal pressures may influence technological advancements and, conversely, how technological changes influence society and the environment • demonstrate confidence and positive attitudes when solving problems that arise during the design process	• demonstrate a willingness to find unique solutions to problems that arise during the design process • identify methods to improve their abilities to work with others during problem-solving activities • demonstrate the ability to use community resources to help solve problems that come up during the design process • describe new careers and occupations in technological fields and determine their educational prerequisites • identify gender and ethnic bias in technological fields • demonstrate confidence and positive attitudes when solving problems that occur during the design process • describe how societal pressures influence technological advancements and, conversely, how technological changes influence society

COMMUNICATIONS

At home and in the workplace, students will need to use technology in the processing and sharing of information, and communicate ideas using language, graphics, and technology.

It is expected that students will:

Grades K to 1	Grades 2 to 3	Grade 4
• follow instructions to construct a product • communicate ideas for creating a product • make a drawing to communicate solutions to problems that come up during the design process • identify different ways to communicate using technology	• describe the purpose of technical communications used in the home • describe a problem involving design using their own words • describe a solution to a problem involving design • present ideas about products they have made, and show how they work • identify ways of enhancing technical communications	• describe a solution to a problem involving technology • use established criteria for designing presentations of ideas • develop a plan and clearly communicate ideas for creating a product or system • use appropriate tools in the presentation of ideas

COMMUNICATIONS

At home and in the workplace, students will need to use technology in the processing and sharing of information, and communicate ideas using language, graphics, and technology.

It is expected that students will:

Grade 5	Grade 6	Grade 7
• gather information from available resources to solve problems involving technology • describe a solution to a problem involving technology • determine appropriate criteria for the presentation of ideas • choose appropriate tools for the presentation of ideas • develop a plan and communicate ideas for creating products and systems	• use appropriate research strategies to solve problems involving technology • develop a plan and clearly communicate ideas for creating products or systems • choose appropriate tools to represent ideas to others • determine appropriate criteria for the presentation of ideas • select appropriate methods to convey information	• communicate ideas for designing products or systems using different kinds of drawings • choose appropriate tools to transmit ideas to others • develop a plan and clearly communicate ideas to create a product or system • use appropriate research techniques to help solve problems involving technology

COMMUNICATIONS

At home and in the workplace, students will need to use technology in the processing and sharing of information, and communicate ideas using language, graphics, and technology.

It is expected that students will:

Grade 8	Grade 9	Grade 10
• produce initial concept sketches and final drawings using a design process • solve problems that come up during the design process by using various information sources • develop two- and three-dimensional graphics using manual and computer-assisted processes • revise presentations based on suggestions and comments from others • identify how information and concepts from other fields of knowledge are used in the design process	• communicate ideas for designing products and systems using various drawing projection methods, spreadsheets, graphics, or other media • use information-gathering and communication methods to solve problems during the design process and to create effective presentations • revise presentations based on personal review and feedback from others • describe the advantages and disadvantages of various information-gathering and communication processes • develop two- and three-dimensional graphics using manual and computer-assisted processes • identify how information and concepts from other fields of knowledge are used in the design process	• develop a plan to clearly communicate ideas for creating products and systems • use a variety of drawing projection methods • evaluate information-gathering tools and processes used to access, store, organize, and present data • apply knowledge and concepts from other disciplines in solving problems that arise during the design process • revise presentations based on personally set objectives • demonstrate skill in managing time and resources • use information-gathering and communication methods to solve problems involving technology and to create effective presentations

PRODUCTION

Students build skills in designing and developing products and systems that improve the human condition.

It is expected that students will:

Grades K to 1	Grades 2 to 3	Grade 4
• solve problems involving technology using various tools, materials, and processes • modify familiar products by experimenting with ways of combining, separating, forming, and finishing materials • compare the properties and uses of familiar materials • identify common tools, and compare their characteristics and intended uses • recognize the potential safety hazards presented by tools, and identify safety equipment and procedures • recognize and suggest ways to reduce, reuse, and recycle materials and products to control waste	• solve problems involving technology using appropriate tools and materials • identify natural and manufactured materials • follow given steps in making a product • modify a variety of materials by combining, separating, forming, and finishing • identify ways to reduce, reuse, and recycle materials and products to control waste • identify the potential safety hazards presented by tools in the classroom, and use appropriate safety equipment and procedures.	• choose appropriate tools and materials for the construction of a product or system • develop a design, make a product or system, and determine the steps for its construction • determine ways to reduce, reuse, and recycle waste materials • identify natural and manufactured materials used in the manufacture of a product or system • modify a variety of materials by combining, separating, forming, and finishing to construct products or systems • identify the potential hazards of classroom tools, and use appropriate safety equipment and procedures

PRODUCTION

Students build skills in designing and developing products and systems that improve the human condition.

It is expected that students will:

Grade 5	Grade 6	Grade 7
• choose appropriate tools and materials for the design and construction of products or systems • identify the potential hazards of tools, and use appropriate safety equipment and procedures • demonstrate ways to reduce, reuse, and recycle materials and products to control waste • modify a variety of materials by combining, separating, forming, and finishing to construct products or systems • develop a design for a product or system, and determine the steps for its construction	• determine a sequence of steps before making a product or system based on a design • identify and use suitable tools, processes, and materials for combining, separating, forming, and finishing to construct products or systems • use appropriate hand and portable power tools in the safe manufacture of products or systems • describe ways to reduce, reuse, and recycle materials and products to control waste	• describe production processes involved in the development of products • identify and use suitable tools, processes, and materials for combining, separating, forming, and finishing to construct products or systems • modify designs to improve the appearance, usefulness, and function of a product or system • use hand and portable power tools for their intended function in the safe manufacture of products or systems • reuse and recycle materials and products to reduce waste

CONTROL

Control addresses the application of devices and processes used to manage, sort, control, and organize systems.

It is expected that students will:

Grades K to 1	Grades 2 to 3	Grade 4
• identify common control devices in their homes and at school • operate familiar control devices • identify methods to control a device manually • make a manual control device	• identify common control devices in their home and school environments that sense, switch, and regulate • design and make products that use control devices	• describe the function of control devices used in the community • describe a method to control a device • design and construct a control device

CONTROL

Control addresses the application of devices and processes used to manage, sort, control, and organize systems.

It is expected that students will:

Grade 5	Grade 6	Grade 7
• describe familiar control systems and the devices that control them • describe a sequence of steps to control a device • design and construct a control device that senses, switches, or regulates	• describe and use control devices that sense, switch, and regulate • design and construct a mechanical control device that senses, switches, or regulates	• explain the operation of control devices that sense, switch, or regulate • design and construct a control device that operates a system

CONTROL

Control addresses the application of devices and processes used to manage, sort, control, and organize systems.

It is expected that students will:

Grade 8	Grade 9	Grade 10
• design and construct a control device that senses, switches, or regulates • compare ways that various control devices work, and explain their applications • integrate electric, electronic, pneumatic, and mechanical control devices within a system • demonstrate understanding of the concept of control by dismantling devices	• demonstrate an understanding of the operating principles used in various control devices • design and construct a system that uses a control device • use troubleshooting strategies to locate the source of malfunctions in a system • modify electric, electronic, pneumatic, and mechanical control devices for particular applications	• devise ways to monitor, modify, and improve systems by incorporating control devices • devise troubleshooting strategies for correcting malfunctions in a system • demonstrate an understanding of the principles involved with interconnected control devices in product manufacturing • design and construct a system that uses a control device, and assess its environmental and social implications

ENERGY AND POWER

Energy and power addresses the application of devices and processes that convert, transmit, and conserve forms of energy.

It is expected that students will:

Grades K to 1	Grades 2 to 3	Grade 4
• identify products that use various forms of energy • demonstrate an understanding of the ways objects move • make products that use a mechanical power source	• identify a variety of energy sources • identify how energy can be transferred and converted to make devices function • design and make a device that is powered by an energy source	• identify simple machines • identify various forms of energy and how energy can be stored • identify devices that are used to convert, store, and transmit energy • design and construct devices that use simple machines

ENERGY AND POWER

Energy and power addresses the application of devices and processes that convert, transmit, and conserve forms of energy.

It is expected that students will:

Grade 5	Grade 6	Grade 7
• describe ways to conserve energy • identify alternative ways to make an existing product or system function • identify various forms of energy and power • design and construct devices that use simple machines	• identify systems that convert and transmit energy • design a device that converts and transmits energy • design and construct a product or system that uses simple machines	• design a system that converts energy into power • identify various forms of energy and their applications • design and construct devices that use different forms of energy to operate

ENERGY AND POWER

Energy and power addresses the application of devices and processes that convert, transmit, and conserve forms of energy.

It is expected that students will:

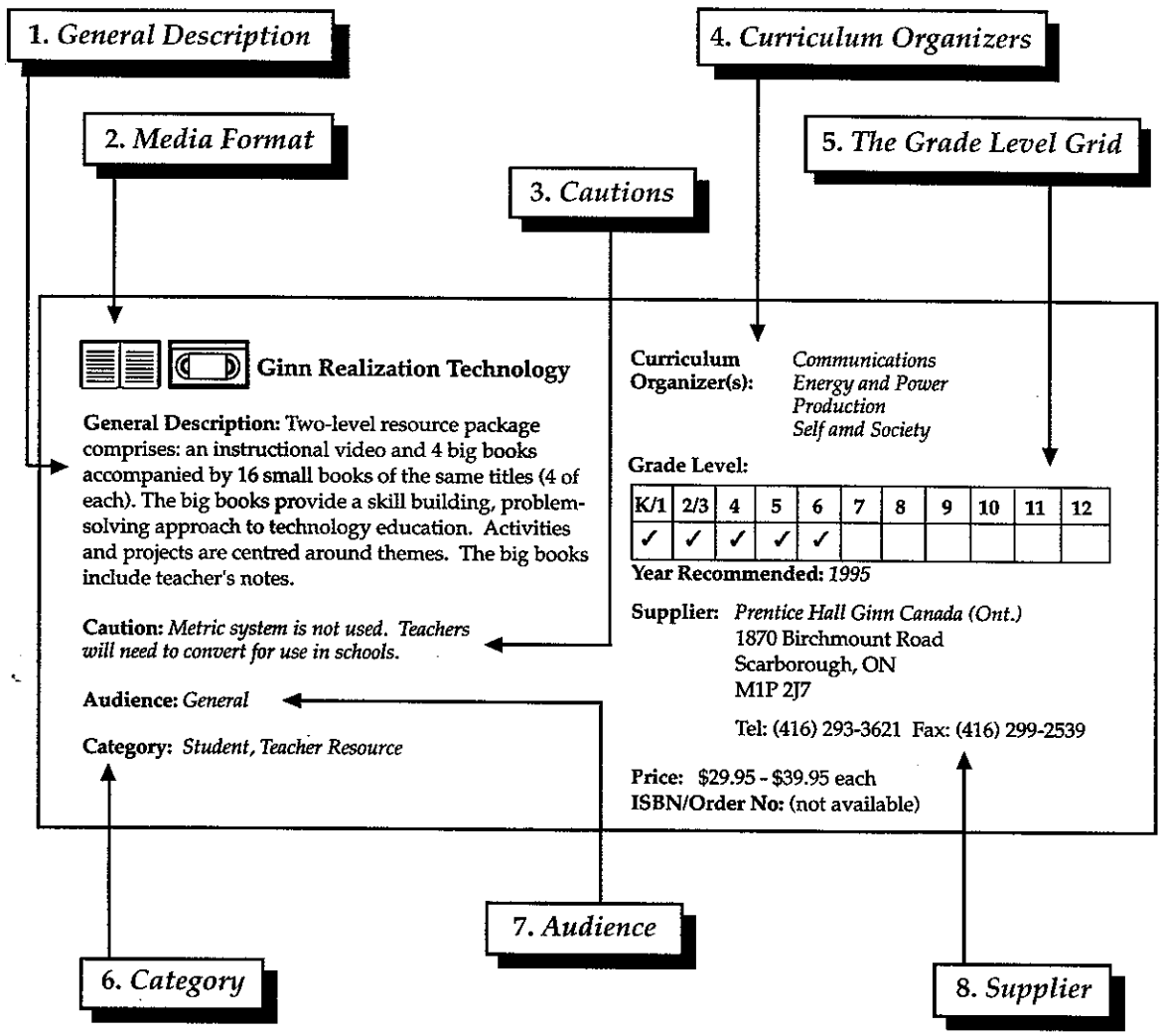
Grade 8	Grade 9	Grade 10
• incorporate selected devices in the design of energy transmission and conversion systems • explain how systems transmit and convert energy • identify how simple machines are combined into energy and power systems • construct devices that are powered in various ways	• explain how systems convert potential energy to kinetic energy, and assess their environmental and social implications • construct devices that convert and transmit various forms of energy • disassemble devices and explain the transfer and conversion of energy within mechanical systems • describe alternative sources of energy • incorporate selected devices in the design of energy transmission and conversion systems	• design systems that multiply, reduce, and transmit power, and assess their social and environmental implications • analyse the function of systems used in machines and equipment • construct devices to convert, store, and distribute energy in usable forms • explain the transfer and conversion of energy within a mechanical system

Appendix B
Learning Resources

WHAT IS APPENDIX B?

Appendix B is a comprehensive list of the *recommended* learning resources for Technology Education K to 7. The titles are listed alphabetically and each resource is annotated. In addition, Appendix B contains information on selecting learning resources for the classroom.

What information does an annotation provide?



