Construction Technology

Guide

NOVA SCOTIA
NOUVELLE-ÉCOSSE

1991

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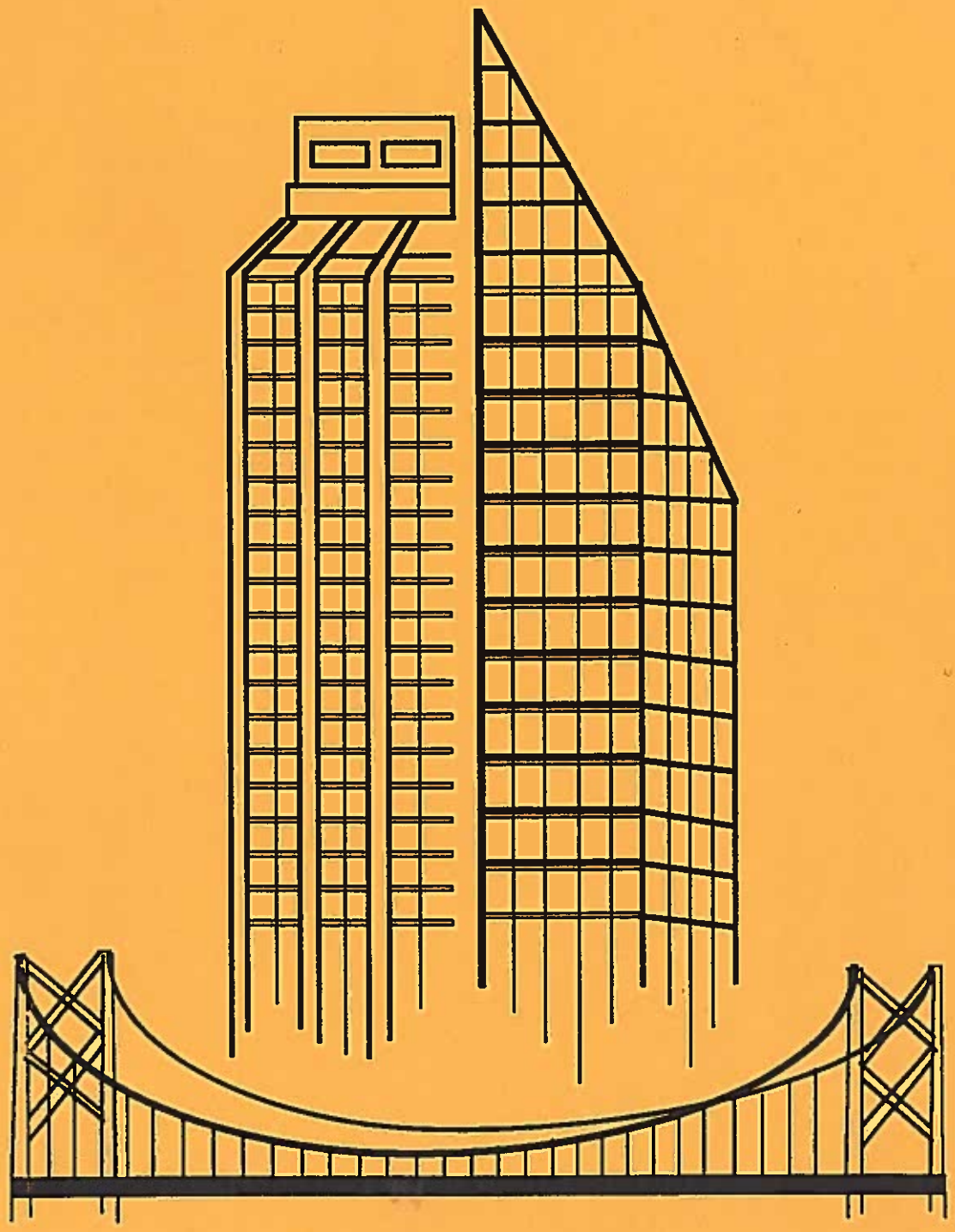
Construction Technology

Prepared by the Department of Education and Early Childhood Development

This is the most recent version of the current curriculum materials as used by teachers in Nova Scotia.



CONSTRUCTION TECHNOLOGY

NOVA SCOTIA
Department of Education

Curriculum Development
Teaching Guide No. 127

CONSTRUCTION TECHNOLOGY COURSE

"Architecture is inhabited sculpture"

Branscusi, quoted by Igor Stravinsky and Robert Craft in Themes and Episodes

"Une maison est une machine a 'habiter' "
"A house is a machine for living in"

Le Corbusier, Vers une architecture

"When we build, let us think that we build forever"

John Ruskin, The Seven Lamps of Architecture

"We must remember that Architecture is about shelter elementary"

Robert Venturi - Architect of the Sainsbury Wing addition to the U. K. National Gallery... Newsweek, July 1991

PREFACE

The following is quoted from the current Public School Programs document 1991-93;

The Goals and Aims of Public Education

The general aim of public education is to provide a school environment that will enable students to develop the ability to think clearly, to communicate effectively, to make sound judgements, and to discriminate among values.

The major goals in teaching children and young people are:

To develop skills that can help them achieve their full potential mentally, physically and socially;

To help them acquire knowledge and understanding needed for a full, rich life and for making a useful contribution to society;

To encourage positive attitudes to school and learning.

Included in the specific aims of public education are the following statements:

To develop competence in effective written and oral communication . . .

To develop competence in the use and the understanding of the basic principles of mathematics.

To develop knowledge and understanding of history and geography . . .

To develop the habits and methods of critical thinking and reasoning . . .

to be creative and to exercise originality and imagination;
to have their curiosity encouraged and to develop knowledge, understanding and appreciation of themselves, their fellow human beings, their environment, and the relationship of the three;
to acquire habits, attitudes, and intellectual skills that will be helpful in employment and in training for employment;
to develop civic, social , and moral responsibility and judgement;
to develop knowledge, habits and skills related to appropriate uses of science and technology.

The following construction technology course is designed to complement these goals and aims.

The course was developed by a Senior High School Task Force composed of the following educators:

Eric Worden	–	Industrial Arts Technology Education Consultant
Win Naugler and Daryl Hayes	–	Nova Scotia Teachers College
Ray Lockhart	–	Industrial Arts Technology Education Teacher, East Hants District School Board
Kevin McPhee	–	Industrial Arts Technology Education Teacher, Cape Breton District School Board
Robert Holman	–	Industrial Arts Technology Education Teacher, Halifax County Bedford District School Board
Gerald Williams	–	Supervisor - Industrial Arts Technology Education, Dartmouth District School Board

Further assistance was received from Greg Jollymore, Industrial Arts Technology Education teacher at New Ross Consolidated, Lunenburg County; Paul Martin, Industrial Arts Technology Education teacher at River John School, Pictou County; and Edward MacInnes, Industrial Arts Technology teacher, Lawrenctown Consolidated, Annapolis County; as well as Robert Fraser of the Canadian Homebuilders Association of Nova Scotia.

These teachers provided invaluable input and ideas for the development of this guide. If readers have comments or suggestions about the material please direct them to the Consultant, Industrial Arts Technology Education, Curriculum Development, Nova Scotia Department of Education, P O. Box 578, Halifax, NS, B3J 2S9.

CONSTRUCTION TECHNOLOGY COURSE

CONTENTS

Construction Technology Course

1.0 AIM

To develop in students a knowledge and understanding of construction technology.

2.0 RATIONALE

2.1 Construction technology has evolved to fulfil one of humanities three basic needs of food, shelter and clothing, and its beginnings are traced to when people first commenced constructing shelters. This technology plays an important role in the economic growth and social progress of the nation, and it would be difficult to imagine our present way of life without the results of construction technology. Therefore our students need to be made aware of and to understand how construction technology is applied to solve human problems.

2.2 Our environment includes houses and apartments which are constructed. There are roads and streets over which people travel. There are schools, factories, office buildings and other structures built for special purposes. Facilities are constructed for transmitting water, energy and information. Construction plays such an important part in our society that students need to gain greater understanding and appreciation of this technology and its relationship with the natural environment.

2.3 The future of our environment, whether society builds a satisfying and beautiful environment or a frustrating and ugly one, depends on people's knowledge of the constructed world, and their ability to solve its problems.

2.4 Construction takes place through the co-operative efforts of labor and management. It is important that students be made aware of this and gain first hand knowledge of what the people in the construction technology industry do, and of the careers available in the construction technology.

3.0 CLIENTELE

3.1 The course is available for all students at the senior high school level.

3.2 Recommended class size:
Should be appropriate to the range of technological activities offered considering the safety of all clientele.

4.0 SCHOOL CONTEXT

4.1 The course is part of the senior high school Industrial Arts Technology Education Program.

4.2 The course is an "Academic" full credit course, i.e. minimum 120 hours. (With careful planning it can be offered under the semestering system.)

4.3 Since this is an activity based course, it is recommended that extended class periods be scheduled in the timetable.

5.0 CORRELATION WITH OTHER SUBJECT AREAS

Cross curriculum correlation can be achieved as follows:

Language Arts

There are many possibilities for correlating construction technology studies and the development of English language skills.

For example, students can:

- make spoken and written presentations of construction technology design proposals
- use books and data bases to research their construction technology designs
- use texts in a variety of media, including guidebooks, textbooks, consumer reports, instruction manuals, information leaflets, directions, contracts, forms, brochures, newspapers and magazines, publicity materials and electronically stored information

Students will also have opportunities to write in a range of forms and for a range of purposes including describing, explaining, giving instructions and reporting.

Sample activities could include:

- Research an environmental topic for discussion using slides, overhead transparencies, picturegrams, notes or diagrams.
- Record and present the progress of their ideas using a range of media; detail and refine their design proposals and incorporate modifications; use computer aided design, image generation and desktop publishing techniques.

The Industrial Arts Technology teacher should find many opportunities for implementing writing in conjunction with exploring construction technology activities. Such an inter-disciplinary approach will assist in preparing students to communicate in a world very much involved in information exchange. There are also opportunities for creative writing whereby students are encouraged to express themselves freely on a particular subject of interest to themselves. Examples of topics would include:

1. A typical home in Nova Scotia in the year 2100 in the town of (my home town)
2. The first pioneer structures in my home town
3. New building materials used in my home, bedroom/kitchen/community

Describing how well a process works or evaluating a product for its quality also allows students to demonstrate that they can express in written form the value of their experience. Students should be evaluated not only on the

accuracy of response, but also for using complete sentences, proper grammatical construction and spelling.

Writing to learn new content is writing that causes the student to explore an area in-depth or a new topic not otherwise covered in class. The subject might be the results of a research and development activity or an exploration into the background of the topic.

An excellent example of how writing to learn new content can be applied in construction technology would be as follows:

Students could be asked to identify a new product used in construction technology. Using trade or technical magazines the students would then gain insight into how this product has evolved or is being applied. A summary or report would then provide the students with an opportunity to describe what they have learned about this product. This could also be supported by show and tell presentation (see product evaluation form Appendix K).

These creative writing activities could be done individually or by students working in pairs or small groups. Another approach could be to appoint recorders to document and report on the TLA's done by the students (see Appendix B).

Social Studies

The evolution of shelters for human beings to protect them from the elements and dangers which surrounded them is as old as the history of human development. The first shelters were actually natural ones such as rock overhangs and caves. As people moved around to hunt for food, natural shelters were no longer sufficient and therefore temporary or semipermanent shelters were required. This need started the development of construction skills which today have evolved to a fine art as well as a complex technology. Construction technology therefore is closely interrelated with the historical and social development of human beings. As people learned to grow plants for food, the necessity of constantly moving to seek out food sources diminished and therefore people started to settle in one place where they built villages and towns.

The economic survival of these early town dwellers depended on a thriving commercial land transportation system and therefore an infrastructure of roads and bridges and utility systems gradually evolved. Construction technology was crucial to these developments as society became more sophisticated at constructing a built environment.

This construction technology course therefore provides many opportunities for correlation with social studies. Social institutions such as the family, community, state, religion, trade, recreation and education have created the need for construction systems and structures and in turn these systems influence the development of these institutions.

Some specific ideas for correlation with social studies are as follows:

— impact of construction technology on society and the environment

— historical development of construction in different cultures

— economics and construction technology

— construction technology and social and avocational development

— neighborhood development principles

Science

The structural materials used for construction technology have many important properties to withstand pulling forces known as tension and/or pushing forces known as compression. Since most structures are systems created by combining several basic structural elements, it is important that the architect, engineer and builder be aware of the nature of these structural elements, the materials they are made of and their basic characteristics. It is important therefore that correlation be made with the science program especially in reference to the following topics:

— mechanical properties of construction materials - tensile and compression strengths, elasticity, plasticity, brittleness and toughness.

— composition of material and synthetic materials - iron, steel, aluminum, brick, wood, concrete, resin fiber composites, plastics, etc.

— structural elements - beams, columns, post and lintel, geodesic domes, plates, truss, space frames, mass, bearing walls, cables, membranes, etc.

— loads on structures - stability, rigidity, strength, static and dynamic, dead, load, wind, earthquake, thermal, snows, etc.

— electricity and electronics

— different forms of energy

— electromagnetism

— acoustics

— experiments with mechanisms, gears, levers & pulleys

— experiments with structure and load distribution

— testing materials - expansion, contraction, hardness, etc.

— scientific composition of different construction materials

— formulation of common structures

— laser surveying

Mathematics

Measuring accurately is an extremely important construction technology skill. Construction workers must be able to read customary measuring devices in inches and fractions of an inch as well as in metric units. Geometry is used in measuring the length of angled structural components like roof rafters or laying out a square angle between two components. A knowledge of calculating square roots and being able to multiply accurately is therefore essential.

Estimating the cost of a project and determining the amount of cubic volume measure are also crucial to construction technology. Surveying involves not only linear measurement but also an understanding of degrees, minutes and seconds of an arc.

The construction technology course therefore provides many opportunities for correlation with mathematics and the following are some specific examples.

- fractions and mixed numbers - adding, subtracting, multiplying, dividing
- area measure
- volume measure
- finding an unknown side of a right triangle given two sides
- accurate layout measurement
- timing presentations
- scheduling
- plotting co-ordinates for CAD
- applying ratios, proportion and scale
- calculating volume, area and slope angles
- investigating space shape relationships
- computing and calculating the consumption of construction materials
- estimation, cost analysis and quantity surveying and applying geometrical concepts

Fine Arts

The art of construction as it developed and evolved through the years has been highly dependent on the design process. Design is the process of deciding what a structure will look like and how it will function. The two important aspects of design — function and appearance must have a fine balance to provide good design. There are many examples of old and new buildings which have been well designed as well as many examples of those which have been poorly designed.

The construction technology course provides many opportunities for correlation with the fine arts, especially from the building architecture perspective. Some buildings have been constructed as works of art in themselves and furthermore some of the world's finest buildings have been constructed to house works of art, exhibitions and museums and/or the performing arts of music and drama.

Some specific ideas for correlation are as follows:

— aesthetics and interior and exterior design

— materials; shape, color and texture

— creativity and design problem solving

Business Education

Construction companies are organized and compete against one another in the highly competitive free enterprise system. The building of structures has itself become a highly complex business with similarities to many other contemporary businesses and there is an opportunity in this course to establish a student enterprise. — see Appendix L.

Consequently there are many opportunities for correlating this course with business education courses and in some instances a joint venture could be planned between the Industrial Arts Technology Department and the Business Education Department.

Some specific ideas for correlation are as follows:

— mass production, merchandising and distribution of materials

— company organizations and product production

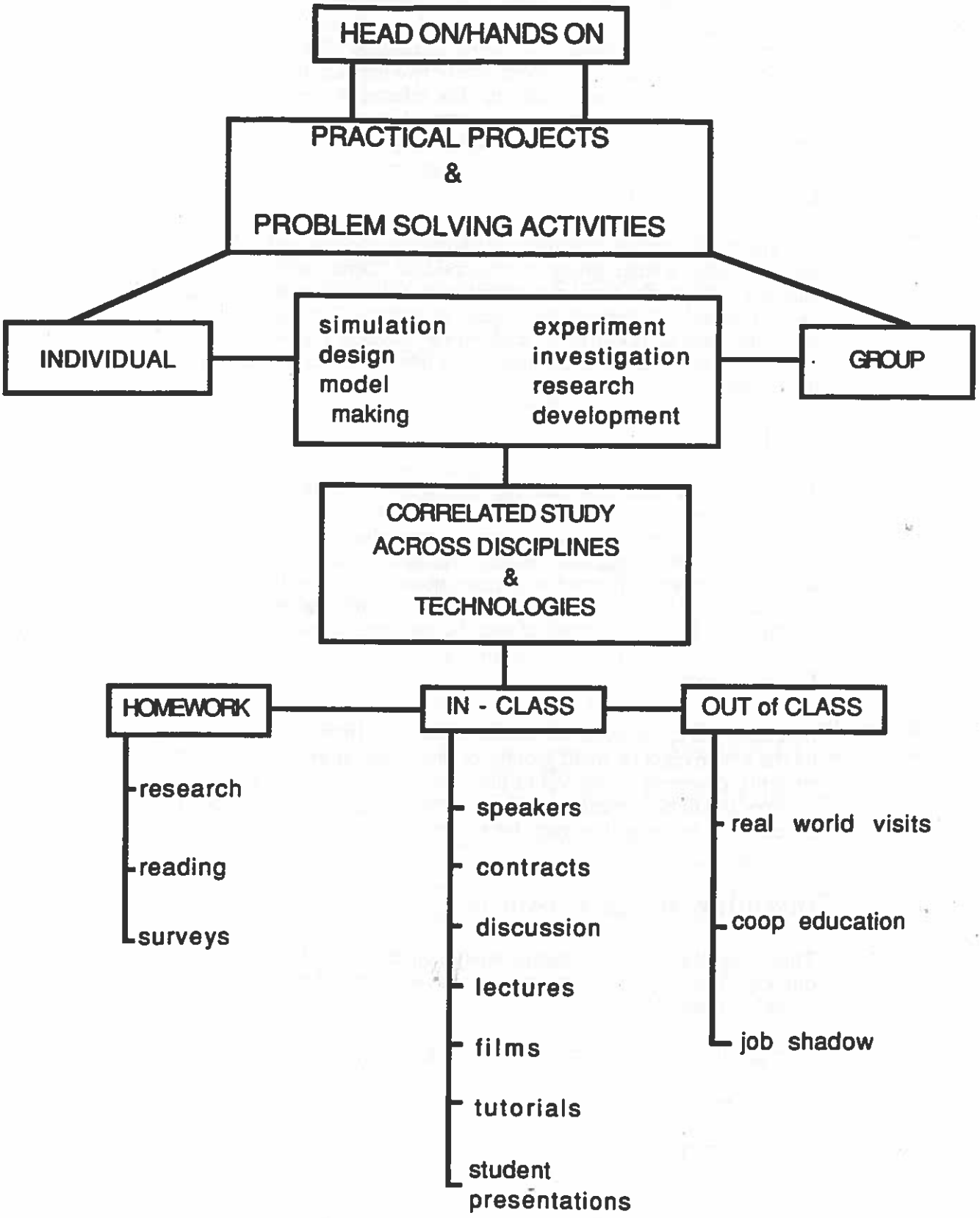
Other Industrial Arts Technology Areas

— communications

— production

— power energy and transportation

6.0 FEATURES OF THE COURSE



7.0 Suggested Teaching Strategies

Listed in Appendix A are a variety of teaching strategies. This is not a complete list nor it is expected that each strategy would be used for each class, because different students respond differently to different strategies. The list is a suggested list only, from which teachers might choose one or two depending upon the needs and abilities of their individual students. The selected strategies might well be be added to the list which the teacher normally uses. Any one particular strategy requires considerable time and practice to develop fully.

7.1 Demonstrations

Demonstrations are an effective and traditional teaching method and can be given to an entire class, a small group or an individual. Demonstrations help to provide students with an overview of a process and can be extended to actually let students "walk themselves" through the process or activity. Through carefully co-ordinated instruction and demonstration, students can develop a mental and visual image of the process and gain an understanding of how the different parts of the whole are interrelated.

7.2 Lectures

The lecture is a traditional teaching technique and can be very effective if used judiciously and very ineffective if overused. Short, well prepared and illustrated lectures can be very effective for quickly providing an overview of a topic or, alternatively, providing specific information on a particular concept or process. The lecture can be very effective when used in co-ordination with other methods and well illustrated lectures using a variety of visual aids can provide an effective introduction to a whole range of specific teaching techniques.

