Public and Catholic District School Board Writing Partnerships

Course Profile

Construction Technology

Grade 11
Workplace Preparation
TCJ3E

- *for teachers by teachers*

This sample course of study was prepared for teachers to use in meeting local classroom needs, as appropriate. This is not a mandated approach to the teaching of the course. It may be used in its entirety, in part, or adapted.

Course Profiles are professional development materials designed to help teachers implement the new Grade 11 secondary school curriculum. These materials were created by writing partnerships of school boards and subject associations. The development of these resources was funded by the Ontario Ministry of Education. This document reflects the views of the developers and not necessarily those of the Ministry. Permission is given to reproduce these materials for any purpose except profit. Teachers are also encouraged to amend, revise, edit, cut, paste, and otherwise adapt this material for educational purposes.

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Public and Catholic District School Board Writing Teams –

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Catholic School Board Writing Team - Grade 11 Construction Technology
Lead Board
Dufferin-Peel Catholic District School Board
Denise Panunte, Project Manager

Course Profile Writing Team - Catholic
Paul Owens, Dufferin-Peel Catholic District School Board (Lead Writer)
Brian Andres, Wellington Catholic District School Board
Joanne Durst, Peel District School Board

Internal Reviewers
Rosario Kalino, Dufferin Peel Catholic District School Board
Carmen Leith, Dufferin Peel Catholic District School Board
Sergio Borghesi, Niagara Catholic District School Board

Public School Board Writing Team – Grade 11 Construction Technology
Lead Board
Simcoe County District School Board
Robert Emptage, Laura Featherstone, Project Managers

Course Profile Writing Team – Public
Robert Fisher, Limestone District School Board
Robert Stonehouse, Trillium Lakelands District School Board

Course Overview
Construction Technology, Grade 11, Workplace Preparation, TCJ3E

Secondary Policy Document: *The Ontario Curriculum, Grades 11 and 12, Technological Education, 2000*

Course Description

This course focuses on residential and light construction systems related to commercial, industrial, and/or recreational construction, the development of generic employment skills, and preparation for apprenticeship and training programs. Students learn about and gain practical experience with various types of materials, processes, labour, tools, and equipment used in the construction industry; technical drawings, and auxiliary systems. They study industry standards and building codes, consider health and safety issues, explore careers, the importance of lifelong learning, and the impact of construction technology on society.

How This Supports the Ontario Catholic School Graduate Expectations

The design of this program allows for students (of all gender and race) to improve their skills and knowledge in the area of the construction industry and better themselves, their families and the community. The students are challenged with open-ended problems that allow them not only to problem-solve but also be innovative in their creative decisions. Students are given the opportunity to use these challenges to grow in the communication of their faith through their solutions.

There are various methods of making a student aware of their surroundings and to relate to the student's life and values demonstrated by Jesus Christ during His time on earth. The world and its possessions are a gift from God and as stewards of His world, we must make informed decisions being mindful of both the short and long term consequences on our environment, quality of life and how this relates to our Catholic values as followers of Jesus Christ. The graduate has the skills and confidence to continue on as a contributing member of society.

Course Notes

It is imperative that safety be the prime concern of both the teacher and student. To help ensure that all possible precautions are taken, it is suggested that a Safety Passport (Appendix B – Safety Passport) be given to each student. This form tracks the student through the process of teacher introduction to and demonstration of a tool, and then the student demonstrating the safe operation of the same tool.

The use of newspapers, magazines, Internet, journal entries, and other sources of information allow students to demonstrate an understanding of local, community and world environmental issues as they relate to Christian responsibility. The skills that are learned throughout the course develop a base that prepares students for direct entry into the workforce, apprenticeship programs or other training programs.

The student-centred, activity-based mode of delivery provides students with opportunities to develop individual and group skills, time management skills, and to demonstrate the ability to design and follow an organizational plan for the completion of a range of different tasks.

Each unit provides the opportunity for students to have exposure to many career opportunities and provide insights into the skills required for related professions. A variety of teaching/learning strategies are employed in the classroom to allow for career orientation (i.e., job shadowing, computer career and education research, field trips, and guest speakers).

Units: Titles and Time

Unit 1	Environmental Concerns and Community Responsibilities	10 hours
* Unit 2	Residential and Urban Structures	40 hours
* Unit 3	Building Support Systems	30 hours
Unit 4	Concrete Structures and Forms	20 hours
Unit 5	Entrepreneurship and Small Business	10 hours

* These units are fully developed in this Course Profile.

Unit Overviews

Unit 1: Environmental Concerns and Community Responsibilities

Time: 10 hours

Unit Description

Students research a topic from an area of the construction industry and report to the class at the end of the semester on their findings. Areas of research may include; apprenticeship requirements, construction processes, e.g., wood studs versus steel; shingle development; cost differential, scrap, environmental impacts; steps to be followed in the process of designing a local community project; overview of local by-laws. Students are given these open-ended assignments so they can display their Catholic leadership skills and have a direct application of their faith by making choices in consideration of what most benefits the environment and the people in it.

Unit Overview Chart

Activity	Time	Expectations	Assessment	Tasks
1. Project Introduction	1 hour	TFV.01, TFV.02, TFV.03, TFV.04, TF1.01, TF3.01, SP1.01, CGE1i, 2b, 2c	Knowledge	Instructor describes the assignment, gives examples and promotes discussion of possible topics.
2. Topic Investigated by student	7 hours	SP1.01, SP1.02, SP1.06, IC2.01, IC2.03, IC2.04, CGE2a, 2b, 2c, 2e	Application Thinking/ Inquiry	Students research and gather information on the topic(s) they have chosen through various mediums.
3. Presentation and Discussion	2 hours	SP1.05, SP1.06, ICV.01, ICV.02, ICV.03, ICV.04, IC1.01, IC1.02, IC3.01, IC3.02, IC3.03, IC3.04, CGE2c, 2d	Communication	Students present for class discussion, materials that support their position.

Unit 2: Residential and Urban Structures

Time: 40 hours

Unit Description

This unit focuses on designing, costing and the construction of small residential and/or urban structures. Initial ideas are developed into detailed plans including project costing. The projects can be installed on site and used to meet specific customer requirements. Working individually and in groups, students select the proper materials, tools and construction methods to complete various projects. The projects allow students to develop their God-given potential and make meaningful contributions to society. Projects incorporate a variety of floor, wall and roofing systems specific to each individual project. Interior and exterior finish and support systems such as electrical and plumbing are incorporated, where appropriate, to each individual project. Students gain practical experience by taking the class projects to the construction site. Emphasis is given to the design process, current methods and materials relating to construction technology, and safety. Projects could include, out buildings, sheds, playhouses, ice fishing huts, wood shelters, school bus shelters, or decks.

Unit Overview Chart

Activity	Time	Expectations	Assessment	Tasks
1. Designing and Planning the Structure	5 hours	TFV.01, TFV.02, TFI.02, CGE 2b, 2c, CGE3c	Knowledge Thinking/Inquiry	Use the design process and several drawing methods to create plans for a small building(s) or structure(s).
2. Building Materials and Methods	7 hours	TFV.03, TF2.02, TF3.03, ICV.02, IC2.02, IC2.03, IC2.04, CGE7i	Thinking/Inquiry Application	Examine the construction concepts and techniques required to construct the project. Identify, select and use correctly the various tools and materials required.
3. Costing and Estimating the Project	5 hours	SPV.01, SPV.05, SPI.01, SP1.06, SP2.03, SP2.05, SP3.02, SP4.01, SP4.02, CGE3c	Application Knowledge	Estimate the quantity of materials needed. Develop a costing for the overall project including materials and labour.
4. Let's Build It	18 hours	SPV.01, SPV.04, SP2.01, SP2.02, SP2.03, SP2.04, SP2.08, SP3.02, ICV.02, IC2.02, CGE4c, f, CGE5a, f	Application Communication	Set time lines, distribute the various tasks and construct the project(s).
5. On Site	5 hours	SPV.01, SPV.04SP2.02, SP2.03, SP2.04, SP2.08, ICV.02, IC2.02, CGE5a, b, c, d, CGE6e CGE7j	Application Knowledge Communication	Prepare the site, install the project(s). Review and evaluate the overall project. Self and peer evaluation.

Unit 3: Building Support Systems

Time: 30 hours

Unit Description

Students focus on the work of the sub-trades, and their extensive role in the contemporary building industry. They explore the concepts of building support systems, that include plumbing, electrical and heating/ventilation. After the design process (Appendix A – Design Report Process) has been completed, the students have an opportunity to develop practical skills relating to the fabrication and installation of building support systems. During the process of building projects, they have the opportunity to investigate the many career opportunities that relate to these trades, as well as reflect on the issues relating to the environment and society. The teacher may approach local trades persons in industry to assist with brief demonstrations, career discussions and donations of surplus materials. [Although these activities are similar in appearance, the skill development by the student is very different in each activity.]

Unit Overview Chart

Activity	Time	Expectations	Assessment	Tasks
3.1 Design and build a solar powered hot water heater	10 hours	TFV.01, TF1.01, TF2.01, TF3.01, SPV.01, SP2.05, ICV.01, CGE 4b, 5b, 5g, 7i	Knowledge Application	Design and build a system that uses the suns' energy to heat water.
3.2 Design and install an electric security system	10 hours	TFV.01, TF1.02, TF3.01, SPV.01, SP1.01, SP2.05, IC1.02, GCE 5g, 7i	Application Communication	Design and install an electric security system for a classroom in the school.
3.3 Design and build an air quality system	10 hours	TFV.01, TF1.01, TF1.02, TF3.01, SPV.01, SPV.02, SP1.01, SP2.05, ICV.01, IC1.02, CGE 5g, 7i	Thinking/ Inquiry Application	Design and install an air quality system.

Unit 4: Concrete Structures and Forms

Time: 20 hours

Unit Description

This unit investigates masonry as a sub-trade. It includes casting/forming, and working with blocks and bricks. Students use the design process to develop several individual or group projects. All of their projects directly relate to the fundamentals of masonry in the building industry. Students are allowed and encouraged to integrate their Catholic faith with the life experience of informed decision making for the betterment of society through their project design and completion.

Unit Overview Chart

Activity	Time	Expectations	Assessment	Tasks
1. Building concrete patio stones	10 hours	TFV.01, TFV.02, TFV.03, TFV.04, TF1.01, TF1.02, TF2.01, TF2.02, TF2.03, TF3.02, TF3.04, TF3.05, SPV.01, SPV.02, SPV.03, SPV.04, SPV.05, SP1.01, SP1.02, SP1.03, SP1.04, SP1.05, SP2.01, SP2.02, SP2.03, SP2.04, SP2.05, SP2.06, SP2.07, SP2.08, SP3.02, SP4.01, SP4.02, ICV.01, ICV.02, ICV.03, ICV.04, IC1.01, 1C2.01, IC2.02, IC2.03, IC3.02, IC3.03	Knowledge/ Understanding Thinking/ Inquiry Communication Application	Casting concrete
2. Building an outdoor fire pit or barbeque	10 hours	TFV.01, TFV.02, TFV.03, TFV.04, TF1.01, TF1.02, TF2.01, TF2.02, TF2.03, TF3.02, TF3.04, TF3.05, SPV.01, SPV.02, SPV.03, SPV.04, SPV.05, SP1.01, SP1.02, SP1.03, SP1.04, SP1.05, SP2.01, SP2.02, SP2.03, SP2.04, SP2.05, SP2.06, SP2.07, SP2.08, SP3.02, SP4.01, SP4.02, ICV.01, ICV.02, ICV.03, ICV.04, IC1.01, 1C2.01, IC2.02, IC2.03, IC3.02, IC3.03	Knowledge/ Understanding Thinking/Inquiry Communication Application	Use blocks, bricks or pre-cast stones to construct a small barbeque or fire pit

Unit 5: Entrepreneurship and Small Business

Time: 10 hours

Unit Description

This unit focuses on careers, apprenticeships and small business opportunities relating to the construction industry. Students explore potential careers, supporting roles, educational requirements, apprenticeship training possibilities, and business opportunities. A short presentation from a local business is used to give an example of small business opportunities within the community. Focus is placed on the relationship between learning in the class and learning in the workplace with practical connections between project work and real life construction situations. Students are encouraged to discuss their Catholic values when choosing employment opportunities, and application of ethics in business. Students present a career research project at the conclusion of the unit.

Unit Overview Chart

Activity	Time	Expectations	Assessment	Tasks
1. Construction Related Careers	3 hours	ICV.03, 1C1.01, IC3.01, IC3.02, CGE1g, CGE2b, c, CGE5b	Knowledge	Explore a variety of construction careers and supporting roles. Examine educational and skill requirements. Research one or two careers.
2. Skilled Trades and Apprenticeship Training	2 hours	ICV.04, IC3.01, IC3.02, IC3.03, IC3.04, CGE4g, CGE5e	Thinking/ Inquiry Communication	Research apprenticeship opportunities. Examine employment opportunities, issues and responsibilities.
3. Small Business Opportunities and the Construction Industry	5 hours	ICV.03, IC1.01, IC3.02, IC3.03, IC3.04, CGE4g, CGE5h, CGE7i, j	Thinking/ Inquiry Application	Investigate opportunities in industry for small business. Present example(s) of existing small businesses within the community. Introduce a small business plan. Present their career research findings.

Teaching/Learning Strategies

Teaching/Learning Strategies

Includes the following:

- Brainstorming through group generation of initial ideas expressed without criticism or analysis;
- Collaborative/Cooperative in small group learning providing high levels of student engagement and interdependence;
- Conferencing through student-to-student discussion;
- Design Process is applied in a problem solving approach using a prescribed series of steps;

Assessment & Evaluation of Student Achievement

Students are assessed using the following strategies:

- *Diagnostic:* at the beginning of a term, a unit of study or whenever information about prior learning is useful;
- *Formative:* during learning; ongoing feedback to the teacher about the quality of learning and the effectiveness of instruction;
- *Summative:* usually carried out at the end of a learning process.