1. *General Description:* This section provides an overview of the resource.
2. *Media Format:* is represented by an icon next to the title. Possible icons include:

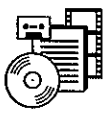
Audio Cassette

CD-ROM

Film

Games/Manipulatives

Laserdisc, Videodisc


Multimedia

Music CD

Print Material

Record

Slides

Software

Video

3. *Caution:* This category is used to alert teachers about potentially sensitive issues.
4. *Curriculum Organizers:* This category helps teachers make links between the resource and the curriculum.
5. *Grade Level Grid:* This category indicates the suitable age range for the resource.
6. *Category:* This section indicates whether it is a student and teacher resource, teacher resource, or professional reference.
7. *Audience:* The audience category indicates the suitability of the resource for different types of students. Possible student audiences include the following:
   - general
   - English as a second language (ESL)
   - *Students who are:*
     - gifted
     - blind or have visual impairments
     - deaf or hard of hearing
   - *Students with:*
     - severe behavioural disorders
     - dependent handicaps
     - physical disabilities
     - autism
     - learning disabilities (LD)
     - mild intellectual disabilities (ID-mild)
     - moderate to severe/profound disabilities (ID-moderate to severe/profound)
8. *Supplier:* The name and address of the supplier are included in this category. Prices shown here are approximate and subject to change. Prices should be verified with the supplier.

What about the videos?

The ministry attempts to obtain rights for most *recommended* videos. Negotiations for the most recently recommended videos may not be complete. For these titles, the original distributor is listed in this document, instead of British Columbia Learning Connection Inc. Rights for new listings take effect the year implementation begins. Please check with British Columbia Learning Connection Inc. before ordering new videos.

SELECTING LEARNING RESOURCES FOR THE CLASSROOM

Selecting a learning resource means choosing locally appropriate materials from the list of recommended resources or other lists of evaluated resources. The process of selection involves many of the same considerations as the process of evaluation, though not to the same level of detail. Content, instructional design, technical design, and social considerations may be included in the decision-making process, along with a number of other criteria.

The selection of learning resources should be an ongoing process to ensure a constant flow of new materials into the classroom. It is most effective as an exercise in group decision making, co-ordinated at the school, district, and ministry levels. To function efficiently and realize the maximum benefit from finite resources, the process should operate in conjunction with an overall district and school learning resource implementation plan.

Teachers may choose to use provincially recommended resources to support provincial or locally developed curricula; or they may choose resources that are not on the ministry's list; or they may choose to develop their own resources. Resources that are not on the provincially recommended list must be evaluated through a local, board-approved process.

CRITERIA FOR SELECTION

There are a number of factors to consider when selecting learning resources.

Content

The foremost consideration for selection is the curriculum to be taught. Prospective resources must adequately support the particular learning objectives that the teacher wants to address. Resources on the ministry's *recommended* list are not matched directly to learning outcomes, but they are linked to the appropriate curriculum organizers. It is the responsibility of the teacher to determine whether a resource will effectively support any given learning outcomes within a curriculum organizer. This can only be done by examining descriptive information regarding that resource; acquiring additional information about the material from the supplier, published reviews, or colleagues; and by examining the resource first-hand.

Instructional Design

When selecting learning resources, teachers must keep in mind the individual learning styles and abilities of their students, as well as anticipate the students they may have in the future. Resources have been recommended to support a variety of special audiences, including gifted, learning disabled, mildly intellectually disabled, and ESL students. The suitability of a resource for any of these audiences has been noted in the resource annotation. The instructional design of a resource includes the organization and presentation techniques; the methods used to introduce, develop, and summarize concepts; and the vocabulary level. The

suitability of all of these should be considered for the intended audience.

Teachers should also consider their own teaching styles and select resources that will complement them. The list of *recommended* resources contains materials that range from prescriptive or self-contained resources, to open-ended resources that require considerable teacher preparation. There are *recommended* materials for teachers with varying levels and experience with a particular subject, as well as those that strongly support particular teaching styles.

Technology Considerations

Teachers are encouraged to embrace a variety of educational technologies in their classrooms. To do so, they will need to ensure the availability of the necessary equipment and familiarize themselves with its operation. If the equipment is not currently available, then the need must be incorporated into the school or district technology plan.

Social Considerations

All resources on the ministry's *recommended* list have been thoroughly screened for social concerns from a provincial perspective. However, teachers must consider the appropriateness of any resource from the perspective of the local community.

Media

When selecting resources, teachers should consider the advantages of various media. Some topics may be best taught using a specific medium. For example, video may be the most appropriate medium when teaching a particular, observable skill, since it provides a visual model that can be played over and over or viewed in slow motion for detailed analysis. Video can also bring otherwise unavailable experiences into the classroom and reveal "unseen worlds" to students. Software may be particularly useful when students are expected to develop critical-thinking skills through the manipulation of a simulation, or where safety or repetition are factors. Print resources or CD-ROM can best be used to provide extensive background information on a given topic. Once again, teachers must consider the needs of their individual students, some of whom may learn better from the use of one medium than another.

Funding

As part of the selection process, teachers should determine how much money is available to spend on learning resources. This requires an awareness of school and district policies, and procedures for learning resource funding. Teachers will need to know how funding is allocated in their district and how much is available for their needs. Learning resource selection should be viewed as an ongoing process that requires a determination of needs, as well as long-term planning to co-ordinate individual goals and local priorities.

Existing Materials

Prior to selecting and purchasing new learning resources, an inventory of those resources that are already available should be established through consultation with the school and district resource centres. In some districts, this can be facilitated through the use of district and school resource management and tracking systems. Such systems usually involve a computer database program (and possibly bar-coding) to help keep track of a multitude of titles. If such a system is put on-line, then teachers can check the availability of a particular resource via a computer.

SELECTION TOOLS

The Ministry of Education has developed a variety of tools to assist teachers with the selection of learning resources.

These include:

- Integrated Resource Packages (IRPs) which contain curriculum information, teaching and assessment strategies, and *recommended* learning resources
- learning resources information via annotation sets, resource databases on disks, the Learning Resources CD-ROM, and, in the future, on-line access
- sets of the most recently recommended learning resources (provided each year to a number of host districts throughout the province to allow teachers to examine the materials first hand at regional displays)
- sample sets of provincially recommended resources (available on loan to districts on request)

A MODEL SELECTION PROCESS

The following series of steps is one way a school resource committeee might go about selecting learning resources:

1. Identify a resource co-ordinator (for example, a teacher-librarian).
2. Establish a learning resources committee made up of department heads or lead teachers.
3. Develop a school vision and approach to resource-based learning.
4. Identify existing learning resource and library materials, personnel, and infrastructure.
5. Identify the strengths and weaknesses of the existing systems.
6. Examine the district Learning Resources Implementation Plan.
7. Identify resource priorities.
8. Apply criteria such as those found in *Selection and Challenge* to shortlist potential resources.
9. Examine shortlisted resources first-hand at a regional display or at a publishers' display, or borrow a set from the Learning Resources Branch.
10. Make recommendations for purchase.

FURTHER INFORMATION

For further information on evaluation and selection processes, catalogues, CD-ROM catalogues, annotation sets, or resource databases, please contact the Learning Resources Branch at 387-5331 or by fax at 387-1527.

Alternative Energies: Fuels for the Future

General Description: Twenty-minute video examines a variety of renewable and non-renewable energy resources, their uses, concerns, and environmental impact. Teacher's guide with glossary, discussion topics, and follow-up activities is included.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Energy and Power
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
					✓	✓	✓	✓		

Year Recommended: *1995*

Supplier: *McIntyre Media Ltd.*

30 Kelfield Street
Rexdale, ON
M9W 5A2

Tel: 1-800-565-3036 Fax: (416) 245-8660

Price: $99.00

ISBN/Order No: 849600-61

Artstraws

General Description: Carton of 1800 paper straws 43.2 cm long accompanied by two instruction pamphlets. Activities allow students to discover properties of the straws and learn how to modify a structure using scissors, tape, and plasticine. Complementary print resource is *Challenging Artstraws.*

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Production
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓	✓	✓	✓	✓	✓	✓	✓	✓		

Year Recommended: *1995*

Supplier: *Louise Kool + Galt Ltd.*

Unit 11, 1149 Bellamy Road
Scarborough, ON
M1H 1H7

Tel: (416) 439-4322 Fax: (416) 439-1861

Price: $39.95

ISBN/Order No: 009.N3519E

Brio-Mec Educational Set 3

General Description: Four hundred and thirty-piece investigative kit of tools, blocks, connectors, coloured blocks, axles, wheels, etc., accompanied by two teacher's guides and six activity cards. The manipulatives help develop skills in design, problem solving, production, and manipulation.

Audience: *General*
ESL - does not rely on reading for problem solving
LD - does not rely on reading for problem solving
ID (Mild) - does not require illustration to employ
Blind/Visual Impairments - safe, identifiable by feel

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Production
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓	✓	✓	✓							

Year Recommended: *1995*

Supplier: *Louise Kool + Galt Ltd.*

Unit 11, 1149 Bellamy Road
Scarborough, ON
M1H 1H7

Tel: (416) 439-4322 Fax: (416) 439-1861

Price: $295.00

ISBN/Order No: 009-N4714E

Capsela

General Description: Construction and modelling kit of moving gears and parts that are contained inside transparent capsules. The interlocking parts snap together to make a variety of motorized land and water models. The resource engages students in active learning of mechanical and electrical principles.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Energy and Power
Production

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
		✓	✓	✓	✓	✓				

Year Recommended: *1995*

Supplier: *Louise Kool + Galt Ltd.*

Unit 11, 1149 Bellamy Road
Scarborough, ON
M1H 1H7

Tel: (416) 439-4322 Fax: (416) 439-1861

Price: Class Pack: $119.95
Junior 400 Kit: $59.95

ISBN/Order No: Class Pack: 019-08848
Junior 400 Kit: 019-08845

The Car

General Description: Book offers a historical approach to cars and provides background information on the principles of technology.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Energy and Power
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
				✓	✓					

Year Recommended: *1995*

Supplier: *Nelson Canada*

1120 Birchmount Road
Scarborough, ON
M1K 5G4

Tel: (416) 752-9100 (ext 261) Fax: (416) 752-9365

Price: $16.99

ISBN/Order No: 0-531-17415-8

Challenging Artstraws

General Description: Reproducible book offers suggestions and teaching tips for the design and construction of models using artstraws that are close to real-life structures. Challenges are presented in a problem-solving format to develop students' concept of systems.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Production
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
	✓	✓	✓	✓						

Year Recommended: *1995*

Supplier: *Spectrum Educational Supplies Ltd.*

125 Mary Street
Aurora, ON
L4G 1G3

Tel: (905) 841-0600 Fax: (905) 727-6265

Price: Book: $17.65
Artstraws: $12.50

ISBN/Order No: Book: 1-884461-07-7
Artstraws: 20092

Design and Make Folios

General Description: Ten reproducible activity and reference books for: transportation; building structures; control, switches, electricity; science at work; hydraulics, pneumatics; joining, adhesives; levers, linkages; simple machines; alternative energy; our heritage; and making it move. Require students to measure, cut and join materials together to control structure and circuits. Activities reflect real-world experiences. All materials and equipment are extra and available from supplier.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Energy and Power
Production
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
			✓	✓	✓					

Year Recommended: *1995*

Supplier: *Technology Teaching Systems*

Unit 2 - 45 Basalatic Road
Concord, ON
L4K 1C5

Tel: (905) 660-3933 Fax: (905) 660-3056

Price: $15.95 each

ISBN/Order No: (not available)

Design and Technology

General Description: Book contains a selection of activities to increase student awareness of technology and design in familiar contexts. It is organized into three sections dealing with communication, problem-solving activities, and structural and mechanical devices.

Audience: *General*

Category: *Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power
Production, Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓	✓									

Year Recommended: *1995*

Supplier: *Nelson Canada*

1120 Birchmount Road
Scarborough, ON
M1K 5G4

Tel: (416) 752-9100 (ext 261) Fax: (416) 752-9365

Price: (not available)

ISBN/Order No: 216-92625-4

Discovery Kits: Pumping it up with Pneumatics

General Description: Resource kit provides an introduction to pneumatics and hydraulics through theory and practical, hands-on activities. Support structures and several circuits can be constructed.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Energy and Power

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
					✓	✓	✓	✓		

Year Recommended: *1995*

Supplier: *Spectrum Educational Supplies*

2102 Elspeth Place
Port Coquitlam, BC
V3C 1G3

Tel: (604) 942-5835 Fax: (604) 941-1066

Price: $29.95

ISBN/Order No: 70022

Experience Technology: Communication, Production, Transportation, Biotechnology

General Description: Multi-format resource introduces students to the principal fields of technology. Visually rich, it provides challenging problem-solving activities. Components include introductory student text, student workbook, student video, annotated teacher's text, resource binder, teacher's video, and computer testbank in Macintosh or MS-DOS format.

Audience: *General*
Gifted - extension in activities
LD - concept development, highly visual, appropriate vocabulary, other forms of communication such as group presentation, speaking versus writing

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power
Production, Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
				✓	✓	✓				

Year Recommended: *1995*

Supplier: *McGraw-Hill Ryerson Ltd. (Ontario)*

300 Water Street
Whitby, ON
L1N 9B6

Tel: (905) 430-5000 Fax: (905) 430-5020

Price: $40.00 - $140.00

ISBN/Order No: (not available)

The Factory

General Description: Macintosh software program creates problem-solving situations using a factory production line context. Students use various methods to determine the design solution at the end of a sequence of operations including patterning, sequencing, and rotating. A teacher's guide is included.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Production

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
		✓	✓							

Year Recommended: *1995*

Supplier: *Sunburst / Wings for Learning*

920 Mercer Street
Windsor, ON
N9A 7C2

Fax: (914) 747-4109

Price: $79.00

ISBN/Order No: 6475

Fixing The Fence

General Description: Six-minute video positively portrays a father and his four-year-old son repairing a section of an old fence. The process involves use of tools and materials.

