Public and Catholic District School Board Writing Partnerships

Course Profile

Technological Design

Grade 11
Workplace Preparation
TDJ3E

- *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.

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Course Overview
Technological Design, Grade 11, Workplace Preparation, TDJ3E

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

Course Description

This course provides students with opportunities to apply the principles of basic design to technological challenges in industry, engineering, architecture, manufacturing, and graphics. Students develop problem-solving and design skills through the use of technical drawings and illustrations, model building, testing, and marketing. They become aware of consumer, business, and environmental issues in the creation and marketing of products or services, and the educational requirements of design-related careers.

How This Course Supports the Ontario Catholic School Graduate Expectations

The role of Technological Education in the Catholic faith community is to enable students to develop and utilize their gifts and talents while creating products that benefit others in a way that models Gospel values. The focus of the curriculum enables students to become critical and innovative problem-solvers. Students gain an awareness of their use of resources – renewable and non-renewable and are encouraged to recognize the implications of technological innovations on society as a whole. An emphasis on process and results ensures that students create products and provide services that recognize our societal responsibility to respect the dignity and value of the individual and the global community. Collaboration and leadership are emphasized as students work as a team to create a work/learning environment that is safe, welcoming, and respectful of individual differences.

Course Notes

This course is designed to provide the skills and knowledge that leads to Grade 12 Technological Design (TDJ4E), then to the workplace, apprenticeship, job-training programs, or other endeavours that are involved in the development of products and environments. Many of the skills developed in this course can be applied to a wide variety of careers. A list of careers directly involved in design are outlined in Human Resources Development Canada's (HRDC) National Occupational Classifications (NOC) database, partially listed (see Resources for HRDC NOC website):

NOC Code	Occupation Category
2225	Landscape and Horticulture Technician and Specialist
2231	Civil Engineering Technologist and Technician
2232	Mechanical Engineering Technologist and Technician
2241	Electrical and Electronic Engineering Technologist and Technician
2251	Architectural Technologist and Technician
2253	Drafting Technologist and Technician
5241	Graphical Designers and Illustration Artists
5242	Interior Designers
5243	Theatre, Fashion, Exhibit, and Other Creative Designers

The delivery of the Technological Design (Workplace) course has an emphasis on teaching practical elements of the process of technical drawing, modelling, testing, and fabrication. This course focuses on evaluating existing products or environments, and provides a basis for innovating practical designs.

Students apply Gospel teachings in examining the safe, ethical use of technology and the environmental and sociological impacts technology may have.

This course, followed by the Grade 12 Technological Design (TDJ4E) program, provides students with opportunities to develop skills and understanding in entry-level design-related careers. These careers may include technical or artistic functions such as drafting/CAD operations, production members of custom manufacturing teams, graphic and/or interface designers, or business entrepreneurs. Design is a broad-based activity in which illustration, drafting, communication, fabrication techniques, and the safe use of tools and equipment must remain an important focus. An integral part of the learning process should be a continual atmosphere of self-assessment and group assessment through the testing and evaluation of models and products.

The units in this course allow students to work through processes of designing and developing products. Through problem-solving activities, students develop skills in the areas of technical drawing, modelling, and fabrication techniques. Design problems are based on existing designs in which students can redesign or make modifications to improve a situation, product, and/or environment.

Unit 1 provides an overview of the design and product development process. Skills in generating, communicating, fabricating, and testing ideas are developed.

Unit 2 further explores the communication of ideas through various drawing, illustration, and modelling techniques. Students develop skills in freehand sketching techniques, technical drafting, and computer-aided design and drafting (CAD).

Unit 3 allows students to practise the skills developed in the previous units by applying them to example design problems. This unit takes an extensive look at how technology impacts society, the environment, and future career options.

Unit 4 offers practical applications in design and serves as a culmination to the course.

It is important to note that even though each unit has a stated focus, many skills and concepts, such as safety, illustration techniques, and social impact, are addressed throughout all units.

To facilitate classroom and resource management, students can rotate through various activities, work in groups or teams, or simultaneously work on individual activities. The teacher should provide students with the list of course projects at the beginning of the semester, to help students with planning options in advance. Resources required for each activity should be prepared before activity initiation. These include:

- design and communication tools/materials;
- modelling and fabrication tools;
- materials and equipment;
- research tools;
- professional expertise in specific areas, such as local businesses or industries.