• Inquiry conducted through a problem solving approach using prescribed processes involving a number of steps, e.g., SPICE model; • Independent Study through an exploration and research of a topic; • Construction activities in the development of products and services; • Report/Presentation using a variety of media both orally and in writing of the researched topics to the class; • Further development of conflict resolution strategies is utilized in the observation of student's ability to resolve differences in a mature and Christian manner; • Daily positive feedback is established with the student to ensure they remain on task and are working at an appropriate level; • A clear set of classroom rules, regulations and expectations are established and reinforced through the semester.	**Assessment and Evaluation Techniques** *Personal Communication:* • journals/conferencing logs; • self-assessment; • student/teacher conferencing. *Paper-and-pencil Tests:* • unit tests. *Observation:* • formal and informal. *Performance Assessment:* • product research; • construction projects, i.e., how they meet design expectations; • drawing and sketching. *Conferencing:* • student/teacher; • roving conferencing. *Reflection:* • self-assessment; journal; learning logs; peer assessment. **Assessment tools include:** • checklists; • marking schemes (i.e., tests, written assignments, presentations); • rubrics; • anecdotal comments with suggestions for improvement.

Seventy per cent of the grade will be based on assessments and evaluations conducted throughout the course. Thirty per cent of the grade will be based on a final evaluation in the form of an examination, performance, essay, and/or other method of evaluation.

Accommodations

- The nature of these units and their activities allow for a wide range of course delivery methods. Accommodations are made to cover the broad spectrum of students identified with exceptionalities.
- Facilities for students with special needs must be considered, e.g., ramps, lowered tables, special tools, protective wear;
- Written, audio and video taped materials in the form of notes, or samples of completed work, sketches, drawings;
- *Ministry Document: Technology and Education 1999*, p. 48.
- Large print texts, large screen monitors;
- Pre-testing at the beginning for knowledge and specific vocabulary where appropriate;
- Data received from IPRC or IEP must use student's strength to build understanding and confidence;
- Use Educational Resource Worker or Special Education staff for 1:1 support, and support with/in group if required;
- Modify testing and evaluation as required.

Resources

Print

Canadian Electrical Code. Rexdale, Ontario: Canadian Standards Association, current.

Canadian Home Workshop. Volumes 1-22. Markham, Ontario: Camar Publications. ISSN 1485-8509 http://www.canadianhomeworkshop.com (1-905-475-8440)

Cantanese, A. J. and J.C. Snyder. *Introduction to Urban Planning*. Toronto: McGraw Hill, 1979. ISBN 0 070102287

Clidero, Robert K. and Kenneth H. Sharpe. *Applications of Electrical Construction*. Don Mills, Ontario: General Publishing, 1979. ISBN 0-7725-1719-3

Expanding Your Horizons. McGraw-Hill Ryerson Limited, 1993. ISBN 0-07-551392-7

Hire Expectations – Employment Strategies for Canada's Youth. Canadian Federation of Independent Business, 1998. ISBN 0-9693268-4-X

The Home Depot. *Kitchen and Bath 1-2-3*. Des Moines, Iowa: Meredith Books, 1999.

The Home Depot. *Outdoor Projects 1-2-3*. Des Moines, Iowa: Meredith Books, 1998.

Hosie, R.C. *Native Trees of Canada*. Canada: Fitzhenry and Whiteside Ltd., 1979. ISBN- 0-88-902-572-X

Kirchner, Harold B. *Wiring Installation and Maintenance*. Toronto: McGraw-Hill Ryerson, 1978. ISBN – 0 070828296

Kirklighter, Clois E. *Modern Masonry Brick, Block, Stone*. South Holland, Illinois: The Goodheart-Willcox Company, 1985.

Landers, Jack M. *Home Repair and Maintenance*. Tinley Park II: Goodheart-Willcox 1991. ISBN 0-87006-820-2

Lieper/De Jordy/Schultz. *The Entrepreneurial Spirit*. Toronto: McGraw Hill Ryerson, 1991. ISBN 0-07-549931-2

Long, Frank J. *Intermediate Electricity,* 3rd ed. Toronto: General Publishing, 1985. ISBN- 0 773650296

Massey, Howard C. *Plumbers Handbook,* 2nd ed. Carlsbad, California: Craftsman Book Company, 1985. ISBN – 0 91046093

Ontario Hydro Electrical Safety Code. Toronto, Ontario, current.

Ontario Job Futures and the Ontario Ministry of Training, Colleges and Universities. ISBN 0-7778-8799-1

Ontario Plumbing Code. current.

Plywood Handbook. Revised. Vancouver, British Columbia: Council of Forest Industries of British Columbia, 1980.

Stirling, Norman. *Fundamentals of Technical Drawing*. Canada: Gage Educational Publishing, 1984. ISBN 0-7715-0327x

Tech Prep Career Programs – A Practical Guide to Preparing Students for High-Tech, High-Skill, High-Wage Opportunities. Corwin Press Inc., Thousand Oaks, California, 1997. ISBN 0-8039-6510-9

Transitions – A Practical Guide to the Workplace. Collier MacMillan Canada, Inc., (1989).

Wood, Robert W. *All Thumbs Guide to Home Plumbing*. Blue Ridge Summit, Pennsylvania: Tab Books, 1992. ISBN 0 830625461

Websites

Note: The URLs for the websites have been verified by the writer prior to publication. Given the frequency with which these designations change, teachers should always verify the websites prior to assigning them for student use.

http://www.lafarge.ca
La Farge Construction Materials, Technical Services Group, 7880 Keele St., Concord, Ontario, L4K 4G7. 1-800-523-2743

http://www.scc.ca
Publications of the Standards Council of Canada. Rexdale, Ontario.

http://www.finehomebuilding.com
Fine Homebuilding. Numbers 1-126. Newtown, Connecticut: The Taunton Press. ISSN 1096-360-X (1-800-477-8727)

http://www.finewoodworking.com
Fine Woodworking. Numbers 1-139. Newtown, Connecticut: The Taunton Press. ISSN 0361-3453 (1-800-477-8727)

http://www.finehomebuilding.com
Canadian Home Workshop. Volumes 1-22. Markham, Ontario: Camar Publications. ISSN 1485-8509

http://www.augusthome.com
Shopnotes. Numbers 1-48. Des Moines, Iowa: August Home Publishing Company. ISSN 1062-9696 (Tel: 1-800-333-5854)

http://www.augusthome.com
Woodsmith. Numbers 1-126. Des Moines, Iowa: August Home Publishing Company. ISSN 0164-4114 (Tel: 1-800-333-5075)

www:Algonquincollege.com
Algonquin College WebPage

www.pacificconcrete.com
Material Search site

Www.recycle.net
Recycled Furniture Info

www.ilovethisplace.com

Eco Choices Community WebPage

http://www.wood.ca
Canadian Wood Council. http://www.wood.ca (613) 747-0755

http://www.scc.ca
Publications of the Standards Council of Canada. Rexdale, Ontario.

www.msbigday.com
Microsoft Free Seminar Series

www.msnbc.com/news/SMALLBUSINESS
Assistance for Small Business

www.hrdc-drhc.gov.ca
Human Resources Development Canada

www.edu.gov.on.ca
Apprenticeship Web Site Address: Ministry of Education and Training

www.rubricbuilder.on.ca
An Ontario web site that assists teachers with the new assessment tool, rubrics.

Videos

Miscellaneous and Custom Installations Video; 1st ed. ISBN/ISSN 0-7668-2440-3

Ground Fault Circuit Interrupters Video. ISBN/ISSN 0-7668-2437-3

Electrical Wiring Residential. ISBN/ISSN 0-7668-2429-2

Community Resources

Co-op placements, job shadows, speakers, local businesses, Municipal, Provincial, and Federal Government Agencies, local clubs (gardening and landscape), Royal Botanical Gardens (Aldershot), Public and University Libraries, School Libraries

Human Resources and Development Canada

Local school and Public Libraries

Municipal Offices of local Communities

Province of Ontario

Ministry of Municipal Affairs and Housing. *Ontario Building Code,* (1997). Housing Development and Buildings Branch, 777 Bay Street, 2nd Floor, Toronto, Ontario, M5G 2E5.

OSS Policy Considerations

"To prepare students effectively for the challenges that await them, Ontario's schools should offer an education program that promotes a high standard of achievement, that provides all students with the learning opportunities and support they need, and that is relevant to society's needs and expectations".

Today's technology programs, challenge students to recognize they have a responsibility for the effects of technological applications on individuals and society. In order to earn their diploma for graduation, students must complete a total of 30 credits. These credits are made up of 18 compulsory and 12 optional plus 40 hours of community involvement.

Technological Education Programs offer the students an exciting and challenging opportunity to investigate what may be areas of interest in post-secondary schooling or for direct entry into the work force.

Courses allow students to work with computers and computer software that will encourage and improve their ability to research, analyse, and present information on researched topics.

Technology offers students the opportunity to complete credits in a variety of ways including co-op placements, courses that include school time towards apprentice programs, correspondence, independent study, private study, continuing education, as well as summer school.

Anti-discrimination education, equity/social justice issues, career goals/cooperative education, conflict resolution/violence prevention, and community partnerships are addressed in the course. These support many of the Ontario Secondary School Policies. Career exploration throughout the document is made available with *Choices in Action: Guidance and Career Education Program Policy for Elementary and Secondary School, 1999.*

Technology has the ability to accommodate students of all abilities with diverse, challenging and applicable projects. The only boundary applied to the students' problem resolution is their own imagination. The use of open-ended project/student-driven assignments ensure the courses appeal to all students. The following Ontario Ministry of Education Policy Documents are the basis upon which Technology courses are developed:

- *Ontario Secondary Schools Grades 9 to 12*, 1999;*
- *Program and Diploma Requirements*, *1999*;
- *Technological Education Curriculum Guidelines, Grades 11 and 12, 1999*.

Appendix A

Design Report Process

Design is the act of inventing and innovating new products or services to satisfy new or changing needs. Design is a creative, problem-solving activity. As with most creative processes, there are no correct procedures but there are guidelines that assist the designer in obtaining the optimal solution. These guidelines are called the design process.

At the beginning of the design process, students analyse a given set of conditions in order to identify a technological problem, challenge, or need. They work through a number of stages in order to arrive at a solution. All stages in the development of a product are included in the design process. Although the design process may have distinctive stages, they do not need to be followed in a rigid, step-by-step sequence. For example, students evaluate their work at each stage of the process. As they do so, they may discover that they need to return to an earlier stage to make modifications or need to complete a particular step sooner than originally planned. A portfolio and/or a design report are used to document the design process.

Identification and Clarification of a Technological Problem

Students identify the technological problem and begin keeping a record of the design process. Initially, students outline the broad objectives of the project and describe in a general way what needs to be done to achieve those objectives. As work progresses on the project, students periodically revise the initial broad plan to reflect what is actually happening.

The teacher identifies the problem by assigning the project or challenge. Students need to translate the information given to them by the teacher into the sub-stages below. This provides an understanding of each sub-stage so that they can independently complete the stage in later grades. Possible sub-stages for this stage of the design report are:

- define the context;
- identify the problem situation;
- state the technological problem;
- list performance specifications and constraints;
- identify sources of information.

Generation of Multiple Solutions

Students identify possible solutions for the technological problem and the resources required for achieving each proposed solution. They determine whether the required resources are available and record their findings. During this stage, students may discover that they need to redefine the problem. Possible sub-stages for this stage of the design report include:

- brainstorm to generate ideas/solutions for the technological problem;
- select several ideas from the solutions generated in the brainstorming exercise (typically three);
- draw rough sketches for these ideas;
- complete an analysis for each idea, i.e., indicate details on the rough sketches)
- identify the materials and tools needed for each idea;
- make scale models of technological problem ideas to work out initial details of complexity and feasibility (scale models are not always required but are used only to help clarify ideas).

Appendix A (Continued)

Selection of a Best Solution
Students establish evaluation criteria for the selection of a best solution. They consider factors such as:

- available materials;
- tools and resources;
- the amount of time needed to carry out difficult procedures;
- any relevant ergonomic and aesthetic requirements.

Based on the results of these activities, they select the best solution and record the reasons for their choice. Possible sub-stages for this stage of the design report include:

- establish evaluation criteria for the best solution based on performance specifications, constraints, attribute analysis (details from rough sketches of ideas), and available materials;
- evaluate ideas according to the established evaluation criteria for the best solution by creating a chart to rate each idea;
- create a working drawing of the idea selected as the best solution.

Production Plan
Students determine ways of producing the best solution and then construct a prototype of the product. They produce a model size prototype using production-type materials, where possible. They first draft a revised or working drawing and then develop a production plan. As students move through the production phase they may modify their best solution to incorporate ideas that emerge during constructions. Students document all such changes. Possible sub-stages for this stage of the design report include:

- create three-view drawings of the selected ideas, (i.e., front, top and side);
- calculate the materials needed to produce the selected idea and the associated costs;
- order supplies for the project;
- develop a critical path, incorporating key dates;
- complete the project, producing (in detail) the sequential steps used and all modifications made.

Project and Process Evaluation
Students evaluate the project and their design report. They consider their own expectations and criteria and the reactions of their peers, teachers, and if applicable, their client.

Presentation
The final project and design report are presented to communicate the results.

*This design process adapted from the work of Dr. Ann Marie Hill, Queens University

Appendix B

Sample Safety Passport

This is a sample of a generic safety passport that may be adopted for use in a number of technology classrooms. The purpose of the safety passport is to ensure that students are fully aware of all safety features on each piece of equipment in the technical facility prior to using them independently. This process may be adapted to suit the individual teacher and students' needs.

The general process is as follows:

1. When the teacher introduces a new piece of equipment, (e.g., lathe) the student records the date of the safety demonstration on their safety passport and this is initialled by the teacher (see sample below). While the teacher demonstrates techniques for the safe operation of the machine and personal protective equipment (e.g., proper eye protection, loose hair secured, jewellery removed, protective clothing, etc.), the students carefully note the techniques in their notebooks. The teacher also notes the attendance for that day. Any students who are absent for the safety lesson must be provided with a makeup lesson.
2. Each student must complete a written/oral test on the safe operation of the machine tool, outlining all safety features to be observed. All written tests must be kept by the students in their notebooks. These individual machine tests are designed to compliment any general facility safety rules. Upon satisfactory completion of the test the student dates the "tested" column and teacher initials this as complete.
3. Students must demonstrate to the teacher that they have a thorough knowledge of the safety rules for the equipment and are able to demonstrate their competency on the equipment. Once the teacher has observed the required safe set-up and operation of the equipment by a student they sign off that portion of the student's safety passport.
4. Once the student has completed the first three steps, the teacher signs the final column of student's safety passport to indicate that they are able to use that equipment. Students must be able to provide the teacher with their signed passport each time they wish to use a given piece of equipment. A summary document of all the various permissions may be created by the student and signed by the teacher (as permissions are earned); these summary safety passports may be protected with page protectors or laminated for protection. See the sample summary passport below.