Caution: *Safety in use of real tools as compared to toy tools requires further development and consideration.*

Audience: *General*

Category: *Teacher Resource*

Curriculum Organizer(s): *Production*
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓										

Year Recommended: *1995*

Supplier: *International Tele-Film Enterprises Ltd.*

5090 Explorer Drive, Suite #301
Mississauga, ON
L4W 4T9

Tel: (905) 629-3133 Fax: (905) 629-1211

Price: $49.95

ISBN/Order No: FIX200

Folens Technology

General Description: Package of design and technology activities consisting of: five student booklets containing projects centred on a theme, and two support manuals offering a variety of skill-based activities. Projects and activities focus on "designing and making."

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Energy and Power*, *Production*, *Self and Society*

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
		✓	✓	✓	✓					

Year Recommended: *1995*

Supplier: *Bacon & Hughes*

13 Deerlane Avenue
Nepean, ON
K2E 6W7

Tel: (613) 226-8136 Fax: (613) 226-8121

Price: $14.95 - $17.95 each

ISBN/Order No: (not available)

Ginn Realization Technology

General Description: Two-level resource package comprises: an instructional video and 4 big books accompanied by 16 small books of the same titles (4 of each). The big books provide a skill-building, problem-solving approach to technology education. Activities and projects are centred around themes. The big books include teacher's notes.

Caution: *Metric system is not used. Teachers will need to convert for use in schools.*

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*, *Energy and Power*, *Production*, *Self and Society*

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓	✓	✓	✓	✓						

Year Recommended: *1995*

Supplier: *Prentice Hall Ginn Canada (Ont.)*

1870 Birchmount Road
Scarborough, ON
M1P 2J7

Tel: (416) 293-3621 Fax: (416) 299-2539

Price: $29.95 - $39.95 each

ISBN/Order No: (not available)

How to Make Great Videos - With Just a Camcorder

General Description: Twenty-five-minute video examines numerous stages in planning a video, developing ideas, storyboarding, and casting. Techniques such as lighting, in-camera editing, and animation are demonstrated. Student-centred activities show how to plan and produce using just one camera.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*, *Production*, *Self and Society*

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
					✓	✓	✓	✓		

Year Recommended: *1995*

Supplier: *McIntyre Media Ltd.*

30 Kelfield Street
Rexdale, ON
M9W 5A2

Tel: 1-800-565-3036 Fax: (416) 245-8660

Price: $149.00

ISBN/Order No: 352700-21

In the Kitchen

General Description: Twenty-minute British video shows students working in groups to design kitchens based on efficient use of space for two different situations. It walks the viewer through a series of steps for solving design problems while emphasizing scale drawing and modelling.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Production
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
					✓	✓	✓	✓		

Year Recommended: *1995*

Supplier: *Marlin Motion Pictures Ltd. (Man.)*

418 Waterloo Street
Winnipeg, MB
R3N 0S8

Tel: (204) 489-6185 Fax: (204) 489-0347

Price: $750.00

ISBN/Order No: 73842

Investigating Technology

General Description: Two books offer a collection of problem-solving challenges centred around 10 topics: building, clothes, communication, conservation, food, home, recreation, school, transport, and the world of work. Teacher's notes are included. A 17-page resource section details techniques and materials.

Audience: *General*
Gifted - extensions, open-ended
LD - not prescriptive, user-friendly, does not rely on text

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power
Production, Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
	✓	✓	✓	✓	✓					

Year Recommended: *1995*

Supplier: *Copp Clark Longman Ltd.*

2775 Matheson Boulevard East
Mississauga, ON
L4W 4P7

Tel: (905) 238-6074 Fax: (905) 238-6075

Price: Book 1: $24.40
Book 2: $24.40

ISBN/Order No: Book 1: 05828-79981
Book 2: 05828-7999X

Investigating the World of Science, Math and Real Technology

General Description: Binder integrates the areas of Technology Education, Math, and Science using five broad themes: "parks and recreation," "bricks," "bicycles," "hot and cold," and "water world." Each lesson plan includes teacher notes, student skills, teachable moments, key questions, and ideas for cross-curricular development.

Audience: *General*

Category: *Teacher Resource*

Curriculum Organizer(s): *Control*
Energy and Power
Production
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
		✓	✓	✓						

Year Recommended: *1995*

Supplier: *Exclusive Educational Products*

243 Saunders Road
Barrie, ON
L4M 6E7

Tel: (705) 725-1166 Fax: (705) 725-1167

Price: $34.95

ISBN/Order No: 0057

Lego /Dacta Early Simple Machines

General Description: Resource package has three components: a construction kit of simple machine manipulatives, colour-coded activity cards, and an instructor's guide. Teaching topics address stable structures, pivot point, wheels and axles, movement, and gears. Teacher direction required.

Audience: *General*
ESL - visuals and manipulatives
LD - hands-on activities

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Energy and Power
Production
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓	✓									

Year Recommended: *1995*

Supplier: *LEGO Canada Inc.*

380 Markland Street
Markham, ON
L6C 1T6

Tel: (905) 887-5346 Fax: (905) 887-1274

Price: $109.00

ISBN/Order No: Kit: 9651

Lego/Dacta Science and Technology Activities Collection

General Description: Binder of reproducible activity cards for using Lego/Dacta materials to solve sophisticated problems. Specific Lego/Dacta modules 1030, 1032, and 9605 required.

Audience: *General*
Gifted - opportunities for extension

Curriculum Organizer(s): *Control*
Energy and Power

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
	✓	✓	✓							

Year Recommended: *1995*

Light Magic

General Description: Book contains 24 problem-solving activities covering a range of topics based on energy. The activities integrate real-world experiences.

Audience: *General*
ESL - variety of hands-on activities
LD - variety of hands-on activities, easy applications

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power
Production, Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
		✓	✓	✓	✓					

Year Recommended: *1995*

Supplier: *Firefly Books Ltd.*

250 Sparks Avenue
Willowdale, ON
M2H 2S4

Tel: (416) 499-8412 Fax: (416) 499-8313

Price: $8.96

ISBN/Order No: 1-895688-16-7

Machines At Work

General Description: Book explores mechanical devices and machines. Simple principles of technology such as levers, cranks, and friction are studied. Explicit diagrams and a glossary are included.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Production

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
		✓	✓	✓	✓					

Year Recommended: *1995*

Supplier: *Nelson Canada*

1120 Birchmount Road
Scarborough, ON
M1K 5G4

Tel: (416) 752-9100 (ext 261) Fax: (416) 752-9365

Price: $16.99

ISBN/Order No: 0531-142-434

Making the Most of Things

General Description: Twenty-six-minute video features the life of Elizabeth Gale, an 81-year-old furniture maker from Newfoundland. Completely self-taught and using just a few tools, she developed her own style of folk art furniture.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Production*
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
				✓	✓	✓	✓	✓		

Year Recommended: *1995*

Supplier: *Moving Images Distribution*

402 West Pender Street, Suite 606
Vancouver, BC
V6B 1T6

Tel: (604) 684-3014 Fax: (604) 684-7165

Price: $295.00

ISBN/Order No: 662-1

Parking Places

General Description: Twenty-minute British video explores the principles behind a well-designed parking lot. It shows students in groups brainstorming and working toward a conclusion and solution.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Production
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
			✓	✓	✓	✓				

Year Recommended: *1995*

Supplier: *Marlin Motion Pictures Ltd. (Ont.)*

211 Watline Avenue
Mississauga, ON
L4P 1P3

Tel: (905) 890-1500 Fax: (905) 890-6550

Price: $750.00

ISBN/Order No: 73807

Q Science Series

General Description: Collection of seven books organized around three themes: "forces and energy," "material," and "communications." The books contain a large number of student activities and experiments related to each concept.

Audience: *General*

Category: *Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power
Production, Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
				✓	✓	✓				

Year Recommended: *1995*

Supplier: *Copp Clark Longman Ltd.*

2775 Matheson Boulevard East
Mississauga, ON
L4W 4P7

Tel: (905) 238-6074 Fax: (905) 238-6075

Price: $7.60 - $8.40 each

ISBN/Order No: (not available)

The Random House Book of How Things Were Built

General Description: Book explores the history and development of structures including buildings, bridges, dams, aqueducts, and roads. Clearly detailed scene-setting diagrams are used. A comprehensive glossary is included.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Production*

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
				✓	✓	✓	✓			

Year Recommended: *1995*

Supplier: *Random House of Canada Ltd.*

1265 Aerowood Drive
Mississauga, ON
L4W 1B9

Tel: (905) 624-0672 Fax: (905) 624-6217

Price: $19.00

ISBN/Order No: 0679820442

The Really Practical Guide to Primary Technology

General Description: Book provides a comprehensive overview of the process involved in teaching, modifying, and assessing topics in elementary design and technology. A large bank of practical lessons with illustrations is included.

Audience: *General*
Gifted - open-ended problems promote critical thinking
LD - addresses special needs

Category: *Teacher Resource*

Curriculum Organizer(s): *Control*, *Energy and Power*, *Production*

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓	✓	✓	✓							

Year Recommended: *1995*

Supplier: *Bacon & Hughes*

13 Deerlane Avenue
Nepean, ON
K2E 6W7

Tel: (613) 226-8136 Fax: (613) 226-8121

Price: $19.95

ISBN/Order No: 7487-1174-0

The Resources and Projects Book

General Description: Ninety-six-page book presents a number of technological concepts in two main sections: "resources" and "projects." It contains simple explanations of key areas using a cartoon approach and including skill tips. Suggestions for flexible, open-ended projects emphasize the links between technology and business.

Audience: *General*

Category: *Teacher Resource*

Curriculum Organizer(s): *Communications*, *Energy and Power*, *Production*, *Self and Society*

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
		✓	✓	✓	✓					

Year Recommended: *1995*

Supplier: *Nelson Canada*

1120 Birchmount Road
Scarborough, ON
M1K 5G4

Tel: (416) 752-9100 (ext 261) Fax: (416) 752-9365

Price: (not available)

ISBN/Order No: 0-02-954154-9

Robots at Work

General Description: Ten-minute video provides an introduction to robotics and the principles of robotics movements using industrial applications as examples. It shows how Cartesian co-ordinates are applied to program the robots for three-dimensional movement. Questions are posed to viewers during the video and highlighted by examples.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*, *Production*, *Self and Society*

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
					✓	✓	✓	✓		

Year Recommended: *1995*

Supplier: *Marlin Motion Pictures Ltd. (Man.)*

418 Waterloo Street
Winnipeg, MB
R3N 0S8

Tel: (204) 489-6185 Fax: (204) 489-0347

Price: $500.00

ISBN/Order No: (not available)

Science, Technology and Society Themes for Early Childhood

General Description: Four resource binders contain illustrated activity cards for using duplo with skill-building and problem-solving projects related to animals, transportation, homes and spaces, and buildings and structures. A broad range of activities are offered.

Audience: *General*
ESL - heavily visual, relates to child's experiences
LD - heavily visual, relates to child's experiences

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power
Production, Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓	✓									

Year Recommended: *1995*

Supplier: *Spectrum Educational Supplies*

2102 Elspeth Place
Port Coquitlam, BC
V3C 1G3

Tel: (604) 942-5835 Fax: (604) 941-1066

Price: $55.00 each

ISBN/Order No: (not available)

The Sky's the Limit with Math and Science

General Description: Reproducible investigations provide a technological approach to math and science. The major focus is on an aerodynamics theme. Concepts such as trigonometry and Bernoulli's Principle are explored through a technology education problem-solving approach.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Energy and Power
Production

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
			✓	✓	✓	✓	✓			

Year Recommended: *1995*

Supplier: *Spectrum Educational Supplies*

2102 Elspeth Place
Port Coquitlam, BC
V3C 1G3

Tel: (604) 942-5835 Fax: (604) 941-1066

Price: $34.95

ISBN/Order No: 1-881431-44-4/20128

Techniques For Technology

General Description: Book promotes practical ideas and concepts related to power, energy, and controls, especially electrical. Black and white design sketches provide information about using a variety of materials, ranging from everyday to sophisticated, to encourage technological activities in the classroom.

Audience: *General*

Category: *Teacher Resource*

Curriculum Organizer(s): *Control*
Energy and Power

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
					✓	✓	✓			

Year Recommended: *1995*

Supplier: *Technology Teaching Systems*

Unit 2 - 45 Basalatic Road
Concord, ON
L4K 1C5

Tel: (905) 660-3933 Fax: (905) 660-3056

Price: $19.95

ISBN/Order No: 1-8994-13-103/TTS-TFT

Technology

General Description: Two British resource binders offer a large bank of reproducible technology ideas and activities from topics and stories related to: vehicles, pets, houses, movement, machines, and change. Problem-solving projects explore principles of technology. Also included are techniques, evaluation sheets, and equipment checklists.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power
Production, Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓	✓	✓	✓	✓	✓					

Year Recommended: *1995*

Supplier: *Bacon & Hughes*

13 Deerlane Avenue
Nepean, ON
K2E 6W7

Tel: (613) 226-8136 Fax: (613) 226-8121

Price: $24.95 each

ISBN/Order No: (not available)

Technology Craft Topics

General Description: Collection of six books: *Planes and Flight, Land Transportation, Space, Canals and Waterways, Ships and Shipwrecks,* and *Bridges and Tunnels.* Each book provides a historical and international approach to its topic, and gives background information. Some activities are suggested. Large, colourful visuals enhance the text.

Audience: *General*
Gifted - opportunities for independent study

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power
Production, Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
				✓	✓	✓				

Year Recommended: *1995*

Supplier: *Nelson Canada*

1120 Birchmount Road
Scarborough, ON
M1K 5G4

Tel: (416) 752-9100 (ext 261) Fax: (416) 752-9365

Price: $16.99 each

ISBN/Order No: (not available)

Technology I.D.E.A.S.: A Teaching Resource Book

General Description: Book provides some philosophy of technology education, implementation ideas, processes for evaluation, and numerous project ideas that tie technology education to other curricular areas.