Local experts from engineering, manufacturing, architectural, or design firms provide students with an opportunity to investigate and explore career and apprenticeship choices.

The use of Overview Appendix A – Safety Passport is recommended to record and maintain safe working practices in a workshop environment.

Units: Titles and Times

Unit 1	Generating Design	20 hours
Unit 2	Technical Design	25 hours
* Unit 3	Design and Society	30 hours
* Unit 4	Applications of Design	35 hours

* These units are fully developed in this Course Profile.

Unit Overviews

Unit 1: Generating Design

Time: 20 hours

Description

The focus of this unit is on generating, testing, and evaluating designs. Through problem-solving activities, students are introduced to the concepts of safe operating procedures and designing for user needs and requirements. Students create models, prototypes, products, and services that solve design problems. Students learn to appreciate designing for the common good and think reflectively and creatively to evaluate situations and solve problems. Students assess products for aesthetics, function, and safety while applying human values and socially responsible criteria.

Unit Synopsis Chart

Activity	Time	Expectations	Assessment	Tasks
1.1: Engineering Physics and Materials	5 hours	TFV.04, TF1.02, TF2.02 SPV.01, SPV.02, SP1.01, SP2.02, SP2.03 ICV.03, ICV.04, IC1.03, IC1.04, IC2.01, IC2.03 CGE2b, 3e, 4f, 5b, 7b	Knowledge Inquiry	Example: Design, build, and fly kites that can be made from easily found materials (quick "ice-breaker" project).
1.2: Rapid Prototyping: Tool Design	5 hours	TFV.03, TFV.05, TF1.01, TF2.01, TF3.02 SPV.02, SPV.03, SP1.03, SP2.01, SP2.02, SP2.03 ICV.01, ICV.03, IC1.01, IC1.03, IC2.02, IC2.03 CGE2e, 3b, 3c, 4f	Knowledge Inquiry Communication Application	Example: Fabricate a model of a household or workshop tool. Students look at aesthetics, function, and ergonomics when constructing tool models.
1.3: Designing for Human Needs	10 hours	TFV.01, TFV.03, TFV.04, TF1.01 SPV.02, SPV.04, SP2.03 ICV.01, ICV.03, ICV.04, IC1.01, IC1.03, IC2.02, IC2.03 CGE1d, 2e, 3d, 4a, 4f, 5d, 7d, 7j	Knowledge Inquiry Communication Application	Example: Design and build a device that would increase accessibility in the school for those with disabilities (e.g., accessibility ramps).

Unit 2: Technical Design

Time: 25 hours

Description

Students engage in a series of activities to develop the necessary technical skills for creating design solutions common to any field of design. Activities focus on the technical aspects of communicating ideas, such as technical drawing, 3-D modelling, testing, and report development through the process of examining existing design solutions. Students use and integrate the Catholic faith tradition, in the critical analysis of the arts, media, technology, and information systems to enhance the quality of life.

Unit Synopsis Chart

Activity	Time	Expectations	Assessment	Tasks
2.1: The View: Sketching and Drawing	10 hours	TFV.02 SPV.01, SP1.01, SP1.02 ICV.04 CGE4f, 5g	Knowledge Communication Application	Example: Create a portfolio of 2-D/3-D drawings and sketches of various objects.
2.2: Developing Working Drawings	5 hours	TFV.02, TF2.01 SPV.01, SP1.01, SP1.02, SP1.04 ICV.01, IC1.04 CGE4f, 5g	Knowledge Communication Application	Example: Generate orthographic working drawings and analysis reports on simple devices from the home or school.
2.3: Modelling Architecture and Career Exploration	10 hours	TFV.01, TFV.05, TF1.01, TF1.02, TF2.01, TF3.01 SPV.03, SP1.04, SP2.01, SP2.02 ICV.01, ICV.02, IC2.01, IC2.02 CGE2c, 4f, 3b, 4d, 7a, 7d, 7i, 7j	Knowledge Communication Application	Example: Generate a model of an existing architectural structure or architectural detail. Identify careers in architecture and construction.

Unit 3: Design and Society

Time: 30 hours

Description

The human ability to design and create technology has had a profound impact on individuals and societies throughout history. This unit examines the effect of technology on societies in the past, present, and future, while allowing students to engage in problem-solving activities based primarily on humanitarian and environmental issues. In developing and applying technology to the issues, students are provided the opportunity to use their knowledge and begin to formulate attitudes and values based on social responsibility and the Gospel and develop their God-given potential and make a meaningful contribution to society. They are encouraged to explore various avenues to apply the design concepts (e.g., patent process) and reflect upon the possible effects of the chosen applications.