7.3 Discussion

Discussion in a classroom environment can take many forms, including discussions by the whole class or small groups, or discussion among a specific group of students, observed by the rest of the class. Discussions can evolve naturally out of lectures and demonstrations or they can be arranged to discuss specific topics. Discussions are very important for ensuring the success of co-operative small group learning.

7.4 Inventing and Brain-storm

This is a quick way of producing a large number of different and novel ideas very quickly. Working in groups, students are encouraged to think of many ideas as quickly as possible.

Four ground rules of brain-storming are as follows:

— Do not criticize ideas -note them and continue

— "Crazy" ideas and "long shot" ideas should be encouraged.

— The more ideas the better.

— Combine and improve ideas.

7.5 Co-operative Small Group Learning and Design Problem Solving

One way students can solve problems is to work some of the time as members of small co-operative groups.

The co-operative learning technique can be used to promote higher achievement among students, to develop social skills and to facilitate learning involving students of different levels of ability. The experience of working in a group should provide a balanced opportunity for reflecting on understanding and practice.

Co-operative learning can help to develop the following skills relevant to the problem solving process:

- exploring and developing ideas
- working with other students
- generating alternative ideas
- listening and analysing
- checking for understanding
- sharing ideas
- role playing and simulation
- assessing previously learned knowledge
- checking for understanding
- individual thinking and self expression

The following are some ideas for structuring groups:

- use the multiple station workshop bench for a group structure base
- balance students' strengths and weaknesses for the pairs and/or groups
- test sample group structures during the workshop/lab clean-up schedule
- encourage sharing of responsibilities
- practise using groups or pairs for doing special tasks or projects such as:
    - unloading material supplies
    - working on computer applications
    - sorting and cataloguing workshop/lab materials and supplies
    - measurement and surveying tasks
    - equipment and machine trouble shooting
    - focus orientation of lab or workshop

NOTE: Co-operative learning groups require careful organization, observation and monitoring to ensure that intervention is used appropriately.

7.6 The Line Production Approach

The line production approach is designed to acquaint students with the following:

- the ways in which contemporary industry organizes people, materials and machines into a common endeavor;
- occupations related to the management of the construction industry;
- the ways in which machines and materials are used in industry, in the preparation and production of commodities in large quantities.

A study of technology and industry can be accomplished by involving students in developing a company and participating in a line production which will offer the student opportunities to learn through real experiences.

A list of the living-learning involvement activities are as follows:

Problem Solving
Marketing
Role Playing
Organizing
Designing
Analysing
Producing
Negotiating
Training

7.7 Product Analysis

Analysing and evaluating a product are useful activities to increase students' awareness of everyday products and the technology used to produce them. This activity can be done by students working in groups or individually and is an excellent way of developing students' discussion skills. A sample product evaluation form is illustrated in Appendix K and can be used to record the students observations. This would be a good activity to help familiarize students' with the products used in the construction industry.

7.8 Learning Contracts

A learning contract is an agreement between student and teacher about virtually any expected kind of learning experience. It usually involves a clear statement of the purpose of what the student hopes to accomplish as well as a description of the experience, the resources to be used and the general time frame for the completion of the contract. Usually provision is included for the content to be negotiated to accommodate changes to circumstances.

Advantages:

Increases student motivation and provides a definite sense of ownership as well as providing opportunities for students to utilize their own strengths and learning styles.

8.0 Construction Technology in Different Cultures

Shelters and building structure have been basic to human development and survival. Once human beings began to move out of the protected environment of the cave, they needed to construct shelters to protect themselves from inclement weather and

the environment. Shelters such as huts, yurts, wigwams, igloos and tepees evolved into more permanent structures which could survive many decades and in some cases hundreds and thousands of years. All these structures involved construction technology and many of them have been utilized by various cultures to perfect the art of construction technology (for example, see the appendix H).

9.0 Personnel in Construction and Design

Numbers of people equivalent to the population of Nova Scotia are employed in the construction industry in Canada. These people work in thousands of large and small companies across Canada practising many different careers. The construction industry offers a wide variety of careers. Participation in the industry by women has been increasing in recent years. For more information see the following publications:

- Discover the Construction Industry
- Women in Construction

available from The Canadian Construction Association

85 Albert Street
Ottawa, Ontario
K1P 6A9

(613) 236-9455

10.0 Special Construction Information

Many significant construction projects have taken place in Canada recently and others are in the planning stage. For example, the CN Tower, The Skydome, various bank towers in the major cities, restorations such as Fortress Louisbourg and Citadel Hill, Purdys Wharf development and the World Trade and Convention Centre, Halifax. Smaller projects such as school buildings, government buildings, and industrial parks are constructed on a regular basis across the province. These projects can provide excellent information on construction technology which can be used in the different aspects of this course. An example of information about the Skydome is included in Appendix C which can be used as the subject of a TLA or as support material for the different units. (See 11.0 next).

11.0 Technology Learning Activities

A technology learning activity involves students working on activities to become more familiar with "new technology" in communications, power, energy and transportation, and production areas. Usually students work in small or large groups and the activities include one or more of the following: problem solving, investigation, research, model making or simulation. See Appendix B for examples.

12.0 Safety Program

The nature of industrial arts technology education requires that correct safety practices be established as soon as students commence their studies. The teacher must provide instruction so that students work safely in school shops, laboratories, classrooms or elsewhere. It is of paramount importance that the teacher establish a comprehensive safety program and develop a wholesome safety consciousness among students. The following is a list of considerations which should be included in all safety programs:

1. Instruction in the use of machine tools and portable power equipment - Before a student may operate a machine the student must pass a test covering the essential points of technical knowledge and safe procedures in operating this machine. This test should be recorded and kept on file.

2. Student dress - Students should be dressed correctly and safely before operating any machine. Students should be instructed to dress so that no part of their clothing constitutes a hazard when operating a machine or tool or participating in a course activity.

3. Guards on machinery - Guards should be kept in place during the operation of all machines and equipment.

4. Supervision of students in a shop class - The teacher of an industrial arts technology program or course must remain in the workshop, classroom, or laboratory area of instruction at all times when the program is in operation. If the teacher has to leave in the case of an emergency, the power should be shut off and appropriate instructions left with the students.

5. Ground wires on portable electric-driven machines - All portable electric motor-driven machines must be adequately grounded.

6. Housekeeping - Procedures should be established to ensure that the instructional area is kept in good, clean and safe condition. Excessive dust and dirt and accumulation of waste materials contribute to a careless attitude toward safety. Shop cleaning procedures should be established and form a continued part of any program.

7. Tool condition - An organized plan for maintaining tools and equipment should be an important part of any safety program. For example, sharp tools are safer than dull tools and a student will do better work and develop correct techniques if tools are always kept sharp and in good condition. Broken tools should be removed from service until they are repaired or replaced.

8. Operator's zones - Most machines need to be operated by one person only and therefore observers or students waiting to use a machine must stand clear of the operator's zone. Specially designated machine operation zones can be instituted to assist in this regard.

Precautions Against Fire and Other Disasters

A workshop, laboratory, classroom or worksite used to offer an industrial arts technology program can present many hazards and it is important that precautions be taken to prevent possible accidents or disasters. The following factors need to be considered:

1. It is recommended that school systems ask their local fire departments for recommendations regarding the type and capacity of extinguishers to be placed in each shop or laboratory.

2. Students should know and understand how fire extinguishers work. Operating instructions should be fastened to the outside of the container (or placed near it).

3. Fires are less likely to start in shops or laboratories that are clean (see housekeeping section).

4. Properly designed containers should be provided for each kind of scrap and waste material and should be emptied daily. Rags used to wipe up oil, paint or other flammable liquids should be placed in a safety metal container, with a self-closing cover (See WHMIS information).

5. Flammable materials such as wood and metal finishers, solvents and cleaners must be stored in steel cabinets and must have the correct WHMIS designation (see WHMIS information).

6. Electrical equipment should be checked regularly for defects and worn live wires. This is especially important where extension cords are used with lights and equipment.

7. Electrical equipment such as soldering guns and coppers and heating elements should be inspected daily to ensure that they are not left turned on. This should be part of the end-of-session housekeeping procedures.

8. Gas equipment needs to be checked frequently for leaks and all defective equipment must be replaced immediately.

9. Special precaution procedures should be established to light and operate gas powered and fueled equipment.

10. Evacuation procedures should be established and practised regularly by the students. Specifically, students must know the signal used for a fire drill, how to stop work safely, which exit and alternative exits to use, and what to do when outside the building.

First Aid

1. A cabinet to be used exclusively for first aid materials should be provided for each shop or laboratory or worksite. The cabinet should be sanitary and dustproof and compartmentalized so that it is easy to determine any materials which need updating.

2. Local or provincial health officials should be contacted about the amount and kinds of first-aid materials which should be contained in the cabinet.

3. Procedures should be established for recording and reporting accidents. School authorities should be consulted to establish the proper procedures and necessary forms to be completed.

Color-Coding

Workshops and laboratories that are color coded provide students with a pleasant place to work and learn. Color coding also emphasizes safety by helping students identify potential hazards in the workshop situation.

1. The standard colors used for identifying specific hazards are as follows:

Red - identifies fire protection equipment and emergency stop buttons and switches, and generally indicates danger.

Orange - indicates dangerous parts of machines or equipment.

Yellow - indicates caution, and is the standard color for working hazards that can result in accidents.

Green - designates the location of first aid and safety supplies and equipment - other than fire-fighting equipment

Blue - is used for informational signs, and in some situations replaces the excessive use of orange.

Black and white, and combinations of them in stripes or checks are used for housekeeping and traffic markings.

2. Examples of items in the workshop and the correct color identification are as follows:

Red - fire extinguishers, emergency stop switches, fire exit signs, cans and cabinets that contain flammable material.

Orange - the following parts of a machine: parts that cut; parts that crush; parts that shock. Guards that cover pulleys, belts and blades. Machine switch-box covers.

Yellow - parts of a machine that move and make adjustments such as: hand wheels, knobs, adjustable levers.

Green - first aid kits (with a white cross; safety bulletin boards; general information and safety supplies).

Blue - the outside of large switch boxes.

A non-gloss pale blue, green or gray can be used to identify the main body of all machines other than specific parts listed above.

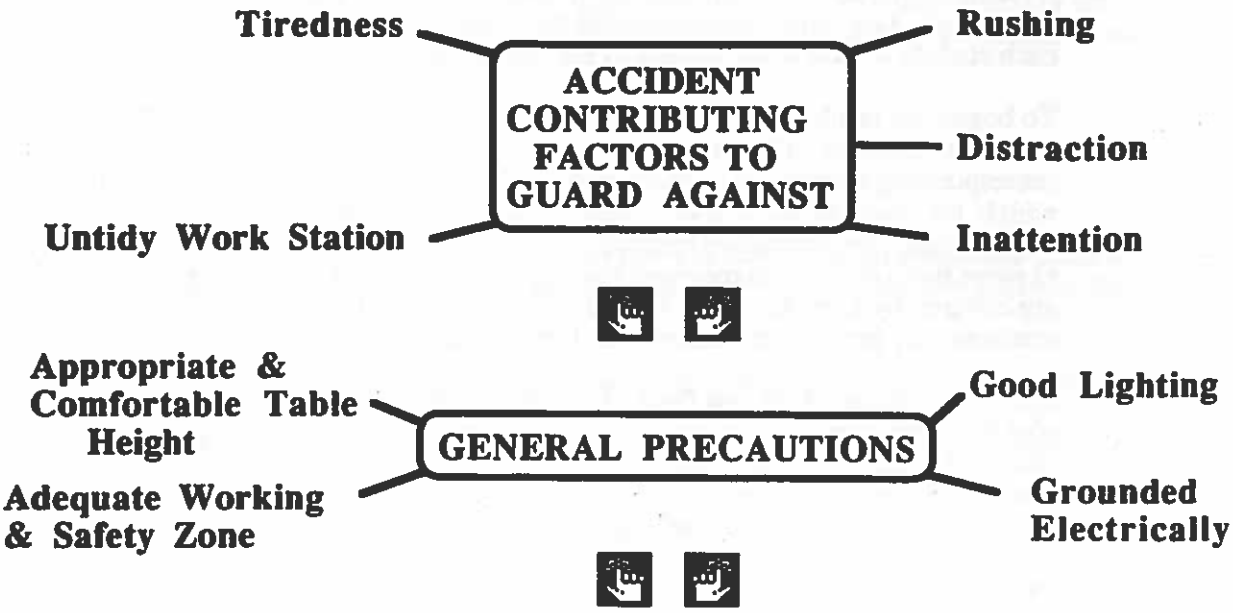
Machine operation safety: The following is a sample machine operation safety program which is included here as a guide for teachers.

Various methods have been used for preparing students to operate power equipment. One which has been used and found quite workable is that of requiring each student to pass a test similar to the procedure for securing a driver's license.

To begin, the teacher has an introductory lesson for the whole class on the particular machine. The students are then required to read and study the corresponding material in their textbooks. The teacher can then schedule a test in which the students will answer questions concerning the care and safe operation of the machine. An alternative method is to duplicate the tests and allow the students to write them as they are required, making certain that all of the necessary machines are covered by a certain date. The advantage of this is that the more progressive students may proceed at a faster rate than slower students.

Upon completion of the test (and a high percentage should be required for a pass, plus the correction of all mistakes) a practical part must also be done. Under the teacher's supervision, each student must demonstrate how to adjust and operate the machine properly. Any errors or unsafe procedures should be pointed out at this time. Having shown his/her ability to operate the machine safely, the student is given an operator's permit which must be shown when asked. A good plan is to have the license stapled to the student's notebook (this places a little more emphasis on having the notebook in class).

TABLE SAW SAFETY



SPECIFIC PRECAUTIONS

* Keep kickback pawls sharp.
* Use only true and sharp blades.
* Control cross-cuts with a secure mitre gauge.
* Do not cut freehand.
* Avoid being behind the blade.
* Wear protective glasses.
* Use the table saw guard including a splitter.
* Set the blade to clear wood thickness by only a small amount - 6 mm or 1/4 inch.
* Check the wood stock for loose knots, twists, warps, cupping, roughness and excess moisture content.
* Make all adjustments with the power turned off.
* Use control devices such as push sticks.
* Keep hands a minimum of 100mm - 150mm or 4 - 6 inches from the blade or guard.
* Concentrate on the task.

12.1 LASERS

Even though the power of a helium-neon laser is low the beam should be treated with caution and common sense because it is intense and concentrated. The greatest potential of harm from the laser is to the eyes. No one should look directly into the laser beam or stare at its bright reflections, just as no one should stare at the sun or arc lamps.

Always observe the following:

1. Never look into the laser beam.
2. Never direct the laser beam into another person's or animal's eyes.
3. Do not operate the laser without the teacher's permission.
4. Operate the laser only with prior instruction.
5. Use the laser only for the designated purpose.
6. Always turn off the laser when finished using it.

12.2 VIDEO DISPLAY TERMINALS (VDT)

According to authorities no radiation hazard is emitted from VDT's. Measurements of X-ray, radio frequency, ultraviolet, infrared and visible radiation associated with VDT's show that exposure levels from display screens are well below current exposure standards. However, extended eye exposure can lead to fatigue and eye irritation. Similarly, muscle strain of the neck and back often occurs with long sitting sessions or the improper positioning of the equipment. Since students will only be involved with computers for short periods of time these hazards should not present any difficulty. Computer equipment should be positioned so that it is convenient to use and away from other potential hazards.

12.3 WHMIS

Information regarding Workplace Hazardous Material Information System (WHMIS) for SCHOOL SAFETY PROGRAMS is included in Appendix G.

13.0 Construction Models - Modules, Full Scale Modular

The practical construction projects can take the form of

(a) Construction models - (static and dynamics)

(b) Modular structure - large models and wall sections using actual full size lumber which can be used as display units or assembled into one larger structure

(c) Full size building structure - a "company" could be formed by the students to produce such a structure which may take the form of:

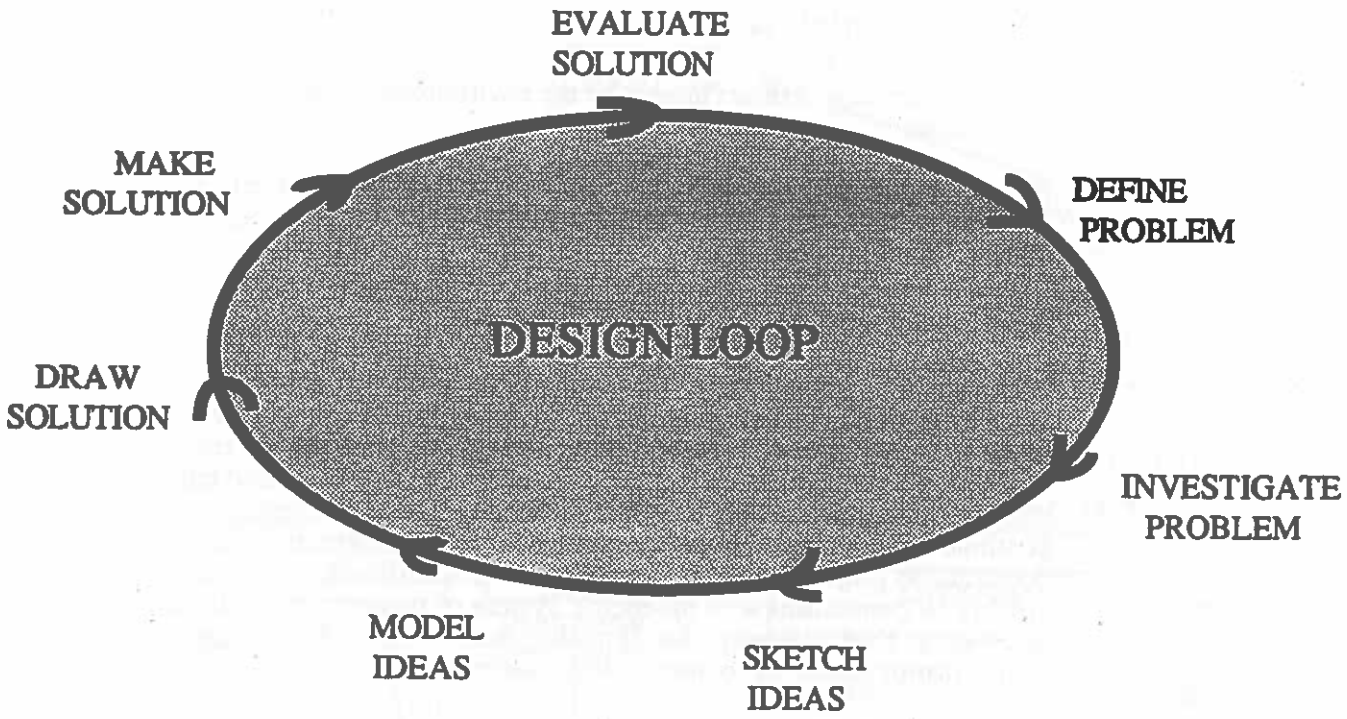
(a)	garden shed	(g)	greenhouse
(b)	tool shed	(h)	bicycle shed
(c)	refreshment stand	(i)	calf hutch
(d)	exhibit booth	(j)	dog house
(e)	playhouse or theatre	(k)	bus shelter
(f)	resource centre	(l)	sets for school drama productions

NOTE: It is preferable that buildings of this nature be built on a non profit basis and that the quantity be controlled. **SCHOOL BOARD APPROVAL SHOULD BE SOUGHT BEFORE PROCEEDING.** Corporate sponsorship may be appropriate, especially if the school board is participating in such ventures.