Audience: *General*

Category: *Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
			✓	✓	✓	✓	✓	✓		

Year Recommended: *1995*

Supplier: *Prentice Hall Ginn Canada (Ont.)*

1870 Birchmount Road
Scarborough, ON
M1P 2J7

Tel: (416) 293-3621 Fax: (416) 299-2539

or

2102 Elspeth Place
Port Coquitlam, BC
V3C 1G3

Tel: (604) 942-5835 Fax: (604) 941-1066

Price: $30.00

ISBN/Order No: 0-02-954154-9

Technology in Action

General Description: Multi-level British resource comprises big books, project cards, game books, and teacher material which explore processes involved in design and technical skills through four themes: "movement," "life forces," "structures," and "leisure." Focus is on an activity-oriented, skill-building, cross-curricular approach.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power
Production, Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓	✓	✓	✓	✓						

Year Recommended: *1995*

Supplier: *Bacon & Hughes*

13 Deerlane Avenue
Nepean, ON
K2E 6W7

Tel: (613) 226-8136 Fax: (613) 226-8121

Price: $85.00 - $99.00

ISBN/Order No: (not available)

Tracktronics: Opportunities for Design Using Electronics

General Description: Student workbook and teacher's guide provide a framework for a hands-on approach to electronic components. Resource focusses on recognition and understanding of electronic components, ability to read and work with simple schematic diagrams and real circuits, and developing manipulative skills.

Audience: *General*

Category: *Teacher Resource*

Curriculum Organizer(s): *Control*
Energy and Power
Production

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
					✓	✓				

Year Recommended: *1995*

Supplier: *Spectrum Educational Supplies*

2102 Elspeth Place
Port Coquitlam, BC
V3C 1G3

Tel: (604) 942-5835 Fax: (604) 941-1066

Price: Student Workbook: $24.95
Teacher's Guide: $39.00

ISBN/Order No: Student Workbook: 1-873101-15-5/21672
Teacher's Guide: 1-873101-16-3/21670

Transportation Cards

General Description: One hundred and eight black and white cards, 9 by 14 cm, provide pictoral representations of different modes of transportation. They feature significant Canadian content and could be used to promote active learning in the areas of design, problem solving, and principles of technology.

Audience: *General*
ESL - pictures of various modes of transportation from several cultures
LD - open-ended, can be used to develop language skills

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Energy and Power
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
✓	✓	✓	✓	✓	✓					

Year Recommended: *1995*

Supplier: *McCracken Educational Services*

#15 19257 Enterprise Way
Surrey, BC
V3S 6J8

Tel: (604) 534-2434 Fax: (604) 534-2554

Price: $9.63

ISBN/Order No: 1104

Visual Guides Series

General Description: Collection of four hardcover books with large cutaway illustrations, photographs, and simple text: *Transport Machines, Flying Machines, Sport Machines,* and *Space Machines.* Each machine or vehicle presented on a double page. Background information discusses the principles of technology.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Communications*
Energy and Power
Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
		✓	✓	✓	✓					

Year Recommended: *1995*

Supplier: *Nelson Canada*

1120 Birchmount Road
Scarborough, ON
M1K 5G4

Tel: (416) 752-9100 (ext 261) Fax: (416) 752-9365

Price: $17.99 each

ISBN/Order No: (not available)

The Way Things Work

General Description: CD-ROM with an entertaining and interactive design features a program that provides information on a variety of technological topics using visual aids and sound very effectively. Format allows the student to move easily through various levels of scope and depth. Requires Windows PC. Macintosh version under development.

Audience: *General*

Category: *Student, Teacher Resource*

Curriculum Organizer(s): *Control*
Communications
Energy and Power
Production, Self and Society

Grade Level:

K/1	2/3	4	5	6	7	8	9	10	11	12
		✓	✓	✓	✓	✓	✓	✓		

Year Recommended: *1995*

Supplier: *Irwin Publishing*

1800 Steeles Avenue West
Concord, ON
L4K 2P3

Tel: (905) 660-0611 Fax: (905) 660-0676

Price: $60.00

ISBN/Order No: 1-56458-901-3

Appendix C
Cross-Curricular Outlines

The three principles of learning stated in the introduction of this Integrated Resource Package (IRP) support the foundation of the Kindergarten to Grade 12 Education Plan. They have guided all aspects of the development of this document, including the curriculum outcomes, instructional strategies, assessment strategies, and learning resource evaluations. In addition to these three principles, it is recognized that British Columbia's schools include young people of varied backgrounds, interests, abilities, and needs. In order to meet these needs and ensure equity and access for all learners, the development of each component of this document has also been guided by a series of cross-curricular outlines. It is expected that these principles and cross-curricular outlines will guide the users of this document as they engage in school and classroom organization and instructional planning and practice.

The following cross-curricular outlines have been used to focus the development and evaluation of the components of the IRP:

- Applied Focus in Curriculum
- Career Development
- English as a Second Language (ESL)
- Environment and Sustainability
- First Nations Studies
- Gender Equity
- Information Technology
- Media Education
- Multiculturalism and Anti-Racism
- Science-Technology-Society
- Special Needs

APPLIED FOCUS IN CURRICULUM

An applied focus in all subjects and courses promotes the use of practical applications to demonstrate theoretical knowledge. Using real world and workplace problems and situations as a context for the application of theory makes school more relevant to students' needs and goals. An applied focus strengthens the link between what students need to know to function effectively in the workplace or in post-secondary education and what they learn in Kindergarten through Grade 12.

Implementation of an applied approach involves working with a wide range of partners including universities, colleges, institutes, employers, community groups, parents, and government.

The applied focus in curriculum is consistent with the following statements from the Kindergarten to Grade 12 Education Plan:

> *All levels of the program are developed around a common core of learning to ensure that students learn to read, write, and do mathematics, solve problems, and use computer-based technology.*
>
> *Employers expect graduates to be good learners, to think critically and solve problems, to communicate clearly, to be self-directed, and to work well with others. The new workplace also re quires people to be knowledgeable about technology and able to search out and apply information from many sources.*

Some examples of an applied focus in different subjects are:

English Language Arts—increasing emphasis on language used in everyday situations and in the workplace, such as for job interviews, memo and letter writing, word processing, and technical communication (including the ability to interpret technical reports, manuals, tables, charts, and graphics)

Mathematics—more emphasis on skills needed in the workplace, including knowledge of probability and statistics, logic, measurement theory, and problem solving

Science—more practical applications and hands-on experience of science, such as reducing energy waste in school or at home, caring for a plant or animal in the classroom, using computers to produce tables and graphs and for spreadsheets

Business Education—more emphasis on real world applications such as preparing résumés and personal portfolios, participating in groups to solve business communication problems, using computer software to keep records, and using technology to create and print marketing material

Visual Arts—applying visual arts skills to real world design, problem solving, and communications; exploring career applications of visual arts skills; experimenting with a variety of new technologies to create images; and a new emphasis on creating and understandng images of social significance to the community.

This summary is derived from the Kindergarten to Grade 12 Education Plan (September 1994), and curriculum documents from British Columbia and other jurisdictions.

CAREER DEVELOPMENT

Career development is an ongoing process through which learners integrate their personal, family, school, work, and community experiences to facilitate career and lifestyle choices. The main emphases of career development are career awareness, career exploration, career preparation, career planning, and career work experience.

In the process of career development students develop:

- an open attitude toward a variety of occupations and types of work
- an understanding of the relationship between work and leisure, work and the family, and work and one's interests and abilities
- an understanding of the role of technology in the workplace and in daily life
- an understanding of the relationship between work and learning
- an understanding of the changes taking place in the economy, society, and the job market
- an ability to construct learning plans and reflect on the importance of lifelong learning
- an ability to prepare for multiple roles throughout life

In the Primary Years

Career awareness promotes an open attitude toward a variety of career roles and types of work. Topics include:

- the role of work and leisure
- relationships among work, the family, one's personal interests, and one's abilities

A variety of careers can be highlighted through the use of in-class learning activities focussing on the students themselves and on a range of role models, including non-traditional role models.

In Grades 4 to 8

The emphasis on self-awareness and career awareness is continued. Topics include:

- interests, aptitudes, and possible future goals
- technology in the workplace and in our daily lives
- social, family, and economic changes
- future education options
- career clusters (careers that are related to one another)

- lifestyles
- external influences on decision making

Games, role-playing, drama, and appropriate community volunteer experience can be used to help students actively explore the world of work. Field experiences in which students observe and interview workers in their occupational environments may also be appropriate. These learning activities will facilitate the development of interpersonal communications and group problem-solving skills needed in the workplace and in other life situations.

In Grades 9 and 10

The emphasis is on providing students with opportunities to prepare for and make appropriate and realistic decisions. In developing their student learning plans, they will relate self-awareness to their goals and aspirations. They will also learn many basic skills and attitudes that are required for an effective transition into adulthood. This will assist in preparing them to be responsible and self-directed throughout their lives. Topics include:

- entrepreneurial education
- employability skills (e.g., how to find and keep a job)
- the importance of lifelong education and career planning
- involvement in the community
- the many different roles that an individual can play throughout life
- the dynamics of the working world (e.g., unions, unemployment, supply and demand, Pacific Rim, free trade)

The examination of personal interests and skills through a variety of career exploration opportunities (e.g., job shadowing) is emphasized at this level. Group discussion and individual consultation can be used to help students examine and confirm their personal values and beliefs.

In Grades 11 and 12

Career development in these grades is focussed more specifically on issues related to the world of work. These include:

- dynamics of the changing work force and changing influences on the job market (e.g., developing technology and economic trends)
- job-keeping and advancement skills (interpersonal skills needed in the workplace, employment standards)
- occupational health issues and accessing health support services
- funding for further education
- alternative learning strategies and environments for different life stages
- mandatory work experience (minimum 30 hours)

Work Experience

Work experience provides students with opportunities to participate in a variety of workplace situations to help prepare them for the transition to a work environment. Work experience also provides students with opportunities to:

- connect what they learn in school with the skills and knowledge needed in the workplace and society in general
- experience both theoretical and applied learning, which is part of a broad liberal education
- explore career directions identified in their Student Learning Plans

Descriptions of career development are drawn from the Ministry of Education's *Career Developer's Handbook, Guidelines for the Kindergarten to Grade 12 Education Plan, Implementation Resource, Part 1*, and the *Career and Personal Planning IRP*, April 1995.

ENGLISH AS A SECOND LANGUAGE (ESL)

ESL assistance is provided to students whose use of English is sufficiently different from standard English to prevent them from reaching their potential. Many students learning English speak it quite fluently and seem to be proficient. School, however, demands a more sophisticated version of English, both in reading and writing. Thus even fluent speakers might require ESL to provide them with an appropriate language experience that is unavailable outside the classroom. ESL is a transitional service rather than a subject. Students are in the process of learning the language of instruction and, in many cases, the content matter of subjects appropriate to their grade level. Thus ESL does not have a specific curriculum. The provincial curriculum is the basis of much of the instruction and is used to teach English as well as individual subject areas. It is the methodology, the focus, and the level of engagement with the curriculum that differentiates ESL services from other school activities.

Students in ESL

Nearly 10% of the British Columbia school population is designated as ESL students. These students come from a diversity of backgrounds. Most are recent immigrants to British Columbia. Some are Canadian-born but have not had the opportunity to learn English before entering the primary grades. The majority of ESL students have a well-developed language system and have had similar schooling to that of British Columbia-educated students. A small number, because of previous experiences, are in need of basic support such as literacy training, academic upgrading, and trauma counselling. Teachers may have ESL students at any level in their classes. Many ESL students are placed in subject-area classes primarily for the purpose of contact with English-speaking peers and experience with the subject and language. Other ESL students are wholly integrated into subject areas. A successful integration takes place when the student has reached a level of English proficiency and background knowledge in a subject to be successful with a minimum of extra support.

Optimum Learning Environment

The guiding principle for ESL support is the provision of a learning environment where the language and concepts can be understood by the students.

Good practices to enhance the learning of students include:

- using real objects and simple language at the beginning level
- taking into consideration other cultural backgrounds and learning styles at any level
- providing adapted (language-reduced) learning materials
- respecting a student's "silent period" when expression does not reflect the level of comprehension
- allowing students to practise and internalize information before giving detailed answers
- differentiating between form and content in student writing
- keeping in mind the level of demand placed on students

This summary is drawn from *Supporting Learners of English: Information for School and District Administrators*, RB0032, 1993, and *ESL Policy Discussion Paper (Draft)*, Social Equity Branch, December 1994.

ENVIRONMENT AND SUSTAINABILITY

Environmental education is defined as a way of understanding human relationships with the environment. It involves:

- students learning about their connections to the natural environment through all subjects
- students having direct experiences in the environment, both natural and human-built
- students making decisions about and acting for the environment

The term *sustainability* helps to describe societies that "promote diversity and do not compromise the natural world for any species in the future."

Value of Integrating Environment and Sustainability Themes

Integrating these themes into the curriculum helps students develop a responsible attitude toward caring for the earth. Studies that integrate environment and sustainability themes provide students with opportunities to identify their beliefs and opinions, reflect on a range of views, and ultimately make informed and responsible choices.

The guiding principles that should be interwoven in subjects from Kindergarten to Grade 12 are:

- Direct experience is the basis of human learning.
- Analysis of interactions helps humans make sense of their environment.
- Responsible action is both integral to and a consequence of environmental education.

Some organizing principles are:

- Human survival depends on complex natural and human-built systems.
- Human decisions and actions have environmental consequences.
- Students should be provided with opportunities to develop an aesthetic appreciation of the environment.

The theme study units might include: Consumerism, School Operating Systems, Pollution, or Endangered Species.