Unit Synopsis Chart

Activity	Time	Expectations	Assessment	Tasks
3.1: Investigating Modern Inventions	3 hours	TF1.03, SP1.04 ICV.02, IC1.03, IC2.01 CGE2b, 2c, 3f, 7g	Knowledge Inquiry Communication	Examine how a product or technique has developed over time and its impact on society. Form a timeline of the technology and create a visual display of the invention over time.
3.2: Investigating the Life Cycle of a Product	5 hours	TFV.01, TFV.04, TF2.02, TF2.03, ICV.04, IC1.02, IC2.01, IC2.02 CGE2b, 3f, 4e, 4g, 5b, 5h	Knowledge Inquiry Communication	Investigate the process of product development from its conception (patent process) to final product on the sales shelf. Identify jobs and careers associated with the development of the product.
3.3: Protecting Our Children: Safety Design Challenge	10 hours	TFV.03, TF1.01, TF1.02, TF2.02, TF3.02, SPV.01, SPV.02, SP1.03, SP2.01, SP2.03, ICV.01, ICV.02, IC1.01, IC1.02, IC1.03 CGE1d, 3b, 3c, 3f, 4f, 5a, 5c, 7i	Inquiry Application	Identify safety hazards of everyday objects in the home, at school, and at work. Make appropriate modifications to these objects to prevent future accidents from occurring (e.g., shopping carts, childproofing the home, etc.).
3.4: Technology, Amusement, and Leisure	12 hours	TFV.01, TFV.03, TF2.01, TF2.02, TF2.03, SPV.02, SPV.04, SP1.03, SP1.04, ICV.03, IC1.01, IC1.02 CGE1d, 2e, 3b, 3c, 3d, 3f, 4f, 5a, 7g, 7i	Knowledge Inquiry Application Communication	Investigate the role of technology in amusement and leisure throughout history. Identify specific user needs with respect to amusement and leisure and design a solution to meet these needs (e.g., developing a carnival or board game). Prepare a presentation to demonstrate user needs and the final solution.

Unit 4: Applications of Design

Time: 35 hours

Description

In this culminating unit, students apply learned communication, decision-making, and problem-solving skills to challenges in theatre and film production design. Students explore the development of design solutions through the development of technical drawings, illustrations, models, test models, fabricated products, proposals, and reports. Skills developed in this unit can be applied to a wide variety of careers in architecture, industrial design, fashion, or theatre/film production.

Unit Synopsis Chart

Activity	Time	Expectations	Assessment	Tasks
4.1: Reproducing History for Film or Video	15 hours	TFV.02, TFV.03, TF1.03, TF2.01, TF2.02, SPV.01, SPV.02, SP1.01, SP1.02, SP1.03, ICV.03, IC2.03	Knowledge Inquiry Communication Application	Generate artefacts or costumes from a historical period as portrayed in film or video.
4.2: Theatre Set Design and Production	20 hours	TFV.01, TFV.02, TFV.03, TF1.01, TF1.02, TF2.01, SPV.01, SPV.02, SPV.03, SP1.01, SP1.02, SP1.03, SP2.03, ICV.03, IC1.01, IC1.02, IC2.03	Knowledge Inquiry Communication Application	Design and construct a theatre or video set.

Teaching/Learning Strategies

Technological Design involves generating solutions to human needs problems and requires a hands-on, project-based approach that incorporates individual and team efforts, a flexible process for creative idea generation, and a variety of materials and tools to model, test, and communicate solutions. In a typical design project, the teacher provides students with a design brief, which describes the problem to be solved, the constraints or criteria to be met in solving the problem, and, in many cases, possible paths to take to develop a viable solution. Activity initiation may take place with the whole classroom or with select groups.

The teacher may provide students with a list of the course projects at the beginning or introduce them in sequence. This lends itself to a variety of strategies for learning that is dependent on the project, the level of student understanding and experience, and the availability of local facilities and resources. Possible teaching and learning strategies in a design project include:

- Group Collaboration
  Students work in teams or with partners to accomplish specific tasks, modelled after design or engineering firms where individuals with differing strengths, skills, and knowledge work together to solve problems or issues. This is particularly effective for large projects such as designing and constructing drama sets or accessibility ramps. Groups of three or four may be more manageable than five or more.
- Individual Work
  Students work individually to accomplish specific tasks. This may include working through the design process to develop a product such as a tool or individual tasks related to a group project such as drawing, drafting, model building, or presentation preparation.