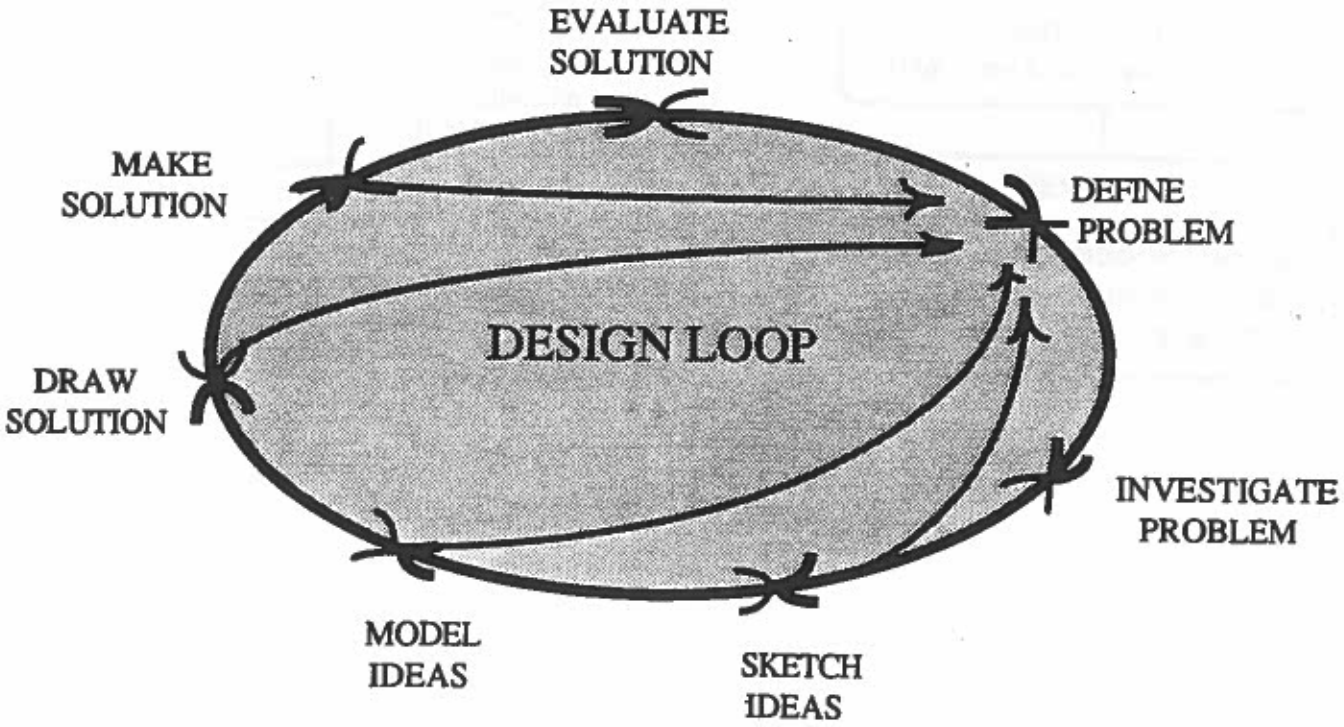
14.0 THE DESIGN PROBLEM SOLVING PROCESS:

Experience and research have shown that learning can be more effective when students' interests, experience and ideas are taken into account. This means not only relating content to everyday experiences but also involves students in perceiving and finding answers to their own questions as well as exploring and developing their own ideas. The design problem solving process therefore uses teaching methods which actively encourage students to participate in the learning process. (see the Design Technology Resource Book, Industrial Arts Supplementary Curriculum Document No. 53, 1985).

The design problem solving process can be illustrated using various graphic representations. In its most elementary form it can be depicted as a loop known as the design loop.



NOTE : Any model is not exclusively linear or elliptical but may include looping back to earlier stages or even starting over.



15.0 Environmental Impacts

All structures have a direct impact on the environment in which they are constructed.

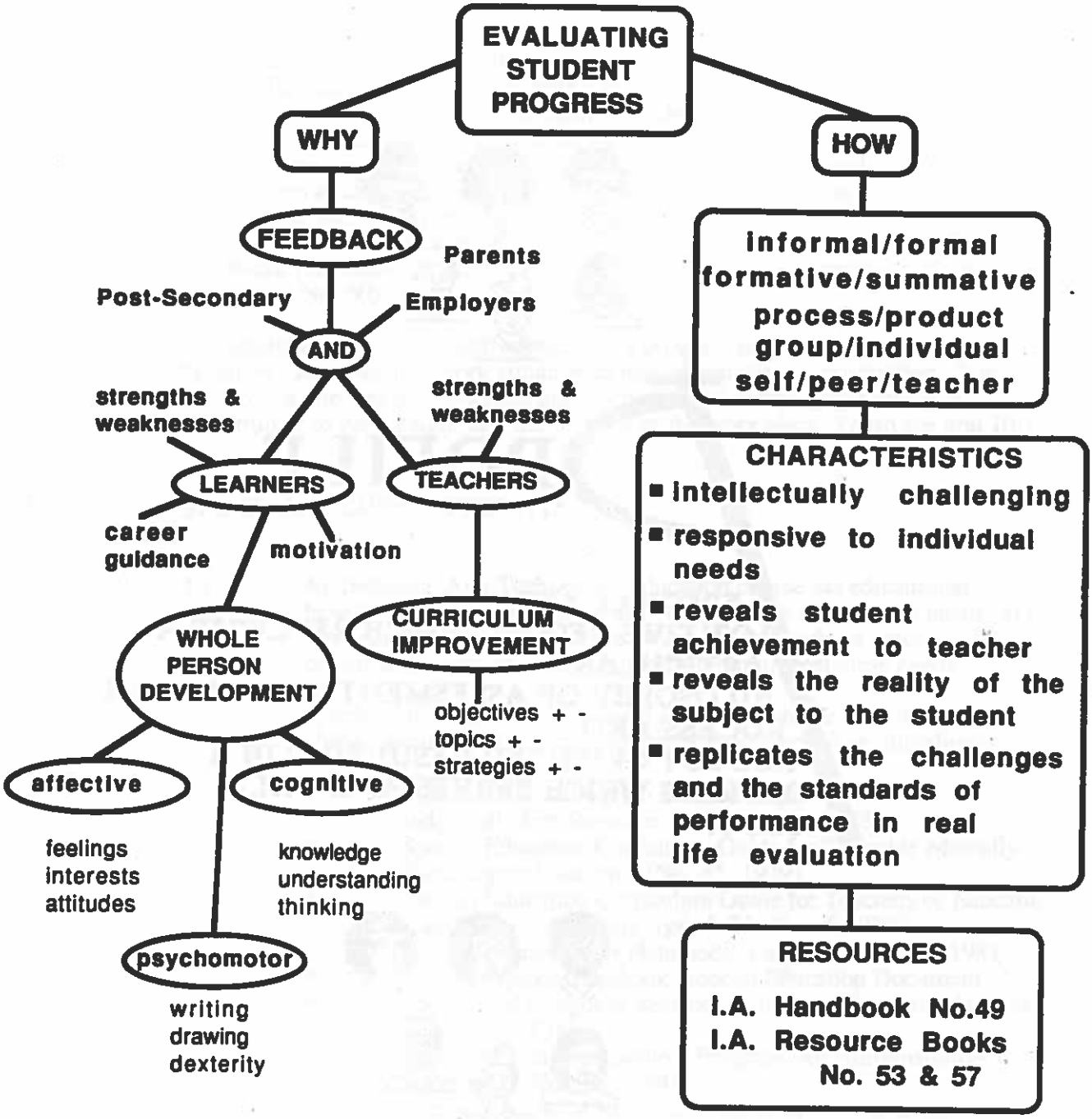
An environmental impact study is a study which evaluates the effects of a project on the environment. An environmental impact study makes an excellent TLA. (See Chunnel TLA Appendix B).

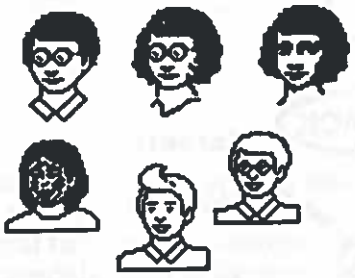
16.0 Measurement

Metrication was introduced in Canada in 1970 and it was the original intention that there be complete conversion to SI Metric in all phases of construction by January 1, 1977. Several factors have changed this conversion timetable and as a result many building materials, such as lumber and manufactured construction components, continue to be marketed in imperial sizes. Imperial measurements also continue to be the general working practice of the construction site! Some construction projects are constructed to metric specifications and students will already be conversant with the metric system of measurement. **It will be necessary that students be familiar with both systems to understand their importance to construction technology.**

See also the information contained in the SI Metric Implementation Guide - Supplementary Document No. 6, especially Appendix E - Lumber and the Change to SI Metric, Appendix F —Designing and Planning projects to SI Metric and Appendix G — Metric in the Construction Industry.

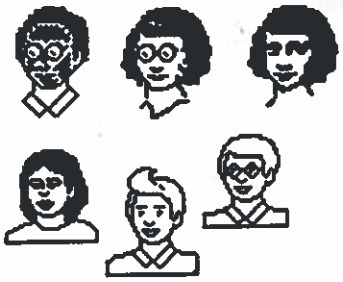
17.0 Evaluating student progress





A STUDENT PROFILE

S A
ERSONAL AND
OSITIVE RECORD WHICH REFLECTS A
ARTICULAR
HILOSOPHY OF ASSESMENT THAT IS BOTH
ROCESS AND
RODUCT ORIENTED RESULTING IN A
ORTRAIT WHICH SERVES AS A VALID
ASSPORT



18.0 Co-operative Education and Job Shadowing

Co-operative Education provides opportunities for students to earn a high school credit when taken in conjunction with a public school program course. Co-operative education integrates a student's in-school program with community-based learning in an educationally beneficial way. This provides students opportunities to apply classroom learning to out-of-school experiences and to apply out-of-school experiences to classroom learning. Students enrolled, for example, in a construction technology course have the opportunity to earn a co-operative education credit. (For more information see: Guideline for Co-Operative Education and Work Experience in Public Schools, Curriculum Development Supplementary Document No. 60)

Job shadowing is a short term segment of a program in which students observe or "shadow" someone in a work situation as part of their career exploration. It is normally a one-day out-of-school activity which provides students with the opportunity to gain insight into the realities of the work place. (Also see unit 10.)

19.0 SPECIAL NEEDS STUDENTS

19.1 An Industrial Arts Technology Education course has educational benefits for all students including students with exceptional needs. It is important that teachers become aware of each students unique educational needs and then plan instruction to meet these needs.

Specific information pertaining to students with exceptional needs is already available in the following published curriculum guidelines:

* Industrial Arts Program Handbook (No. 49, 1980)
* Industrial Arts Resource Book (No. 42 1983)
* Special Education Curriculum Guide for Trainable Mentally Handicapped Students (No. 45, 1979)
* Special Education Curriculum Guide for Teachers of Educable Handicapped Students Ages 5-21 (No. 60, 1980)
* Learning Disabilities Handbook, Document No. 34, 1981
* Administrative Handbook, Special Education Document
* Speech and Language Service, A Special Education Handbook (No. 38, 1983)
* Special Education Resource Program, An Administrative Handbook (No. 50, 1984)
* Special Education Resource Programs, Supplementary Document (No 50, 1984)

19.2 It is recommended that adequate consideration be given to the following items for students with exceptional needs:

PLANNING FOR STUDENTS WITH EXCEPTIONAL NEEDS

* Pre-assessment and formulation of an I.E.P. - Individualized Education Plan
* Individualizing Instruction
* Contracts and Independent Study
* Cooperative Teaching
* Evaluation of all resource materials especially reading materials to determine their appropriateness
* Invite the special education and resource teacher to the workshop/lab to learn about the program
* Develop lists of terminology used in the course and advise the special education teacher and reading specialist of these words.
* Try to involve the use of as many senses as possible e.g.,
  - the smell of different materials such as wood shavings, lubrication oils, etc.
  - the different sounds of cutting, shaping, hammering, sawing, etc.
  - color of different materials and processes such as welding
* Rely more on performing tasks and talking through the steps and procedures involved while the student observes and then encourage the student to perform the task at the same time as talking themselves through it.
* utilize progress charts that provide constant feedback.
* utilize the cooperative small group learning approach where appropriate (see 7.4.3)
* Use concrete examples continually including models and graphic charts.

19.3 ADDITIONAL TECHNIQUES:

Gifted and Talented:

* Encouraged the Design Technology Approach including R & D, Problem Solving and Brainstorming

Students With Physical Disability:

* Employ a Buddy System
* Utilize strengths
* Do a facility modification inventory and utilize design problem solving with the whole class

Students With Speech Impairment and/or Communication Disorders:

* Use diagrams, pictures and charts often
* Label tools, machines and work stations, etc.
* Pay full attention to students speech

Students With Hearing Impairment:

— To aid lip reading: visual contact
: use clear articulation
: re-phrase if necessary

— Ensure students pay full attention
— Utilize visual aids and written materials

Students With Visual Impairment:

— Use students name when communicating
— Give consistent clear directions
— Keep physical plant rearrangements to a minimum and inform student when changes are made
— Do a facility modification inventory and utilize design problem solving with the whole class

Students With Intellectual Impairments:

— Organize learning in small incremental stages
— Provide constant feedback and positive reinforcement
— Use aids and peer teaching techniques
— Utilize imitation and modeling techniques
— Use demonstration and as much visually oriented instruction as possible

Students With Emotional and/or Behaviorial Disorders:

— Try to control visual and auditory distractions
— Establish one goal at a time in a step by step method
— Utilize structure and routine as much as possible
— Use discipline which is firm, fair and consistent
— Use positive reinforcement constantly

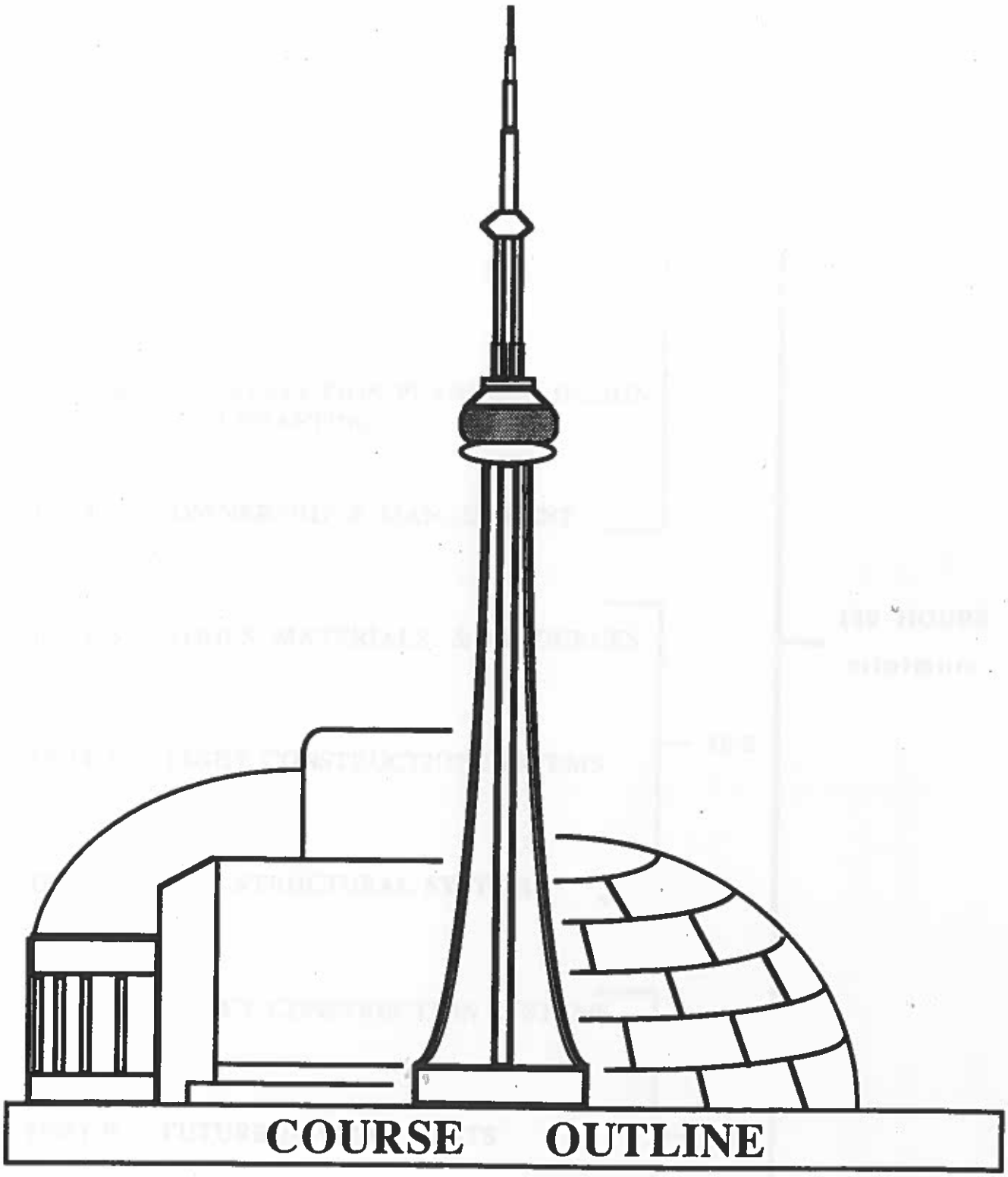
Students With Learning Disabilities:

— Utilize A-V materials, tape cassettes, films and filmstrips
— Double space handouts and highlight key words
— Keep assignments as simple as possible - one task at a time
— Pre-teach "New Words"

CAD And The Students With Mobility Impairment:

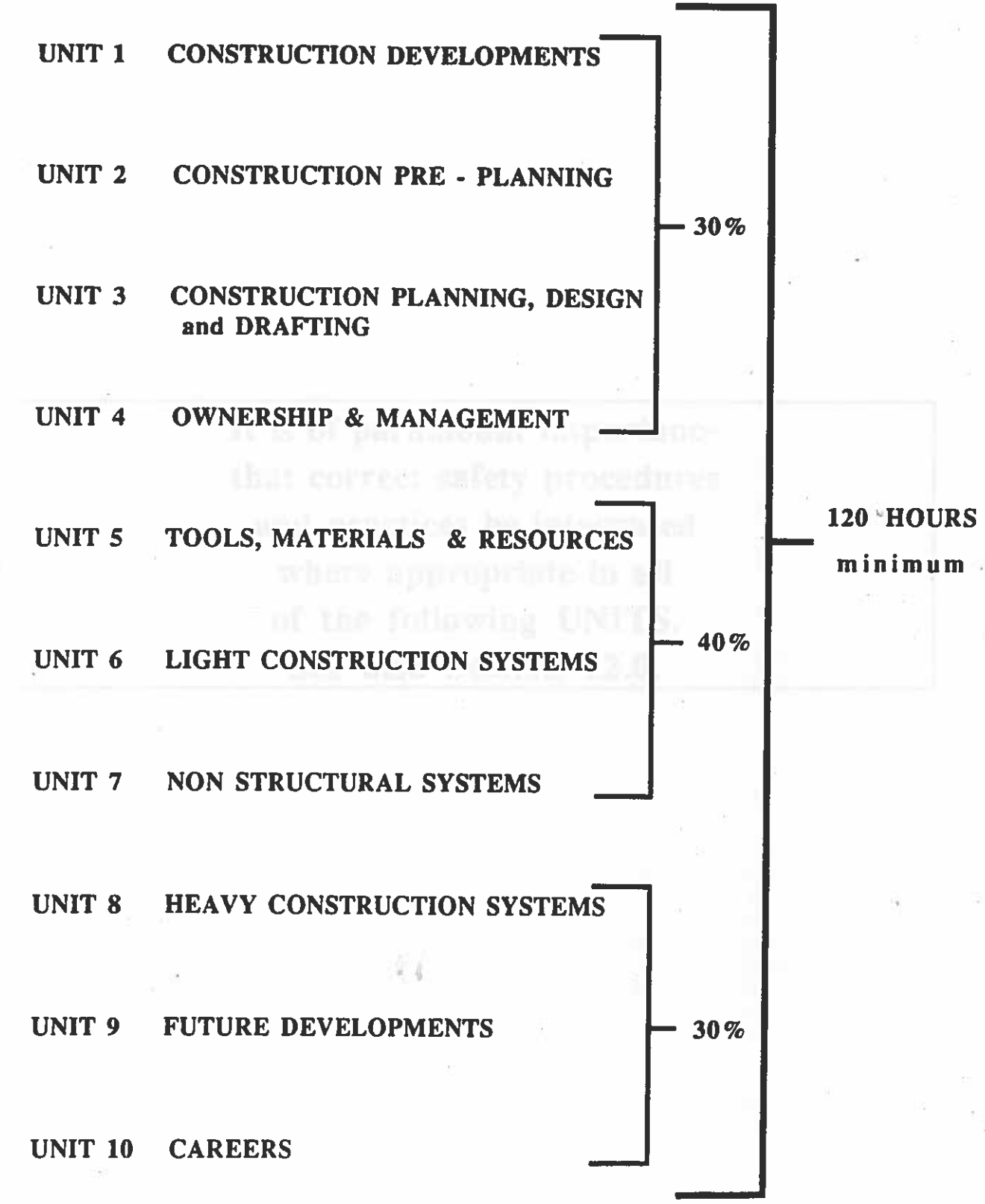
Modification is possible through adaptation to hardware and the utilization of special software. Input devices such as the joystick and mouse, may be able to be used together with some minor adaptation such as a small extension to the joystick handle.

The working environment may also require adaptation such as ensuring that the doorways and aisles are wide enough to allow for wheelchairs.