Sample Equipment Safety Passport

Student Name: _____ Equipment: _____ See notebook for the note on safe set-up and operation of the equipment.							
Attended Teacher Safety Instruction and Demonstration (and note recorded)	Passed Written or Oral Testing	Demonstrated Safe Set-up and Operation of Equipment to Teacher	Granted Permission to use Equipment by Teacher				
Date of Lesson	Teacher Initial	Date Tested	Teacher Initial	Date of Demo	Teacher Initial	Date	Teacher Initial

Coded Expectations, Construction Technology, Grade 11, Workplace Preparation, TCJ3E

Theory and Foundation

Overall Expectations

TFV.01 · apply the design process to develop solutions, products, processes, or services in response to challenges or problems in construction technology;

TFV.02 · describe the properties and application of building materials, and of construction techniques and processes;

TFV.03 · describe the different technologies, materials, tools, and equipment applicable to construction technology;

TFV.04 · identify building codes, regulations, and standards applicable to construction, including those for electrical, mechanical, and structural systems.

Specific Expectations

The Design Process

TF1.01 – explain how a human need or want can be met through a new or improved product;

TF1.02 – apply the following steps of the design process to solve a variety of construction technology challenges or problems:

- ❑ identify what has to be accomplished (the problem);
- ❑ gather and record information, and establish a plan of procedures;
- ❑ brainstorm a list of as many solutions as possible;
- ❑ identify the resources required for each suggested solution, and compare each solution to the design criteria, refining and modifying it as required;
- ❑ evaluate the solutions (e.g., by testing, modelling, and documenting results) and choose the best one;
- ❑ produce presentation and working drawings, sketches, graphics, mathematical and physical models, or a prototype of the best solution;
- ❑ evaluate the prototype and determine the resources, including computer applications, required to produce it;
- ❑ communicate the solution, using one or more of the following: final drawings, graphs, charts, sketches, technical reports, electronic presentations, flow charts, mock-ups, models, prototypes, and so on;
- ❑ obtain feedback on the final solution and repeat the design process if necessary to refine or improve the solution.

Building Materials and Methods

TF2.01 – describe the properties (physical, structural, and thermal) of both natural and manufactured building materials, and describe the processes used to produce or modify them;

TF2.02 – describe the materials used, and methods of applying them, for the various components of a construction project (e.g., footings, foundations, floors, walls, roofs, windows, doors, millwork, interior and exterior finishes, hardware);

TF2.03 – identify the building codes, regulations, and standards applicable to a construction project;

TF2.04 – describe the strength of a variety of species of wood, and of wood products, used in construction.

Electrical, Mechanical, and Structural Systems

TF3.01 – describe the various systems applicable to the construction industry, including electrical, plumbing, heating, ventilation, and air-conditioning systems;

TF3.02 – identify the requirements for the various systems used in different construction projects, using technical resources such as charts, tables, and building codes, regulations, and standards;

TF3.03 – identify the structural elements (including materials, spans, loads, forces, and methods of assembly) of a construction project;

TF3.04 – identify materials with different structural properties used for different parts of construction projects (e.g., for footings, bearing walls, columns, beams and lintels, floor systems, ceiling and roof systems);

TF3.05 – identify the size of structural members required for a variety of projects, using technical resources such as charts, tables, and building codes, regulations, and standards.

Skills and Processes

Overall Expectations

SPV.01 · apply the design process to a variety of construction projects;

SPV.02 · demonstrate an ability to use resources such as technical data, reports, charts, tables, and building codes, regulations, and standards;

SPV.03 · demonstrate a general understanding of construction systems in terms of loads and stresses, structural members (shape, size, and placement), and the strength of the materials used for the foundation, floor, wall-framing, and roof systems found in residential and light construction projects;

SPV.04 · demonstrate appropriate technical skills involving the use of construction tools, materials, and equipment;

SPV.05 · apply mathematical and estimation skills in a variety of construction projects.

Specific Expectations

Design, Planning, and Communication Skills

SP1.01 – design, plan, and implement solutions for a variety of construction projects;

SP1.02 – use both conventional and computer-aided methods to produce working drawings (e.g., site plans, floor plans, assembly drawings) – including elevations, sections, and details – for construction projects;

SP1.03 – research and gather requisite information, using electronic and traditional methods, for a variety of construction projects;

SP1.04 – evaluate and document construction projects in relation to predetermined criteria, specifications, needs, and building codes, regulations, and standards;

SP1.05 – explain the choice of structure and materials for a particular project;

SP1.06 – use appropriate equipment and techniques to describe, illustrate, and market various construction technology projects.

Building and Materials Application Skills

SP2.01 – use various tools and equipment to calculate the dimensions of and to lay out appropriate structural members for footings, floors, walls, roofs, openings, and other parts of a construction project;

SP2.02 – demonstrate the measurement and layout skills required to build, assemble, erect, and install a variety of components related to construction technology;

SP2.03 – identify suitable materials for a variety of components of a construction project;

SP2.04 – use a variety of appropriate tools, equipment, and materials to complete a construction project;

SP2.05 – prepare accurate working drawings for a variety of projects;

SP2.06 – demonstrate an ability to design and, where appropriate, build a stairway for a construction project;
SP2.07 – demonstrate an ability to design and, where appropriate, build a fireplace for a construction project;
SP2.08 – complete a construction project using a variety of methods and procedures for laying out, assembling, and joining.

Skills Relating to Electrical, Mechanical, and Structural Systems
SP3.01 – design and prepare drawings indicating the structural elements of a variety of construction projects;
SP3.02 – determine the size of structural members required for a construction project using charts, tables, technical data, and building codes, regulations, and standards;
SP3.03 – prepare and interpret electrical and mechanical drawings, and identify the components of the electrical and mechanical systems used in a variety of construction projects;
SP3.04 – calculate the size of the mechanical systems used in a construction project using charts, tables, and technical data;
SP3.05 – design and install, where appropriate, the mechanical systems of a building project (including electrical, plumbing, heating, ventilation, and air-conditioning systems) in accordance with building codes, regulations, and standards.

Estimating Costs
SP4.01 – describe the units of measurement applicable to a variety of building products and how these units are used in estimating quantities for a construction project;
SP4.02 – calculate the quantities of materials and costs of labour for a project, using the area and volume estimating method, and technical data in charts and tables.

Impact and Consequences

Overall Expectations
ICV.01 · explain the effects of technological change in the construction industry on society and on the environment;
ICV.02 · apply appropriate health and safety legislation; general shop and site safety rules; and rules specific to the use of materials, tools, and equipment;
ICV.03 · describe careers in construction technology, identifying the skills, education, and training required for each;
ICV.04 · identify and describe the employability skills required and the need for lifelong learning in the construction industry.

Specific Expectations
Economic, Social, and Environmental Impacts
IC1.01 – explain how the local economy is directly linked to the construction industry;
IC1.02 – explain the social and environmental impacts on the construction industry of urban planning, land use by-laws, and building codes, regulations, and standards.

Health and Safety

IC2.01 – identify hazards related to materials, processes, and equipment used in a construction work environment;

IC2.02 – demonstrate safe shop and construction site practices for the use of hand and power tools, materials, and equipment;

IC2.03 – describe the basic health and safety needs of workers on construction sites;

IC2.04 – identify, and apply where appropriate, safety codes, regulations, and standards applicable to construction projects and the workplace;

IC2.05 – explain how to handle hazardous materials in accordance with the Workplace Hazardous Materials Information Systems (WHMIS) guidelines.

Education, Training, and Career Opportunities

IC3.01 – identify career opportunities in a variety of sectors of the construction industry;

IC3.02 – identify and describe the various skilled trades involved in the construction industry;

IC3.03 – describe the education and training required for employment in construction-related careers;

IC3.04 – explain the importance of lifelong learning for someone choosing a career in the construction field.

Ontario Catholic School Graduate Expectations

The graduate is expected to be:

A Discerning Believer Formed in the Catholic Faith Community who

CGE1a -illustrates a basic understanding of the **saving story** of our Christian faith;
CGE1b -participates in the **sacramental life** of the church and demonstrates an understanding of the centrality of the Eucharist to our Catholic story;
CGE1c -actively reflects on **God's Word** as communicated through the Hebrew and Christian scriptures;
CGE1d -develops attitudes and values founded on Catholic **social teaching** and acts to promote social responsibility, human solidarity and the common good;
CGE1e -speaks the **language of life**... "recognizing that life is an unearned gift and that a person entrusted with life does not own it but that one is called to protect and cherish it." (Witnesses to Faith)
CGE1f -seeks intimacy with God and celebrates **communion** with God, others and creation through prayer and worship;
CGE1g -understands that one's purpose or **call in life** comes from God and strives to discern and live out this call throughout life's journey;
CGE1h -respects the **faith traditions**, world religions and the life-journeys **of all people of good will**;
CGE1i -integrates faith with life;
CGE1j -recognizes that "sin, human weakness, conflict and forgiveness are part of the human journey" and that the cross, the ultimate sign of forgiveness is at the heart of **redemption**. (Witnesses to Faith)

An Effective Communicator who
CGE2a -listens actively and critically to understand and learn in light of gospel values;
CGE2b -reads, understands and uses written materials effectively;
CGE2c -presents information and ideas clearly and honestly and with sensitivity to others;
CGE2d -writes and speaks fluently one or both of Canada's official languages;
CGE2e -uses and integrates the Catholic faith tradition, in the critical analysis of the arts, media, technology and information systems to enhance the quality of life.

A Reflective and Creative Thinker who
CGE3a -recognizes there is more grace in our world than sin and that hope is essential in facing all challenges;
CGE3b -creates, adapts, evaluates new ideas in light of the common good;
CGE3c -thinks reflectively and creatively to evaluate situations and solve problems;
CGE3d -makes decisions in light of gospel values with an informed moral conscience;
CGE3e -adopts a holistic approach to life by integrating learning from various subject areas and experience;
CGE3f -examines, evaluates and applies knowledge of interdependent systems (physical, political, ethical, socio-economic and ecological) for the development of a just and compassionate society.

A Self-Directed, Responsible, Life Long Learner who

CGE4a -demonstrates a confident and positive sense of self and respect for the dignity and welfare of others;
CGE4b -demonstrates flexibility and adaptability;
CGE4c -takes initiative and demonstrates Christian leadership;
CGE4d -responds to, manages and constructively influences change in a discerning manner;
CGE4e -sets appropriate goals and priorities in school, work and personal life;
CGE4f -applies effective communication, decision-making, problem-solving, time and resource management skills;
CGE4g -examines and reflects on one's personal values, abilities and aspirations influencing life's choices and opportunities;
CGE4h -participates in leisure and fitness activities for a balanced and healthy lifestyle.

A Collaborative Contributor who

CGE5a -works effectively as an interdependent team member;
CGE5b -thinks critically about the meaning and purpose of work;
CGE5c -develops one's God-given potential and makes a meaningful contribution to society;
CGE5d -finds meaning, dignity, fulfillment and vocation in work which contributes to the common good;
CGE5e -respects the rights, responsibilities and contributions of self and others;
CGE5f -exercises Christian leadership in the achievement of individual and group goals;
CGE5g -achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others;
CGE5h -applies skills for employability, self-employment and entrepreneurship relative to Christian vocation.

A Caring Family Member who

CGE6a -relates to family members in a loving, compassionate and respectful manner;
CGE6b -recognizes human intimacy and sexuality as God given gifts, to be used as the creator intended;
CGE6c -values and honours the important role of the family in society;
CGE6d -values and nurtures opportunities for family prayer;
CGE6e -ministers to the family, school, parish, and wider community through service.

A Responsible Citizen who

CGE7a -acts morally and legally as a person formed in Catholic traditions;
CGE7b -accepts accountability for one's own actions;
CGE7c -seeks and grants forgiveness;
CGE7d -promotes the sacredness of life;
CGE7e -witnesses Catholic social teaching by promoting equality, democracy, and solidarity for a just, peaceful and compassionate society;
CGE7f -respects and affirms the diversity and interdependence of the world's peoples and cultures;
CGE7g -respects and understands the history, cultural heritage and pluralism of today's contemporary society;
CGE7h -exercises the rights and responsibilities of Canadian citizenship;
CGE7i -respects the environment and uses resources wisely;
CGE7j -contributes to the common good.

Unit 2: Residential and Urban Structures

Time: 40 hours

Unit Description

This unit focuses on designing, costing, and the construction of small residential and/or urban structures. Initial ideas are developed into detailed plans including project costing. The projects can be installed on site and used to meet specific customer requirements. Working individually and in groups, students select the proper materials, tools and construction methods to complete various projects. Projects incorporate a variety of floor, wall, and roofing systems specific to each individual project. Interior and exterior finish and support systems such as electrical and plumbing are incorporated, where appropriate, to each individual project. Students gain practical experience by taking the class projects to the construction site. Emphasis is given to the design process, current methods and materials relating to construction technology, developing technical skills, and safety. Throughout this unit students develop and find meaning, dignity, and fulfillment in work which ministers to the wider community and contributes to the common good. Projects could include: out buildings, sheds, playhouses, ice fishing huts, wood shelters, school bus shelters, or decks.

There are opportunities to discuss moral/ethical issues with the students as how to approach the unit, (e.g., Product A is cheaper but environmentally harmful where product B is more expensive but more responsible in content, etc.). It is through discussions such as this that they can apply/expand their Catholic values in the classroom.

Unit Synopsis Chart

Activity	Time	Expectations	Assessment	Tasks
1. Designing and Planning the Structure	5 hours	TFV.01, 02, TFI.02, CGE 2b, 2c, CGE 3c	Knowledge Thinking/ Inquiry	Use the design process and several drawing methods to create plans for a small building(s) and/or structure(s).
2. Building Materials and Methods	7 hours	TFV.03, TF2.02, TF3.03, ICV.02, IC2.02, 03, 04, CGE7i	Thinking/ Inquiry Application	Examine the construction concepts and techniques required to construct the project. Identify, select and use correctly the various tools and materials required.
3. Costing and Estimating the Project	5 hours	SPV.01, 05, SPI.01, 06, SP2.03, 05, SP3.02, SP4.01, 02, CGE3c	Application Knowledge	Estimate the quantity of materials needed. Develop a costing for the overall project including materials and labour.
4. Let's Build It	18 hours	SPV.01, 04, SP2.01, 02, 03, 04, 08, SP3.02, ICV.02, IC2.02, CGE4c, f, CGE5a, f	Application Communication	Set time lines, distribute the various tasks and construct the project(s).
5. On Site	5 hours	SPV.01, 04, SP2.02, 03, 04, 08, ICV.02, IC2.02, CGE5a, b, c, d, CGE6e, CGE7j	Application Knowledge Communication	Prepare the site for installation and install the project(s). Review and evaluate the overall project. Self and peer evaluation.