- Class Discussion
  Students actively participate by taking turns discussing current issues. The teacher may direct discussions by:
  - posing initial questions;
  - demonstrating specific procedures (e.g., a proper and safe tool operation);
  - presenting a media topic relating to the current activity (e.g., a video or newspaper clipping).

  Relevant issues may include the job market as it relates to careers in technology, the effects of technology on the environment, or the impact of a historical technology on today's society.
- Theoretical Study
  Students learn concepts and theory in application through the study and analysis of case studies. They test and observe scientific and engineering principles through experimentation, through Socratic lessons provided by the teacher or invited guests, or by experiencing them while testing a solution to a problem (e.g., building a kite, observing how well it flies, then making the appropriate modifications to improve its performance).

It should be noted that important issues such as safety should be reinforced throughout the course. Following initial lessons, demonstrations, and testing of general lab and machine safety at the beginning of the course, the teacher should reintroduce specific topics at the time required (e.g., before cutting wood on a table saw, the teacher reviews specific table saw safety items). The approach of learning safety at the beginning and then reinforcing that learning with the Just-In-Time (JIT) method ensures students have more than one opportunity to learn very important skills.

In Technological Design, the computer may be used extensively to:

- generate illustrations and drafted drawings;
- generate and test 3-D models;
- research on-line resources;
- communicate with peers and experts in the field;
- download images, papers, and software;
- produce products with Computer Numerical Control (CNC);
- produce finished prints, reports, and presentations.

If there are insufficient computer resources, teachers ensure that there are plenty of activities that involve conventional illustration and/or sketching, library or text research, hand modelling, and testing.

Design ideas and concepts are generated through a variety of methods including:

- group brainstorming;
- conducting surveys or interviews of clients or end users;
- developing and testing of prototypes or models;
- holding discussions with workers in the relevant field of study.

Students are instructed to focus on the kinds of entry-level career skills this course destination leads to, such as drafting technicians, CAD operators, graphic illustrators, or technical or entrepreneurial jobs in architectural, artistic, or engineering firms. Problems that require students to generate their own designs have prescriptive restrictive criteria and are limited in scope of design choices, allowing students to focus on the communicating, constructing, and testing of designs. Ample opportunity must be given for students to develop the practical skills involved in designing and to practise and apply those skills on both an individual basis and as a member of a team.

A key component of this course is for students to be made aware of career opportunities in the field of design. Strategies such as inviting guest speakers, conducting field trips or industry visits, participating in community-based projects, and encouraging job shadowing, co-op, or apprenticeship placements are highly recommended.

Assessment & Evaluation of Student Achievement

Students demonstrate recognition of a structured process in problem solving. Evaluation is based primarily on formative assessment, as it occurs during learning. This assessment occurs through ongoing feedback to the teacher and students about the quality of learning and the effectiveness of instruction. Throughout the course, students demonstrate a learning process in conjunction with a specified amount of skill, knowledge, and values.

Assessment and evaluation tasks can include:

- design briefs;
- design proposals;
- technical and/or design reports;
- research reports;
- drawings, illustrations, and/or blueprints;
- finished models, prototypes, and products;
- presentations;
- competition deliverables;
- daily log or work journal.

Examples of previous work help students to develop the skills necessary to evaluate their projects and products. They provide students and the teacher with a progressive and ongoing means of monitoring the level of achievement attained. Comparisons of the teacher's evaluation of a skill and the student's self-assessment through teacher/student discussion often clarifies the standards that are expected. The addition of a peer assessment component, especially in a group work situation, also helps to identify reasonable expectations. The ability to combine skills and knowledge successfully in practical work tasks are demonstrated by students in their planning and implementation of projects, work assignments, and problem-solving activities. Daily teacher observation of each student's achievement on such assignments is a technique for assessing progress.

Self-assessment encourages students to reflect on their growth and learning, giving them a sense of where they have been, where they are, and where they are going. Self-evaluation is a valuable skill and aids students in developing their God-given potential. With the use of self-, peer, and teacher assessment, students are provided with feedback on their work.