COURSE OUTLINE

CONSTRUCTION TECHNOLOGY UNITS

NOTE: All the units are compulsory and the percentage values illustrate the appropriate emphasis.



It is of paramount importance that correct safety procedures and practices be integrated where appropriate in all of the following UNITS. See also Section 12.0.

Unit 1 Construction Developments

TIME FRAME EMPHASIS — 30%
TOGETHER WITH UNITS 2, 3 & 4

OBJECTIVES

Students will:

- develop an awareness of technology in relation to construction activities and their impact on society.
- study the historical development of construction technology
- be able to identify the major construction categories
- be able to distinguish the four components of construction systems

CONTENT	SAMPLE ACTIVITIES
Overview of construction from the past to future Relationship of time, equipment, material and advancements in construction technology Social implications : — Human needs — Environment impact Construction trends: — Planning — Information — Awareness — Evaluation — Necessity — Controlled environment — Energy sources	— Construct a model of a primitive structure. — Research a major structure in today's world and classify the type of construction. — View/present/produce a slide presentation on major world structures. — Design a visual representation - of the development of construction past/present/future. — Produce an ecology research paper. — Review an environment update information package re: water, pollution, food, transportation. — Develop class presentations (including research in groups) about the different types of structures used in the development of a community such as - multiunit dwellings, road networks, institutional facilities, etc.

CONTENT

Types of Construction:

- Industrial
- Commercial
- Residential
- Transportation

Construction Systems:

- Input
- Processes
- Outputs
- Feedback

SAMPLE ACTIVITIES

- View a video demonstrating the construction of an authentic Micmac, birch bark, hunting wigwam.
- Using the twigs of uniform size collected from a forest construct a minature log cabin using the correct notching procedures at the corners.

Unit 2 Construction Preplanning

TIME FRAME EMPHASIS — 30%
TOGETHER WITH UNITS 1, 3 & 4

OBJECTIVES

Students will:

- discuss the importance of preplanning a construction project
- distinguish and discuss the difference between the two levels of planning
- demonstrate a basic understanding of surveying principles
- identify the process of initiating a construction project

CONTENT	SAMPLE ACTIVITIES
Provincial, County & Town Planning — Transportation — Rail — Highways — mail routes — truck routes — access — Shipping — Air — Environmental — Forestry — Agricultural — Education — Registry of Deeds — Streets and Roads	— Visit the county planning office and registry of deeds office and compile a written report utilizing a prearranged format. — Have the county or town planner visit the classroom to explain the parameters of his/her job.

CONTENT	SAMPLE ACTIVITIES
— Zoning	— Use a zoning map of your community to locate sites in the community that are in different zoning areas.
— Residential — Commercial — Institutional — Agricultural	
— Waste Collection and Treatment	— Investigate how waste is collected and treated in your community.
— Landfill — Incinerator — Sewage	
— Water Systems	
— Reservoir treatment — Treatment — Distribution	— Try to locate a water supply spring by using divining rods.
Types of Surveys	— Convert a deed description to a graphic layout.
— Land — Topographical — Construction — Aerial — Road	— Convert a deed description to a lot layout. — Layout a grid system on a lot. Take rod readings and convert to ground elevations.
Survey Equipment	Draw a plot plan with grid showing ground elevations and contour lines.
— Transit — Level — Tripod — Rod — Chain	— Observe a demonstration of a lot survey.
Survey Parties	— Using the appropriate geometrical degree markings construct and use an inclinometer from scrap wood or plastic materials and measure the slope of a driveway or path.
— Chief surveyor — Recorder — Instrument person — Rod person — Axe person	

Unit 3

Construction Planning, Design and Drafting

TIME FRAME EMPHASIS — 30%
TOGETHER WITH UNITS 1, 2 & 4

OBJECTIVES

Students will:

- be able to identify the basic steps in acquiring and purchasing real estate
- demonstrate the basic principles involved in designing and planning part or the whole of a structure.

CONTENT	ACTIVITIES
I. PLANNING A STRUCTURE	
— The Design Process System and problem identification	— Have a local architect visit the class to talk about planning structures.
— Design Considerations — Measurement systems — Sketching and drawing ideas — Energy efficiency — Heating — Room layout — Utilities — Traffic flow — Local By-laws — Financial considerations	— Visit a home show or local building supplies dealer to view the various materials commonly used in the building construction industry. — Invite a local building inspector to talk about building codes and permits.

CONTENT	SAMPLE ACTIVITIES
II. DESIGNING & DRAFTING PLANS	— Using CAD or instrument drafting and basic modelling techniques produce a "layout" for a building or part of a building; e.g., kitchen, den, playroom, garage, workshop, youth centre.
Method A (Computer Aided Drafting) Method B (Instrument Drafting)	
— Working drawings	
— floor plans — sections — elevation — detail — pictorial — foundation — plot	— Develop a model or plan layout for the construction project to be built in Unit 6.
— Writing Specifications	
— Building codes — Structural drawings — Systems drawings — electrical — plumbing — security — ventilation — heating	
III. ACQUIRING REAL ESTATE	— Have a real estate agent visit the class to discuss purchasing real estate locally.
— Leasing or purchasing	
Expropriation Negotiation Listing Agreement	— Complete a listing agreement for a property.
— Agreement of Purchase & Sale — Title Search — Financing — The Closing — Recording Data	— Break the class into groups and have them role play the purchase of a property. — Complete a loan application and study relevant CMHC documents.
— House Financing Problems	— Investigate the different forms of ownership common in Nova Scotia, including co-op housing.
— Forms of Ownership	

Unit 4 Ownership and Management

TIME FRAME EMPHASIS — 30%
TOGETHER WITH UNITS 1, 2 & 3

OBJECTIVES

Students will:

- demonstrate the importance of estimating, scheduling and writing specifications for construction technology projects
- identify the different personnel involved in construction projects
- understand the establishment and organization of a construction business and the forms of ownership
- be able to explain how a construction project is bid for, contracted and financed
- understand home management, including the purchase and financing of land and/or property

CONTENT	SAMPLE ACTIVITIES
Forms of ownership — sole proprietorship — partnerships — co-operatives — corporations — entrepreneurship	— Arrange a visit to or a visit by a representative of a local construction company or a company involved in supplying construction materials to discover how the company was formed, operates and does business.
Personnel — union and non union — collective bargaining — labor relations	— Research and make a list of the personnel involved in a construction project currently underway in the community (should include written reports of interviews).
Management — contracts and contractors — bidding — estimating and scheduling	— Estimate the cost of a new building for an important activity in the local community; e.g. school, church, library, sports complex. Start with sketches and floor plans and utilize models/computer programs where possible.
	— Estimate the materials needed to insulate or to wallpaper and paint a typical home bedroom.
	— Prepare a schedule for a common daily activity or activities. Use minutes and or hours to schedule these activities. Illustrate the schedule with a computer generated flow chart or graph.
Specifications	— Compile a specification sheet for a 4' X 8' tool shed.
	— Compile a specification sheet of windows and entrance systems for a typical bungalow.
Contracts, contractors & lending	— Explore several types of contracts; i.e. fixed — cost - plus — unit price — verbal

CONTENT	SAMPLE ACTIVITIES
	Explore the responsibilities of a contractor re: — arranging warranties — subcontracting — labor force management — material acquisition Set up a situation where a prospective home owner needs a house constructed and determine the necessary types of contract and contractors necessary. (group activity) — Produce a flow chart to show all personnel necessary and steps to take.
Financing projects	— Obtain a loan application form from a financial institution in the community and make a list of the essential information required. — Research how large construction projects are financed

Unit 5 Tools Materials and Resources

TIME FRAME EMPHASIS — 40%
TOGETHER WITH UNITS 6 & 7

OBJECTIVES

Students will:

- classify and identify construction materials in relation to their composition and desired results.
- know (and should observe) the proper and safe use of hand and power tools and machines
- identify and demonstrate the proper use of cutting, sawing and drilling and fastening tools
- recognize the new computer age tools currently in use in the building construction industry and analyse their advantages and disadvantages with respect to traditional tools
- classify and identify construction materials in relation to their composition and desired results

SAFETY AT ALL TIMES

NOTE: Encourage the student to measure in a system which reflects the current practice in the industry (Metric, Imperial)

CONTENT	SAMPLE ACTIVITIES
Measurement and layout tools	— Identify types of hand tools currently in use in industry which cut, saw and drill, as well as power handtools which perform those operations.
	— Formulate a safety hazard inventory of a workshop or construction site and recommend improvements.
Cutting, sawing and drilling and fastening	— Design and construct an item which would involve the use of construction tools.
Power tools — stationary — portable	— Determine which stationary power tools are necessary to the "on site" building industry and why.
Construction equipment and machines	
New Tools — laser levels — micro processors in power tools — "power pack" tools — portable generators — electronic stud finder — pneumatic power tools — sonic measuring tapes	— Construct a jig or fixture to perform a specific construction task. — Explore the use and advantages that some new computer age tools have provided to the construction industry. — Research the development of concrete/mortar and its applications within history.
Concrete and Masonry Materials — definition — materials — methods — occupations	— In a group: construct a form and "place" a brick.

Wood Materials:
- classifications
- method of production
- moisture content
- manufactured wood products
- sizing and grading
- air and kiln dryed

Metal materials
- types
- quality
- usage
- cost effectiveness

Insulation Materials
- reflective
- rigid
- loose fill
- batt
- vapor barrier
- wall board

Finishing Materials
- gypsum
- plastics
- glass
- polymers
- sealants
- adhesives

New materials

- Visit a local saw mill.
- Work in a design team and design and construct a tall tower using materials like - drinking straws, balsa wood, pine wood strips, aluminum foil, spaghetti pieces, etc. (see pages 183 and 184 Exploring construction systems by Horton, Komacek, Thompson and Wright - 1992-93 List of Authorized Instructional Materials)
- View a movie or video about wood materials. (see Mac's Mill page 97 of Nova Scotia Department of Education Video Dubbing Catalogue - Title #V9386)
- Listen to a forestry officer talk about N.S. Forest products.
- Compose a list of the building construction materials made from metal used in a — school
  — home
  — office.
- Construct a small building such as the dog house in appendix L and use the Science Tool Kit computer software to measure the effectiveness of different insulation materials.
- Collect sample articles and information on new material in construction.
- Research -- Journals, Magazines, Information bulletins for articles on the use of new materials in the construction industry.

Unit 6 Light Construction Systems

THEORY — TIME FRAME EMPHASIS — 50%
— TOGETHER WITH UNITS — 5& 6

OBJECTIVES

Students will :

- recognize the local code and permit requirements for constructing a light construction
- distinguish and illustrate the various systems used in light construction
- compare and demonstrate the application of light construction finishes

NOTE

The content and sample activities in this unit should be imlemented bearing in mind three broad categories of construction as follows - those using:

- **Traditional methods**
- **Energy efficient methods**
- **Techniques likely to be developed in the future.**

CONTENT	SAMPLE ACTIVITIES
— Local Requirements — code requirements — permits — inspections — occupancy permit — Preparing the site	— This unit provides the opportunity for students to be involved in the construction of any of the items suggested in Section 13.0, page 18. Similar hands-on experiences may also be possible by having the students participate in co—operative education and job shadowing experiences suggested in Section 18.0, page 23.

CONTENT	SAMPLE ACTIVITIES
— Foundation systems — concrete — wood — footing design and placement — foundation walls — damp proofing and drainage	— Develop a business plan for completing the practical construction project suggested above.
— Floor systems — sills, girders and posts — joists — headers — bridging — beams — subfloor	— Erect a variety of different small tents used for camping and observe the advantages and disadvantages of each design. Notice what happens when one or more of the following parts are removed or are improperly placed - tent poles, pegs, guyropes.
— Wall Framing and Roof Systems — traditional framing methods — energy efficient methods — R2000 framing systems — double wall — framing for 21st Century — types of roofs — rafter framing	
— Exterior Sheathing Coverings — wall sheathing — doors — windows — siding — roof coverings — masonry veneer and stucco	
— Finishing — Walls—interior/exterior — Floors/ceilings — Fitments — Wood finishes and preservatives	— Working as a team identify a home maintenance task which is required by an elderly or disabled person and plan and perform its completion.

CONTENT	SAMPLE ACTIVITIES
Landscaping and Design Maintenance and repair procedures	— Compile an inventory of the maintenance tasks which need to be done in — a workshop — school — home — office and participate in activities to complete these tasks.

Unit 7 Non Structural Systems

TIME FRAME EMPHASIS — 40%
TOGETHER WITH UNITS — 5, 6 & 7

OBJECTIVES

Students will:

- identify the tools and materials used in plumbing, electrical and climate control systems and installation
- be able to explain the basic principles used to design plumbing, electrical and climate control systems
- demonstrate the correct use and application of plumbing, electrical and climate control systems

CONTENT	SAMPLE ACTIVITIES
— Plumbing — systems, design and installation — materials, metal and plastic — fittings	— Solder copper joints on a mock up of a supply system.
— Electrical — circuit theory — power distribution — electrical system design — materials and installation	— Design & build a mini-filtration plant, either supply water or sewage water. — Research the methods for disposing of home sewage. — Listen to a presentation by local building and electrical inspectors.
— Climate Control — Forced air — Hot water — Electrical — Solar — Thermal insulation — Air exchange system	— See a demonstration of a climate control system borrowed from local suppliers.

Unit 8 Heavy Construction Systems

TIME FRAME EMPHASIS — 30%
TOGETHER WITH UNITS — 9 & 10

OBJECTIVES

Students will:

- identify the different types of heavy construction
- be able to differentiate between modular and conventional forms of house construction

CONTENT	SAMPLE ACTIVITIES

— Industrial construction
  — single story buildings
  — multistory buildings
	— Survey the local community to make a list of the various types of industrial construction projects located there. (See Constructing a Town/City TLA Appendix B).

— Public buildings	
— Light steel-frame buildings	— Choose one industrial construction project in the community and have students develop a pictogram illustrating how it was constructed.
	— Divide the class into two groups and using foam board have students design and build a house in a) modular form b) conventional form.
— Manufactured & modular construction	

— Supporting structures
  — Roads
  — Towers
  — Bridges
  — Dams
  — Railroads
  — Pipelines
  — Tunnels
	— Visit a company that builds modular homes.
	— Construct a model of a bridge or tower and test its strength.

Unit 9 Future Developments

TIME FRAME EMPHASIS — 30%
TOGETHER WITH UNITS — 8 & 10

OBJECTIVES

Students will:

- define present and future construction trends
- be able to identify classifications of construction systems in future developments

CONTENT	SAMPLE ACTIVITIES
— Trends — Energy efficient buildings — Super skyscrapers — Smart building systems — CADD applications — Recycling and waste materials — Clustered communities — Mass transit — Multi-versus single unit housing	— Design and model a dwelling which could be used in the year 2100. — Collect and present information about "Intelligent Buildings" or "Smart Homes". — Develop a plan to renovate an old building in the local community. — Construct a model of a pneumatic structure using a garbage bag for the membrane material, duct tape for sealing joints and a hair dryer for inflation purposes. — In groups (2 or 3 to a group) Design a city layout complete with models re: — roads — buildings — accessibility — business. (Keep in mind environmentally safe conditions.) NOTE: See also Construction of a Town/City TLA Appendix B

Unit 10 Careers

TIME FRAME EMPHASIS — 30%
TOGETHER WITH UNITS — 8 & 9

OBJECTIVES

Students will:

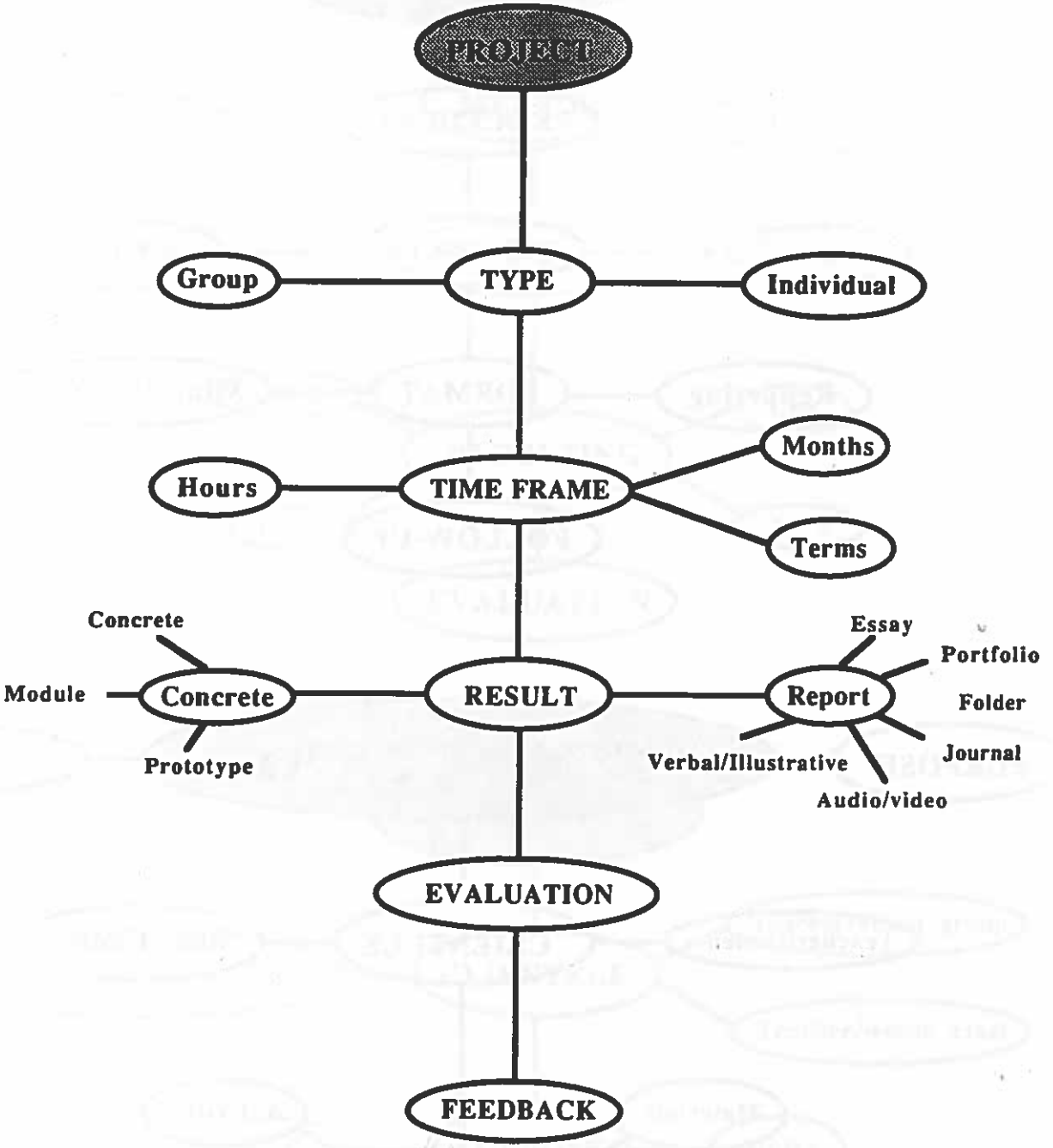
- recognize and understand the careers in the construction industry and the importance of working with each other in co-operative ventures
- locate information on careers in construction as well as the different sources of training possibilities for construction related careers and, where possible, participate in a co-operative education and/or job shadowing experience for approximately five working days