Activity 1: Designing and Planning the Structure

Time: 5 hours

Description

Within this activity students receive the overall challenge for the unit. The teacher may present an already predetermined project(s) or students may brainstorm several ideas and select a project(s) for construction. The project(s) selected should incorporate the (selected expectations), keeping in mind the available resources, tools and equipment, and classroom space, as well as on-site considerations. For the purpose of this unit a predetermined project is used as an example. Students design and construct a two-story structure with a suitable roof incorporating a shed on the first story and a playhouse on the second story. Stair construction and a wiring scheme for interior and exterior lighting will be included. In groups, students brainstorm, plan, produce sketches, and develop time lines breaking down the overall challenge into several major tasks. Emphasis is placed on collaboration, problem solving, design, as well as developing an understanding of God's call on one's life and to provide opportunities to minister to and serve the community. The cost for the project could be covered by the presale of the project, through a partnership with a local material supplier, or through a raffle raising funds for a local charity. The project will require final approval by the teacher and potential customer.

Strand(s) & Learning Expectations

Strand(s): Theory and Foundations

Overall Expectations

TFV.01 - apply the design process to develop solutions, products, processes, or services in response to challenges or problems in construction technology;
TFV.02 - describe the properties and application of building materials, and of construction techniques and processes.

Specific Expectations

TFI.02 - apply the following steps of the design process to solve a variety of construction technology challenges or problems:

- ❑ identify what has to be accomplished (the problem);
- ❑ gather and record information, and establish a plan of procedures;
- ❑ brainstorm a list of as many solutions as possible;
- ❑ identify the resources required for each suggested solution, and compare each solution to the design criteria, refining and modifying it as required;
- ❑ evaluate the solutions (e.g., by testing, modelling, and documenting results) and choose the best one;
- ❑ produce presentation and working drawings, sketches, graphics, mathematical and physical models, or a prototype of the best solution;
- ❑ evaluate the prototype and determine the resources, including computer applications, required to produce it;
- ❑ communicate the solution, using one or more of the following: final drawings, graphs, charts, sketches, technical reports, electronic presentations, flow charts, mock-ups, models, and prototypes,
- ❑ obtain feedback on the final solution and repeat the design process if necessary to refine or improve the solution.

SP2.06 - demonstrate an ability to design and, where appropriate, build a stairway for a construction project.

Ontario Catholic School Graduate Expectations
CGE 2b - reads, understands and uses written materials effectively;
CGE 2c - presents information and ideas clearly and honestly and with sensitivity to others;
CGE 3c - thinks reflectively and creatively to evaluate situations and solve problems;
CGE 5b - thinks critically about the meaning and purpose of work.

Prior Knowledge Skills

Note: There are no prerequisites for Technology programs under new guidelines, and as such teachers must be mindful of the differences in the students' previous experiences. Some skills are transferable from one course to another.

- Decision-making skills
- The use of design and problem-solving models
- Cooperative learning skills
- Measuring, sketching and drawing skills
- Brainstorming techniques
- Research skills
- Mathematical skills (volume, area, addition, subtraction, multiplication, division)

Planning Notes

- Create groups considering student abilities and strengths.
- Photocopy the Cooperative Learning Rubric (Appendix 2.1A).
- Prepare the challenge for the unit and a method for communicating the challenge (handouts, overhead, other).
- Prepare teacher-generated project design modules. The modules should provide opportunities for students to sketch, brainstorm, plan and create final drawings.
- Prepare the teacher-generated time-line handout and photocopy.
- Review Board policy on computer/Internet use (safety/censorship).
- Review proper report writing including the ethics of piracy and plagiarism of information previously done.
- Review Board policy on safety for the construction lab.
- Review Board policy regarding field trips.
- Teachers should provide for student development and allow the practice of in the areas of conflict resolution, negotiation, assertiveness, consensus building, etc. (This should be encouraged throughout all the unit activities.)
- Contact local municipal governments regarding local building codes and regulations.
- Contact local building associations for support material.
- Contact local charitable (religious) groups to see if your project could be used for families in need.
- Ensure you have a Safety Passport system (or similar in place) for the students to follow.

Teaching/Learning Strategies

The teacher will:

- divide students into predetermined groups of three. Groups may be enlarged depending on the complexity of the group's specific project;
- distribute the Cooperative Learning Rubric and review the various skills required to collaborate including; actively listening to others, respecting the rights of others, sharing information, responsibilities of self and others;

- present the overall challenge. The challenge for the purpose of this unit will be the construction of a two-story structure incorporating a shed and play house. The challenge could be presented in a variety of ways including; a predetermined customer, the project built and sold or the project constructed and raffled off raising money for a local charity. The example to be used as a resource in this unit will be shown the later. A partnership with a local material supplier would be an excellent resource and increase the overall money raised for charity;
- discuss with the class the overall challenge including the various possibilities for partnerships, variety of designs, materials available, timelines, and the opportunity to serve and minister to the wider community. The teacher should provide links to Scripture such as Jesus' ministry, the Church and the Christian community, and each Catholic believer;
- provide opportunities to discuss ethical issues and Christian values with respect to the project. (e.g., materials, health and safety, environment, etc.;
- distribute and discuss the project design modules including; the problem solving model (based on the design process expectations TF1.02), web diagram, time-management sheets, and paper for initial sketches and designs;
- distribute the teacher-generated timeline handouts and instruct the students to develop deadlines for project sketches, final drawings, bill of materials, project approval, construction, and installation. time lines will be reviewed and refined as a class;
- collect the completed project design modules from each group;
- review and discuss the various designs following the design process outlined (TF1.02), comparing each solution, evaluating the solutions, refining and modify where appropriate. Select the best one;
- instruct the students, working in their groups, to make the necessary changes and modifications to their design packages.

Students will:

- participate in discussion revolving around cooperative learning skills;
- participate in whole class and small groups discussion reviewing the overall challenge, the various components of a shed/playhouse, and other considerations such as; various designs, marketing, partnerships, available materials, timelines, and the opportunity to serve the wider community by making environmentally sound choices;
- complete the project design modules following the problem-solving model (based on the design process expectations. TF1.02);
- complete the web diagram and time management sheets following the class discussion regarding timelines and tasks to be completed. Students will be required to develop deadlines for project sketches, final drawings, bill of materials, project approval, construction, and installation;
- discuss ideas and begin sketching and drawing potential shed/playhouse concepts within their small groups;
- submit their initial proposals for review and discussion as a whole class comparing each solution, evaluating, refining and modifying where appropriate;
- select the best one based on a class consensus and return to their groups to make the necessary changes to their design packages.

Assessment Evaluation of Student Achievement

- Formative assessment of students' contribution to group and class discussions using observation and anecdotal comments (Appendix 2.1A).
- Formative assessment of project design modules checking for completeness and accuracy (Appendix 2.1B and Appendix 2.1C).

- Testing of students to determine the amount of prior knowledge (tool usage, safety, etc.)
- Personal communication both diagnostic and formative (teacher/student conferencing)
- Teacher observation (checklist, etc.)

Accommodations

- Form groups of students of differing abilities and strengths to ensure an opportunity for successful completion of tasks.
- Group students for peer tutoring.
- Provide additional support where necessary (using OSR and IPRC student information), ensuring a positive working environment.
- Provide samples and exemplars for students to see the variations of drawing quality and completed design modules.
- Students give oral responses or solutions to challenges and extra time is given to complete tasks.
- Assign tasks to be appropriate with student's abilities and provide additional teacher direction as needed.

Resources

Canadian Home Workshop, Volumes 1-22. Markham, Ontario: Camar Publications. ISSN 1485-8509

Ching, D.K. with Cassandra Adams. *Building Construction Illustrated*. International Thomson Publishing, 1991. ISBN 0-442-00895-3

Creative Homeowner Press. *Gazebos and Other Outdoor Structures*. Saddleriver, N.J.: Creative Home Owner Press, 1995. ISBN 1-880029-04-9

Fundamentals of Technical Drawing. Gage Education Publishing. ISBN 0-7715-0327x

Fine Homebuilding. *Numbers 1-126*. Newtown, Connecticut: The Taunton Press. ISSN 1096-360-X http://www.finehomebuilding.com (1-800-477-8727)

Growing Collaboratively. Prentice-Hall Inc., 1993

Taunton Press. *Porches, Decks and Outbuildings*. Newtown, Conn.: The Taunton Press, 1997. ISBN 1-56158-181-4

The Holy Bible. New International Version of similar.

The Home Depot. *Outdoor Projects 1-2-3*. Des Moines, Iowa: Meredith Books, 1998.

Time-Life. *The Complete Book of Outdoor Projects*. Alexanderia, VA. : Time-Life Inc., 1997. ISBN 0-7835-5290-4

Video Resources

www.pbs.org/hometime
Public and School libraries

www.ontariocontractors.com

http://main.wgbh/tv/nyw/nywindex.html

Algonquin College Video Library

V8222: Walls of Stone- masonry and brick work techniques

V8182: Framing Options- history of sash windows (principle type from 1700 to 1950), upgrading and repair

Local Municipal Offices

It is important to include in your course delivery the local rules regarding the procurement of licenses, surveys, inspections and other functions provided by the municipal government.

Activity 2: Building Materials and Methods

Time: 7 hours

Description

The students are exposed to a variety of building materials and construction concepts required to construct the project. Emphasis is placed on the safe and correct use of tools, equipment, and procedures, and the proper selection (students become aware that their choices should reflect a Christian concern for the environment and the people in it) of materials needed to complete the various major tasks. Students are divided into groups according to the specific projects required to construct the overall challenge. Specific projects could include: floor, wall, or roof construction, exterior finish, electrical systems, detailed working drawings (site plans, floor plans, assembly drawings, elevations, and details), and project marketing. Working in groups, students select the appropriate materials and procedures, and review and modify their existing drawings. Each group presents their drawings and material lists to date for approval at the conclusion of this activity.

Strand(s) & Learning Expectations

Strand(s): Theory and Foundation, Impact and Consequences

Overall Expectations

TFV.01 - apply the design process to develop solutions, products, processes, or services in response to challenges or problems in construction technology;
TFV.02 - describe the properties and application of building materials, and of construction techniques and processes;
TFV.03 - describe the different technologies, materials, tools, and equipment applicable to construction technology;
ICV.02 - apply appropriate health and safety legislation; general shop and site safety rules; and rules specific to the use of materials, tools, and equipment.

Specific Expectations

TF1.02 - apply the following steps of the design process to solve a variety of construction technology challenges or problems:

- identify what has to be accomplished (the problem);
- gather and record information, and establish a plan of procedures;
- brainstorm a list of as many solutions as possible;
- identify the resources required for each suggested solution, and compare each solution to the design criteria, refining and modifying it as required;
- evaluate the solutions (e.g., by testing, modeling, and documenting results) and choose the best one;
- produce presentation and working drawings, sketches, graphics, mathematical and physical models, or a prototype of the best solution;
- evaluate the prototype and determine the resources, including computer applications, required to produce it;
- communicate the solution, using one or more of the following: final drawings, graphs, charts, sketches, technical reports, electronic presentations, flow charts, mock-ups, models and prototypes,
- obtain feedback on the final solution and repeat the design process if necessary to refine or improve the solution.

TF2.02 - describe the properties (physical, structural, and thermal) of both natural and manufactured building materials, and describe the processes used to produce or modify them;
TF3.03 - identify the structural elements (including materials, spans, loads, forces, and methods of assembly) of a construction project;

SP2.06 - demonstrate an ability to design and, where appropriate, build a stairway for a construction project;
IC2.02 - demonstrate safe shop and construction site practices for the use of hand and power tools, materials, and equipment;
IC2.03 - describe the basic health and safety needs of workers on construction sites;
IC2.04 - identify, and apply where appropriate, safety codes, regulations, and standards applicable to construction projects and the workplace.

Ontario Catholic School Graduate Expectations
CGE 7i - respects the environment and uses resources wisely.

Prior Knowledge & Skills

- Mathematical skills (volume, area, addition, subtraction, multiplication, division)
- The safe and correct use of tools and equipment relevant to the construction of the project
- Knowledge and understanding of a variety of materials and methods used in the construction of floors, walls, roofs, and interior and exterior finish
- Decision-making skills
- The use of design and problem solving models
- Cooperative learning skills
- Measuring, sketching and drawing skills

Planning Notes

- Prepare a safety test.
- Prepare all materials for the safety demonstrations.
- Photocopy the Safety Assessment Rubric (Appendix 2. 2B) - one for each student.
- Prepare the Safety Passport for each student (Appendix 2.2A) - one for each student.
- Prepare all tools and equipment required for the safety demonstration ensuring that the equipment is in good working order and the safety guards are in place.
- Prepare a worksheet listing the available materials and resources and their characteristics.
- Prepare a discussion lesson for further discussion on materials and their uses, environmental and ethical issues.

Teaching/Learning Strategies

The teacher will:

- conduct a review of safety codes;
- list the various major components of the overall project through a class discussion. The components could include; floor, wall, or roof construction, exterior finish, electrical systems, detailed working drawings (site plans, floor plans, assembly drawings, elevations, and details), and project marketing/partnerships;
- assign the various tasks to be completed or allow each group to choose, on their own, the specific task(s) of interest, in order to meet the challenge;
- discuss the various building materials and resources available for the project;
- review all of the safety rules for the classroom and those applicable to the overall project;
- describe and demonstrate the proper selection and safe use of all the tools and equipment available in the classroom; and necessary to complete the various projects.
- provide opportunities for students to demonstrate the safe use of some of the major tools and equipment that will be used. Scrap materials can be used as available. New materials can be cut and machined according to some of the project specifications;
- administer a safety test and discuss the expected responses as a review of safe practice;

- share the Safety Assessment Rubric (Appendix 2.2B) with students and allow students to assess themselves. Students use the rubric by reading each of the criteria and highlighting their individual level of achievement. Students will complete another self-assessment at the end of this unit using the same rubric;
- allow students class time to focus on their individual group task. Further design details, materials selection, and material lists specific to the group's major component(s) will be presented to the class by each group at the conclusion of this activity.