This summary is derived from *A Plan for Environmental Education*, Curriculum Branch October 1995

FIRST NATION STUDIES

First Nations studies focus on the richness and diversity of First Nations cultures and languages. These cultures and languages are examined within their own unique contexts and within historical, contemporary, and future realities. First Nations studies are based on a holistic perspective that integrates the past, present, and future. First Nations peoples are the original inhabitants of North America and live in sophisticated, organized, and self-sufficient societies. The First Nations constitute a cultural mosaic as rich and diverse as that of Western Europe, including different cultural groups (e.g., Nisga'a, KwaKwaka'Wakw, Nlaka'pamux, Secwepemc, Skomish, Tsimshian). Each is unique and has a reason to be featured in the school system. The First Nations of British Columbia constitute an important part of the historical and contemporary fabric of the province.

Value of Integrating First Nations Studies

- First Nations values and beliefs are durable and relevant today.
- There is a need to validate and substantiate First Nations identity.
- First Nations peoples have strong, dynamic, evolving cultures that have adapted to changing world events and trends.
- There is a need to understand similarities

and differences among cultures to create tolerance, acceptance, and mutual respect.
- There is a need for informed, reasonable discussion and decisionmaking regarding First Nations issues, based on accurate information (for example, as modern treaties are negotiated by Canada, British Columbia, and First Nations).

In studying First Nations, it is expected that the students will:

- demonstrate an understanding and appreciation for the values, customs, and traditions of First Nations peoples
- demonstrate an understanding of and appreciation for unique First Nations communications systems
- demonstrate a recognition of the importance of the relationship between First Nations peoples and the natural world
- recognize dimensions of First Nations art as a total cultural expression
- give examples of the diversity and functioning of the social, economic, and political systems of First Nations peoples in traditional and contemporary contexts
- describe the evolution of human rights and freedoms as they pertain to First Nations peoples

Some examples of curriculum integration include:

Visual Arts—comparing the artistic styles of two or more First Nations cultures

English Language Arts—analysing portrayals and images of First Nations peoples in various works of literature

Home Economics—identifying forms of food, clothing, and shelter in past and contemporary First Nations cultures

Technology Education—describing the sophistication of traditional First Nations technologies (e.g., bentwood or kerfed boxes, weaving, fishing gear)

Physical Education—participating in and developing an appreciation for First Nations games and dances

This summary is derived from *First Nations Studies: Curriculum Assessment Framework (Primary through Graduation)*, Aboriginal Education Branch, 1992, and *B.C. First Nations Studies 12 Curriculum*, Aboriginal Education Branch, 1994.

Gender Equity

Gender-equitable education involves the inclusion of the experiences, perceptions, and perspectives of girls and women, as well as boys and men, in all aspects of education. It will initially focus on girls in order to redress historical inequities. Generally, the inclusive strategies, which promote the participation of girls, also reach boys who are excluded by more traditional teaching styles and curriculum content.

Principles of Gender Equity in Education

- All students have the right to a learning environment that is gender equitable.
- All education programs and career decisions should be based on a student's interest and ability, regardless of gender.
- Gender equity incorporates a consideration of social class, culture, ethnicity, religion, sexual orientation, and age.
- Gender equity requires sensitivity, determination, commitment, and vigilance over time.
- The foundation of gender equity is cooperation and collaboration among students, educators, education organizations, families, and members of communities.

General Strategies for Gender-Equitable Teaching

- Be committed to learning about and practising equitable teaching.
- Use gender-specific terms to market opportunities—for example, if a technology fair has been designed to appeal to girls, mention girls clearly and specifically. Many girls assume that gender-neutral language in non-traditional fields means boys.
- Modify content, teaching style, and assessment practices to make non-traditional subjects more relevant and interesting for female and male students.
- Highlight the social aspects and usefulness of activities, skills, and knowledge.
- Comments received from female students suggest that they particularly enjoy integrative thinking; understanding context as well as facts; and exploring social, moral, and environmental impacts of decisions.
- When establishing relevance of material, consider the different interests and life experiences that girls and boys may have.
- Choose a variety of instructional strategies such as co-operative and collaborative work in small groups, opportunities for safe risk taking, hands-on work, and opportunities to integrate knowledge and skills (e.g., science and communication).
- Provide specific strategies, special opportunities, and resources to encourage students to excel in areas of study in which they are typically under-represented.
- Design lessons to explore many perspectives and to use different sources of information; refer to female and male experts.
- Manage competitiveness in the classroom, particularly in areas in which male students typically excel.
- Watch for biasses (e.g., in behaviour or learning resources) and teach students strategies to recognize and work to eliminate inequities they observe.
- Be aware of accepted gender-biassed practices in physical activity (e.g., in team sport, funding for athletes, and choices in physical education programs).
- Do not assume that all students are heterosexual.
- Share information and build a network of colleagues with a strong commitment to equity.
- Model non-biassed behaviour: use inclusive, parallel, or gender-sensitive language; question and coach male and female students with the same frequency, specificity, and depth; allow quiet students sufficient time to respond to questions.
- Have colleagues familiar with common gender biasses observe your teaching and discuss any potential bias they may observe.
- Be consistent over time.

This summary is derived from the preliminary *Report of the Gender Equity Advisory Committee*, received by the Ministry of Education in February 1994, and from a review of related material.

INFORMATION AND TECHNOLOGY

Information technology is the use of tools and electronic devices that allow us to create, explore, transform, and express information.

Value of Integrating Information Technology

As Canada moves from an agricultural and industrial economy to the information age, students must develop new knowledge, skills, and attitudes. The information technology curriculum has been developed to be integrated into all new curricula to ensure that students know how to use computers and gain the technological literacy demanded in the workplace.

In learning about information technology, students acquire skills in information analysis and evaluation, word processing, database analysis, information management, graphics, and multimedia applications. Students also identify ethical and social issues arising from the use of information technology.

With information technology integrated into the curriculum, students will be expected to:

- demonstrate basic skills in handling information technology tools
- demonstrate an understanding of information technology structure and concepts
- relate information technology to personal and social issues
- define a problem and develop strategies for solving it
- apply search criteria to locate or send information
- transfer information from external sources
- evaluate information for authenticity and relevance
- arrange information in different patterns to create new meaning
- modify, revise, and transform information
- apply principles of design affecting appearance of information
- deliver a message to an audience using information technology

The curriculum organizers are:

- ***Foundations***—the basic physical skills, and intellectual and personal understandings required to use information technology, as well as self-directed learning skills and socially responsible attitudes
- ***Explorations***—defining a problem to establish a clear purpose for search strategies and retrieval skills
- ***Transformations***—filtering, organizing, and processing information
- ***Expressions***—designing, integrating, and presenting a message using text, audio and visual information, and message delivery

This information is derived from the draft *Information Technology Curriculum K to 12* currently under development.

MEDIA EDUCATION

Media education is a multidisciplinary and interdisciplinary approach to the study of media. Media education deals with key media concepts and focusses on broad issues such as the history and role of media in different societies and the social, political, economic, and cultural issues related to the media. Instead of addressing the concepts in depth, as one would in media studies, media education deals with most of the central media concepts as they relate to a variety of subjects.

Value of Integrating Media Education

Popular music, television, film, radio, magazines, computer games, and information services—all supplying media messages—are pervasive in the lives of students today. Media education develops students' ability to think critically and independently about issues that affect them. Media education encourages students to identify and examine the values contained in media messages. It also cultivates the understanding that these messages are produced by others to inform, persuade, and entertain for a variety of purposes. Media education helps students understand the distortions that may result from the use of particular media practices and techniques. All curriculum areas provide learning opportunities for media education. It is not taught as a separate curriculum.

the context of many societal and individual factors
- develop a conscious awareness of personal values, decisions, and responsible actions about science and technology
- explore scientific processes and technological solutions
- contribute to responsible and creative solutions using science and technology

The organizing principles of STS are: Human and Natural Systems, Inventions and Discoveries, Tools and Processes, and Society and Change. Each organizer may be developed through a variety of contexts, such as the economy, environment, ethics, social structures, culture, politics, and education. Each context provides a unique perspective for exploring the critical relationships that exist and the challenges we face as individuals and as a global society.

Examples of curriculum integration include:

Visual Arts—recognizing that demands generated by visual artists have led to the development of new technologies and processes (e.g., new permanent pigments, fritted glazes, drawing instruments)

English Language Arts—analysing the recent influence of technologies on listening, speaking, and writing (e.g., CDs, voice mail, computer-generated speech)

Physical Education—studying how technology has affected our understanding of the relationship between activity and well-being

This summary is derived from *Science-Technology-Society—A Conceptual Framework*, Curriculum Branch, 1994.

SPECIAL NEEDS

Students with special needs have disabilities of an intellectual, physical, sensory, emotional, or behavioural nature; or have learning disabilities; or have exceptional gifts or talents.

All students can benefit from an inclusive learning environment that is enriched by the diversity of the people within it. Opportunities for success are enhanced when provincial learning outcomes and resources are developed with regard for a wide range of student needs, learning styles, and modes of expression.

Educators can assist in creating more inclusive learning environments by introducing the following:

- activities that focus on development and mastery of foundational skills (basic literacy)
- a range of co-operative learning activities and experiences in the school and community, including the application of practical, hands-on skills in a variety of settings
- references to specialized learning resources, equipment, and technology
- ways to accommodate special needs (e.g., incorporating adaptations and extensions to content, process, product, pacing, and learning environment; suggesting alternate methodologies or strategies; making references to special services)
- a variety of ways, other than through paper-and-pencil tasks, for students to demonstrate learning (e.g., dramatizing events to demonstrate understanding of a poem, recording observations in science by drawing or by composing and performing a music piece)
- promotion of the capabilities and contributions of children and adults with special needs
- participation in physical activity

All students can work toward achievement of the provincial learning outcomes. Many students with special needs learn what all students are expected to learn. In some cases the student's needs and abilities require that education programs be adapted or modified. A student's program may include regular instruction in some subjects, modified instruction in others, and adapted instruction in still others. Adaptations and modifications are specified in the student's Individual Education Plan (IEP).

Adapted Programs

An adapted program addresses the learning outcomes of the prescribed curriculum but provides adaptations so the student can participate in the program. These adaptations may include alternative formats for resources (e.g., Braille, books-on-tape), instructional strategies (e.g., use of interpreters, visual cues, learning aids), and assessment procedures (e.g., oral exams, additional time). Adaptations may also be made in areas such as skill sequence, pacing, methodology, materials, technology, equipment, services, and setting. Students on adapted programs are assessed using the curriculum standards and can receive full credit.

Modified Programs

A modified program has learning outcomes that are substantially different from the prescribed curriculum and specifically selected to meet the student's special needs. For example, a Grade 5 student in language arts may be working on recognizing common signs and using the telephone. A student on a modified program is assessed in relation to the goals and objectives established in the student's IEP.

Ministry Resources for Teachers of Students with Special Needs

The following publications are currently available from the Learning Resources Branch or are under development and will be made available soon:

The Universal Playground: A Planning Guide (Ministry of Education, 1991, FCG 129)

Hard of Hearing and Deaf Students—A Resource Guide to Support Classroom Teachers (Ministry of Education, 1994, RB0033)

Special Education Services—A Manual of Policies, Procedures and Guidelines (Ministry of Education, 1995)

I.E.P. Planning Resource (Ministry of Education, 1995)

Students with Visual Impairments—A Resource Guide to Support Classroom Teachers (Ministry of Education, 1995)

Gifted Students—A Resource Guide to Support Classroom Teachers (Ministry of Education, 1995)

Students with Intellectual Disabilities: A Resource Guide to Support Teachers (Ministry of Education, 1995)

Teaching for Student Differences—A Resource Guide to Support Classroom Teachers (Ministry of Education, 1995)

Resource Handbook for Adapted Curriculum Software (Ministry of Education, 1995)

Awareness Series (Ministry of Education, 1995)

This summary is derived from the *Handbook for Curriculum Developers*, February 1994, and *Special Education Services—A Manual of Policies, Procedures and Guidelines*, June 1995.

Appendix D
Assessment and Evaluation

ABOUT THIS APPENDIX

Prescribed learning outcomes, expressed in measurable terms, provide the basis for the development of learning activities, and assessment and evaluation strategies. After a general discussion of assessment and evaluation, this appendix uses sample evaluation plans to show how activities, assessment, and evaluation might come together in a particular technology education program. The generic assessment and evaluation tools in this appendix provide further planning support for teachers.

ASSESSMENT AND EVALUATION

Assessment is the systematic gathering of information about what students know, are able to do, and are working toward. Assessment methods include: student self-assessments, reviews of performance, portfolio assessments, and conferencing. Assessment tools may include observation, daily practice assignments, quizzes, samples of student work, pencil-and-paper tests, holistic rating scales, projects, and oral and written reports.

Student performance is evaluated from the information collected through assessment activities. Teachers use their insight, knowledge about learning, and experience with students, along with the specific criteria they establish, to make judgments about student performance in relation to prescribed learning outcomes.

Students benefit most when evaluation is provided on a regular, ongoing basis. When evaluation is seen as an opportunity to promote learning rather than as a final judgment, it shows learners their strengths and suggests how they can develop further. Students can use this information to redirect efforts, make plans, and establish future learning goals.

Evaluation may take different forms, depending on the purpose.

- Criterion-referenced evaluation should be used to evaluate student performance in classrooms. It is referenced to criteria based on learning outcomes described in the provincial curriculum. The criteria reflect a student's performance based on specific learning activities. When a student's program is substantially modified, evaluation may be referenced to individual goals. These modifications are recorded in an Individual Education Plan (IEP).
- Norm-referenced evaluation is used for large-scale system assessments; it is not to be used for classroom assessment. A classroom does not provide a large enough reference group for a norm-referenced evaluation system. Norm-referenced evaluation compares student achievement to that of others rather than comparing how well a student meets the criteria of a specified set of learning outcomes.