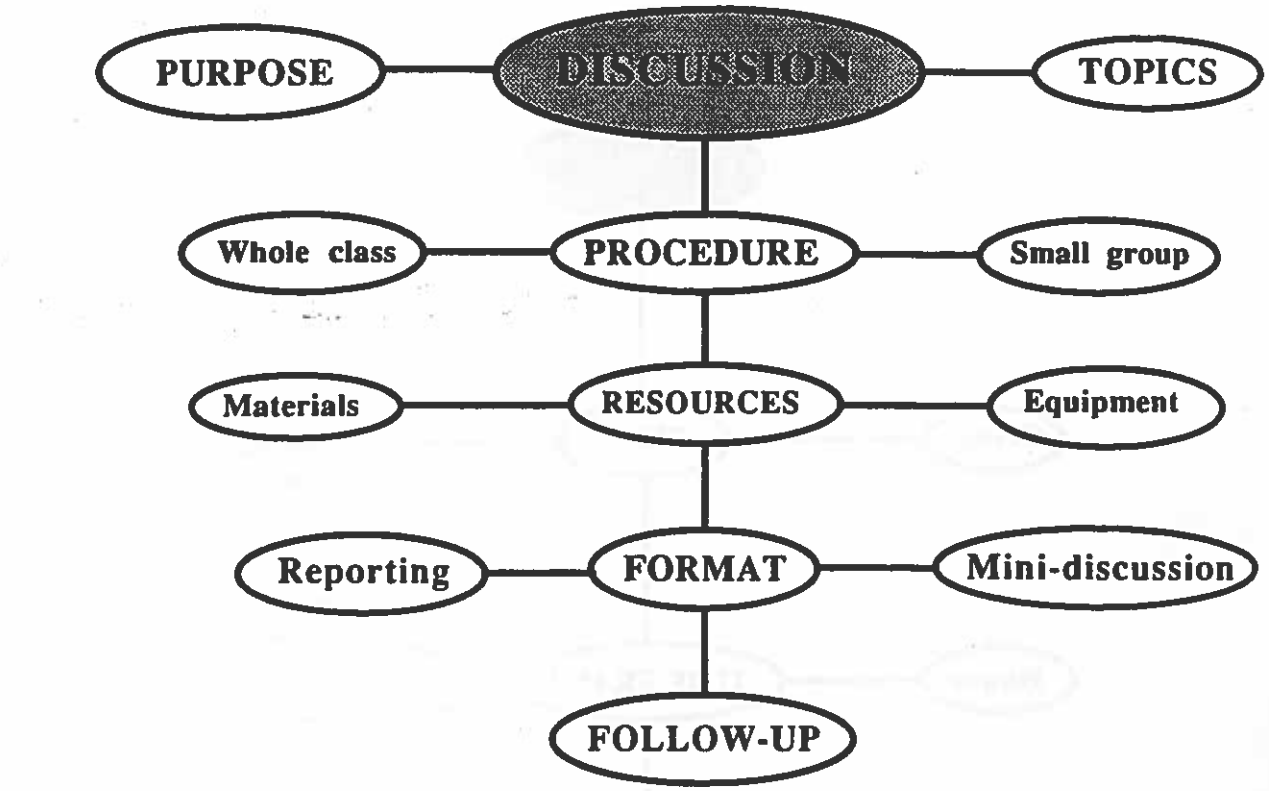
CONTENT	SAMPLE ACTIVITIES
— Construction careers	— Research local newspapers for construction jobs commonly available locally.
— Construction personnel — unskilled and semiskilled — trades and crafts — technical — professional	— Have local crafts and trades people (artisans, carpenters, plumbers etc.) visit the class to talk about working in construction.
— Other construction related professions	— Consider arranging for students to participate in co-operative education and/or job shadowing. (see p. 23) - Highly recommended.
— Construction design and engineering professions	

CONTENT	SAMPLE ACTIVITIES
— Determining career interests	See unit 6 also.
— Making career choices	
— Identifying personal interests, aptitudes and abilities	
— Occupational dictionaries and handbooks	
— Career paths and preparation routes	
— Student/class enterprise	
— working in groups	
— leadership/fellowship	

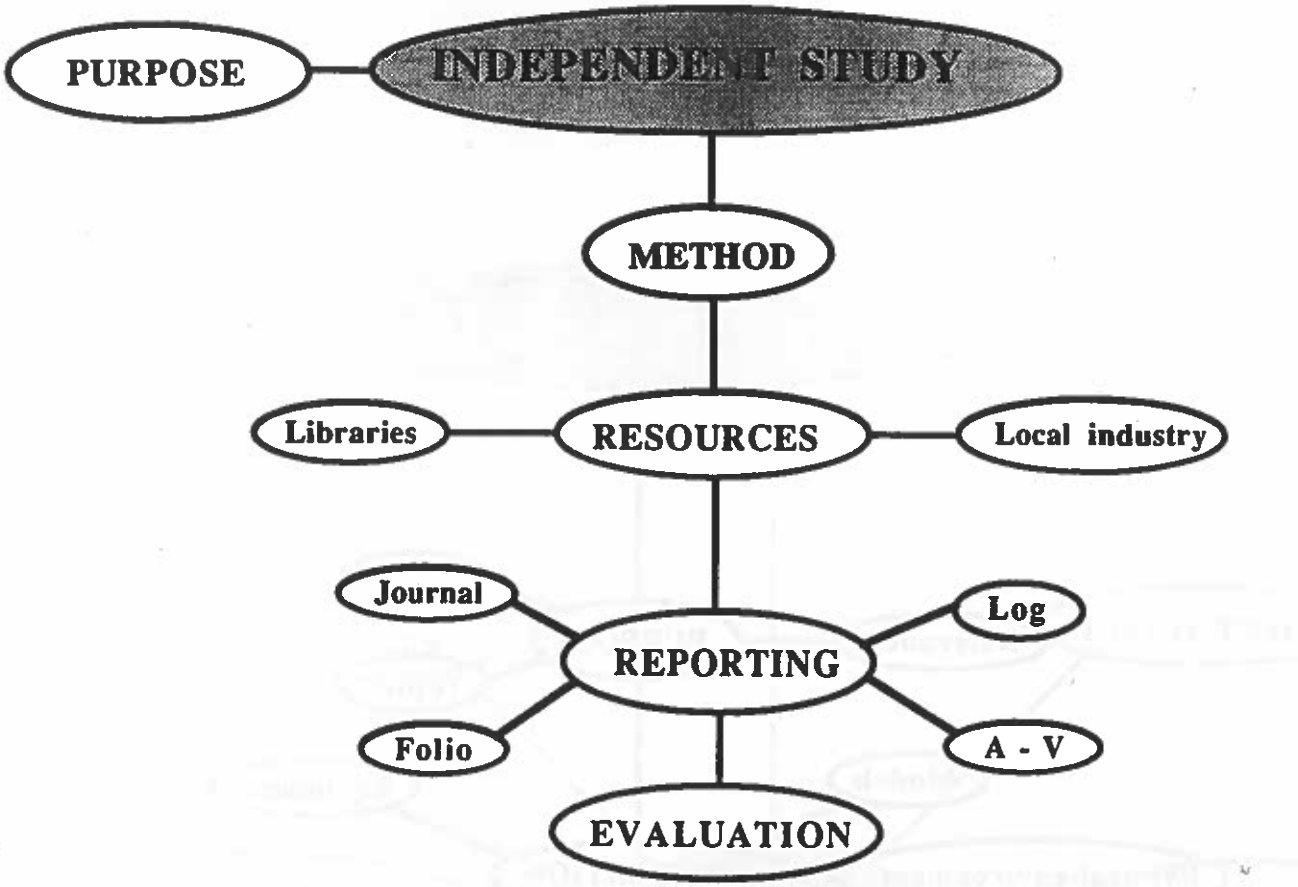
APPENDIX A

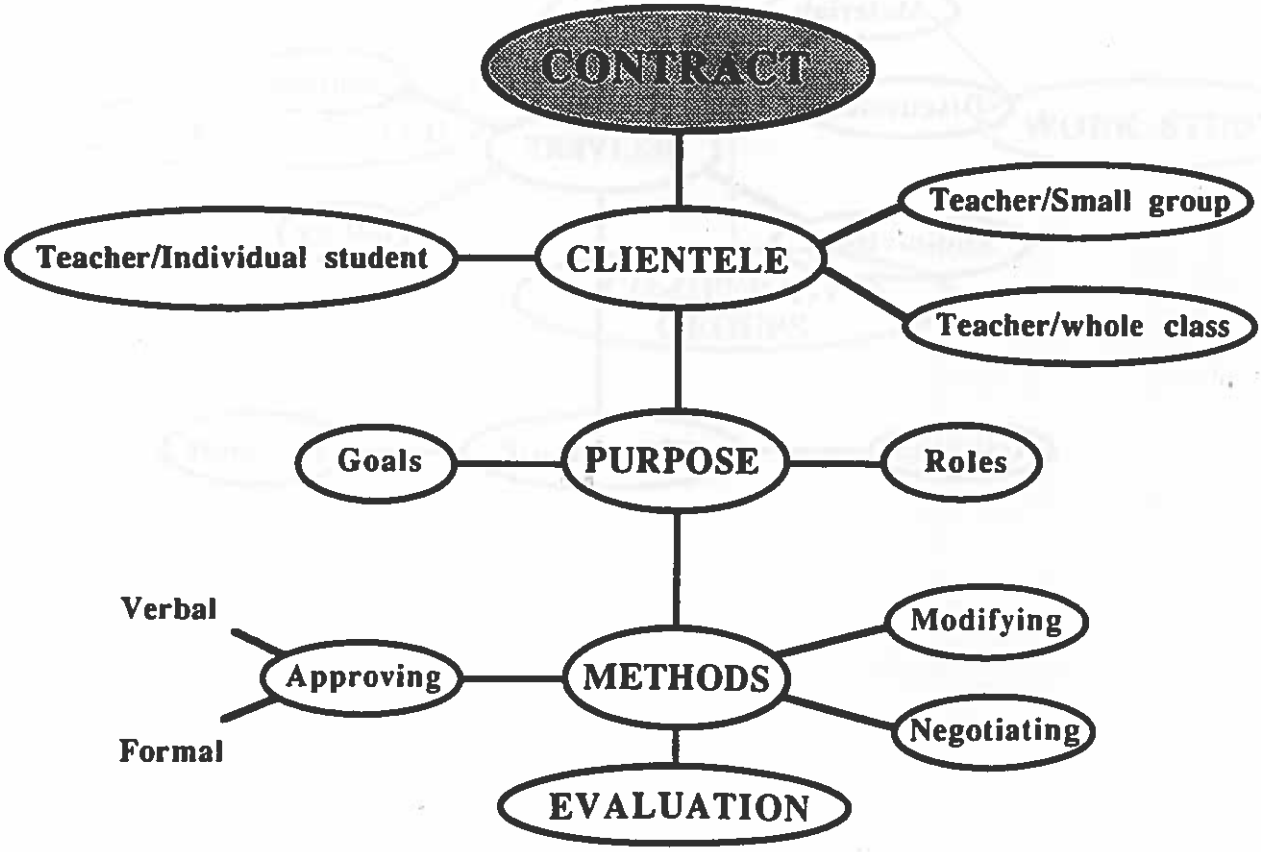
(TEACHING STRATEGIES)

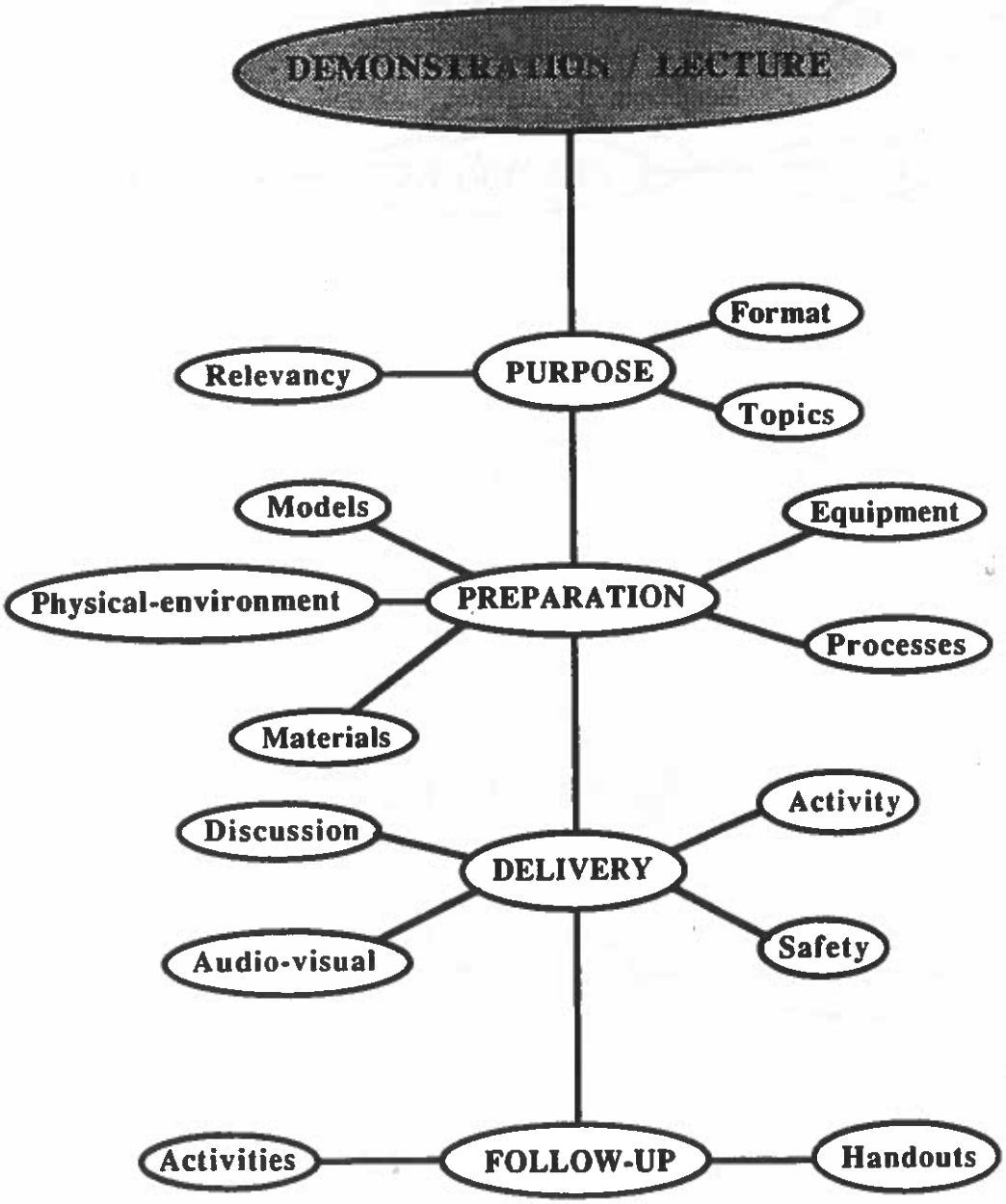

PROJECT
Group
TYPE
Individual
Hours
TIME FRAME
Months
Terms
Concrete
Module
Concrete
Prototype
RESULT
Essay
Portfolio
Folder
Report
Journal
Verbal/Illustrative
Audio/video
EVALUATION
FEEDBACK

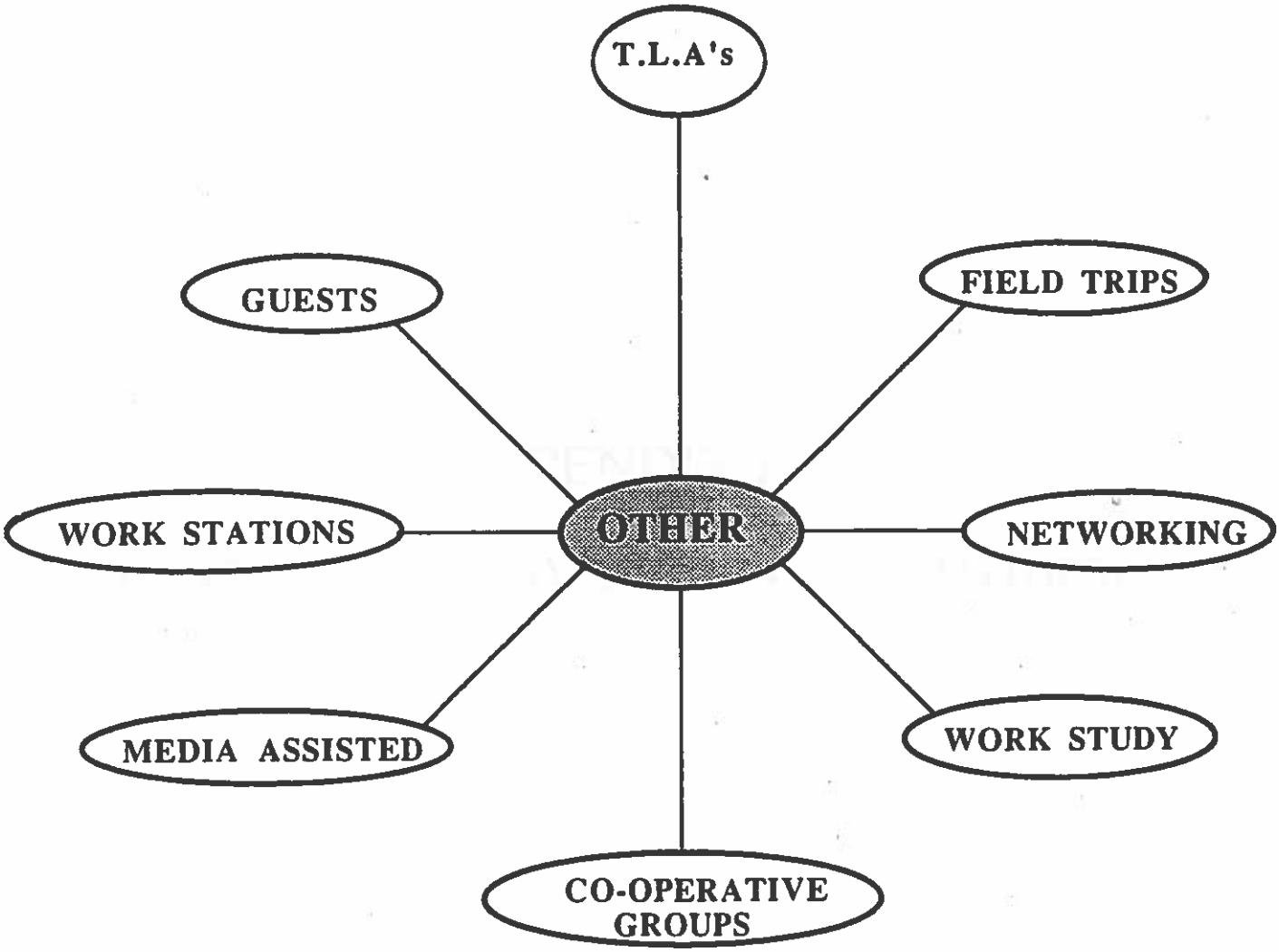

PURPOSE
DISCUSSION
TOPICS
Whole class
PROCEDURE
Small group
Materials
RESOURCES
Equipment
Reporting
FORMAT
Mini-discussion
FOLLOW-UP


PURPOSE
CONFERENCE / SEMINAR
TOPICS
Teacher/student
CLIENTELE
Student/student
Materials
Avtivities
PLANNING
Location
Agenda/program
Evaluation
FOLLOW-UP
Mini
Conference
Seminar


PURPOSE
INDEPENDENT STUDY
METHOD
Libraries
RESOURCES
Local industry
Journal
Log
REPORTING
Folio
A - V
EVALUATION


CONTRACT
Teacher/Small group
Teacher/Individual student
CLIENTELE
Teacher/whole class
Goals
PURPOSE
Roles
Verbal
Modifying
Approving
METHODS
Negotiating
Formal
EVALUATION


DEMONSTRATION / LECTURE
PURPOSE
Format
Relevancy
Topics
PREPARATION
Models
Equipment
Physical-environment
Processes
Materials
DELIVERY
Activity
Discussion
Audio-visual
Safety
FOLLOW-UP
Activities
Handouts


T.L.A's
GUESTS
FIELD TRIPS
WORK STATIONS
OTHER
NETWORKING
MEDIA ASSISTED
WORK STUDY
CO-OPERATIVE GROUPS

APPENDIX B

(SAMPLE TECHNOLOGY LEARNING ACTIVITIES)

TLA DOME CONSTRUCTION TLA

INTRODUCTION

Facts and figures about the Skydome in Toronto are given on the attached sheet (See Appendix C). This is the world's first fully retractable roof which when fully open exposes 100% of the playing field. Domes of this kind are becoming more popular in the major cities across Canada and North America as construction technology becomes more sophisticated.

DESIGN BRIEF

Imagine that you are the employee of one of the major construction companies in your area and that you work in the design engineering department. Your company has been given a construction contract to build a covered stadium to cover your school's playing fields using the materials listed below. Design a model of your covered stadium which quickly illustrates how the roof of your stadium will retract to uncover the playing field. This should be a conceptual model only and should be produced within twenty minutes to illustrate to the other groups how the roof will work.

AIM

The aim of this technology learning activity (TLA) is to introduce you to the importance of design engineering in the construction industry.

PROCEDURE

You will work in a small group and be provided with the following materials -

- 2 shells
- 2 balloons
- 4 pipe cleaners
- 4 straws
- 1 roll masking tape
- 2 grapefruits
- plastic sheet
- foam board
- cardboard
- paper clips
- 1 package of T-Pins

Related Activities

Use a computer software program like PC Globe and produce a map of the world or North America only. Then save and transfer this map to a desk top publishing program such as First Publisher to provide a map outline which can be edited. Use this edited version to produce a map of cities which have constructed dome stadiums similar to the Sky Dome.