Summative assessment, usually carried out at the end of a learning process and which includes feedback and evaluation resulting in a grade, is a focus in the evaluation of student achievement. Students should be able to articulate knowledge of design processes through oral and written methods such as a design report. Students demonstrate proficiency in the variety of practical skills developed throughout the course.

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 teacher should be acquainted with students' Individual Education Plans (IEPs) and unique learning characteristics to make the necessary accommodations.

There is a wide range of teaching/learning strategies and assessment employed to ensure that all students with special needs can be successful in the course. The teacher is encouraged to modify and expand strategies to accommodate learning styles. These may include:

- developing activities around student's strengths and needs (e.g., limiting the amount of reading and writing activities);
- keeping instructions simple and providing limited steps at a time (e.g., consider oral instructions with a demonstration as opposed to written instructions);

- providing accommodations of approaches to assessment;
- providing the option for oral testing and student demonstrations of acquired skills;
- encouraging conferencing/discussion;
- encouraging student-to-student and teacher-to-student discussion to encourage confidence and motivation;
- allowing oral presentations to small groups rather than to the whole class;
- encouraging cooperative small-group learning as opposed to teacher-presented material;
- providing flexible timelines;
- providing adaptation of student resources and equipment;
- encouraging peer tutoring;
- a supporting Educational Assistant in the classroom;
- providing enrichment and extension activities;
- providing classroom accessibility.

Teachers should be aware of students who require modification to the mandated expectations for this course. *Ontario Secondary Schools* (page 24) allows teachers to modify the learning expectations for exceptional students in order to support the contents of the student's IEP. This applies also to students who have not been identified as exceptional but are receiving Special Education programs and services.

Resources

Books

Browning, Heighington, Parvu, and Patillo. *Design and Technology*. Toronto: McGraw-Hill Ryerson, 1993. ISBN 0.07.549650.X

Gordon, J.E. *The New Science of Strong Materials*. Markham, Ontario: Penguin Books, 1978. ISBN 0-306-80151-5

Gordon, J.E. *Structures, or Why Things Don't Fall Down*. Markham, Ontario: Penguin Books, 1978. ISBN 0-306-80151-5

Gradwell, Welch, and Martin. *Technology Shaping Our World*. Tinley Park, Illinois: The Goodheart-Willcox Company, 1996. ISBN 1.56637.217.8

Huchinson, Karsnitz. *Design And Problem Solving*. New York: Glencoe/McGraw- Hill, 1994. ISBN 0-8273-5244-1

Norman, Donald A. *The Design of Everyday Things*. New York: Doubleday, 1988. ISBN 0-385-26774-6

Papanek, Victor. *Design for the Real World*. New York: Bantam Books, 1971.

Salvadori, Mario. *The Art of Construction, Projects and Principles for Beginning Engineers and Architects*. Chicago: Chicago Review Press, 1990. ISBN 1.55652.080.8

Wright, Smith. *Understanding Technology*. Tinley Park, Illinois: The Goodheart-Willcox Company, 1998. ISBN 1.56637.374.3

Periodicals

Popular Science.
Popular Mechanics.
Wired.
Various architecture and home improvement magazines
Tech Directions.
DTTO Bulletin

Publications

Publications on many aspects of architectural design considerations and research are available from Canada Mortgage and Housing Canadian Housing Information Centre, Ottawa, Ontario, phone 613-748-2367

ITEA (International Technology Education Association) publications

Canadian Standards Association publications

ASTM testing standards

Ontario Building Code

Sweet's Catalogue

Machinery's Handbook

Model-making manuals and magazines are available from local hobby stores

Videos

Videos on designing products such as washing machines, bicycles, toys, and mobile homes are available from: Classroom Video, 107 1500 Hartley Avenue, Coquitlam, BC V3K 7A1, phone 604-523-6677.

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.