Students will:

- participate in a class discussion regarding the various components of the shed/playhouse;
- select specific task(s) of interest for their group. The teacher ensures that all of the tasks have been distributed evenly;
- participate in class discussion of safety worksheets and rules covering the available building materials and resources;
- participate in the safety demonstrations;
- write a safety test outlining rules and procedures for the classroom, tools, equipment, and materials;
- assess themselves using the Safety Assessment Rubric (Appendix 2.2B)
- design and refine the details and materials selection for their task(s) using the teacher-generated handout;
- present their design and material lists to date.

Assessment & Evaluation of Student Achievement

- Formative assessment of students' contribution to group and class discussions, ability to describe materials, products, (the quality, characteristics and their uses) and methods used in construction using observation, teacher conferencing with groups and anecdotal comments.
- Diagnostic assessment surrounding safety issues and the correct identification of equipment and tools needed to complete tasks using class discussion and question and answer periods.
- Formative assessment of students' participation in safety demonstrations – observation and performance.
- Self evaluation using the Safety Assessment Rubric (Appendix 2.2B)
- Summative evaluation of completed project design sheets – using a checklist for completeness and accuracy.

Accommodations

- Allow written scripts or handouts.
- Ensure that all students share in the presentation: lead speaker and question and answer later.
- Allow students to demonstrate competency when using various tools, equipment, and procedures.
- Pair students with peer mentors (encourage an atmosphere of accepting everyone's uniqueness).
- Provide a teacher assistant if required (check OSRs and IPRC for any information on this matter).
- Provide opportunities for an oral safety test as necessary.

Resources

Local Municipal offices and Building Associations

The Canadian Electrical Code. Rexdale, Ontario: Canadian Standards Association, current.

Ching, D.K. with Cassandra Adams. *Building Construction Illustrated*. International Thomson Publishing, 1991. ISBN 0-442-00895-3

Clider, Robert K. and Kenneth H. Sharpe. *Applications of Electrical Construction*. Don Mills, Ontario: General Publishing, 1979.

Feirer, John L. and Gilbert R. Hutchings. *Carpentry and Building Construction*. Glencoe/McGraw-Hill, 1997. ISBN 0-02-838699-X

Hardie, Glenn M. *Building Construction Principles, Practices and Materials*. University of British Columbia: Prentice-Hall, Inc., 1995. ISBN 0-13-350570-7

Holy Bible. New International Version of similar.

Kirchner, Harold B. *Wiring Installation and Maintenance*. Toronto: McGraw-Hill Ryerson, 1978.

Ontario Hydro Electrical Safety Code. Toronto, Ontario, current.

Plywood Handbook. Revised. Vancouver, British Columbia: Council of Forest Industries of British Columbia, 1980.

Smith, Ronald C. and Ted L. Honkala. *Carpentry and Light Construction*. Southern Alberta Institute of Technology, 1994. ISBN 0-13-096579-0

Video Resources

www.pbs.org/hometime
Public and School libraries

www.ontariocontractors.com

http://main.wgbh/tv/nyw/nywindex.html

Algonquin College Video Library

V8222: Walls of Stone- masonry and brick work techniques
V8182: Framing Options- history of sash windows (principle type from 1700 to 1950), upgrading and repair

Activity 3: Costing and Estimating the Project

Time: 5 hours

Description

After the teacher reviews the materials costing and estimation assignment, the student groups calculate the materials needed, and research and gather information on material costs. Students develop a bill of materials for each major task with emphasis placed on the concern for the environment and their Catholic responsibility as stewards of the environment. Each group will present their final proposal including all sketches, drawings, and bill of materials for final project approval. Project time lines will be set and adjusted as necessary.

Strand(s) & Learning Expectations

Strand(s): Skills and Processes

Overall Expectations

SPV.01 - apply the design process to a variety of construction projects;
SPV.05 - apply mathematical and estimation skills in a variety of construction projects.

Specific Expectations

SP1.01 - design, plan, and implement solutions for a variety of construction projects;
SP1.06 - use appropriate equipment and techniques to describe, illustrate, and market various construction technology projects;
SP2.03 - identify suitable materials for a variety of components of a construction project;
SP2.05 - prepare accurate working drawings for a variety of projects;
SP3.02 - determine the size of structural members required for a construction project using charts, tables, technical data, and building codes, regulations, and standards;

SP4.01 - describe the units of measurement applicable to a variety of building products and how these units are used in estimating quantities for a construction project;
SP4.02 - calculate the quantities of materials and costs of labour for a project, using the area and volume estimating method, and technical data charts and tables.

Ontario Catholic School Graduate Expectations
CGE 2c - presents information and ideas clearly and honestly and with sensitivity to others;
CGE 3c - thinks reflectively and creatively to evaluate situations and solve problems;
CGE 7i - respects the environment and uses resources wisely.

Prior Knowledge & Skills

- Mathematical skills (volume, area, addition, subtraction, multiplication, division)
- Measuring, sketching and drawing skills
- Decision-making skills
- Research skills
- Costing and estimating construction materials
- Cooperative learning skills
- Time management skills
- The use of design and problem-solving models

Planning Notes

- Prepare a lesson on project costing using a bill of materials.
- Provide resources for student research of material costs. Provide time during class and/or as homework.
- Prepare a discussion lesson on environmental issues and the responsibility of the Catholic believer. The student should understand the responsibility to use technology ethically.
- Photocopy the Cooperative Learning Rubric (Appendix 2.1A).
- Provide necessary resources for presentations.
- Prepare a presentation content and procedure checklist.

Teaching/Learning Strategies

The teacher will:

- present a lesson on project costing and estimating for construction materials;
- discuss the environmental issues surrounding the selection and use of various construction materials. Discussion should also include the responsibility of the Catholic believer in relation to the use of natural resources, respect for the environment, and our role as stewards of God's creation;
- distribute the costing and estimating bill of materials handouts;
- provide resources for the various material costs. Resources could include building supply flyers or current price lists;
- allow students time to search for material prices and complete the bill of materials for their groups' specific task;
- observe and give direction as needed;
- discuss the project time lines and refine as necessary;
- share the Cooperative Learning Rubric (Appendix 2.1A) with students and allow the students to evaluate themselves. Students use the rubric the same way they used the Safety Rubric (Appendix 2.2B) in the previous activity. Students will be given another opportunity to evaluate themselves in the final activity using the same rubric;

- arrange class time for group presentations of final proposals. These will include; all sketches to date, first designs of the overall structure, project design modules, web diagrams, time lines, lists of materials, bill of materials, and final drawings for the specific components of the project. Final proposals should be presented to the whole class, the teacher, and the customer, where appropriate.

Students will:

- participate in the class discussion and lesson regarding costing and estimating, materials and the environment, and the role of the Christian believer;
- research and determine pricing for materials to complete the costing and estimating and bill of materials worksheets for their specific task(s);
- complete the Cooperative Learning Rubric (Appendix 2.1A)
- present their Final Proposals including: all sketches to date, first designs of the overall structure, project design modules, web diagrams, time lines, lists of materials, bill of materials, and final drawings for the specific components of the project;

Assessment & Evaluation of Student Achievement

- Formative assessment of student's contribution to group and class discussions using observation and anecdotal comments.
- Formative assessment of project design modules checking for completeness and accuracy.
- Summative evaluation of completed drawings and bill of materials, checking for completeness, neatness, accuracy, and detail.
- Summative assessment of presentation of final proposal using a presentation checklist.
- Self-assessment of individual performance as a member of a team using the Cooperative Learning Rubric (Appendix 3.1A).

Accommodations

- Provide samples and exemplars for students to see the variations of bill of materials, timelines, and cutting/assembly lists.
- Students give verbal responses or solutions to challenges and extra time is given to complete tasks.
- Group students to ensure a proper balance of different types of learners, adult students as mentors, etc.
- Provide print samples or video tape presentations
- Partially completed forms for students to practice on.

Resources

Ching, D.K. with Cassandra Adams. *Building Construction Illustrated*. International Thomson Publishing, 1991. ISBN 0-442-00895-3

Feirer, John L. and Gilbert R. Hutchings. *Carpentry and Building Construction*. Glencoe/McGraw-Hill, 1997. ISBN 0-02-838699-X

Hardie, Glenn M. *Building Construction Principles, Practices and Materials*. University of British Columbia: Prentice-Hall, Inc., 1995. ISBN 0-13-350570-7

Mackenzie, D. *Design for the Environment*. New York: Rizzoli International Publisher, 1991. ISBN 0-8478-1390-8

McHarg, I. *Design with Nature*. New York: Natural History Press, 1969.

Ministry of Natural Resources

Native Trees of Canada. ISBN 0-88-902572-X

The Holy Bible. New International Version of similar.

Local Building Associations
Local Municipal Offices
Provincial Office of the Environment

Video Resources
www.pbs.org/hometime
Public and School libraries
www.ontariocontractors.com
http://main.wgbh/tv/nyw/nywindex.html
www.recycle.net

Algonquin College Video Library
V8222: Walls of Stone- masonry and brick work techniques
V8182: Framing Options- history of sash windows (principle type from 1700 to 1950), upgrading and repair

Activity 4: Let's Build It

Time: 18 hours

Description

The students, following their project designs and bill of material plans (Final Proposals), select the appropriate materials and use the proper methods for construction of their specific projects. Specific projects could include; floor, wall, or roof construction, exterior finish, electrical systems, detailed working drawings (site plans, floor plans, assembly drawings, elevations, and details), and project marketing as assigned in Activity 2. The various components of the project are constructed and assembled in the classroom, and/or attached later at the construction site i.e., Activity 5 (depending on classroom size limitations.) The overall structure should be constructed in a modular fashion in order to accommodate transportation to the final site. In addition to skill building and safety, this activity should emphasize team work, collaboration, and further develop the student's awareness of the meaning, dignity, and fulfillment of work that contributes to the common good.

Strand(s) & Learning Expectations

Strand(s): Skills and Processes, Impact and Consequences

Overall Expectations
SPV.01 - apply the design process to a variety of construction projects;
SPV.04 - demonstrate appropriate technical skills involving the use of construction tools, materials, and equipment;
ICV.02 - apply appropriate health and safety legislation; general shop and site safety rules; and rules specific to the use of materials, tools, and equipment.

Specific Expectations
SP2.01 - use various tools and equipment to calculate the dimensions of and to lay out appropriate structural members for footings, walls, roofs, openings, and other parts of a construction project;
SP2.02 - demonstrate the measurement and layout skills required to build, assemble, erect, and install a variety of components related to construction technology;
SP2.03 - identify suitable materials for a variety of components of a construction project;
SP2.04 - use a variety of appropriate tools, equipment, and materials to complete a construction project;
SP2.06 - demonstrate an ability to design and, where appropriate, build a stairway for a construction project;

SP2.08 - complete a construction project using a variety of methods and procedures for laying out, assembling, and joining;
SP3.02 - determine the size of structural members required for a construction project using charts, tables, technical data, and building codes, regulations, and standards;
IC2.02 - demonstrate safe shop and construction site practices for the use of hand and power tools, materials, and equipment.

Ontario Catholic School Graduate Expectations
CGE 4c - takes initiative and demonstrates Christian leadership;
CGE 4f - applies effective communication, decision-making, problem-solving, time and resource management skills;
CGE 5a - works effectively as an interdependent team member;
CGE 5c - develops one's God-given potential and makes a meaningful contribution to society;
CGE 5d - finds meaning, dignity, fulfillment and vocation in work which contributes to the common good;
CGE 5f - exercises Christian leadership in the achievement of individual and group goals;
CGE 7j – contributes to the common good.

Prior Knowledge & Skills

- Ability to select the correct tools, equipment, and materials for the various tasks and projects
- Ability to use the tools and equipment safely.
- Knowledge of the handling procedures for construction materials.
- Knowledge of construction concepts required to construct floors, walls, roofs, add exterior finish and electrical components, and construct stairs.

Planning Notes

- Ensure that all materials for each of the project tasks has been ordered.
- Review IEP and OSRs for students who may require additional support.
- Provide necessary resources and modules outlining assembly procedures for walls, roofs, floors, exterior finish, and electrical components.
- Ensure that all tools, equipment, and machines are in proper working order and all safety guards are in place.
- Ensure all facilities are in place for students with special needs.
- Ensure all students who require enrichment or additional support are accommodated.

Teaching/Learning Strategies

The teacher will:

- review the timelines and projects for the overall challenge;
- instruct students to review their final proposals. Instructions should be given on preparing a cutting and assembly list listing the step-by-step procedures for project completion. The teacher will review each group's list and give the go ahead to start construction;
- observe and instruct as necessary;
- instruct students on the proper installation of the various components of the project, group and one-on-one instruction as required;
- examine the finished components and the overall project for completeness and accuracy and give feed back to each group.
- encourage students to become aware of their talents and abilities and how they can be used for the greater good.

Students will:

- review the project timelines and final proposals;
- prepare a cutting and assembly list for each of their projects;
- begin constructing group projects based on the final proposals and the cutting/assembly list;
- install the various components of the shed/playhouse where appropriate. Students who finish early can assist other groups.

Assessment & Evaluation of Student Achievement

- Formative assessment of safe working skills – observation, Safety Rubric (Appendix 2.2B)
- Summative evaluation of group project design, construction, and final project

Accommodations

- Provide samples and exemplars for students to see the variations of bill of materials, timelines, and cutting/assembly lists.
- Students give oral responses or solutions to challenges and extra time is given to complete tasks.
- Allow written scripts or handouts for students who may require them for the presentation.
- Ensure that all students share in the presentation spreading out the responsibilities: lead speaker and question and answer later.

Resources

Canadian Electrical Code. Rexdale, Ontario: Canadian Standards Association, current.

Ching, D.K. with Cassandra Adams. *Building Construction Illustrated*. International Thomson Publishing, 1991. ISBN 0-442-00895-3

Clider, Robert K. and Kenneth H. Sharpe. *Applications of Electrical Construction*. Don Mills, Ontario: General Publishing, 1979.