TLA TOWN/CITY TLA

INTRODUCTION

The construction of a town or city is a complex endeavor. Many factors influence the success of a town or city. For instance, its success in attracting people, business, industry and commerce will depend upon how well it is designed. All these are necessary for towns and cities to grow and thrive.

DESIGN BRIEF

Your brief is to design a successful city which will be populated by SIMS-Simulated Citizens.

It will be necessary to build residential areas in attractive areas of the terraforming (landform) and to build commercial and industrial zones, power stations and power lines, roads, etc. to make your city grow. The main goal is to design, manage and maintain the city of your dreams. It can be a bustling megalopolis, with many people, cars, tall buildings and high density living or it can be a small rural community. Alternatively it can be a linked group of small communities. It is important, though, that your community provides an attractive place for people to live. If so, it will attract residents and prosper. However, beware of traffic congestion, overcrowding, crime and high taxes, for these will drive away residents instead of attracting them.

AIM

The purpose of this TLA is to simulate the construction of a town and or city using a computer software simulation program such as SIMCITY.

PROCEDURE

Working in groups run the software and proceed with your design brief. Three different levels can be chosen. It is preferable to start at the easy level, and for now the disaster elements such as fires, flooding, tornadoes, earthquakes, monster attacks, melt downs and shipwrecks should be disabled. The auto-bulldoze feature should also be selected under the options menu to facilitate planning residential zones. To make the city grow it will be necessary to follow these general guidelines.

1. Grow slowly and budget money wisely.

2. All the zones must be powered to be developed.

3. Road or rails can be used for access to and from each zone.

4. There is a yearly maintenance cost for each section of road, rail, bridge and tunnel.

5. Extra power plants and redundant power lines are expensive.

6. Rails can carry much more traffic than roads.

7. Grouping zones together can facilitate use of power lines segments.

8. It is a good idea to keep industrial areas separate from residential areas. Proximity to forest parks and water helps to increase land value which keeps taxes high.

9. The bulldozer icon can be used for fine tuning the terrain before construction. It can be used to square off the uneven edges with landfill so that the corner of a new development zone can be accommodated.

10. Roads can be constructed over water and the program automatically builds bridges.

11. Power lines can be constructed under water as underwater cables to carry power across water.

12. Commercial zones begin with small retail stores, gas stations and strip malls and later metamorphose into highrise office buildings and parking garages.

13. For best efficiency roads should be placed beside commercial developments and not run right into them.

14. Fire departments and police departments should be constructed as soon as the city budget will allow.

15. Sports stadiums are expensive but maintenance costs are covered by ticket revenues; therefore sufficient residential zones will be required to support the stadium.

16. Airports are expensive but help tremendously with commercial development and, where possible, should be constructed so that the planes take off over water.

Related Activities

- Save a copy of your completed town/city and print of a copy. Using a CAD program make a detailed drawing of an area you would like to live in.

- Study how you decided on the routes for your utilities - road, rail, power lines and map out alternative or better routes.

- Research the utilities used in your area and investigate how these are financed.

- Build a model of the whole or part of the community using materials such as balsa, styrofoam, foam board, etc. to help to visualize how well the community would work.

- Using a CAD program draw a cross-section of a roadway showing the pavement thickness, and width and to approximately 3 metres or ten feet above the surrounding grade.

- Study a local industrial or commercial construction in your neighborhood and make a sketch plan of the layout of the building and how roadways and utilities facilitate its use.

- Assess the implications of controlled and uncontrolled development in a small community, town or city. Aim to compose a list of controls already in place as well as ideas for new ones which could or should be implemented.

TLA CHUNNEL TLA

INTRODUCTION

Facts and figures about the construction of the Eurotunnel between England and France are given on the attached sheet . (See Appendix C). This will be the first time a tunnel under the English channel will be completed, in fact the central tunnel link has already been made.

DESIGN BRIEF

Imagine that you are an employee of a consortium in charge of designing a fixed link between Nova Scotia and Prince Edward Island or any local geographic situation. Your company has been given a construction contract to build this link. Using the materials listed below, design a model of your link proposal which will illustrate how the link will be constructed. This need only be a conceptual model and should be produced within twenty minutes to illustrate to the other groups how the link will be constructed and how it will work. The model should also demonstrate any potential impacts which may develop.

AIM

The aim of this Technology Learning Activity is to explore the importance of design engineering in the construction industry.

PROCEDURE

You will work in a small group and be provided with the following materials:

- Small tray and modelling clay
- Balsa wood
- Vacuum cleaner hose
- Masking tape
- Small diameter PVC plastic pipe
- Cardboard
- Foam board
- Glue guns
- Plastic straws

- Pipe cleaners

Related Activities

Use a computer software program like PC Globe and locate Canada by the point and select method. Then save and transfer this map to a desk top publishing program such as First Publisher to provide a map outline which can be edited. Select the Atlantic area of Canada, including Nova Scotia and Prince Edward Island, and use this to produce a graphics representation of exactly where the fixed link will be located. (For an example of this see the Graphics representation of Western Europe - Appendix C).

APPENDIX C

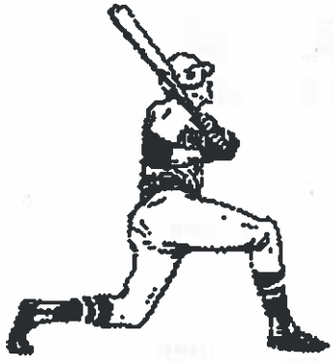
(BACKGROUND INFORMATION FOR TLA'S)

SKYDOME

- The worlds first fully retractable roof.
- Four panels (3 retract on 54 bogies which move on steel tracks)

- When fully open the dome exposes
  - 100% of the field
  - 91% of the seats
- The dome takes 20 minutes to open.
- The roof is constructed of steel trusses covered with
  - corrugated steel cladding
  - pvc single ply membrane
- Weighs 10,000 metric tonnes including 250,000 bolts.
- Spans eight acres equivalent to
  - 32 homes sub division
  - Eaton Centre
- Made of 190 metric tonnes of concrete or equivalent of the sidewalk from Montreal to Toronto.
- 106 rolls of astroturf are needed at 15'x15' x 250'.
- The astroturf is 32 mm thick and is joined by 13,000 metres of zippers.
- To convert from baseball to football takes 12 hrs.
- The astroturf is 80 times more durable than real grass.
- 10,000 light bulbs are used consuming 1,000,000 watts - equivalent to power used in the whole of P.E.I.
- 2,300 construction workers were needed for the construction involving 13,000 person years of effort.
- There are 88 washrooms including 1280 toilets.

SKYDOME cont.



- The dimensions of the Blue Jays home field are

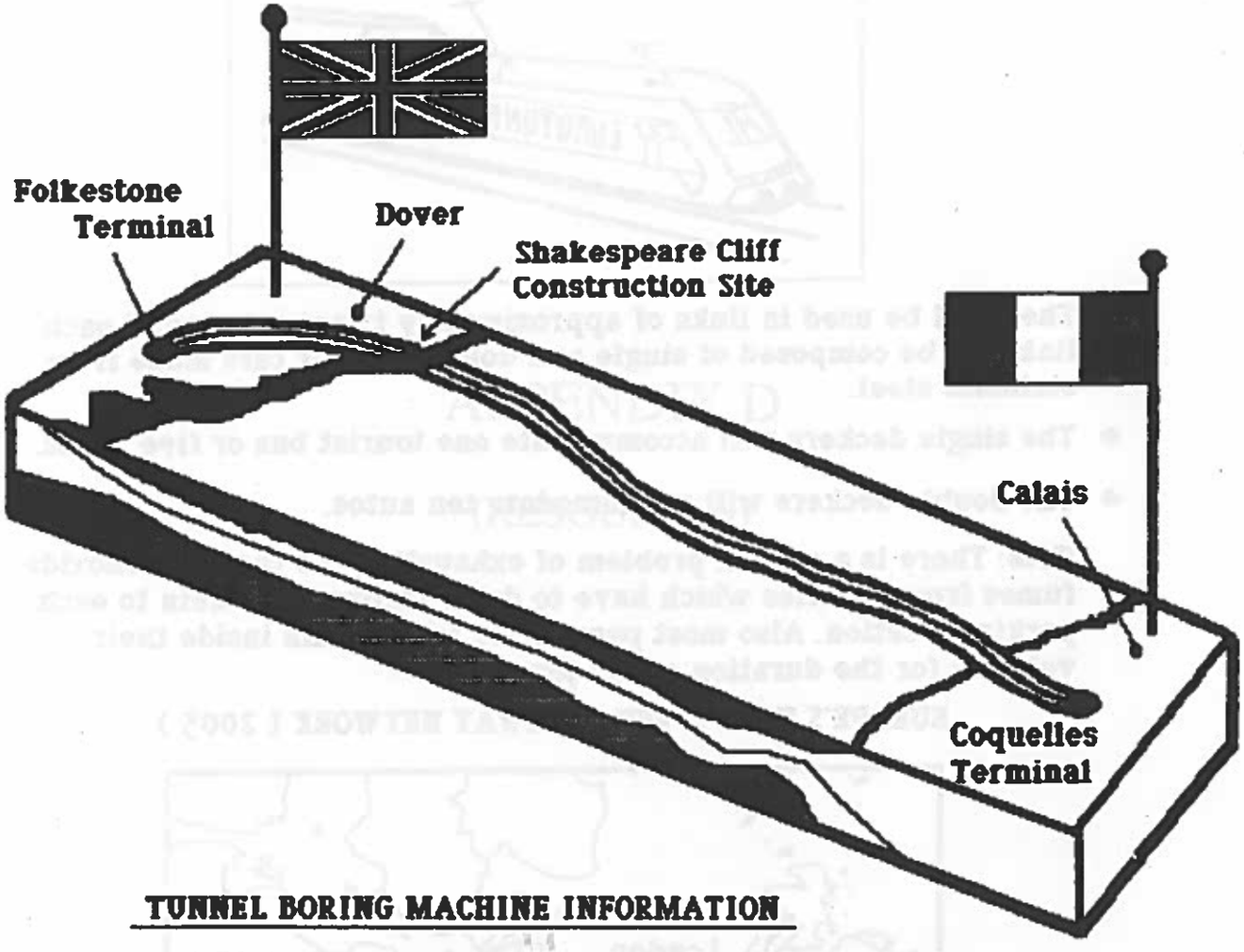
centre field	- 122 m	left foul line	- 100 m
power alley	- 114 m	right foul line	- 100 m

THE HYDRAULIC PITCHERS MOUND

- Built by Ontario Yachts.
- Constructed on a 5.5 m fibreglass dish.
- The dish is placed in a holding chamber filled with water.
- The mound rises to the field level where it is locked in place for the duration of the game.
- At the end of the game the water is drained from the chamber and the mound is lowered below field level.
- This design allows for fast conversion and is consistent.

THE CHANNEL TUNNEL

- The channel tunnel will unite Cap Gris - Nez, France with the White Cliffs of Dover a distance of 34 km.
- The project is scheduled for completion by the summer of 1993.
- Construction of the tunnel involves 12,000 personnel.

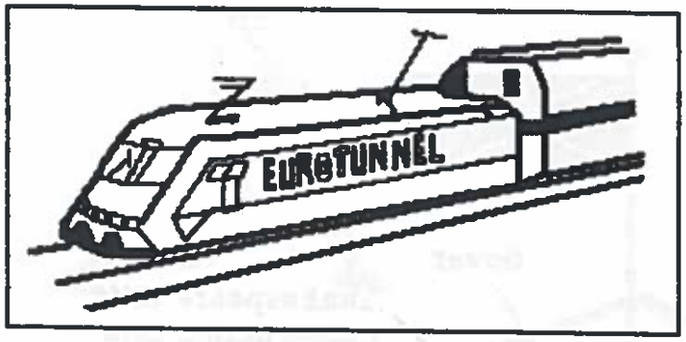


TUNNEL BORING MACHINE INFORMATION

- 11 TBM's are being used each costing 20 million dollars.
- The cutting head diameter = 8.7m.
- Each head is hauled forward by hydraulic jacks which exert forces up to 10,000 tons.
- Each head revolves three revolutions per minute and spews out chalk onto coveyor belts for evacuation out of the tunnel.
- Each head moves at a rate of 4.4 m an hour along satellite aligned reference points.

RAILCAR INFORMATION

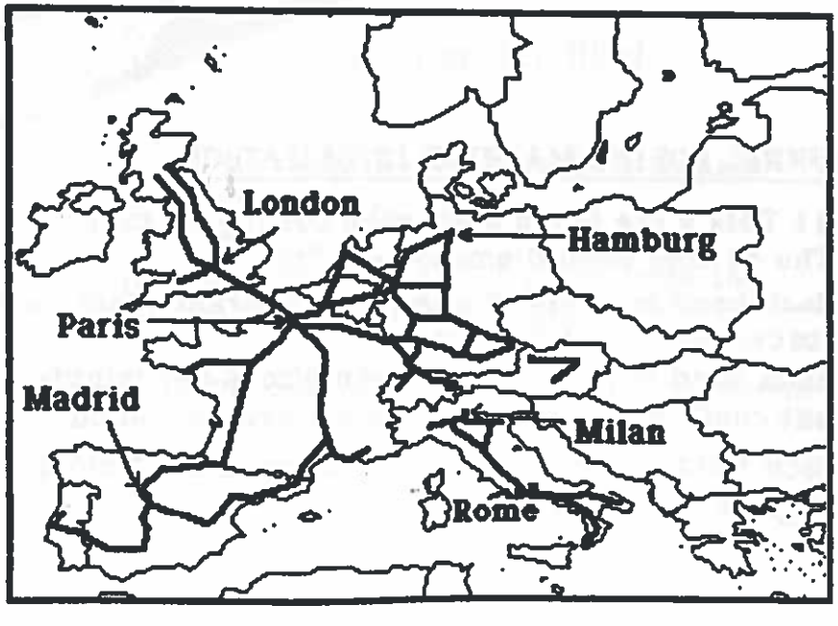
- The railcars for the Eurotunnel train are being built by Trans Manche Link, the Anglo-French consortium in charge of the whole project.
- Subcontractors are Bombardier of La Pocatiere, Quebec.
- The 252 trains, cars and loaders will be the most advanced rolling stock in the world.



- They will be used in links of approximately twenty-four and each link will be composed of single and double decker cars made from stainless steel.
- The single deckers will accommodate one tourist bus or five autos.
- The double deckers will accommodate ten autos.

Note: There is a special problem of exhausting the carbon monoxide fumes from vehicles which have to drive through the train to each parking location. Also most passengers will remain inside their vehicles for the duration of the journey.

EUROPE'S HIGH SPEED RAILWAY NETWORK (2005)



APPENDIX D

(RESOURCES)

List of Resources for Construction Technology

BOOKS

House Form and Culture, by Amos Rapoport, published by Prentice-Hall Canada Inc, 1870 Birchmount Road, Scarborough, Ontario M1P 2Z7.

Shelter, edited by Lloyd Kahn from Home Book Service, Box 650, Bolinas, Cal. 94924.

Appropriate Building Materials, by Roland Stultz from Swiss Centre for Appropriate Technology, Swiss Centre for Appropriate Technology, Varn buelstrasse 14, CH-9000, St. Gallen, Switzerland.

The Owner Built Home, by Ken Kern, Owner Builder Publications, P. O. Box 817, North Fork , Ca. 93643.

The Owner Built Homestead, by Ken Kern, Owner Builder Publications, P. O. Box 817, North Fork , Ca. 93643.

Construction Reference Manual, by Donald Batchelder, from The Experiment in International Living, Kippling Road, Brattleboro, Vermont, 05301.

The ECOL Operation, from the Centre for Minimum Cost Housing, School of Architecture, McGill University, 3480 University Street, Montreal, Quebec H3A 2A7.

Construire en Terre, by Doat Havs Houben, Natuk and Vitoux from the Groupe de Recherche sur Les Techniques Rurales, 34 rue Dumont, d'urville, 75116 Paris, France.

Handbook for Building Homes of Earth, by L. Wolf skill, from the Office of International Affairs, Department of Housing and Urban Development, Washington, D. C. 20410.

Solar Adobes and Sundwellings, by John Timothy Mackey, from the Centre of Village Community Development, 220 Redwood Highway, Mill Valley, Ca 94941.

Soil Block Presses, by Kiran Mukerji, available from German Appropriate Technology Exchange, Dag-Hammarskjold-Weg 1, 6236 Eschborn, Germany.

The Owner Builders Guide to Stone Masonry, by Ken Kern, Steve Magers and Lou Penfield from Owner Builders Publisher Publications, P. O. Box 817, North Fork , Ca. 93643.

The Timber Framing Book, by Stuart Elliott and Eugenie E. Wallas, from Housesmith's Press, P. O. Box 157, Kittery Point, Me. 03905.

Pole Buildings in Papua, New Guinea, by Peter Lattey, from the Forest Products Research Centre, P. O. Box 1358, Papua, New Guinea.

Popular Manual for Wooden House Construction, by Instituto de Pesquisas Tecnologicas, Brazil. Available from the Editor, *UNIDO Newsletter*, P. O. Box 300 A-1400, Vienna, Austria.

Low Cost Home Building, from the Department of Environment and Planning, Australia.

From Hale and Iremonger Limited, G. P.O. Box 2552, Sydney, New South Wales, Australia, 2001.

Nuevas Tecnicas de Construccion com Bambu, by Oskar Hidalgo Lopez, available from Estudios Tecnicos, Colombianos, Ltda P.O. Box 50085 Bogata, Columbia.

A series of articles on the use of bamboo in building construction, collected by Dr. Jules Janssen from Intermediate Technology Development Group, Publications, 9 King Street, London, WC2E 8HW England.

The Yurt by W. Coperthwaitee, from the Yurt Foundation, Bucks Harbour, Maine 04618 (The Yurt is a circular dwelling that orginates in Mongolia where the prototype has for thousands of years been able to withstand the cold and violent winds of the Steppes.)

Earth Sheltered Housing Design: Guidelines , Examples and References, by the Underground Space Centre, University of Minnesota from Van Nostrand Reinhold, 135 West 50th Street, New York, New York 10020.

Building To Resist The Effects of Wind: Volume 3, A Guide for Improved Masonry and Timber Connections in Building by S. Fattal, G. Sherwood and T. Wilkinson from the Superintendent of Documents, United States Government Printing Office, Washington, D.C. 20402.

When You Build a House: The Manual of Construction Details for Carribean Houses with Emphasis On Protection From Strong Winds, from the Carribean Appropriate Technology Centre, Carribean Conference of Churches, P. O. Box 616, Bridgetown, Barbados.

Fireplace by Ken Kern and Steve Magers, from Owner Builder Publications, P. O. Box 817, North Fork , Ca. 93643.

The Book of Bamboo, by David Farrelly from the Siera Club Books, P. O. Box 3886, Rincon Annex, San Francisco,CA 94115.

Ferrocement, A Versatile Construction Material : It's Increasing Use in Asia, edited by R. P. Pama from the International Ferrocement Information Centre, Asian Institute of Technology, P.O. Box 2754, Bankok, Thailand.

The Journal of Ferrocement, from the Journal of Ferrocement IFIC/AIT, P. O. Box 2754, Bangok, Thailand. (Ferrocement is a highy versatile form of reinforced concrete made of wire mesh, sand, water and cement which possesses unique qualities of strength and serviceability).

Gingerbread and House Finish of Every Description, by Barbara R. Robertson, published by the Nova Scotia Museum.