Criterion-Referenced Evaluation

In criterion-referenced evaluation, a student's performance is compared to established criteria rather than to the performance of other students. Evaluation referenced to prescribed curriculum requires that criteria are established based on the learning outcomes listed under the curriculum organizers for technology education.

Criteria are the basis of evaluating student progress; they identify the critical aspects of a performance or a product that describe in specific terms what is involved in meeting the learning outcomes. Criteria can be used to evaluate student performance in relation to learning outcomes. For example, weighting criteria, using rating scales, or perfor-

mance rubrics (reference sets) are three ways that student performance can be evaluated using criteria.

Samples of student performance should reflect learning outcomes and identified criteria. The samples clarify and make explicit the links between evaluation and learning outcomes, criteria, and assessment. Where a student's performance is not a product, and therefore not reproducible, a description of the performance sample should be provided.

Criterion-referenced evaluation may be based on these steps:

1. Identify the expected learning outcomes (as stated in the Integrated Resource Package).
2. Identify the key learning objectives for instruction and learning.
3. Establish and set criteria. Involve students, when appropriate, in establishing criteria.
4. Plan learning activities that will help students gain the knowledge or skills outlined in the criteria.
5. Prior to the learning activity, inform students of the criteria against which their work will be evaluated.
6. Provide examples of the desired levels of performance.
7. Implement the learning activities.
8. Use various assessment methods based on the particular assignment and student.
9. Review the assessment data, and evaluate each student's level of performance or quality of work in relation to criteria.
10. Report the results of the evaluations to students and parents.

EVALUATION SAMPLES

The samples on the following pages illustrate the process a teacher might use in applying criterion-referenced evaluation in technology education. The samples represent a broad use of criterion-referenced evaluation, including individual pieces of work, units of study, and work completed over the course of a term.

There are three key stages to the process:

- planning for assessment and evaluation
- defining criteria
- assessing and evaluating student performance

Planning for Assessment and Evaluation

This section outlines:

- background information to explain the classroom context
- instructional tasks
- opportunities that students were given to practise learning
- feedback and support that was offered students by the teacher
- ways in which the teacher prepared students for the assessment

Defining Criteria

This section illustrates the specific criteria, which are based on:

- learning outcomes
- assessment task
- various reference sets

Assessing and Evaluating Student Performance

This section includes:

- assessment tasks or activities
- support that the teacher offered students
- tools and methods used to gather the assessment information
- the way the criteria were used to evaluate the student performance

GRADES K TO 1

Topic: *Simple Machines (Fairy Tales and Dragons)*

Prescribed Learning Outcomes:

Self and Society

It is expected that students will:

- solve problems that come up during the design process, independently and in groups
- demonstrate confidence and a positive attitude throughout the problem-solving process

Communications

It is expected that students will:

- communicate ideas for creating a product

Production

It is expected that students will:

- solve problems involving technology using various tools, materials, and processes
- recognize the potential safety hazards presented by tools, and identify safety equipment and procedures

Energy and Power

It is expected that students will:

- demonstrate an understanding of the ways objects move

PLANNING FOR ASSESSMENT

Students were studying fairy tales and dragons in an integrated language arts unit. They completed a number of activities and projects, such as creating a large dragon using recycled materials as an art activity.

- The teacher introduced students to the concept of simple machines and first-class levers (e.g., teeter-totters, mobiles) during a visit to the playground. The teacher asked students to demonstrate the use of a teeter-totter and describe how it worked. The teacher recorded their ideas on a chart and introduced vocabulary that described the parts and functions of a lever (e.g., fulcrum, effort, load). Students used objects found in the classroom (e.g., wooden blocks, Lego) to create first-class levers.
- The teacher explained that students would work in groups as village design engineers to solve a problem. They were to build a catapult—a kind of lever that would allow villagers to feed the dragon from a distance. The teacher demonstrated several examples (e.g., elastic band or slingshot, and a cotton ball) and had students determine criteria for building a catapult and for working in a co-operative group. The teacher listed and illustrated criteria on charts, which were posted for easy reference.
- The teacher distributed a selection of construction materials and tools (e.g., plastic spoons of various sizes, elastic bands, hammers and nails, Plasticene, plastic strips) to each group and provided cotton balls for practice.
- The teacher observed groups as they worked, offered encouragement, and provided suggestions. Using marshmallows, students demonstrated how their catapults could feed the classroom dragon and described how their catapults moved the marshmallow. (e.g., "We put the plastic spoon into a big ball of Plasticene and pulled it back, and it pushed the marshmallow high in the air when we let go.")

DEFINING THE CRITERIA

The students developed a list of criteria for building the catapult and for working in a co-operative group.

Building a Catapult

To what extent does the catapult demonstrate:

- effectiveness of design
- safe use of materials and tools
- students' understandings of first-class levers
- components identified and processes explained

Working in Groups

To what extent did students:

- work co-operatively and show respect for the ideas of others
- persist in finding solutions
- assist the group by sharing resources and ideas

ASSESSING AND EVALUATING STUDENT PERFORMANCE

Students worked with their group to assess their performance by completing a checklist based on the criteria for building a catapult and for working in a co-operative group. The teacher read the questions aloud. The teacher used the list of criteria as an outline for recording written observations of both individuals and groups.

The teacher provided feedback and discussed goals for future group work.

Working In Groups:		
Names: _____ _____ _____	**Yes**	**No**
Did we work safely?		
Did our catapult work to feed the dragon?		
Did we tell the class how it worked?		
Did we respect the ideas of all members in our group?		
Did we share?		

Journal Date_____

This is a picture of the catapult my group made:

GRADES 2 TO 3

Topic: *Mechanical Systems (100 Day)*

Prescribed Learning Outcomes:

Self and Society

It is expected that students will:

- solve problems that come up during the design process, independently and in groups
- demonstrate confidence and a positive attitude throughout the problem-solving process
- use a variety of classroom resources when looking for answers to problems involving design

Communications

It is expected that students will:

- describe a solution to a problem involving design

Production

It is expected that students will:

- solve problems involving technology using appropriate tools and materials
- modify a variety of materials by combining, separating, forming, and finishing

In addition, the teacher used the reference set *Problem Solving Across Curriculum* to assess problem-solving skills—specifically, engagement and willingness to persevere.

PLANNING FOR ASSESSMENT

- Students brainstormed to develop a list of things that move. The teacher distributed old magazines. Students searched for and cut out pictures of things that move. They determined three categories for their pictures, sorted them according to their classifications, and glued them onto a wall-sized collage.
- The teacher divided the class into groups and explained that they would be creating land-based vehicles using a variety of materials (e.g., Lego, balsa wood, paper, glue).
- Students participated in a neighbourhood walk, observing land-based vehicles. They listed and drew their observations in design portfolios and shared their findings with the group.
- Students used classroom and library resources, including books and CD-ROM, to gather design ideas for their vehicles. Students designed, constructed, and tested their vehicles, making modifications when necessary. The teacher observed them as they worked, offering encouragement and feedback.
- Each group prepared a report about the design and construction of their vehicles, using drawing and word processing programs on the computer. They presented their report and demonstrated their vehicles to the class, answering questions from the teacher and from fellow students. The groups submitted their design portfolios, which included their findings from the neighbourhood walk, research notes, and design drawings.

DEFINING THE CRITERIA

Building a Land-Based Vehicle

Criteria were determined by the teacher in collaboration with the students. The presentations, design portfolios, and final products were to include evidence that students:

- effectively solved a problem involving design
- included ideas from their research
- effectively incorporated materials in a variety of ways

- participated co-operatively
- encouraged and supported each other
- clearly communicated their ideas through drawings and presentations

ASSESSING AND EVALUATING STUDENT PERFORMANCE

The teacher assessed students' abilities to work effectively in groups using a Happy Face Chart. The same chart could be used as a self-assessment tool.

Name:			
• actively engaged in group problem solving			
• contributed several ideas to the group			
• encouraged and supported others			
• persevered throughout the task			

GRADE 4

Topic: *Product (Aboriginal Culture)*

Prescribed Learning Outcomes:

Self and Society

It is expected that students will:

- demonstrate risk taking and perseverance throughout the problem-solving process

Communications

It is expected that students will:

- describe a solution to a problem involving technology
- use appropriate tools in the presentation of ideas

Production

It is expected that students will:

- choose appropriate tools and materials for the construction of a product or system
- develop a design, make a product or system, and determine the steps for its construction
- modify a variety of materials by combining, separating, forming, and finishing to construct products or systems

In addition, the teacher used the reference set *Problem Solving Across Curriculum* to assess problem-solving skills—specifically, engagement and willingness to persevere.

PLANNING FOR ASSESSMENT

- The teacher provided opportunities (e.g., through reading, viewing, research, discussion) for students to learn about the role the totem pole played in Haida society and culture, and to gain an understanding of the symbols used in Haida totem poles.
- Students brainstormed their own symbols and wrote a legend in a language arts activity that included these symbols. The teacher explained that they would be designing and constructing model totem poles based on their legends.
- The teacher distributed a selection of photographs and illustrations of totem poles from Haida and other Aboriginal cultures and asked students to notice design elements (e.g., proportions, materials, shapes, colours).
- Students made a design plan for the creation of their totem pole that included the following:
  - drawings of front and side views
  - a list of the tools and materials they planned to use based on classroom resources (e.g., styrofoam blocks, materials from the wonderful-junk centre, Plasticene, cardboard boxes)
  - a brief description of the sequence of steps they planned to follow in constructing their totem poles
- Together, the teacher and students developed questions to consider when giving feedback on a partner's design plan. (e.g., "What additional steps might be helpful in constructing the totem pole?" "What kinds of problems could occur?" "How could these be solved?")
- While students shared their design plans, the teacher observed, provided additional feedback, asked questions about their designs, and recorded observations. Students adjusted and revised their designs based on partner and teacher feedback and recorded information in their design portfolios.
- Students constructed their totem poles and presented them to the class during a totem pole raising ceremony.

DEFINING THE CRITERIA

The teacher discussed with students and provided examples of design and problem-solving criteria.

Building a Totem Pole

To what extent was the student able to:

- make choices of tools and materials
- accurately identify the sequence of construction steps
- provide feedback
- incorporate modifications to the design based on feedback
- persist in solving problems involving design
- demonstrate innovation in the design

ASSESSING AND EVALUATING STUDENT PERFORMANCE

This activity worked well for peer and self-evaluations. Partners evaluated one another using a rating scale, combined with a descriptive commentary to justify each rating. Fair judgments for each rating were encouraged. Students also completed self-assessments on the design and construction of their totem poles.

Self-Assessment

- The most important thing I learned was____.
- One thing I would change next time is____.
- The hardest part for me was____.
- What would help me next time is____.

After examining the written observations and the students' design plans, final products, and self-assessments, the teacher used a rating scale to evaluate each student's performance.

Building a Totem Pole

Rating	Criteria
3	• design plan includes relevant information and is detailed and organized • sequence of construction steps is logical and accurate • choice of tools and materials is appropriate • design is interesting and innovative • provides evidence of modifying design based on feedback, and makes connections to future plans. (e.g., "The most important thing I learned is that the base of my totem pole should be wider than the top, so next time I would build the bottom first.") • provides thoughtful feedback to partner • demonstrates thorough understanding of the concept of symbols
2	• design plan includes relevant information, some detail, and is organized • sequence of steps required for construction is included • choices of tools and materials are generally appropriate for the design • shows evidence of modifying design based on feedback • most feedback provided to partner is relevant • demonstrates understanding of the concept of symbols
1	• design plan includes relevant information • most of the steps required for construction are included • is able to create a totem pole using tools and materials selected from classroom resources • some of the feedback provided to the partner is relevant • student includes symbols, but connection to meaning may be incomplete

GRADE 5

Topic: *Historical Structure (Social Studies)*

Prescribed Learning Outcomes:

Self and Society

It is expected that students will:

- solve problems that come up during the design process, independently and in groups

Communications

It is expected that students will:

- gather information from available resources to solve problems involving technology

Production

It is expected that students will:

- develop a design for a product or system, and determine the steps for its construction
- modify a variety of materials by combining, separating, forming, and finishing to construct products or systems
- choose appropriate tools and materials for the design and construction of products or systems
- demonstrate ways to reduce, reuse, and recycle materials and products to control waste

PLANNING FOR ASSESSMENT

- The teacher planned lessons to introduce students to structures at a historical site (e.g., Fort Langley, Barkerville). Students viewed slides, sketches, and models of a variety of historical buildings. Class discussions were held to make connections among each building's purpose, materials, and design.
- Students spent several class sessions working with a variety of materials and tools to investigate the forces that act on structures (e.g., gravity, tension, compression). They also developed and practised the skills of combining, separating, forming, and finishing. Students created an ongoing display of successful techniques representing each of the four principles of production.
- A field trip was taken to Fort Langley to investigate the materials and processes used to create functional, well built, and attractive buildings. Students generated questions for interviewing the docents to collect detailed information about each building.

DEFINING THE CRITERIA

Constructing a Building

The teacher identified the following criteria. To what extent have students:

- developed a detailed plan listing the sequential steps needed to construct a building
- chosen effective materials for production
- selected effective tools for combining, separating, forming, and finishing
- used tools to modify materials safely and accurately
- used effective techniques to modify materials
- carefully planned to minimize waste during production

ASSESSING AND EVALUATING STUDENT PERFORMANCE

As a class, students discussed historical settlements, noting common structures, and planned a community. Co-operative groups were chosen, and students designed and built a community structure. Design ideas,

construction plans, a list of tools and materials required, sketches, and notes were kept in design portfolios and used for discussions with students throughout the project. Each group presented their work at various stages and received feedback from their peers. Assessment criteria were developed by the teacher and students to assess and evaluate each group's completed structure. The teacher used the following weighted scale to evaluate how effectively the students used tools, materials, and processes to construct their buildings. The students completed the same scale as a self-assessment.