Feirer, John L. and Gilbert R. Hutchings. *Carpentry and Building Construction*. Glencoe/McGraw-Hill, 1997. ISBN 0-02-838699-X

Hardie, Glenn M. *Building Construction Principles, Practices and Materials*. University of British Columbia: Prentice-Hall, Inc., 1995. ISBN 0-13-350570-7

Kirchner, Harold B. *Wiring Installation and Maintenance*. Toronto: McGraw-Hill Ryerson, 1978.

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Smith, Ronald C. and Ted L. Honkala. *Carpentry and Light Construction*. Southern Alberta Institute of Technology, 1994. ISBN 0-13-096579-0

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Video Resources

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Algonquin College Video Library

V8222: Walls of Stone- masonry and brick work techniques

V8182: Framing Options- history of sash windows (principle type from 1700 to 1950), upgrading and repair

Activity 5: On Site

Time: 5 hours

Description

Students install the various components of the final project on site. Afterward, the students participate in a review and discussion of the overall challenge. Following the discussion, each student will write a reflection paper focusing on a variety of topics including; materials, processes, collaboration, teamwork, technical skills, and how the project ministers to the wider community. The installation, class discussion and reflection paper will provide the basis for a summative evaluation of this unit. Students complete a self and peer assessment at the conclusion of this activity.

Strand(s) & Learning Expectations

Strand(s): Theory and Foundations, Skills and Processes, Impacts and Consequences

Overall Expectations

SPV.01 - apply the design process to a variety of construction projects;
SPV.04 - demonstrate appropriate technical skills involving the use of construction tools, materials, and equipment;
ICV.02 - apply appropriate health and safety legislation; general shop and site safety rules; and rules specific to the use of materials, tools, and equipment.

Specific Expectations

SP2.02 - demonstrate the measurement and layout skills required to build, assemble, erect, and install a variety of components related to construction technology;
SP2.03 - identify suitable materials for a variety of components of a construction project;
SP2.04 - use a variety of appropriate tools, equipment, and materials to complete a construction project;
SP2.08 - complete a construction project using a variety of methods and procedures for laying out, assembling, and joining;
IC2.02 - demonstrate safe shop and construction site practices for the use of hand and power tools, materials, and equipment.

Ontario Catholic School Graduate Expectations

CGE 5a - works effectively as an interdependent team member;
CGE 5b - thinks critically about the meaning and purpose of work;
CGE 5c - develops one's God-given potential and makes a meaningful contribution to society;
CGE 5d - finds meaning, dignity, fulfillment and vocation in work which contributes to the common good;
CGE 6e- ministers to the family, school, parish, and wider community through service;
CGE 7j - contributes to the common good.

Prior Knowledge & Skills

- Ability to select the correct tools, equipment, and materials for the various tasks and projects;
- Ability to use the tools and equipment safely;
- Knowledge of the handling procedures for construction materials;
- Knowledge of construction practices relating to the installation and assembly of projects obtained through participation in previous activities and demonstration by instructor (basic foundations for small structures, levelling projects, etc.);
- School policy regarding proper conduct on and off school property (re: Project Installation).

Planning Notes

- Ensure that the site is prepared for installation;
- Plan a review of school policy regarding school field trips;
- Prepare all tools and equipment required for site installation;
- Arrange transportation for students and all of the various project components;
- Prepare a discussion reviewing the overall project. The discussion should include: materials used, processes and construction techniques, collaboration, teamwork, technical skills, and how the project ministers to the wider community;
- Photocopy the Cooperative Learning Rubric (Appendix 2.1A);
- Prepare the criteria and due date for the reflection paper.

Teaching/Learning Strategies

The teacher will:

- organize and supervise the final installation on site;
- review and lead a discussion regarding the overall project including; materials used, processes and construction techniques, collaboration, teamwork, technical skills, and how the project ministers to the wider community;
- distribute the Safety and Cooperative Learning Rubric for students to complete;
- distribute a handout detailing the criteria for a reflection paper. Students should reflect on the overall project focusing on several of the topics presented in the class discussion (materials used, processes and construction techniques, collaboration, teamwork, technical skills, and how the project ministers to the wider community). Students should also refer to the two Safety and Cooperative Learning Rubric assessments. The paper can be completed as homework.

Students will:

- install the completed shed/playhouse on site;
- participate in a discussion regarding the overall project. The discussion should include; materials used, processes and construction techniques, collaboration, teamwork, technical skills, and how the project ministers to the wider community;
- complete the Safety Assessment and Cooperative Learning Rubric and compare them to their earlier assessment in Activity 2 and 3;
- complete a reflection paper. The students should reflect on the overall project addressing the topics discussed in class and refer to the Safety Assessment and cooperative Learning Rubric self-assessments. The reflection paper can be completed as homework.

Assessment & Evaluation of Student Achievement

- Performance assessment of group presentation;
- Formative assessment of peer and self evaluation;
- Summative assessment of final project installation and reflection paper.

Accommodations

- Ensure group structure allows all students to work in a safe and productive atmosphere (peer mentoring, adult students, skilled tradesmen as mentors etc)
- Students give oral responses to self and peer evaluations while working with a peer or educational assistant;
- Students are given additional time to complete assigned tasks and evaluations-acceptable answers may include provisions for the use of physical products, pictures, or symbols in lieu of text, where appropriate;

Resources

Canadian Electrical Code. Rexdale, Ontario: Canadian Standards Association, current.

Clider, Robert K. and Kenneth H. Sharpe. *Applications of Electrical Construction*. Don Mills, Ontario: General Publishing, 1979.

Feirer, John L. and Gilbert R. Hutchings. *Carpentry and Building Construction*. Glencoe/McGraw-Hill, 1997. ISBN 0-02-838699-X

Growing Collaboratively. Prentice-Hall Inc., 1993.

Hardie, Glenn M. *Building Construction Principles, Practices and Materials*. University of British Columbia: Prentice-Hall, Inc., 1995. ISBN 0-13-350570-7

Mackenzie, D. *Design for the Environment*. New York: Rizzoli International Publisher, 1991. ISBN 0-8478-1390-8

McHarg, I. *Design with Nature*. New York: Natural History Press, 1969.

Ontario Hydro Electrical Safety Code. Toronto, Ontario, current.

The Holy Bible. New International Version of similar.

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Public and School libraries

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Algonquin College Video Library

V8222: Walls of Stone- masonry and brick work techniques

V8182: Framing Options- history of sash windows (principle type from 1700 to 1950), upgrading and repair

Appendix 2.1A

Cooperative Learning

(This assesses Learning Skills. It will not contribute to the student's final mark.)

Criteria	Level 1	Level 2	Level 3	Level 4
The student contributes to the development of the group's plan.	- rarely contributes to the development of the group's plan	- contributes to the development of the group's plan some of the time	- contributes to the development of the group's plan most of the time	- always or almost always contributes to the development of the group's plan
The student is prepared to discuss issues and make project changes as necessary.	- rarely prepared to discuss issues and make changes to the project	- prepared to discuss issues and make changes to the project some of the time	- prepared to discuss issues and make changes to the project most of the time	- always or almost always prepared to discuss issues and make changes to the project as necessary
The student shows respect for the ideas and opinions of others in the group or class.	- rarely shows respect for the ideas and opinions of others in the group or class	- shows respect for the ideas and opinions of others in the group or class some of the time	- shows respect for the ideas and opinions of others in the group or class most of the time	- always or almost always shows respect for the ideas and opinions of others in the group and class
The student encourages group members to participate and/or stay on task.	- rarely encourages group members to participate and/or stay on task	- encourages group members to participate and/or stay on task some of the time	- encourages group members to participate and/or stay on task most of the time	- always or almost always encourages group members to participate and stay on task
The student shares the workload and helps others.	- limited evidence of sharing the workload and helping others	- some evidence of sharing the workload and helping others	- constantly shares the workload and helps others	- seeks opportunities to share the workload and help others
The student is aware of the group's plans and follows them.	- seldom aware of the group's plans and rarely follows them	- is aware of the group's plans and follows them some of the time	- is aware of the group's plans and follows them most of the time	- always or almost always aware of the group's plans and routinely follows them

Appendix 2.1B

Design Report Rubric

Criteria	Level 1 (50 - 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Communication The student uses various forms of communication to relate thoughts and ideas.	- communicates information with limited clarity	- communicates information with moderate clarity	- communicates information with considerable clarity	- communicates information with a high degree of clarity, and with confidence
Thinking/Inquiry The student demonstrates the ability to research and organize ideas and plans.	- applies few of the skills involved in an inquiry/design process	- applies some of the skills involved in an inquiry/design process	- applies most of the skills involved in an inquiry/design process	- applies all or almost all of the skills involved in an inquiry/design process
Knowledge/ Understanding The student demonstrates a working knowledge of plans and concepts.	- demonstrates limited understanding of design concepts	- demonstrates some understanding of design concepts	- demonstrates considerable understanding of design concepts	- demonstrates thorough and insightful understanding of design concepts
Thinking/Inquiry The student demonstrates the ability to apply concepts and ideas in a safe and correct manner.	- uses procedures, equipment, and technology safely and correctly only with supervision	- uses procedures, equipment, and technology safely and correctly with some supervision	- uses procedures, equipment, and technology safely and correctly	- demonstrates and promotes the safe and correct use of procedures, equipment, and technology

Note: A student whose achievement is below level 1 (50%) has not met the expectations for this assignment or activity.

Appendix 2.1C

Construction Rubric

Criteria	Level 1 (50 - 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Communication The student uses technological terms correctly in written and oral presentations.	- demonstrates limited knowledge of facts, technical terminology, procedures, and standards	- demonstrates some knowledge of facts, technical terminology, procedures, and standards	- demonstrates considerable knowledge of facts, technical terminology, procedures, and standards	- demonstrates thorough knowledge of facts, technical terminology, procedures, and standards
Application The student uses technological concepts correctly, fabrication, and evaluation.	- demonstrates limited understanding of concepts, fabrication and evaluation	- demonstrates some understanding of concepts, fabrication and evaluation	- demonstrates considerable understanding of concepts fabrication and evaluation	- demonstrates thorough and insightful understanding of concepts fabrication and evaluation
Application The student can interpret and produce technical drawings using graphic conventions, techniques, instruments, and computer technologies.	- demonstrates limited ability to interpret, produce, and understand technical drawings and conventions	- demonstrates some ability to interpret, produce, and understand technical drawings and conventions	- demonstrates considerable ability to interpret, produce, and understand technical drawings and conventions	- demonstrates thorough and insightful ability to interpret, produce, and understand technical drawings and conventions
Communication The student can communicate ideas and solutions to technological problems through a variety of media.	- limited ability to communicate ideas and solutions through a variety of media	- able to communicate some ideas and solutions through a variety of media	- able to communicate considerable ideas and solutions through a variety of media	- able to communicate ideas and solutions through a variety of media with clarity and appropriate detail
Application The student can apply problem solving skills to projects.	- applies few of the skills involved in an inquiry/design process	- applies some of the skills involved in an inquiry/design process	- applies most of the skills involved in an inquiry/design process	- applies all or almost all of the skills involved in an inquiry/design process

Application The student can demonstrate skill in the use of tools, materials and processes.	- uses equipment, and technology safely and correctly with supervision	- uses equipment, and technology safely and correctly with some supervision	- uses equipment, and technology safely and correctly	- demonstrates and promotes the safe and correct use of equipment and technology
Knowledge/ Understanding The student can recognize and describe the impacts of construction technology on society and the environment.	- recognizes and describes the impacts of construction technology with limited effectiveness	- recognizes and describes the impacts of construction technology with moderate effectiveness	- recognizes and describes the impacts of construction technology with considerable effectiveness	- recognizes and describes the impacts of construction technology with a high degree of effectiveness

Note: A student whose achievement is below level 1 (50%) has not met the expectations for this assignment or activity.

Appendix 2.2A

Safety Passport

Student Name	Safety Video on Tool	Tool Demonstration	Student Demo	Sign On
Table Saw	Nov. 12	Nov. 12	Nov.13	
Router table				
Miter Saw				
Jointer		Nov. 12		
Planner	Nov. 10	Nov.10	Nov.11	OK
Radial Arm				

Appendix 2.2B

Rubric for Assessing Safety

Criteria	Level 1 (50 - 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Knowledge/ Understanding Application The student selects the correct tools and equipment for the task.	- rarely selects the correct tools and equipment for the task	- selects the correct tools and equipment for the task some of the time	- selects the correct tools and equipment most of the time	- always or almost always selects the correct tools and equipment for the task
Knowledge/ Understanding Application The student demonstrates the correct use of the tools and equipment.	- demonstrates the correct use of the tools and equipment with limited competence	- demonstrates the correct use of the tools and equipment with moderate competence	- demonstrates the correct use of the tools and equipment with considerable competence	- demonstrates the correct use of the tools and equipment with a high degree of competency
Application The student conducts himself/herself in a safe manner in all class activities.	- rarely conducts himself/herself in a safe manner during class activities	- conducts himself/herself in a safe manner during class activities some of the time	- conducts himself/herself in a safe manner during class activities most of the time	- always or almost always conducts himself/herself in a safe manner in class activities
Application The student maintains a safe work environment and encourages others to work safely.	- limited evidence of maintaining a safe work environment; rarely encourages others to work safely	- some evidence of maintaining a safe work environment; occasionally encourages others to work safely	- consistently maintains a safe work environment and encourages others to work safely	- seeks opportunities to create a safe work environment and encourage others to work safely

Note: A student whose achievement is below level 1 (50%) has not met the expectations for this assignment or activity.

Unit 3: Building Support Systems

Time: 30 hours

Unit Description

Students focus on the work of the sub-trades, and their extensive role in the contemporary building industry. They explore the concepts of building support systems, including: plumbing, electrical and heating/ventilation. After the design process has been completed, the students have an opportunity to develop practical skills relating to the fabrication and installation of building support systems. During the process of building projects, the participants have an opportunity to investigate the many career opportunities that relate to these trades, as well as reflecting on issues relating to the environment and social impacts. The facilitator may choose to approach local trades persons in industry to assist with brief demonstrations, career discussions and donations of surplus materials. Although these activities are similar in appearance, the skill development by the student is very different in each activity.