American Standards for Testing and Materials (ASTM)
www.astm.com

Bad Designs, examples of problems in consumer design
www.baddesigns.com

CSA International
www.csa.ca

Carleton University School of Industrial Design, information on industrial design curriculum
www.id.carleton.ca

Core77 Design Network, information on design careers, competitions, events
www.core77.com/

History of Technology, list of resources on the development of technology
www.englib.cornell.edu/ice/lists/historytechnology/historytechnology.html

How Things Work
www.howthingswork.com

Human Resources Development Canada National Occupational Classification database
www.hrdc-drhc.ca/noc

Ontario Prospects (career explorations)
www.edu.gov.on.ca

Popular Science, latest innovations in industrial and architectural design
www.popoularscience.com

Popular Mechanics, latest information of innovations and inventions
www.popularmechanics.com

Scotty's Unofficial Centre for Tech Education, resources for teaching design
www.millenniumwave.com

Sweet's.com (construction industry resources)
www.sweets.com

Tech Streets, (standards and information (ASTM, CSA, ISO, etc.))
www.techstreet.com

Vocabulary definitions
www.whatis.com/index.htm

Wired Magazine, trends and future directions of technology
www.wired.com

Course Development Resources

Blueprints: A Resource Tool for Writing Catholic Secondary School Profiles. Catholic Curriculum Cooperative, Central Region.

Choices Into Action: Guidance and Career Education Program Policy for Ontario Elementary and Secondary Schools, 1999.

The Ontario Curriculum, Grades 9-12, Technological Education, 1999.

Ontario Secondary Schools, Grades 9-12, Program and Diploma Requirements, 1999.

Trafford, Larry. *Educating the Soul: Writing Curriculum for Catholic Secondary Schools*. Toronto: Institute for Catholic Education, 1998. ISBN 0-9699178-5-6

OSS Considerations

The Grade 11 Technological Design Course is designated as a Technological Education program in which students develop an understanding of the design industry. This course is designed to provide students with a broad educational base that prepares them for their studies in Grades 12, and subsequent direct entry into the workplace, or for admission to apprenticeship programs and other training programs. The goal of this program is to empower students to become productive participants in society. Students are introduced to practical aspects of design and fabrication of products to benefit society. The curriculum provides opportunities for students to undertake hands-on practical activities, as well as to conduct research and analysis. There are a wide range of teaching/learning strategies and accommodations through which the needs of students with special needs are met. The hands-on, practical approach provides students with experiences that reflect a workplace environment. However, students should be encouraged to take part in a co-operative education, Ontario Youth Apprenticeship Program, or other program that provides workplace experience in conjunction with this course.

Potential for career exploration is made available to students throughout all units with specific reference to *Choices Into Action: Guidance and Career Education Program Policy for Elementary and Secondary Schools, 1999*.

Overview Appendix A

Safety Passport

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.

The general process is as follows:

1. When the teacher introduces a new piece of equipment (e.g., lathe), students record the date of the safety demonstration on their safety passport. Students prepare a note in their notebooks during this lesson while the teacher demonstrates techniques for the safe operation of the machine and personal protective equipment (e.g., proper eye protection, secure loose hair, remove jewellery, protective clothing, etc.). This safety note is carefully recorded in each student's notebook along with the signed passport slip. If any students are absent for the safety lesson, the teacher carefully notes it on the daily attendance and a make-up opportunity must be provided.
2. 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, the teacher signs off that portion of their passport.
3. Each student must complete a written or oral test on the safe operation of the machine tool, outlining all safety features that must be observed. These individual machine tests are designed to complement any general facility safety rules. Upon satisfactory completion of the test, the student dates the "tested" column and the teacher initials it as complete.
4. Once the student has completed steps 1, 2, and 3, the teacher signs the final column of the student's safety passport indicating they are able to use that equipment. The teacher keeps the signed passports on file. A summary document of all the various permissions may be created by the student and signed by the teacher (as permissions are earned). See the sample summary passport below.

Equipment Safety Passport

School: Instructor:

Student Name: Equipment:

See your instructor for ANY questions about the safe set-up and operation of equipment.

Attended Teacher Safety Instruction and Demonstration (and notes recorded)		Demonstrated Safe Set-up and Operation of Equipment to Teacher		Passed Written or Oral Testing		Permission Granted to Use Equipment by Teacher	
Date of Lesson	Teacher Initial	Date Tested	Teacher Initial	Date of Demo	Teacher Initial	Date	Teacher Initial

Coded Expectations, Technological Design, Grade 11, Workplace Preparation, TDJ3E

Theory and Foundation

Overall Expectations

TFV.01 · demonstrate an understanding of how the design process is used to create products or services for the marketplace;
TFV.02 · create effective technical drawings using standardized drawing practices;
TFV.03 · determine appropriate solutions to design problems;
TFV.04 · describe manufacturing and construction materials and techniques related to their projects;
TFV.05 · write effective technical reports that follow a conventional format.