Constructing a Building	**Weight**	**Comments**
Production Analysis • a detailed plan listing the sequential steps needed to construct a building	10	
Materials • chooses appropriate materials for combining, separating, forming and finishing	15	
Tool Processes • safely and accurately uses tools to modify materials	20	
Synthesis • carefully plans to minimize waste during production	10	
Workmanship • uses appropriate techniques to modify materials	15	

The teacher assessed students' abilities to work effectively in groups using the following chart:

Name:	**3**	**2**	**1**
• actively engages in group problem solving			
• contributes several ideas to the group			
• perseveres throughout the task			
• incorporates the ideas of others into solutions			
• assists and encourages peers			

3 = Consistently 2 = Usually 1 = Sometimes

GRADE 6

Topic: *Rocketry (Earth and Space Science)*

Prescribed Learning Outcomes:

Self and Society

It is expected that students will:

- demonstrate, independently and in groups, confidence and a positive attitude when solving problems involving technology

Communications

It is expected that students will:

- use appropriate research strategies to solve problems involving technology

Production

It is expected that students will:

- identify and use suitable tools, processes, and materials for combining, separating, forming, and finishing to construct products or systems

Energy and Power

It is expected that students will:

- design a device that converts and transmits energy

In addition, the teacher used the reference set *Problem Solving Across Curriculum* to assess problem-solving skills—specifically, engagement and willingness to persevere.

PLANNING FOR ASSESSMENT

- In conjunction with the current science curriculum Earth and Space Science (Space Exploration), the teacher prepared a series of activities on rocketry.
- Students investigated the historical development and principles of rocket-powered flight. Several class sessions were spent gathering information about aerodynamics, Newton's laws of motion, and control systems.
- Students experimented with a variety of tools and materials to investigate structural considerations (e.g., fin positions, fastening techniques, material properties). They had opportunities to design, construct, test, and modify three different rockets, each of increasing complexity. Experiments with control systems for carrying and deploying a payload (e.g., egg) were also conducted.
- Class discussions and presentations were held frequently, allowing ideas, successes, and questions to be shared. Helpful suggestions and design solutions were recorded, in words and drawings, and posted in the classroom for reference. Students kept design portfolios with design ideas, sketches, and reflective notes that were used in conferences.

DEFINING THE CRITERIA

Building a Rocket

While students were involved in activities, the teacher gathered evidence to determine the extent to which students:

- accessed relevant information sources (e.g., CD-ROM, encyclopedia, NASA hook-up via modem) to research the principles of flight
- used precise language in describing the design and construction processes
- used effective tools and materials to modify the function and appearance of the rockets based on testing and peer feedback
- explained and described the energy-transmitting device that powered the rockets (e.g., elastic power, pneumatic pump)

ASSESSING AND EVALUATING STUDENT PERFORMANCE

Students were asked to design and construct a rocket that could be launched and could safely return a payload (e.g., egg). Evaluation criteria for the effectiveness of the rockets were developed co-operatively by the teacher and students.

The teacher used the criteria to create a checklist and to record information on the level of performance of each student's rocket. Performance was rated on a four-point scale. Students completed the same scale as a self-assessment.

Scale	Level	Building a Rocket
4	**Outstanding**	• orientation of rocket is consistently stable throughout flight • rocket safely deploys payload • significantly exceeds class criteria for height
3	**Good**	• orientation of rocket is generally stable throughout flight • rocket safely deploys payload • exceeds class criteria for height
2	**Satisfactory**	• rocket spins in flight • rocket safely deploys payload • meets class criteria for height
1	**Minimally Acceptable**	• rocket spins in flight • rocket cannot safely deploy payload • does not meet class criteria for height

The teacher held conferences and used a performance scale to assess and evaluate students' levels of understanding of the principles and concepts of flight and rocket design.

Strong
- completely understands the concepts of flight and rocket design (e.g., aerodynamics, energy conversion, structural and material considerations)
- uses precise language
- consistently applies the concepts to the rocket design
- makes innovative modifications after testing the rocket

Capable
- has a reasonable understanding of flight and rocket design concepts
- uses some correct technical terms
- usually applies the concepts to the rocket design
- makes some modifications after testing the rocket

Minimal
- has a basic understanding of flight and rocket design concepts
- makes limited use of technical language
- sometimes applies the concepts to the rocket design
- is unable to make effective modifications after testing the rocket

GRADE 7

Topic: *Energy-Powered Vehicles*

Prescribed Learning Outcomes:

Self and Society

It is expected that students will:

- apply innovative thought and actions when solving problems involving technology, independently and in groups
- organize activities to make the best use of time, materials, and resources

Communications

It is expected that students will:

- communicate ideas for designing products or systems using different kinds of drawings

Production

It is expected that students will:

- identify and use suitable tools, processes, and materials for combining, separating, forming, and finishing to construct products or systems
- modify designs to improve the appearance, usefulness, and function of a product or system

Control

It is expected that students will:

- design and construct a control device that operates a system

PLANNING FOR ASSESSMENT

- The teacher introduced a design problem by asking students to consider ways to get a vehicle from point A to point B. The students brainstormed a list of methods, which were posted in the classroom for reference.
- Several class sessions were provided for students to design and construct vehicles using a variety of materials and power sources (e.g., Lego, balsa wood, cardboard, elastics, blow dryers). Problem-solving discussions were held frequently, allowing students to share their ideas and to receive feedback on design and construction. Students were encouraged to modify their vehicles to improve their appearance and function.
- Students worked in small groups to test their completed vehicles and to discuss the efficiency of each with respect to its power source, ease of control, relative speed, and maximum distance travelled. Each group created a chart of their findings to share with the whole class. Throughout the experimentation process, students recorded their ideas and findings in a design portfolio.

DEFINING THE CRITERIA

Building a Vehicle

For the next activity, the teacher, in conjunction with the students, developed criteria to determine the extent to which students:

- clearly restated the problem
- listed several possible solutions
- justified the chosen solution
- listed sequentially the steps necessary to put their plan into action
- provided evidence of a successful solution
- included a functioning prototype

The teacher used the reference set *Problem Solving Across Curriculum* as an assessment tool to further describe each student's learning and performance.

ASSESSING AND EVALUATING STUDENT PERFORMANCE

Students were challenged to design and construct a car that would travel a specified distance uphill, carrying a specified load. Students were permitted to use any resources, tools, and materials available to them, in the classroom or at home. Students kept detailed design portfolios, including design ideas, construction plans, a list of tools and materials required, sketches, and notes.

Students were asked to submit detailed design portfolios, including notes and sketches, that described their thinking and the processes followed for creating the design. While examining students' design portfolios, the teacher used the weighted scale below to evaluate how effectively the students planned, designed, and constructed their vehicles. The students used the same scale as a self-assessment tool.

Criteria	Weighting	Comments
• clearly restates the problem	5	
• lists several relevant solutions	5	
• justifies the chosen solution	10	
• list sequentially the steps necessary to put the plan into action	10	
• include a functioning prototype	15	
• provides evidence of a successful solution	5	

The teacher created the following checklist to evaluate students' abilities to clearly communicate design ideas using drawings:

Criteria	4	3	2	1
• easy to see				
• uses labels to enhance clarity				
• includes rough measurements				
• includes a materials list				

4 = Outstanding 3 = Good 2 = Satisfactory 1 = Progress

To evaluate students' abilities to make the best use of time, materials, and resources, the teacher chose from three levels of performance.

Level 1—Student has difficulty settling down and is often off-task. Frequent trips are made to gather necessary tools and materials, and the work space is disorganized. The student is unable to switch tasks if resources are unavailable.

Level 2—Student begins tasks with prompting and is able to remain focussed with little teacher guidance. Tools and materials are gathered in stages and kept in a semi-organized work space. With teacher support, time is used efficiently.

Level 3—Student begins tasks promptly and remains focussed throughout the lesson. All tools and materials are collected and kept in an organized work space. Student shows flexibility in the use of time (e.g., switches tasks if resources are unavailable).

MANAGING ASSESMENT INFORMATION

Teachers keep track of changes in each student's learning in a variety of ways. The techniques they use to monitor development enable them to make informed decisions about teaching, learning, and the evaluation of learning. The following collection of ideas illustrates some of the ways that teachers keep track of change and use this information to monitor student development in technology education.

Evidence of growth in technology education can be collected in three ways:

- by observing students in the process of working and making products
- by listening to their comments, observations, and questions
- by reviewing their products

Valid judgments about individual students require repeated opportunities to observe and listen to students and to review their work.

Student Journals

Assessment of student performance may be supported through the use of journals. Student journals are useful tools for encouraging students to reflect on their experiences. Journals may be fairly structured, or they may be a general review of the week's events in the class. Entries may comment on a specific activity or topic, or provide broad reflection on progress or an issue.

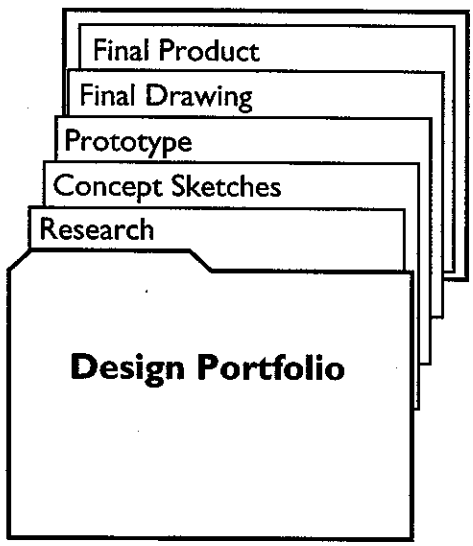
Journals are an important aspect of communication between the student and teacher. Students may ask questions, indicate successes, or identify areas where they need further assistance to develop skills. Teachers can respond to student journals verbally or with a short comment in the journal.

Design Portfolios

A design portfolio is a purposeful collection of a student's work that shows the student's effort, progress, and achievements over time.

Design portfolios provide teachers with the information they need to conduct a comprehensive assessment of students' development as they identify problems or needs and design and create their solutions.

Design portfolios are an important part of career planning, particularly in engineering, graphic arts, and other areas that are design oriented.



There is no preferred format for a design portfolio. Teachers and students tailor their design portfolios to the purposes for which they will be used.

Developing the Design Portfolio

Developing a design portfolio is an integral part of the design process. It provides the teacher with the evidence of the student's level of understanding of the design process.

The following are ideas used by teachers to develop design portfolios:

- **Identify a need or opportunity.** A situation with a recognized need or opportunity is examined.
- **Frame a design brief.** A concise problem statement is formulated that clearly identifies what the student will do and what the successful solution or product will do. The design brief also lists the requirements of the work, such as size, materials, costs, aesthetics, and safety issues.
- **Investigate and research.** Data or information that relates directly to the problem is collected from a wide variety of sources.
- **Generate ideas.** Students record their initial ideas for possible solutions using notes and sketches.
- **Decide on a solution.** Various design possibilities are considered, and the design that best meets the requirements stated in the design brief is chosen for further development.
- **Developmental work.** Through the use of detailed working drawings and renderings, students refine initial design ideas to produce final designs.
- **Planning.** The key stages of production are identified and organized in a logical sequence. This may require the development of flow charts.
- **Produce the solution.** Students begin to produce the final solution or product. Students document problems encountered in the production phase of the development.
- **Test and evaluate.** Students test and reflect on the results to assess the suitability of their design solutions.
- **Modify the solution or product.** Students make changes to their original design based on testing results. They record any modifications in their design portfolios.
- **Summary and evaluation.** Students review their portfolios and make judgments about the achievement of their goals.

Four Step Problem-Solving Model

Design portfolios may be organized around a four step problem-solving model (See, Plan, Do, Check), which guides students through the design process. Students are encouraged to justify their choices and make modifications to their designs as they work toward solutions.

1. See

Restate the problem using your own words:

Draw the problem:

2. Plan

Brainstorm possible solutions:

Advantages and disadvantages of two best solutions:

Advantage	Disadvantage

3. Do

Select favorite solution:

Why did you select this solution?

Action Plan

Outline the steps necessary to complete your solution:

4. Check

Have you solved the problem?

If yes: Please show the **evidence.**
If no: Backtrack to **"See"** and try again.

Draw your solution:

What improvements could be made to this solution?

Interviews

Interviews provide valuable information about students' understanding, thoughts, and feelings about technology education subjects. Interviews may give the student an opportunity to reflect on the unit of study and the teacher a chance to gather information about the student's knowledge and attitudes, as well as to diagnose student needs. Interviews may take the form of a planned sequence of questions that leads to an open-ended discussion or they may require independent completion of specific questions. Informal interviews between the teacher and student should take place on a regular basis throughout instruction.

Observation Sheets

Observation sheets may be used to assess students during individual or co-operative activities. Teachers should focus their assessment by selecting only a few attributes for each observation. This information is useful when reporting on individual student progress.

Checklists

Checklists allow the teacher to observe the entire class "at a glance." They provide a quick reference for keeping track of specific information about student attitudes, knowledge, and skills. Checklists allow the teacher to create an individual record-keeping system organized in a variety of ways. Information might include date, skill-proficiency legends, or a simple checkmark identifying a *yes* or *no*. Checklists can be useful in developing a learning profile of a child that indicates growth over time. Checklists may be created to gather information about student co-operation, participation, attitude, leadership, or skill development.