MAGAZINES

Better Homes and Gardens Window on Wall Ideas, Meridith Corporation, 1716 Locust Street, Demoines, I.A. 50336

Canada's Furniture Magazine, Victor Publishing Company Limited, 7777 Keele Street, Unit 8, Concord, Ontario, L4K 1Y7

- provides reliable insight into the furniture industry

Furniture Producton and Design (Canadian Wood Products, Sentinel Business Publications, 6420 Victoria Avenue, Unit 8, Montreal, Quebec, H3W 2S7

- Contains information on Canada's furniture and manufacturing and woodworking industries

Canadian Journal of Forest Research, National Research Council of Canada, Montreal Road Building M-55, Ottawa, Ontario, K1A OR6

Wood Shop News, Soundings Publishing Incorporated, 33 Pratt Street, Essex, Conn. 06426

- news about people who work with wood

Architectural Technology, 1735 New York Avenue, N. W., Washington, D.C. 20006

- a magazine which contains detailed articles on design techniques, products, computer applications and energy technology with emphasis on graphics and technical drawings

Nova Scotia Association of Architects Newsletter, Nova Scotia Association of Architects, 1361 Barrington Street, Halifax, NS, B3J 1Y9

Original house plans published by L. F. Garlinghouse Company Inc., 34 Industrial Park Place, Box 1717, Middletown, Conn. 06457

- specializes in residential home designs

Association of Canadian Industrial Designers Newsletter, c/o Humber College, 205 Humber College Boulevard, Rexdale, Ontario, M9W 5O7

I.D.E.A.S., Do It Yourself Publishing, P. O. Box 343392, Corral Gables, Florida 33114-3392

- a quarterly dealing with all aspects of design

Better Homes and Gardens, Kitchen and Bath Ideas, Meridith Corporation, 1716 Locust Street Demoines, IA, 50336

- a special interest publication full of how-to information

Woodsmith, Woodsmith Publishing Company, 2200 Grand Avenue, Des Moines, Iowa 50312

- a magazine for woodworkers

Plastics in Building Construction, Technomic Publishing Inc., 851 New Holland Avenue, Box 3535, Lancaster, Penn. 17604

- contains information on new plastic material, applications and markets in building construction

Canada Mortgage and Housing Corporation Publications

1. *Housing For Disabled Persons*- basic design feature for housing the disabled and a variety of types of accommodation. NHA5467

2. *An Overview of the Needs of Children and Youth in the Urban Community* - a general discussion on the important outdoor and indoor environmental needs of children and youth. NHA5106

3. *A Glossary of House Building and Site Development Terms* - contains a list of house building and site development terms used in the housing industry. NHA1165

4. *Canadian Wood-frame House Construction* - explains in detail how a wood-frame house is put together and presents the most commonly employed construction methods and suggestions for the selection of suitable materials. NHA5031M

5. *Details of House Construction.* - a cut away illustration of a house showing the names of the various construction components. NHA5011

6. *Metric Conversion Tables* - tables providing metric equivalent for imperial units over a range of values in common use in the building industry. NHA5159

7. *Energy Efficient Housing Construction* - introduction to principles and housing practices employed in construction of energy efficient housing with construction details on major elements of a house. NHA5488

8. *Inspection Checklist for Maintenance and Repair* - checklist to identify symptoms, causes and cures for common problems found in a home. NHA5731

9. *Landscape Architectural Design and Maintenance* - advisory document on related physical and financial aspects of landscape, architectural design, construction and maintenance. NHA5476

10. *Rennovation.* A catalogue of CMHC renovation publications and videos. NHA637210/90

Canada Mortgage and Housing Corporation - Société Canadienne d'hypothèques et de logement

Consumer Series

- Performance of house systems
- Drywall applications
- Siding problems
- Wood-frame construction problems
- Roofing and flashing problems
- Moisture problems
- How to improve the quality of air in your home

11. "Building Science for Cold Climates" - Hutchin and Handegard. Published by the Construction Technology Center, Altantic Inc., Fredericton, NB

12. Canadian Building Digest published by the National Research Council

SEMINARS - COURSES

The Canadian Home Builders Association of Nova Scotia offers training and education workshops for building professionals.

One-day workshops are offered around the province and include a range of topics such as:

House Foundations

- Concrete
- Preserved wood foundations
- Moisture problems
- Radon

Envelope Excellence

- Drywall
- Framing
- Windows and doors
- Noise control
- Moisture problems
- Roofing and flashing
- Siding

Air Quality/Environmental Construction

- Indoor air quality
- Ventilation
- Moisture problems
- Radon
- Waste management
- Water & electrical conservation

Costing & Estimating

- Plan your business for Profit
- How your bottom line affects your business
- Do computers really help?
- Marketing methods

Site Supervisor/Client Relations

- Planning
- Scheduling
- Site supervision
- Site inspections
- Client relations
- Communication skills
- Dealing with subs

Renovations

- How renovation affects house performance
- Assessing a house for renovation
- Structural and moisture problems
- Air, heat and moisture flow
- Renovation applications

The Workshop presenters include:

Robert Fraser - Has been a renovation contractor for five years in the Halifax-Dartmouth area.

Lansing Small - From Sydney, NS, specializes in concrete work and is also a home builder/renovator with 15 years experience.

Glenn Denny - Is a custom home builder in Cape Breton and has been operating his own business for the past 20 years.

Gary Wilneff - Has been building homes for the past 12 years in the Sydney area. Builder of custom homes, he specializes in R - 2000 homes.

Stu Green - Is a builder/renovator from New Glasgow who has been operating his own company for the past 6 years.

Terry Watters - Is an experienced educator in the energy efficient housing industry. Has held various positions as an energy consultant.

The workshop presenters are all mature construction industry professionals with years of experience in the home building and renovation industries. Complete information can be obtained by contacting the Canadian Home Builders Association of Nova Scotia, P. O. Box 3055 D.E.P.S., Dartmouth, NS, B2W 4Y3. Telephone: (902) 462-7876.

COMPUTER PROGRAMS

The following computer software items are included in List E - A Detailed Report of Educational Software Evaluations published by the Nova Scotia Department of Education, May, 1991. They are included here to provide information on the computer software referred to in various sections of the guide and to provide information on software which will be generally useful for teaching the course.

COMPUTER AIDED DRAFTING PROGRAMS:

- AUTO SKETCH 2.0
  Supplier: Addison-Wesley Publishers Ltd.
  Format: MSDOS

- CADDRAW
  Supplier: Hearlihy & Co.
  Format: IIe IIgs

- GENERIC CADD Level 3.0
  Supplier: Generic Software
  Format: MSDOS (Level 1.1 MAC)

- MACDRAFT 2.0
  Supplier: Hearlihy
  Format: Mac

- DESIGN YOUR OWN HOME - Architecture
  Supplier: Abracadata
  Format: MSDOS

NOTE: A level 3.0 Autosketch and a Level 5 Generic Cadd are also available and are currently being evaluated.

GENERAL PROGRAMS

- PORTABLE WOODWORKING EQUIPMENT
  SUPPLIER: Hearlihy & Company
  FORMAT: MSDOS

- SIM CITY
  SUPPLIER: Broderbund
  FORMATS: MSDOS, C64, MAC

  PC GLOBE 4.0
  SUPPLIER: PC Globe, Inc.
  FORMAT: MSDOS

- PFS FIRST PUBLISHER
  SUPPLIER: PC Connection
  FORMAT: MSDOS

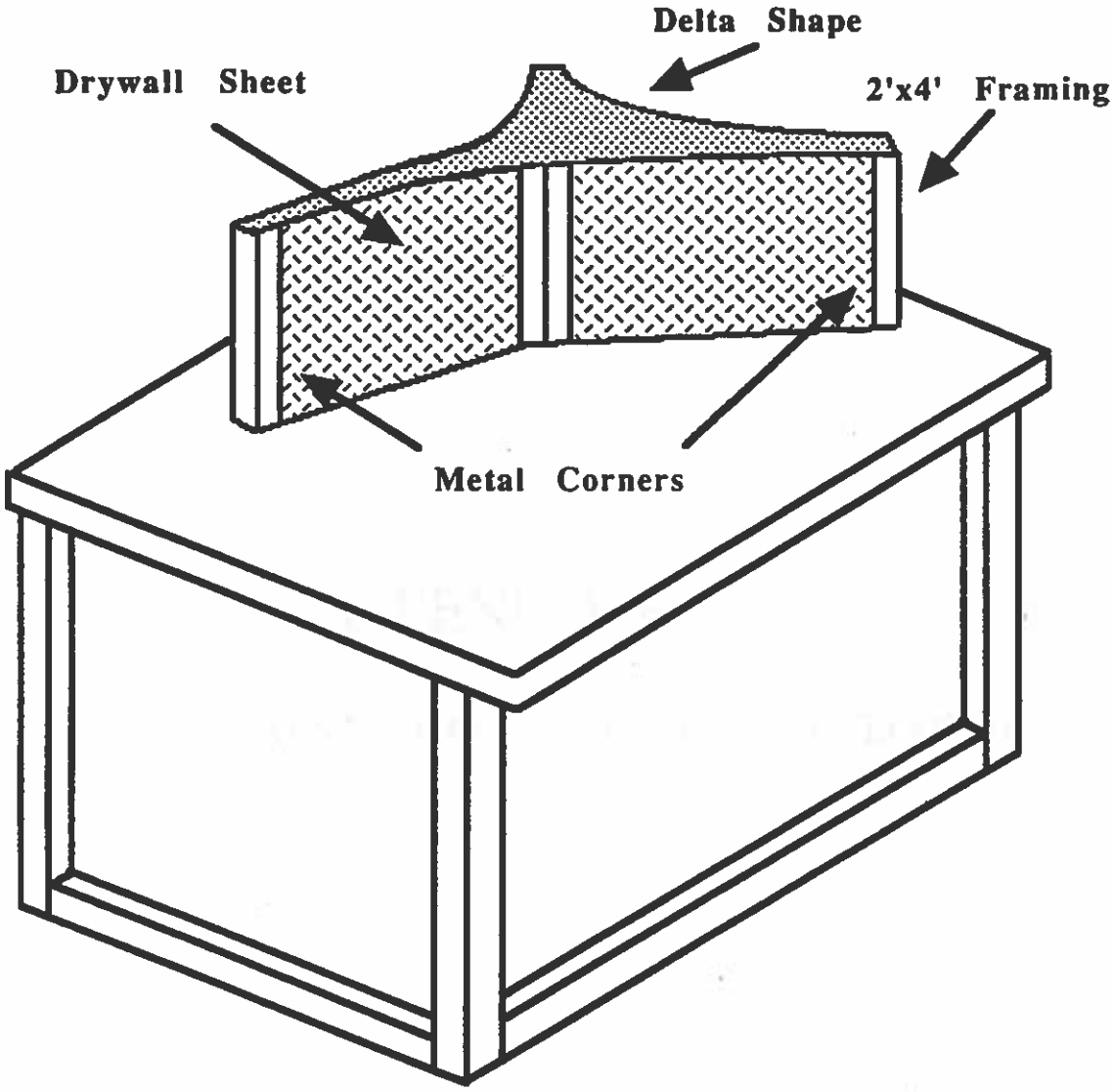
VIDEOS

Wikuom (Video Dubbing)
V7722
13 min j,s 1979 Education Media Services
Mike Martin demonstrates the construction of an authentic Micmac, two-man, birch bark, hunting wigwam with an introduction illustrating other dwellings.

APPENDIX E

(DRYWALL PRACTICE MODULE)

DRYWALL PRACTICE MODULE



* 2"x4" framing is used which is assembled dry by using screws so that it can be dis-assembled easily.
* The module is designed so that three pairs of students can work at the module at the same time.
* The module is made of a size so that it can be easily accommodated on the top of a four - station workbench.

Designed by Paul Martin

APPENDIX F

(PEOPLE IN CANADIAN CONSTRUCTION AND DESIGN)

PEOPLE IN CANADIAN CONSTRUCTION & DESIGN

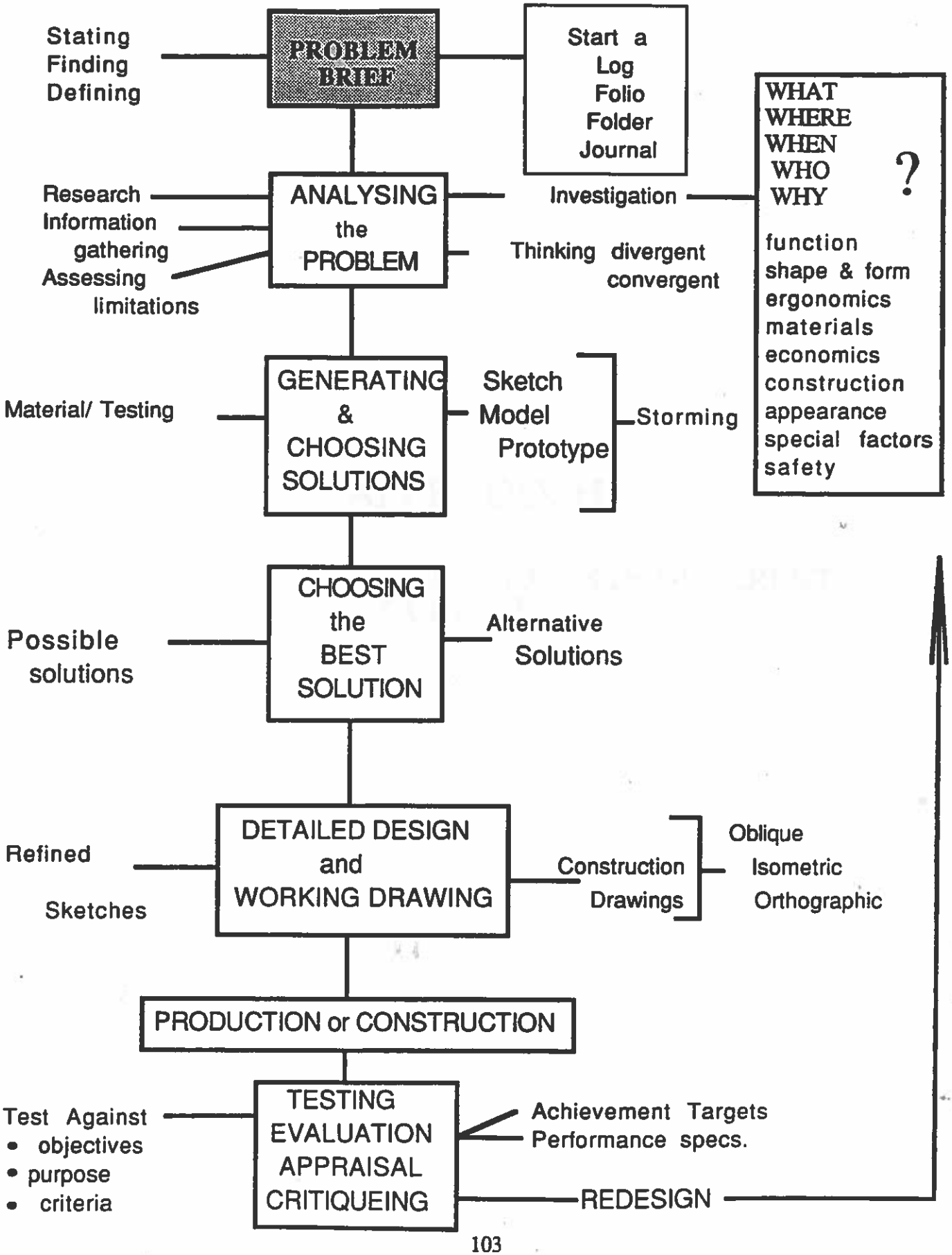
ARCHITECTS/DESIGNERS		BUILDING
Edward Jones	—	Mississauga City Hall
Philip Johnson and John Burgee	—	CBC Broadcast Centre, Toronto
IKOY Winnipeg Architects and Mathers and Haldenby, Toronto	—	William G. Davies Computer Research Centre, University of Waterloo
Arthur Erickson	—	Canadian Embassy, Washington, D.C.
Vancouver Architect Richard Henriquiz	—	Trent University, Environmental Sciences Centre
Peter Dickinson		(Anglo—Canadian Modern)
	—	Beuvenuto Place Apartments
	—	Toronto Teachers' College
	—	Beth Tzedec Synagogue
	—	Four Seasons Motor Hotel, Jarvis Street, Toronto
	—	Canadian Imperial Bank of Commerce
	—	Windsor Plaza Montreal
	—	Queen Elizabeth Building at the Canadian National Exhibition
Douglas Cardinal — Metis Architect (CAD)	—	Canadian Museum of Civilization
Herbert Irvine, Interior Decorator	—	Toronto Ladies Club
Phyllis Lambert	—	Started the Canadian Centre for Architecture
Moshe Safdie	—	Proposed Ballet Operahouse, Toronto
	—	Musée National de la Civilization, Quebec City
	—	National Gallery, Ottawa
	—	Toronto City Hall and Peace Gardens
	—	Nathan Phillips Square
Ron Thom	—	Massey College, Toronto, Ontario
Affleck, Desbarats, Dimakopoulos, Lebensold and Sise		Confederation Centre, Charlottetown, P.E.I.
Victor Prus	—	Metro Bonaventure, Montreal

Ray Affleck	—	Place Bonaventure, Montreal
J. W. Long, H. W. T. MacMillan, J. Shimwell,	—	Calgary Centenary Planetarium, Calgary, Alberta
Raymond Moriyama	—	Japanese Canadian Cultural Centre, Toronto, Ontario
Arthur Ericson	—	Simon Fraser University, Burnaby, B. C.
R. J. Thom	—	Trent University, Peterborough, Ontario

APPENDIX G

(THE TOTAL DESIGN PROBLEM SOLVING PROCESS)

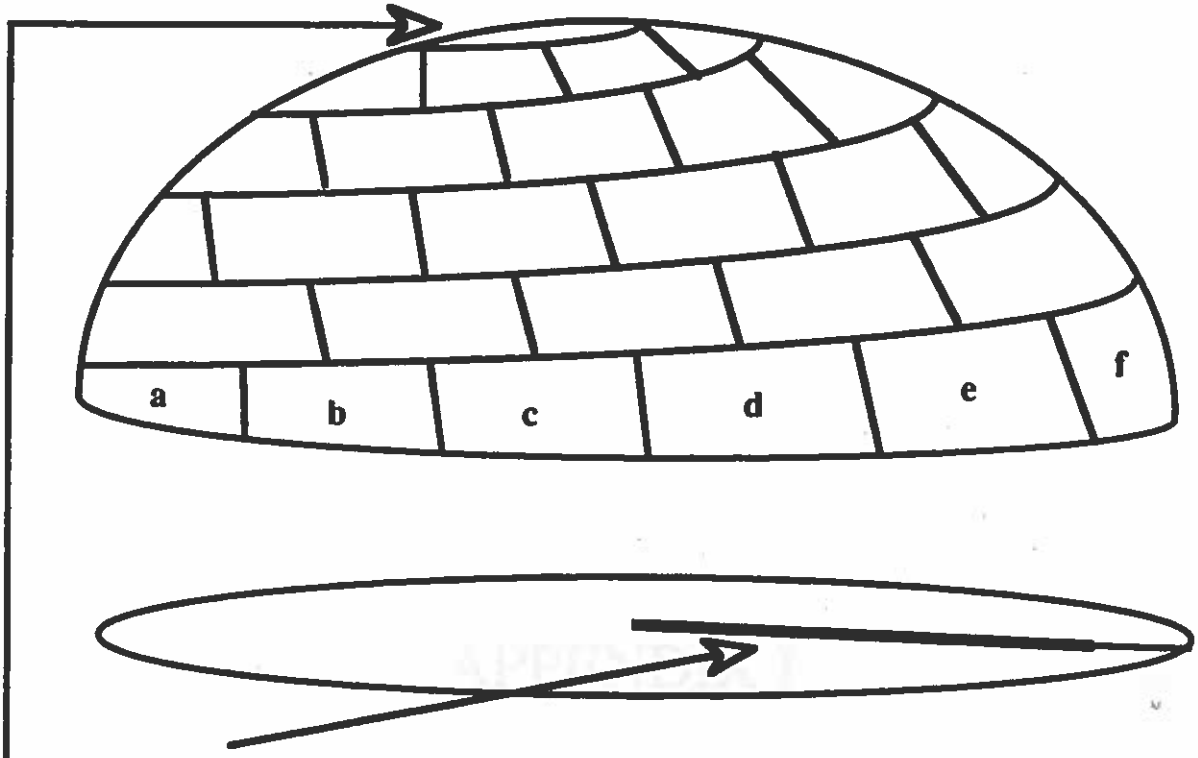
THE DESIGN PROBLEM SOLVING PROCESS



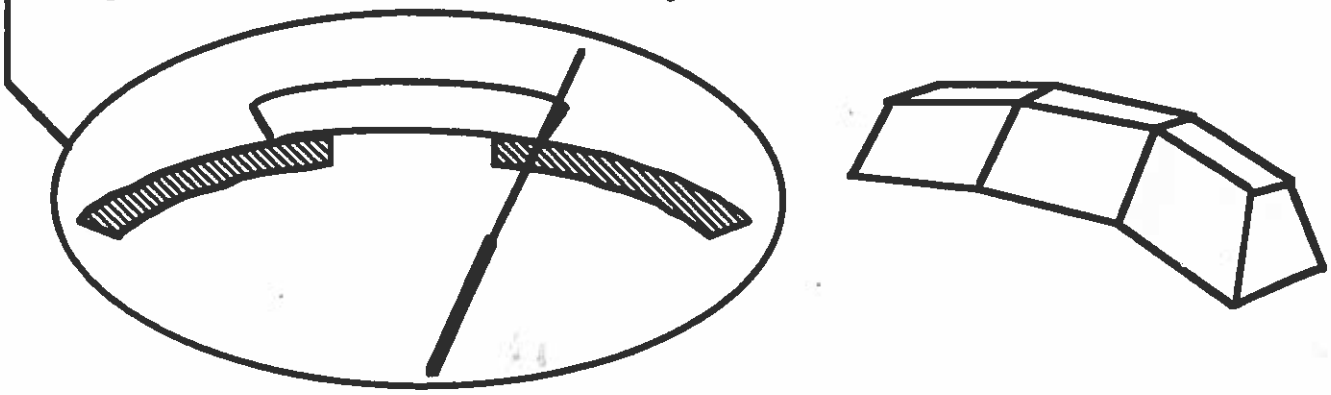
APPENDIX H

(CONSTRUCTION TECHNIQUES IN DIFFERENT CULTURES)

PLAN of the CONSTRUCTION of an IGLOO typical of the INUIT people of BAFFIN ISLAND



- A hunting spear is used to mark out the perimeter of the construction.
- The blocks are cut from hard packed deep snow and are cut using a woodworker's hand saw.
- The individual blocks - approximately 1000 x 500 x 200 mm thick are angled on all sides to fit into the spiral effect of the construction.