Specific Expectations

Planning

TF1.01 – describe user requirements, design criteria, and ways of developing and testing solutions;
TF1.02 – justify design decisions that involve alternative approaches;
TF1.03 – describe the historical development of a variety of designed products and services.

Preparing Designs

TF2.01 – use technical illustrations, drafting, computer graphics, and models to present ideas and solutions effectively;
TF2.02 – describe materials that are appropriate for the manufacture or construction of given projects;
TF2.03 – describe appropriate methods of manufacture or construction for given projects.

Evaluating and Documenting Designs

TF3.01 – write reports summarizing how the criteria and constraints influenced a particular design decision;
TF3.02 – evaluate solutions based on given design criteria.

Skills and Processes

Overall Expectations

SPV.01 · illustrate their design solutions effectively using a variety of technical drawing methods that conform to industry drafting conventions;
SPV.02 · fabricate projects or displays using hand and power tools safely;
SPV.03 · write effective design briefs and technical reports;
SPV.04 · evaluate solutions against design criteria.

Specific Expectations

Preparing Designs

SP1.01 – draw appropriate technical illustrations using industry-standard practices, including lettering techniques, scales, and symbols;
SP1.02 – produce correct orthographic or pictorial technical drawings (e.g., floor plans, perspectives and elevation views, section and assembly drawings) using traditional or computer-based methods;
SP1.03 – fabricate models and prototypes for analysis and testing using standard safety procedures;
SP1.04 – create displays of the finished products using computer graphics, posters, or multimedia productions.

Evaluating and Documenting Designs

SP2.01 – produce appropriate design briefs based on their analysis of user needs and on consumer product research;

SP2.02 – prepare technical reports documenting the design process and proposed solution;

SP2.03 – evaluate design solutions to determine how well they suit the design criteria.

Impact and Consequences

Overall Expectations

ICV.01 · identify factors that must be considered when designing for the consumer marketplace (e.g., costs, materials, safety, durability);

ICV.02 · identify environmental concerns related to the development, use, and disposal of manufactured goods;

ICV.03 · use tools and materials safely to fabricate products;

ICV.04 · describe design-related careers and their educational requirements.

Design Impacts

IC1.01 – assess project solutions in terms of safety, ergonomics, and efficiency;

IC1.02 – identify design issues, such as production costs, instructional materials for assembly and use, special design needs related to controls and instrumentation, safety issues in handling products, and product durability;

IC1.03 – describe problems that can result from improper design.

Environmental and Safety Issues

IC2.01 – identify alternative environmentally friendly materials that could be used to produce specific products;

IC2.02 – explain various methods of handling materials and reducing waste;

IC2.03 – handle tools and materials safely.

Education, Training, and Career Opportunities

IC3.01 – identify a variety of design-related careers;

IC3.02 – identify the educational and training requirements for careers related to technological design.

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 3: Design and Society

Time: 30 hours

Unit Description

The human ability to design and create technology has had a profound impact on individuals and societies throughout history. This unit examines the effect of technology on societies in the past, present, and future, while allowing students to engage in problem-solving activities based primarily on humanitarian and environmental issues. In developing and applying technology to the issues, students have the opportunity to use their knowledge and begin to formulate attitudes and values based on social responsibility and the Gospel and to develop their God-given potential and make a meaningful contribution to society. They are encouraged to explore various avenues to apply the design concepts (e.g., patent process) and reflect upon the possible effects of the chosen applications.