Interviews

Questions	Teacher Notes
• How do you feel about your solution?	
• Did you have any new thoughts when _____?	
• How did you go about _____?	
• Tell me another way of doing _____?	
• What sources/resources did you use?	
• What was the most interesting thing you found out?	
• What would happen if _____?	
• Why did you _____?	
• What would you do differently next time?	
• Tell me about _____.	
• Tell me what you learned from _____.	
• Is there anything you would like to change in your product?	
• What is the best part/aspect of your product?	

Observation Sheet 1

Name(s): _____

Date	Activity	Observed behaviour	Comments for Improvement

Observation Sheet 2
September–November

Name(s): _____

Date	Activity	Observation	Instructional Implications

Problem Solving

Individual Assessment Checklist

Student _____

Problem ❶ _____ Date _____

Problem ❷ _____ Date _____

Problem ❸ _____ Date _____

	Beginning	Developing	Maturing	Comments
Engagement	❶❷❸ ☐☐☐ • shows little interest ☐☐☐ • has difficulty defining problem ☐☐☐ • works too quickly ☐☐☐ • gets sidetracked ☐☐☐ • needs frequent reinforcement to stay engaged	❶❷❸ ☐☐☐ • seems to want to solve problem ☐☐☐ • has some difficulty defining problem ☐☐☐ • may seek frequent reinforcement	❶❷❸ ☐☐☐ • shows interest ☐☐☐ • clarifies problem ☐☐☐ • approaches problem actively and thoughtfully ☐☐☐ • works independently	
Background Knowledge	☐☐☐ • is unsure of what to look for ☐☐☐ • has gaps in content knowledge ☐☐☐ • needs explanation ☐☐☐ • has narrow focus ☐☐☐ • seldom transfers knowledge or strategies	☐☐☐ • can identify some required content knowledge ☐☐☐ • has some gaps in content knowledge ☐☐☐ • focus may be narrow, may seek out information ☐☐☐ • may transfer information or strategies	☐☐☐ • relates prior knowledge ☐☐☐ • gives clear evidence ofcontent knowledge ☐☐☐ • recognizes and finds missing information ☐☐☐ • transfers information, strategies	
Process	☐☐☐ • may lose sight of problem ☐☐☐ • is not aware when on the wrong track ☐☐☐ • gives up, doesn't change strategies	☐☐☐ • is unsure of approach to problem ☐☐☐ • is aware when on wrong track, but not sure what to do ☐☐☐ • frustrated, but looks for help	☐☐☐ • uses appropriate strategies ☐☐☐ • is aware when on wrong track and changes strategies ☐☐☐ • uses unique or unusual strategies	
Representation	☐☐☐ • has difficulty restating problem ☐☐☐ • has difficulty communicating processes used ☐☐☐ • solution is disorganized, partial, or incorrect	☐☐☐ • restates salient features of problem ☐☐☐ • may communicate some of the processes used ☐☐☐ • solution may be complete, but not thorough and organized	☐☐☐ • communicates subtle features of problem ☐☐☐ • communicates thinking and processes used ☐☐☐ • solution is thorough, organized, appropriate, and may be original	

Appendix E
Acknowledgments

Many people contributed their expertise to this document. The project co-ordinator was Douglas Halladay of the Curriculum Branch, working with ministry personnel and our partners in education. The ministry would like to thank all who participated in this process.

Donna Allan
School District No. 22 (Vernon)

Fred Andrews
School District No. 35 (Langley)

Chris Bastone
School District No. 44 (North Vancouver)

Fran Beckow
School District No. 63 (Saanich)

Paul Boscariol
School District No. 42 (Maple Ridge)

Ken Caig
School District No. 38 (Richmond)

Donna Chan
School District No. 37 (Delta)

Phil Crawford
School District No. 35 (Langley)

John Daniel
School District No. 38 (Richmond)

Hans Dewit
School District No. 42 (Maple Ridge)

Eric Dickie
School District No. 23 (Central Okanagon)

Maureen Dockendorf
School District No. 41 (Burnaby)

Lori Driussi
School District No. 41 (Burnaby)

Dave Eddy
School District No. 36 (Surrey)

Jim Ellingson
School District No. 02 (Cranbrook)

Phil Esworthy
British Columbia Institute of Technology

Ron Fazackerley
School Distinct No. 23 (Central Okanagon)

David Fraser
School District No. 41 (Burnaby)

Sandra Fugger
School District No. 23 (Central Okanagan)

Tom Geoghegan
School District No. 72 (Campbell River)

John Grain
School District No. 23 (Central Okanagon)

Gervin Halladay
School District No. 57 (Prince George)

Bill Henderson
School District No. 34 (Abbotsford)

Frank Heyman
School District No. 39 (Vancouver)

Linda Hoshizaki
School District No. 20 (Summerland)

Carol Ireson
Independent (Kelowna)

Appendix E: Acknowledgments

Ken Ireson
School District No. 20 (Summerland)

David Kalaski
School District No. 39 (Vancouver)

Shane Kenneally
School District No. 39 (Vancouver)

Linda Laidlaw
School District No. 41 (Burnaby)

Lindsay Langill
School District No. 35 (Langley)

Jillian Lewis
School District No. 41 (Burnaby)

Bill Logan
University of British Columbia

Bruce Logan
School District No. 23 (Central Okanagon)

Robert Merriam
British Columbia Institute of Technology

David Mew
School District No. 37 (Delta)

Helen Morrish
School District No. 11 (Trail)

Eric Munsberger
School District No. 42 (Maple Ridge)

John Murphy
School District No. 37 (Delta)

Dan Norman
School District No. 66 (Lake Cowichan)

Ross Norrington
School District No. 62 (Sooke)

Carol Ann Ortega
School District No. 01 (Fernie)

Craig Reitchel
School District No. 43 (Coquitlam)

Kathy Richardson
School District No. 41 (Burnaby)

Rick Russell
School District No. 42 (Maple Ridge)

Vern Sandberg
School District No. 37 (Delta)

Bob Scherer
School District No. 23 (Central Okanagan)

Lennor Stieda
School District No. 63 (Saanich)

Walter Swetlishoff
School District No. 07 (Nelson)

Brian Tivy
School District No. 43 (Coquitlam)

Hope Todd
School District No. 38 (Richmond)

Peter Trant
British Columbia Institute of Technology

Terri White
Industry Representative

Wayne Williamson
School District No. 41 (Burnaby)

Graeme Wilson
School District No. 33 (Chilliwack)

The Ministry of Education gratefully acknowledges the contributions of the people who participated in the review and evaluation of the learning resources.

Donna Allan
School District No. 22 (Vernon)

Allen Cazes
School District No. 39 (Vancouver)

Gregg Parsons
School District No. 39 (Vancouver)

Gordon Li
School District No. 41 (Burnaby)

Paul Boscariol
School District No. 42 (Maple Ridge)

Beverly F. Lenihan
School District No. 61 (Victoria)

Dan Patrick
School District No. 71 (Courtenay)

Appendix F
Glossary

aerodynamic	Designed to move through air with minimal resistance.
aesthetics	A quality dealing with the appearance of an object.
applications software	Software designed to accomplish a specific task, such as desktop publishing or word processing.
ASCII	American Standard Code for Information Interchange; allows computer equipment from different manufacturers to exchange data.
automation	Techniques of self-regulation and self-control for systems that reduce the amount of human supervision required for a machine or process.
backup	An extra copy of a program or information stored on a disk or tape.
baud rate	The speed at which data is transmitted over a communications line; used to transmit data between devices, such as computer-to-computer or computer-to-terminal.
boot	To start a computer or system; to load an operating system into a computer and begin operation.
brainstorming	A stage used in the design and problem-solving process to generate a number and variety of ideas in a noncritical atmosphere.
CAM	Computer-aided manufacturing; the operation of a machine controlled by a host computer.
CD-ROM	Compact Disk Read Only Memory; a device that uses a rigid disk to store information in a form that can be read by a computer.
CO_2 powered	Propelling a device with a cylinder of compressed carbon dioxide.
combining	A production process used to join or add materials together in a permanent or temporary fashion (e.g., glue, nails, screws, welding, soldering).

APPENDIX F: GLOSSARY

communication process	Conveying a message or idea to someone; in technology education the focus is on the use of visual and electronic media.
computer program	A set of instructions in a language understood by a computer; used to direct the operations of a computer.
CAD or CADD	Computer-Aided Design (and Drafting): a precision-drawing software program that speeds up the design process by making it easier to create and modify draft designs.
conservation	Using energy efficiently; finding alternatives to exist ing energy forms; improving energy conversion methods (e.g., reducing friction, engine tune-ups).
control	Methods used to regulate a system or device.
control device	Any device that senses, switches, or regulates an operation (e.g., switch, valve, brake).
control system	A system that senses, switches, or regulates an operation.
conversion	A technological process that changes energy from one form to another (e.g., energy is converted into heat during combustion in an engine; rotary motion is converted into reciprocal motion using a crank).
database	A collection of data that is structured and organized into a chosen format; a computer database makes it easy to create, retrieve, and resort data stored electronically.
design brief	A concise problem statement developed by a student or teacher that identifies what the student will do and what the successful solution will achieve.
design portfolio	A record of the development of a project from inception to completion.
design principles	Qualities of balance, layout, measurement, colour, scale, and projection.

design process — A planning and decision-making process that produces a solution.

electricity — A form of energy that flows along a path and can produce heat, light, magnetism, motion, or a chemical change.

electromechanical — A machine process or device that is controlled electrically.

electronics — The branch of physics that deals with the production, activity, and effects of electrons in motion; the branch of engineering that deals with the design and manufacture of devices that control the flow of electrons, such as the microprocessors used in computers; working with small electronic components (e.g., computers, stereos).

energy — The capacity for doing work; types include mechanical (e.g., motion), chemical, electric, thermal, nuclear, and radiant (e.g., light and sound); may be classified as non-renewable (e.g., fossil fuels), or renewable (e.g., biomass, human and animal muscle, wind, solar, geothermal, water).

engineering principles — The method of operation used to plan, build, and manage engines, machines, roads, and structures.

ergonomics — The field of matching technological products to human dimensions, needs, and characteristics.

finishing — A production process by which the appearance or internal structure of a product or material is changed to improve its durability, strength, usefulness, or aesthetics.

flow chart — A pictorial representation of a sequence of events.

forming — A production process by which the shape of a material is changed without adding or removing anything (e.g., reshaping plastic, bending wire).

graphics	Diagrams, pictures, and electronic images and their use to convey a message.
hydraulics	Using fluids to transmit and regulate the forces in a machine or device.
information processing	The conversion of data into information by sorting in useful ways.
information/communication systems	The use of a device or method to collect, process, store, or deliver information using electronic, graphic, photographic, or mechanical means.
input	Data, materials, resources, or instructions entered into (most often) a computer system.
Internet	A global information network linking thousands of smaller computer networks.
kinetic energy	The energy of a mass in motion (e.g., pendulum swinging, spring unwinding).
learning log	A record of activities completed during an assignment.
machine	An assembly of parts used to change the amount, speed, or direction of a force for a useful purpose.
manufactured materials	Materials that do not exist in nature (e.g., steel, fabric).
media	Various forms of communication (e.g., video, paper, film, computer imagery).
modem	A computer device that transmits and receives infor-mation over a telephone line.
monitor	The part of the feedback loop that has to do with observing the output of a system.
multimedia	The combination of text, sound, and video used to present information.
network	A connected system of software and hardware that transmits data.

operating system (OS)	Software that allows a computer to function by controlling all its application programs (e.g., DOS, OS2, Macintosh OS, UNIX).
output	The actual results of a system, desired or undesired, expected or unexpected.
parameters	Restrictions affecting the design of a product or system (e.g., size, cost, materials).
pneumatics	Using air or gas pressure to operate mechanical devices.
potential energy	The ability to do work using stored energy (e.g., compressed spring, charged capacitor, gasoline).
production	The process of converting and combining resources to construct, manufacture, or grow something.
program	A sequence of movements, steps, or instructions that a system follows to accomplish a task.
prototype	A model used to test and evaluate a design before final production.
RAM	Random Access Memory; the main working memory of a computer.
ROM	Read Only Memory; a type of computer memory in which information can be accessed, but not stored.
regulating	Varying the flow, amount, and direction of all forms of energy (e.g., human, fluid, mechanical, electrical, heat) in systems.
resources	Components necessary to design, build, and maintain technology (e.g., people, information, materials, tools and machines, energy, capital, time).
robotics	Programmable, multifunctional devices that perform physical tasks.
Rube Goldberg device	A complex device that does a simple task.

safety equipment	Devices used to protect workers (e.g., goggles, gloves, guards, ventilation).
scale	The relative size of a plan, drawing, or model.
sensing	Detecting, interpreting, and monitoring energy with electric, electronic, fluid, and mechanical devices.
sensor	A subsystem used to obtain information or data (e.g., light, temperature, number, movement).
separating	A production process in which a shape is changed by removing something (e.g., etching a printed circuit board, cutting wood).
sequential pictorials plans	A series of images representing steps used to complete a task.
simple machines	Basic devices or mechanical powers on which other machines are based (e.g., lever, wedge, pulley, wheel and axle, inclined plane, screw).
store and retrieve	Compiling information in some form of memory and recovering the data as required (e.g., storing sound and images on video tape and playing it back).
storyboard	A series of images that describe sequenced events in a visual production (e.g., video, film, animation, play); used in the the planning process of these productions.
switching	Any method (e.g., mechanical, electronic) used to turn the flow of energy on and off in a system (e.g., light switch, keyboard).
synthetic materials	Materials created through chemical synthesis (e.g., plastics, fiberglass).
system	A regularly interacting or interdependent group of items forming a unified whole.
systems and control	The application of devices and processes to manage, sort, control, and organize.

technical drawings — Drawings that contain the detailed information required to produce an object or system (e.g., measurement, scale, material, finishing information).

WHMIS — Workplace Hazardous Materials Information Systems; product safety information issued by the BC Workers' Compensation Board.