- A hole is left at the peak of the construction and then this is covered by a block which is larger than the hole. A door is then cut into the structure and the last block is cut into place with an angle cut made by using a large snow knife. This technique is similar to that used in the placement of a keystone in a bridge.

The following information is extracted from the Government of Canada Workplace Hazardous Materials Information System (WHMIS) to provide supplementary information for school safety programs. The pertinent sections of the Occupational Health and Safety Act - Statutes of Nova Scotia - Acts of 1985, Chapter 3 contain specific information pertaining to the following topics: The Right to Know, Joint Health and Safety Committee Requirements, Duties of the Employer and Employee, Toxic Substances, and Right of Refusal.

Through legislation the WHMIS has established uniform national requirements to ensure that information regarding the hazards of materials produced, sold in, imported to, or used within the workplaces in Canada is provided by suppliers to employers and employees.

A controlled product is defined for WHMIS as any product, material, or substance specified by the regulations to be included in any of the classes listed in Schedule II to the Hazardous Products Act. Suppliers must convey hazard information to purchasers by means of the correct labelling on the controlled products or containers of controlled products, as well as prescribed information on material safety data sheets (MSDS's). Appropriate workplace labelling and other forms of warnings about controlled products and the ready availability of MSDS's are also part of the system.

Suppliers are also responsible for evaluating their products using the hazard criteria identified in the controlled products regulations of the Hazardous Products Act. The hazard classes specified in the Act are:

- Compressed Gas
- Flammable and Combustible Materials
- Oxidizing Materials
- Poisonous and Infectious Material
- Corrosive Material
- Dangerously Reactive Material

Suppliers must be sure that containers of control products leaving their premises are labelled with a product identifier (e.g., brand name, code name, or chemical name of the product), appropriate hazard symbols, risk phrases, precautionary measures, first-aid measures and the name and address of the manufacturer or other supplier. Labels must be legible and in both official languages, and prominently displayed and must make reference to the material safety data sheet.

As long as the control product remains in the supplier-provided container, it must be ensured that the WHMIS supplier label remains on it or is attached to the container and is legible.

Suppliers must prepare or obtain MSDS's in both official languages for each control product they sell or import and are required to provide MSDS's in the official language or languages requested by the purchaser. There are minimum content requirements for MSDS's. Beyond the product identity information, the supplier must provide information on the hazardous ingredients, physical data, fire and explosion data, reactivity data, toxicological properties, prevention and first-aid measures, and the name and telephone numbers of person or corporate departments, responsible for preparing the MSDS's to be contacted for additional information. MSDS's are to be updated at least every three years or as soon as further information related to the hazard becomes available for a material. Copies of supplier and employer MSDS's for controlled products found in a given workplace are to be kept regularly available in that workplace.

Supplier Identifier Labels

Containers of controlled products must have the appropriate supplier identifier labels. Minimum specifications for supplier labels are as follows:

- A Product Identifier
- Brand Name, Code Name or Chemical Name
- A Hazard Symbol in a Pictogram Form, e.g.

- Risk Phrases (i.e., Toxic Material - Lung and Eye Irritant)
- Precautionary Measures (e.g., Keep Away From Heat)
- First-Aid Measures (e.g.,In Case of Eye Contact, Flush Immediately)
- Supplier Identifiers (e.g., Reference to MSDS for the product)

NOTE: Supplier and workplace labels (can also be signs, placards, tags, or other identifiers) are alerting mechanisms for workers using control materials which may be present in the workplace in such locations as pipes, tanks and portable containers. Also, where a control product in a workplace is in a container other than the container in which it was received from the supplier, it is essential that the container have a workplace label.

Material Safety Data Sheets

These are different but complementary to the supplier identification labels mentioned above and include all the available significant information in the appropriate manner using prescribed headings. They must be complete including all the information on all the hazards, i.e.:

- Safe Work Procedures
- Choice of Proper Safe Protection Equipment
- Procedures to be Followed in Case of Emergencies
- Data for Monitoring Workplace Conditions and Health of Exposed Worker

The prescribed headings for Material Safety Data Sheet are as follows:

- Product Identifier - commercial name of the product
- Hazardous ingredients and the approximate percentage composition of these ingredients
- Physical data such as specific gravity, volatility, vapor pressure at specified temperatures, etc.

- Fire and explosion hazard (i.e. flashpoint)
- Reactivity data - dangerous reaction with other chemicals which may occur under conditions of normal use
- Toxilogical properties of the control product are to be listed (i.e., acute or chronic human health effects related to the types of exposure possibly related to the workplace conditions).

- First-aid measures
- Preparation information - name of contact group for obtaining additional information and the date of the preparation of the MSDS. MSDS's must be stored or positioned where they are easily consulted by people working in the workplace).

Note: It is imperative that all public school programs, especially those in industrial arts technology, follow the appropriate storage and disposal procedures outlined in the Material Safety Data Sheets for all hazardous materials used in that program. Further information can be obtained by contacting these (sources) of information and assistance.

APPENDIX J

(THE GREENHOUSE AS A CONSTRUCTION PROJECT)

The Greenhouse as a Construction Technology Project

Construction technology offers a number of opportunities to combine an industrial arts technology education course with other disciplines within the school system. In addition to mathematics (used in the calculation of stresses, areas, volumes, etc.), physics, chemistry and biology may also be directly related to your course. The greenhouse is one project which meets this goal.

At New Ross Consolidated School students in industrial arts technology education have designed and constructed a solar greenhouse which is to be used by science classes for experimentation. The greenhouse, which is approximately 40 square meters in size, is affixed to the south wall of the school. Glazing on the south wall consists of a a double layer of plate glass which was salvaged from the replacement of the school windows with low emissivity insulating panels.

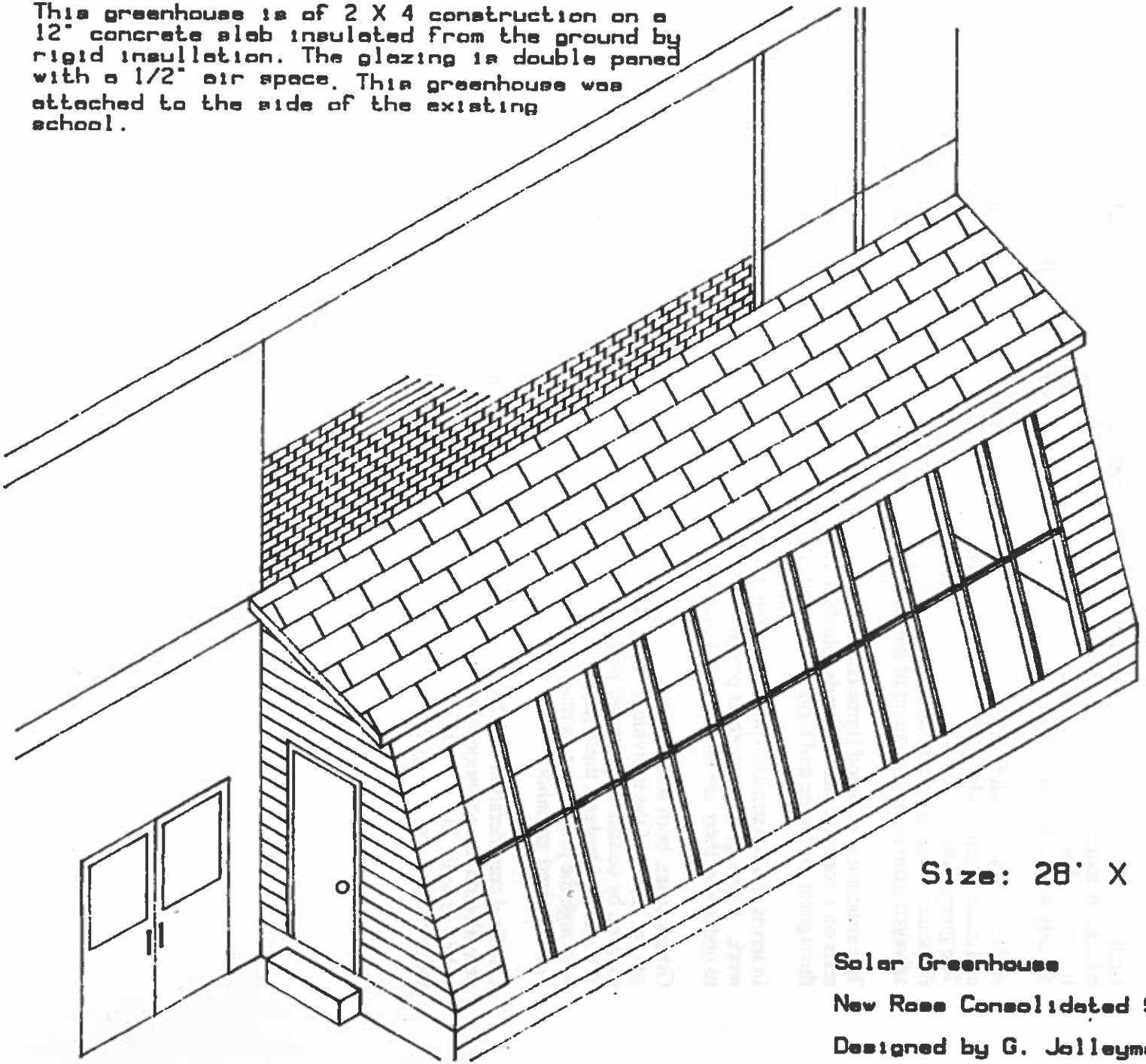
The structure is of wood frame construction with asphalt shingle roof and hardboard siding. It rests on a concrete slab-on-grade foundation. The whole structure is insulated with fiberglass throughout the frame and rigid styrofoam both under as well as around the foundation.

In terms of a construction project it offers students practice from the planning stage to the finish work. Although this project is probably more ambitious and costly than most teachers would wish to undertake, there are other options available to consider.

Greenhouses, both solar and conventional, may be constructed in a variety of sizes and styles to suit the needs of the individual. Cost, which is usually considered a limiting factor, may be reduced by considering smaller projects such as solar coldframes and substituting plastic for glass. With limited budgets these factors may bring such projects within reach of most teachers. Although the project seems much less sophisticated it still retains many of the advantages inherent in a full sized greenhouse.

One final consideration which should be mentioned here is that this is the type of activity that naturally attracts attention - not only from your students but from your administration and the public as well. In almost all cases this publicity tends to be very positive and helps to give industrial arts technology education some well-deserved recognition.

This greenhouse is of 2 X 4 construction on a 12" concrete slab insulated from the ground by rigid insullation. The glazing is double paned with a 1/2" air space. This greenhouse was attached to the side of the existing school.



Size: 28' X 8'

Solar Greenhouse

New Rose Consolidated Schoo

Designed by G. Jolleymore

APPENDIX K

(PRODUCT EVALUATION FORM)

PRODUCT EVALUATION FORM

Product #1 _____

Product #2 _____

Product #3 _____

CRITERIA		PRODUCT		
		1	2	3
How well it meets the specification	(20)			
The suitability of the materials	(5)			
construction	(5)			
sizes	(5)			
appearance	(5)			
The accuracy of the production	(10)			
How easy it is to use/clean/service	(10)			
How safe it is use	(20)			
Value for money	(20)			
TOTAL SCORE	(100)			

BEST PRODUCT SCORE ●——→ _____

Best product strengths _____

_____

_____

_____

Best product weaknesses _____

_____

_____

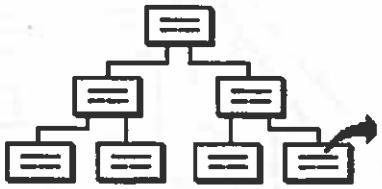
_____

APPENDIX L

(STUDENT ENTERPRISE IDEAS)

STUDENT ENTERPRISE

Small Construction Project

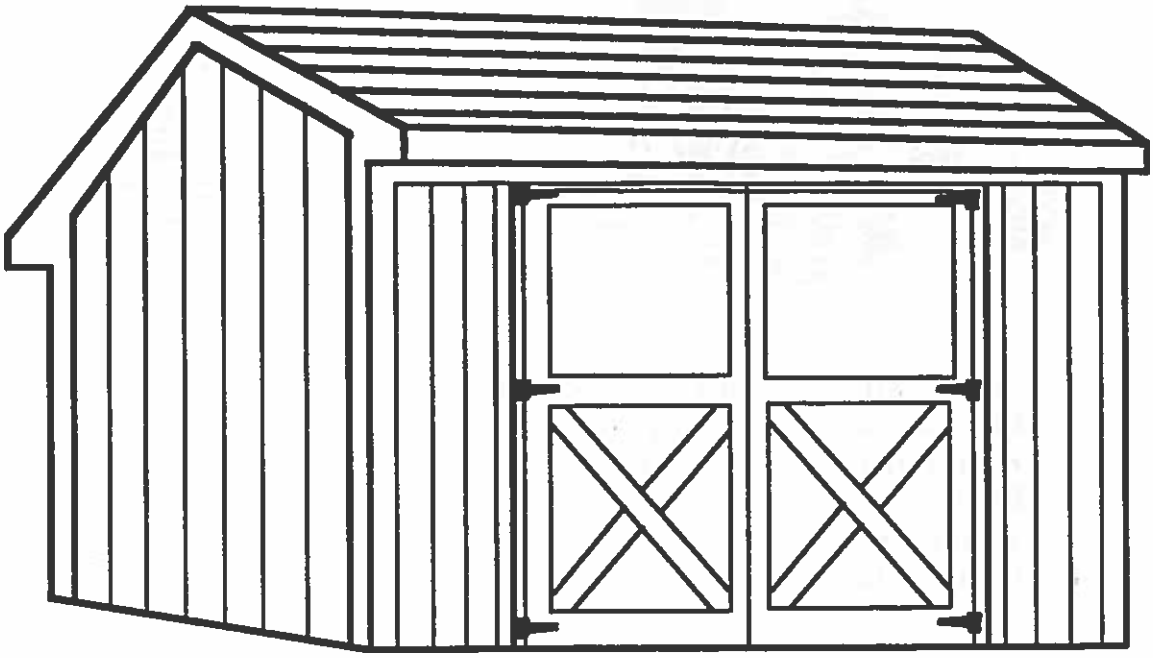


- Choose student jobs and responsiblities.
- Do research and preliminary market analysis.
- Obtain permissions from school principal and school board
- Do design and planning.
- Prepare cost estimates.
- Obtain financing - shares
  - credit
  - loan
- Do marketing and complete contract.
- Obtain materials.
- Commence construction.
- Make modifications and alterations.
- Complete construction.
- Close the sale and the company - pay off bills
  - reward investors

COMPANY RESPONSIBILTIES

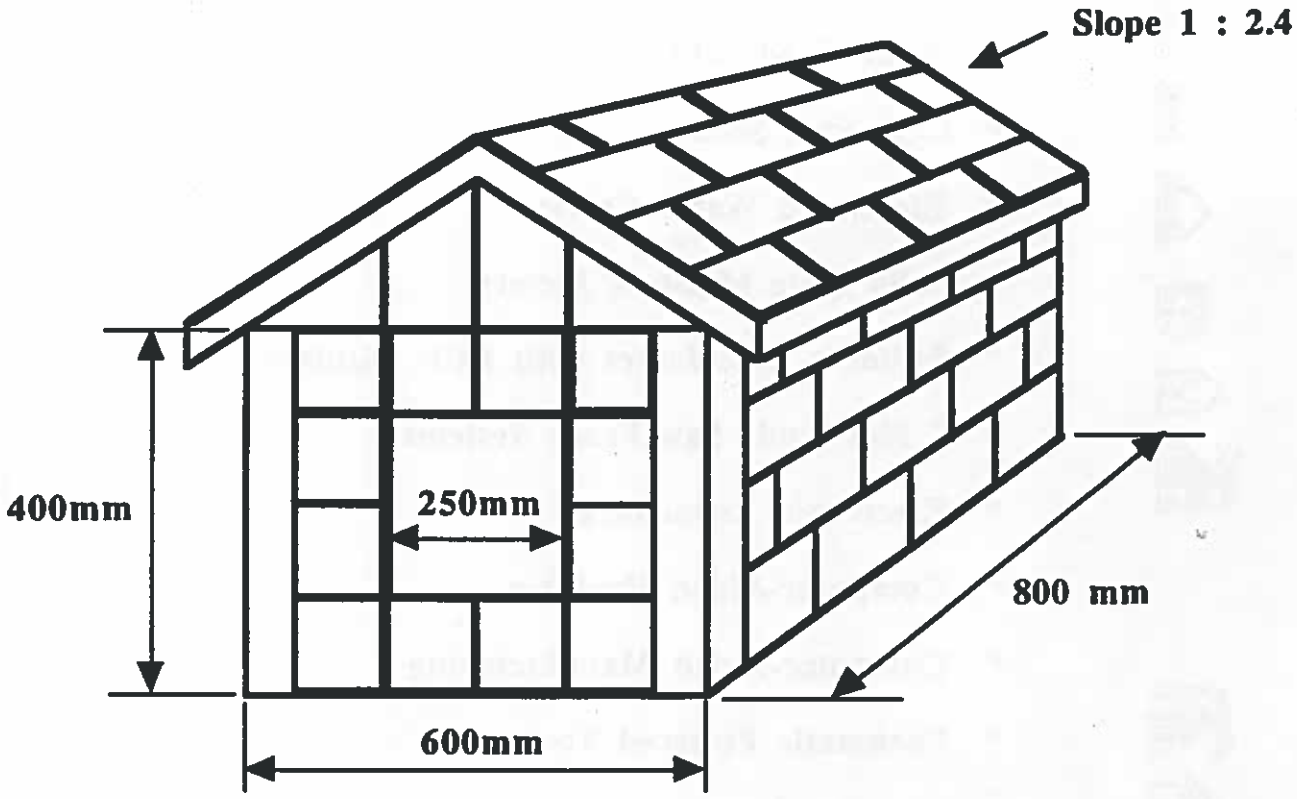
President
Personnel manager
Finance officer
Lawyer
Design and research team
Construction manager
Construction team

A SALT BOX GARDEN SHED



A complete explanation of the procedure to build this project including drawings is available in a booklet titled "Construction Technology Using Computer Planning" which is available from Professor Daryl Hayes, Nova Scotia Teachers College, P.O. Box 810, Truro, B2N 5G5, N.S. The project provides students with the experience of full size construction work. The design was chosen because it provides a lot of storage space with good headroom and a large access door. The construction has been broken down so that there are twelve main panels no larger than four feet by eight feet which facilitates both construction and transportation to the site.

SMALL CONSTRUCTION PROJECT
DOG HOUSE



- Construction is based on wood frame house construction.
- Sizes can be adjusted to suit the size of the dog.
- Regular framing lumber is used for the wall studs and floor joists and the walls are also insulated.
- Three trusses are used to support the roof to a slope of 1 : 2.4
- Walls and roof can be finished using regular cedar shakes and asphalt shingles

NEW TECHNOLGY IN CONSTRUCTION

* Sonic Yardsticks
* LCD Stud Sensors
* Electronic Water Levels
* Solid State Moisture Meters
* Building Calculators with LCD Displays
* T Slot Table Saw Fence Systems
* Electronic Estimators
* Computer-Aided Drafting
* Computer-Aided Manufacturing
* Pneumatic Powered Tools
* Solar Collectors
* Thermal and Reflective Insulation
* Intelligent Buildings
* Sectional and Modular Construction
* Composites and Reinforced Materials
* Energy Efficiency and Air Infiltration Systems