Unit Synopsis Chart

Activity	Time	Expectations	Assessment	Tasks
3.1 Design and build a Solar Powered Hot Water Heater	10 hours	TFV.01, TF1.01, TF2.01, TF3.01, SPV.01, SP2.05, ICV.01	Knowledge Application	Design and build a system that uses the sun's energy to heat water.
3.2 Design and install an electric security system	10 hours	TFV.01, TF1.02, TF3.01, SPV.01, SP1.01, SP2.05, IC1.02	Application	Design and install an electric security system for a classroom in the school.
3.3 Design and build an Air Quality System	10 hours	TFV.01, TF1.01, TF1.02, TF3.01, SPV.01, SPV.02, SP1.01, SP2.05, ICV.01, IC1.02	Thinking/ Inquiry Application	Design and install an air quality system.

Activity 1: Building a Solar Powered Hot Water Heater

Time: 600 minutes

Description

Using the design process, the student groups design and build a device to use the sun's energy to heat a specified amount of water. Implementation of the completed design may include building a support frame and heat exchange box, cutting and connecting a variety of pipe material for water transfer, and utilizing an electric pump to move the water through the pipes. A simple thermometer could be used to measure the effectiveness of each completed unit. Students may use this module as a way of demonstrating that they can have a positive effect on the environment through the careful and strategic use of resources and alternate energy sources.

Strand(s) & Learning Expectations

Strand(s): Theory and Foundations, Skills and Processes, Impact and Consequences

Overall Expectations

TFV.01 - apply the design process to develop solutions, products and processes, or services in response to the challenges or problems in construction technology;
SPV.01 - apply the design process to a variety of construction projects;
ICV.01 - explain the effects of technological change in the construction industry on society and on the environment.

Specific Expectations

TF1.01 - explain how a human need or want can be met through a new or improved product;
TF1.02 - apply the following steps of the design process to solve a variety of construction technology challenges or problems:

- identify what has to be accomplished (the problem);
- gather and record information, and establish a plan of procedures;
- brainstorm a list of as many solutions as possible;
- identify the resources required for each suggested solution, and compare each solution to the design criteria, refining and modifying it as required;
- evaluate the solutions, e.g., by testing, modelling, and documenting results, and choose the best one;
- produce presentation and working drawings, sketches, graphics, mathematical and physical models, or a prototype of the best solution;
- evaluate the prototype and determine the resources, including computer applications, required to produce it;
- communicate the solution, using one or more of the following: final drawings, graphs, charts, sketches, technical reports, electronic presentations, flow charts, mock-ups, models, prototypes, and so on;
- obtain feedback on the following solution and repeat the design process if necessary to refine or improve the solution;

TF3.01 - describe the various systems applicable to the construction industry, including electrical, plumbing, heating, ventilation and air conditioning systems;
SP2.05 - prepare accurate working drawings for a variety of projects.

Prior Knowledge & Skills

- An understanding of the design process;
- An ability to use both metric and imperial measurement;
- Drawing and sketching skills;
- An ability to safely use woodworking tools and processes, (in order to construct a heat exchange box and support frame);
- Interactive and collaborative learning skills;
- Communication skills (written and oral);
- A general awareness of safety, as it relates to shop practice.

Planning Notes

- Plumbing material is reasonably inexpensive, but if need be, small pieces may be recycled from plumbers (corporate sponsors) or scrap metal yards for little or no cost.
- Students who design a non-passive system, will require a water pump. A small drill-powered mini-pump works well.

- Introduce safety policies relating to the specific activity (Plumber's torch, handling adhesives, mixing water and electricity, etc.).
- Provide samples of various plumbing materials (pipe, various connectors, etc.).
- Emphasizing safety, demonstrate how material is cut and refastened. Allow students to practise in groups.
- Invite local plumbers in to provide demonstrations, and to oversee the project implementation. This person could also provide students with information regarding career opportunities.
- Invite a science teacher to discuss convection, pressure, capillary action, etc.

Teaching/Learning Strategies

This activity is a practical application. Students must be comfortable with the design process. (see Overview, Appendix A – Design Report Process)

- The teacher distributes a diagnostic questionnaire to determine skills and knowledge of students in fitting, soldering, layout, sketching, drafting and CAD applications.
- Students complete diagnostic skill performances in fitting, soldering, layout, sketching, drafting and CAD skills. From these diagnostic performance tests the teacher determines what skills need to be emphasized in further lessons.
- Teacher conducts lesson on safety for all equipment to be used. Safety Passports are completed (see Overview, Appendix B – Sample Safety Passport)
- The teacher/facilitator outlines the challenge, To Heat Water with Solar Power, (Appendix 1 – Solar Water Heating System). At this time the design report criteria is outlined, (Appendix 1 – Solar Water Heating System). How the design report relates to various trades is the basis for a class discussion?
- Students are instructed to keep a log or journal of their work during this challenge.
- Students are encouraged to use correct terminology relating to the trades. (Appendix 6 – Glossary of Terms: Building Support Systems)
- Students participate in a discussion based on the rising cost of fuel, and why society needs to investigate alternate sources of energy.
- Students also begin to identify plumbing parts and tools available for possible use.
- Students, working in groups, apply the design report process to the challenge. Students decide on materials and methods to be used. (Facilitator may determine groups based on diagnostic testing.).
- Students sketch a design, with emphasis on orthographic projections and upon approval build a model of their design. If modification to the design is necessary, these are made before the model is built.
- The teacher demonstrates cutting fitting and assembly of plumbing parts and safe and correct use of tools. Emphasis is placed on layout of angles (especially on tubing).
- Teacher consults with various groups assisting in problem solving and terminology use during the building of the prototypes.
- Class discussion explaining the assessment of the prototype as a part of the design process. Students are asked to brainstorm possible methods of ensuring that the prototype meets the design criteria.
- Student groups present prototype to class presenting rationale for design.
- Groups submit their completed design report to teacher for assessment.

Assessment & Evaluation of Student Achievement

- Students will be made aware of all assessment strategies, during the introduction of the activity.
- A complete list of assessment criteria should be presented the class at the beginning of the design challenge. (Appendix 2 – Sample Design Report Rubric)
- The criteria for the challenge may also be used as a checklist by students and teachers to ensure all aspects of the challenge have been covered.

- Students complete a log of activity while working through the design challenge.
- Students complete an assessment based on group work, using Learning Skills Checklist (see Grade 10 Construction Profile, Public).

Accommodations

- The teacher reviews students' IEP and adapts the activity and teaching/learning and assessment strategies to meet the students' needs.
- This project may be developed from very basic to very complex levels.
- Room and/or room layout changes may need to be made.
- Activities are modified to meet the needs of learners by applying various accommodations such as:
  - increasing time allowed for activities;
  - enhancing or compacting content;
  - assisting during evaluation processes;
  - providing peer tutoring assistance where possible;
- Groups can be chosen to balance different abilities;
- Teachers ensure that all equipment is easily accessible.

Resources

Books

Trimly, P. *Solar Water Heating; A DIY Guide*

Horne, B. *Tapping the Sun; A Solar Water Heating Guide*

Home Depot Home. *Improvement 1-2-3*. Des Moines, Iowa: Meredith Books. ISBN 0-696-20168-2

Ortho's Home Improvement Encyclopaedia. ISBN 0-8721-451-X

Ortho's All About Plumbing Basics. ISBN 0-89721-439-0

Better Homes and Gardens Step by Step Plumbing. ISBN 0-696-20634-X

Websites

Check any search engine for dozens of sites

www.vascosolar.com
Solar Heating Systems

www.solar-tec.com
Solar Energy Engineering

www.epsea.org
El Paso Energy Association

Videos

Plumbing Video. Hometime Video, www.hometime.com

Electrical Video. Hometime Video, www.hometime.com

AutoCad 2000 and Its Applications. VMS Supply, www.vms-online.com

Activity 2: Installing a Security System

Time: 600 minutes

Description

Using the design process, students design and build an electrical device, which serves as an in-class security system or door buzzer (often, shops are too noisy to hear delivery persons, office calls, etc.). The completed design involves constructing a simple electrical circuit, which includes a switch, a load, and a testing meter or measuring device. Students have an opportunity to fabricate their projects using audible devices, lights, wood and electronic materials. Students develop skills relating to installing wire, conduit and fixtures.

Strand(s) & Learning Expectations

Strand(s): Theory and Foundations, Skills and Processes, Impact and Consequences.

Overall Expectations

TFV.01 - apply the design process to develop solutions, products and processes, or services in response to the challenges or problems in construction technology;
SPV.01 - apply the design process to a variety of construction projects.

Specific Expectations

TF1.02 - apply the following steps of the design process to solve a variety of construction technology challenges or problems:

- identify what has to be accomplished (the problem);
- gather and record information, and establish a plan of procedures;
- brainstorm a list of as many solutions as possible;
- identify the resources required for each suggested solution, and compare each solution to the design criteria, refining and modifying it as required;
- evaluate the solutions e.g., by testing, modelling, and documenting results) and choose the best one;
- produce presentation and working drawings, sketches, graphics, mathematical and physical models, or a prototype of the best solution;
- evaluate the prototype and determine the resources, including computer applications, required to produce it;
- communicate the solution, using one or more of the following: final drawings, graphs, charts, sketches, technical reports, electronic presentations, flow charts, mock-ups, models, prototypes, and so on;
- obtain feedback on the following solution and repeat the design process if necessary to refine or improve the solution;

TF3.01 - describe the various systems applicable to the construction industry, including electrical, plumbing, heating, ventilation and air conditioning systems;
SP1.01 - design plan and implement solutions for a variety of construction projects;
SP2.05 - prepare accurate working drawings for a variety of projects;
IC1.02 - explain the social and environmental impacts on the construction industry of urban planning, land use by-laws, and building codes, regulations and standards.

Planning Notes

- Divide students into groups of three or four (ensuring the group structure allows all students an opportunity to succeed).
- Provide samples of electrical wire, switches and fixtures. These can be recycled from trades persons.
- Prepare handouts for students.
- Invite an science teacher into the classroom to describe how electrical current works.
- Conduct a diagnostic test to determine that students have a sound knowledge of AC and DC circuits. If needed, prepare a lesson on AC and DC circuits.

Prior Knowledge & Skills

- Use of the Design Report (Appendix A, Design Report Process).
- An understanding of the design process.
- Drawing and sketching skills.
- An ability to safely use woodworking tools and processes, in order to construct project boards, etc.
- A thorough understanding of safety as it relates to general shop practices.

Teacher/Learning Strategies

- This activity has a practical application. Students must be comfortable with the design process.
- The teacher distributes a diagnostic questionnaire to determine skills and knowledge of students in electrical applications, sketching, drafting and CAD applications.
- Students complete diagnostic skill performances in electrical applications, layout, sketching, drafting, and CAD skills. From these diagnostic performance tests the teacher determines what skills need to be emphasized in further lessons.
- Teacher conducts lesson on safety for all equipment to be used. Safety Passports are completed (Appendix B – Sample Safety Passport).
- The teacher/facilitator outlines the challenge, installing a Security System, (Appendix 4 – Installing a Security System). At this time the design report criteria is outlined (Appendix A – Design Report Process). How the design report relates to various trades is the basis for a class discussion.
- Students are instructed to keep a log or journal of their work during this challenge.
- Students are encouraged to use correct terminology relating to the trades. (Appendix 6 – Glossary of Terms: Building Support Systems)
- Students participate in a discussion based on the rising need for security or the need for some situations to have a light flash instead of a buzzer. Students also begin to identify electrical parts and tools available for possible use.
- Students, working in groups, apply the design report process to the challenge. Students decide on materials and methods to be used. (Facilitator may determine groups based on diagnostic testing).
- Students sketch a design, with emphasis on orthographic projections and upon approval build a model of their design. If modification to the design is necessary, these are made before the model is built.
- The teacher demonstrates connection and assembly of electrical devices and safe and correct use of tools and electricity.
- Teacher consults with various groups assisting in problem solving and terminology use during the building of the prototypes.
- Class discussion explaining the assessment of the prototype as a part of the design process. Students are asked to brainstorm possible methods of ensuring that the prototype meets the design criteria.
- Student groups present prototype to class presenting rationale for design.
- Groups submit their completed design report to teacher for assessment.

Assessment & Evaluation of Student Achievement

- Students are made aware of all assessment strategies, during the introduction of the activity.
- A complete list of assessment criteria should be presented the class at the beginning of the design challenge. (Appendix 2 – Design Report Rubric and Appendix 3 – Electrical Wiring Rubric)
- The criteria for the challenge may also be used as a checklist by students and teachers to ensure all aspects of the challenge have been covered.
- Students complete a log of activity while working through the design challenge.
- Students complete an assessment based on group work, using Learning Skills Checklist.

Accommodations

- The teacher reviews students' IEP and adapts the activity and T/L Strategies to meet the students' needs.
- This project may be developed from very basic to very complex levels.
- Room and/or room layout changes may need to be made.
- Activities are modified to meet the needs of all learners by applying various accommodations such as:
  - increasing time allowed for activities;
  - enhancing or compacting content;
  - assisting during evaluation processes;
  - providing peer tutoring assistance where possible.
- Groups can be chosen to balance different abilities.
- Teachers ensure that all equipment is easily accessible.

Resources

Books

Home Depot Home. *Improvement 1-2-3*. USA: ISBN 0-696-20168-2

Ortho's Home Improvement Encyclopaedia. USA: Ortho Books, ISBN 0-8721-451-X

Ortho's All About Wiring Basics. USA: Ortho Books, ISBN 0-89721-440-4

Better Homes and Gardens. *Step by Step Wiring*. ISBN 0-89721-440-4

Electronic Catalogues for Devices such as Motion Detectors, Magnetic Switches.

Websites

www.norcoalarms.com
Home Security Store

www.brinkshomesecurity.com
Brinks Home Security

www.securealert.com
Secure Alert

Videos

Electrical Video. Hometime Video, www.hometime.com

AutoCad 2000 and it's Applications. VMS Supply, www.vms-online.com

Activity 3: Building an Air Quality System For The Workshop

Time: 600 minutes

Description

Using the design process, the students design and build a device, designed to improve the quality of air in a workshop. Examples of this type of project may include; a dust collection system, a small spray booth or a simple system for removing harmful gases. In addition to using the design process, the students have an opportunity to explore electrical, plumbing and sheet metal applications. It should be noted that a simple student-made system should only augment a proper professional system. Facilitators and safety experts are encouraged to ensure a high standard of air quality within their own workshop environment.

Strand(s) & Learning Expectations

Strand(s): Theory and Foundations, Skills and Processes, Impact and Consequences

Overall Expectations

TFV.01 - apply the design process to develop solutions, products and processes, or services in response to the challenges or problems in construction technology;
SPV.01 - apply the design process to a variety of construction projects;
SPV.02 - demonstrate an ability to use resources such as technical data, reports, charts, tables, and building codes, regulations and standards;
ICV.01 - explain the effects of change in the construction industry on society and on the environment.

Specific Expectations

TF1.01 - explain how a human need or want can be met through a new or improved product;
TF1.02 - apply the following steps of the design process to solve a variety of construction technology challenges or problems:

- identify what has to be accomplished (the problem);
- gather and record information, and establish a plan of procedures;
- brainstorm a list of as many solutions as possible;
- identify the resources required for each suggested solution, and compare each solution to the design criteria, refining and modifying it as required;
- evaluate the solutions (e.g., by testing, modelling, and documenting results) and choose the best one;
- produce presentation and working drawings, sketches, graphics, mathematical and physical models, or a prototype of the best solution;
- evaluate the prototype and determine the resources, including computer applications, required to produce it;
- communicate the solution, using one or more of the following: final drawings, graphs, charts, sketches, technical reports, electronic presentations, flow charts, mock-ups, models, prototypes, and so on;
- obtain feedback on the following solution and repeat the design process if necessary to refine or improve the solution;

TF3.01 - describe the various systems applicable to the construction industry, including electrical, plumbing, heating, ventilation and air conditioning systems;
SP1.01 - design plan and implement solutions for a variety of construction projects;
SP2.05 - prepare accurate working drawings for a variety of projects;
IC1.02 - explain the social and environmental impacts on the construction industry of urban planning, land use by-laws, and building codes, regulations and standards.

Planning Notes

- provide samples of all materials required. These can be recycled from landfill sites and various trades' persons.
- old furnace fans will move a high volume of air, and are readily available.
- prepare handouts for students
- organize guest speakers (board Health and Safety Officer to discuss Air Quality)

Prior Knowledge & Skills

Students should have:

- a good understanding of AC and DC circuits and voltages (from previous activity);
- an understanding of the design process;
- drawing and sketching skills;
- an ability to safely use woodworking tools and processes, in order to construct mounting systems, air boxes, bonnets, etc.;
- a general knowledge of safety as it relates to general shop practices.

Teacher/Learning Strategies

- This activity is a practical application. Students must be comfortable with the design process of design, test, redesign, for success. (Appendix A – Design Report Process)
- The teacher distributes a diagnostic questionnaire to determine skills and knowledge of students in electrical, plumbing and sheet metal applications.
- Students complete diagnostic skill performances in electrical wiring, sheet metal, plumbing, layout, sketching, drafting and CAD applications.
- Teacher conducts a lesson on safety for all equipment to be used. Safety passports are completed. (Appendix B – Sample Safety Passport)
- The teacher/facilitator outlines the challenge, Building an Air Quality System, (Appendix 5 – Designing and Building an Air Quality System). At this time the design report criteria is outlined (Appendix 1 – Solar Water Heating System). How the design report relates to various trades is the basis for a class discussion?
- Students are instructed to keep a log or journal of their work during this challenge.
- Students are encouraged to use correct terminology relating to the trades. (Appendix 6 – Glossary or Terms: Building Support Systems)
- Students participate in a discussion based on increased need of purifying air and the health risks associated with various particles that contaminate the air we breath. Students also begin to identify parts and tools available for possible use.
- Students, working in groups, apply the design report process to the challenge. Students decide on materials and methods to be used. (Facilitator may determine groups based on diagnostic testing).
- Students sketch a design, and upon approval build a model of their design. If modification to the design is necessary, these are made before the model is built.
- The teacher demonstrates use of electrical tools and equipment and safe and correct use of tools and equipment related to sheet metal. (Appendix 2 – Sample Design Report Rubric)
- Teacher consults with various groups assisting in problem solving and terminology use during the building of the prototypes.
- Class discussion explaining the assessment of the prototype as a part of the design process. Students are asked to brainstorm possible methods of ensuring that the prototype meets the design criteria.
- Student groups present prototype to class presenting rationale for design.
- Groups submit their completed design report to teacher for assessment.

Assessment & Evaluation of student Achievement

- A complete list of assessment criteria should be presented to the class at the beginning of the design challenge. (Appendix 2 – Sample Design Report Rubric)
- The teacher tracks learning skills of students working in groups.
- Students complete a log of activity while working through the design challenge. This becomes part of their design report submission.
- The criteria for the challenge may also be used as a checklist by students and teachers to ensure all aspects of the challenge have been covered.
- Students will complete an assessment, based on group work using Learning Skills Checklists.

Accommodations

- The teacher reviews the students' IEP and adapts the activity and teaching/learning strategies to meet the students' needs.
- This project can be developed from very basic to very complex levels.
- The classroom or construction lab may need to be rearranged to accommodate all student needs.
- Activities are modified to meet the needs of learners by applying various accommodations such as:
  - increasing time allowed for activities;
  - enhancing or compacting content;
  - assisting during evaluation processes;
  - providing peer tutoring assistance where possible;
- Groups can be chosen to balance different abilities;
- Teachers ensure that all equipment is easily accessible.

Resources

Books

Better Homes and Gardens. *Step by Step Wiring*. ISBN 0-89721-440-4

Better Homes and Gardens. *Step by Step Plumbing*. ISBN 0-696-20634-X

"Dust Alert." *Canadian Workshop Magazine*. December 2000/January 2001, p. 37.
(contains many shop built projects)

Fine Woodworking Techniques. Taunton Press, ISBN: 0-918804-09-4

Fine Woodworking on The Small Workshop. Taunton Press, ISBN:0-918804-27-2

Home Depot. *Home Improvement 1-2-3*. ISBN 0-696-20168-2

Nagyszalanczy, Sandor. *Woodshop Dust Control*. Taunton Press, ISBN: 1-56158-116-X

Ortho's Home Improvement Encyclopaedia. Ortho Books, ISBN 0-8721-451-X

Ortho's All About Wiring Basics. Ortho Books, ISBN 0-89721-440-4

Ortho's All About Plumbing Basics. Ortho Books, ISBN 0-89721-439-0

Web sites

www.airhand.com – Air Handling Systems

www.dustboy.com – Dust Boy Inc.

www.wwforum.com – Wood Worker forum

Videos

Plumbing Video. Hometime Video – www.hometime.com

Electrical Video. Hometime Video – www.hometime.com

AutoCad 2000 and Its Applications. VMS Supply – www.vms-online.com

Appendix 1

Solar Water Heating System

Challenge

You are a design/build contractor who has been hired by a client to build an environmentally friendly house. You must provide a solar water heating system. You will be building a prototype of a single unit which would be used in a multiple unit system.

Criteria

- The system must be cost effective to build.
- The use of recycled materials or reusing materials is recommended.
- The system must raise water temperature from 20 degrees Celsius to at least 40 degrees Celsius.
- For the purpose of this challenge the prototype must be portable so that it may be moved out doors.
- The system should be insulated to minimize heat lost.

This could be a passive or non-passive system. Complete research must be done to facilitate this. A rationale should be given to explain why the system is passive or non-passive.

Appendix 2

Sample Design Report Rubric

Criteria	Level 1 (50 - 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Communication TF1.01	- communicates information with limited clarity	- communicates information with moderate clarity	- communicates information with considerable clarity	- communicates information with a high degree of clarity, and with confidence
Thinking/ Inquiry TF1.02, SP2.05	- applies few of the skills involved in an inquiry/design process	- applies some of the skills involved in an inquiry/design process	- applies most of the skills involved in an inquiry/design process	- applies all or almost all of the skills involved in an inquiry/design process
Knowledge/ Understanding TF1.02	- demonstrates limited understanding of design concepts	- demonstrates some understanding of design concepts	- demonstrates considerable understanding of design concepts	- demonstrates thorough and insightful understanding of design concepts
Application TF3.01	- uses procedures, equipment, and technology safely and correctly and safely only with supervision	- uses procedures, equipment, and technology safely and correctly and safely with some supervision	- uses procedures, equipment, and technology safely and correctly and safely	- demonstrates and promotes the safe and correct use of procedures, equipment, and technology

Note: A student whose achievement is below level 1 (50%) has not met the expectations for this assignment or activity.

Appendix 3

Sample Rubric for an Electric Security System

Criteria	Level 1 (50 - 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Knowledge of Facts TF3.01, IC1.02	- demonstrates limited knowledge of residential wiring	- demonstrates some knowledge of residential wiring	- demonstrates considerable knowledge of residential wiring	- demonstrates thorough knowledge of residential wiring
Thinking Skills TF1.02	- applies few of the skills involved in designing and building a security system	- applies some of the skills involved in designing and building a security system	- applies most of the skills involved when designing and building a security system	applies all or almost all of the skills involved when designing and building a security system
Communication of Information SP2.05	- uses language, symbols and visuals when drawing schematic diagram with limited accuracy and effectiveness	- uses language, symbols and visuals when drawing schematic diagram with some accuracy and effectiveness	- uses language, symbols and visuals when drawing schematic diagram with considerable accuracy and effectiveness	- uses language, symbols and visuals when drawing schematic diagram with a high degree of accuracy and effectiveness
Application of procedures equipment and technology SP1.01	- uses procedures equipment and technology when installing a security system correctly only with supervision	- uses procedures equipment and technology when installing a security system correctly with some supervision	- uses procedures equipment and technology when installing a security system correctly	- demonstrates and promotes the safe and correct use of procedures equipment and technology when installing a security system

Note: A student whose achievement is below level 1 (50%) has not met the expectations for this assignment or activity.

Appendix 4

Installing a Security System

Challenge
You have been hired by a local contractor to install a security system in a large woodworking shop. This system must perform multiple tasks such as, notifying the occupants of the shop when the phone rings, alerting them to a delivery, and protecting expensive tools and equipment from theft. A small table top wooden mock-up of the system must be constructed that demonstrates that the system will meet the following criteria. The mock-up should have a hinged panel to represent a door, horizontal and vertical surfaces to mount devices, power supply and telephone jacks.

Criteria
- A light must flash if the phone is ringing.
- A buzzer or chime must sound if a vehicle or person approaches the back door to make a delivery. The buzzer or chime could also be combined with a different pattern of light flashes.
- A different type of buzzer or chime tone must sound, if a cupboard or door is being opened that should not be opened. Alternately this alarm could also be connected to an auto-dialler to alert the owner.
- The sample unit must be compact or collapsible, easily transportable and simple to set up so that you can take it to your customer and demonstrate how the different options work.

Appendix 5

Designing and Building an Air Quality System

Depending on the nature of the contaminant, air must be filtered particles collected, fumes neutralized and air recycled into the room or vented to the exterior.

Completed unit must be easy to service and dismantle for cleaning and filter changes.

A method of demonstrating the Units effectiveness must be devised, to present a visual before and after comparison of the air quality.

Any dust produced from material that can burn is explosive as are some fumes. Precautions must be taken to ensure that spark producing electrical devices such as fan motors, switches and light fixtures are not in contact with dust or fumes.

Appendix 6

Glossary of Terms: Building Support Systems

Plumbing

ABS (Acrylonitrile Butadiene Styrene): Rigid black plastic pipe used only for drainpipe.

Adaptor: A fitting that unites different types of pipe together.

Cleanout: A plug in a trap or drainpipe that provides access for cleaning out obstructions.

Closet Auger: A flexible rod with a curved end used to access a toilets trap.

Closet bend: A curved fitting that connects the closet flange to the toilet drain.

Closet flange: An anchoring ring secured to the floor for toilets.

Coupling: A fitting that joins two types of pipe.

CPVC (Chlorinated Polyvinyl Chloride): Rigid plastic pipe for supply systems.

Elbow: A pipe fitting with two openings that changes the direction of the line.

Fall/Flow: The proper slope or pitch of a pipe for drainage.

Fixture: In plumbing, the devices that provide a supply of water e.g., sinks tubs, etc.

Flux: The paste that is used in soldering copper joints. Its purpose is to prevent oxidation.

I.D. (Inside Diameter): How all pipe is measured.

O.D.: outside diameter

PB: Flexible plastic tubing, used for supply lines.

Plumber's Putty: A pliable putty used for drain seals.

PVC: (Poly Vinyl Chloride): A rigid white pipe used for drainage.

Reducer: A fitting that connects pipes of different sizes.

Run: A complete section of pipe that extends from supply to fixture or drain to stack.

Solder: A metal alloy that is melted to join copper pipe.

Stop Valve: A valve that controls the flow of water to one fixture.

Tee: A T-shaped fitting with three openings.

Trap: Curved sections of a fixture drain line designed to trap water, and prevent gases from entering building.

Union: Three piece fitting that joins two sections of pipe, but allows them to be disconnected without cutting the pipe.

Wye: a Y-shaped fitting with three openings.

Appendix 6 (Continued)

Electrical

Amp: (Ampere) A unit that measures the strength or rate of flow of electrical current.

Armoured Cable: Electrical cables with metal sheathing.

Branch Circuits: The circuits in a house that branch from the panel to boxes.

Breaker: A switch device that connects and disconnects power.

Cable clamps: Metal clips on an electrical box which secure cable.

Circuit: A continuous loop of electrical current.

Circuit breaker: The most common type of over current protection.

Conduit: A protective plastic or metal tube for wire.

Duplex receptacle: the most common type of receptacle. It has two plug-ins.

Fuses: Removable devices, which link a circuit at the fuse box. Connections blow apart if the circuit overloads or shorts.

Fixture: Any permanently connected light or other device that consumes power.

GFI: Ground fault interrupter, used to prevent shock in wet areas such as bathroom or outdoors

Hot, Neutral, Ground: The three most common circuit wires. The hot (black) brings the current flow in, the neutral (white) returns it to the source, and the ground (green or unsheathed) is a safety route for returning current

Knockout: a removable circle in an electrical box for feeding wire into.

NM: Non-metallic sheathed wire, (plastic).

Ohm: A unit that measures resistance.

Rough-in: Installing all boxes, cables etc, prior to installing walls.

Service entrance: Location where supply enters building.

Service panel: The main circuit breaker panel, where all circuits are connected to the source.

Short circuit: When current flows short of reaching a device. Caused by the hot wire contacting a neutral or ground wire.

UF: (underground feeder) Cable designed for outdoor, underground use.

Volt: A unit that measures the electrical pressure.

Watt: A unit that measures the amount of electrical power.