Unit Synopsis Chart

Activity	Time	Expectations	Assessment	Tasks
3.1: Investigating Modern Inventions	3 hours	TF1.03, SP1.04, ICV.02, IC1.03, IC2.01 CGE2b, 2c, 3f, 7g	Knowledge Inquiry Communication	Examine how a product or technique has developed over time and its impact on society. Form a timeline of the technology and create a visual display of the invention over time.
3.2: Investigating the Life Cycle of a Product	5 hours	TFV.01, TFV.04, TF2.02, TF2.03, ICV.04, IC1.02, IC2.01, IC2.02 CGE2b, 3f, 4e, 4g, 5b, 5h	Knowledge Inquiry Communication	Investigate the process of product development from its conception (patent process) to final product on the sales shelf. Identify jobs and careers associated with the development of the product.
3.3: Protecting Our Children: Safety Design Challenge	10 hours	TFV.03, TF1.01, TF1.02, TF2.02, TF3.02, SPV.01, SPV.02, SP1.03, SP2.01, SP2.03, ICV.01, ICV.02, IC1.01, IC1.02, IC1.03 CGE1d, 3b, 3c, 3f, 4f, 5a, 5c, 7i	Inquiry Application	Identify safety hazards of everyday objects in the home, at school, and at work. Make appropriate modifications to these objects to prevent future accidents from occurring (e.g., shopping carts, childproofing the home, etc.).
3.4: Technology, Amusement, and Leisure	12 hours	TFV.01, TFV.03, TF2.01, TF2.02, TF2.03, SPV.02, SPV.04, SP1.03, SP1.04, ICV.03, IC1.01, IC1.02 CGE1d, 2e, 3b, 3c, 3d, 3f, 4f, 5a, 7g, 7i	Knowledge Inquiry Application Communication	Investigate the role of technology in amusement and leisure throughout history. Identify specific user needs with respect to amusement and leisure and design a solution to meet these needs (e.g., developing a carnival or board game). Prepare a presentation to demonstrate user needs and the final solution.

Activity 1: Investigating Modern Inventions

Time: 180 minutes

Description

This activity is designed to allow students to develop an understanding, appreciation, and respect for the many inventions that have had an impact on our way of life and the individuals responsible for these inventions. More specifically, the contributions of Canadian, women, and minority inventors are considered. The moral and ethical considerations underlying the development of such inventions are also addressed. Students then develop a timeline for an invention of their choice to trace its development and evolution throughout history. Students begin to develop ideas for generating their own inventions in subsequent activities.

Strand(s) & Learning Expectations

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

Overall Expectations

ICV.02 - identify environmental concerns related to the development, use, and disposal of manufactured goods.

Specific Expectations

TF1.03 - describe the historical development of a variety of designed products and services;
SP1.04 - create displays of the finished products using computer graphics, posters, or multimedia productions;
IC1.03 - describe problems that can result from improper design;
IC2.01 - identify alternative environmentally friendly materials that could be used to produce specific products.

Ontario Catholic School Graduate Expectations

CGE2b - reads, understands, and uses written materials effectively;
CGE2c - presents information and ideas clearly and honestly and with sensitivity to others;
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.
CGE7g - respects and understands the history, cultural heritage, and pluralism of today's contemporary society.

Prior Knowledge & Skills

A working knowledge of computer operations such as word processing, creating graphics, printing, and file management is required. It is assumed that students have some knowledge of Internet research techniques. Students must be familiar with computer usage regulations as defined at the local level. Students with little or no knowledge in computer operations should be paired with students who have expertise. Students should also be familiar with library research techniques and the Dewey Decimal System of cataloguing books. Students should have knowledge of timelines gained in the Grade 10 History course.

Planning Notes

As this is primarily an investigative activity, teachers need to ensure that students have access to a variety of resources. Resources include access to the Library/Resource Centre and computer lab equipped with access to the Internet. In order to help students visualize a timeline, teachers may wish to prepare an example ahead of time. This can be laminated and posted on the wall in the technology lab. A technology timeline indicating the various forms of technologies used over the centuries could be used, i.e., Stone Age, Bronze Age, Iron Age, Pre-Industrial Revolution, Industrial Revolution, and the Modern Age (Air Age, Space Age, Information Age). Teachers provide students with glue, scissors, old magazines, bristol board, construction paper, banner paper, and markers.

Teaching/Learning Strategies

Day 1: Introduction and Top Ten List

- The teacher introduces the topic of inventions by asking students to write down as many modern inventions as they can on a piece of paper within a given time frame (approximately five minutes). Next, students rank the inventions they have written down in terms of their importance to society. They then form groups of three or four and share their ideas. In their groups, students try to come to a consensus as to what they feel are the "Top Ten" inventions of the century. The teacher should remain as vague as possible when delivering this particular instruction and allow students to form their own criteria for judging. The results for each group should be written down on chart paper and posted around the classroom.
- The teacher leads students in a discussion as the class tries to come up with a Top Ten list of the most important modern inventions. Opinions will vary according to the criteria of the respective groups. Once students come to a consensus on the criteria, the class compiles its Top Ten list. Students must be able to support their opinions clearly and intelligently. Chances are the inventions listed will have something to do with improving the quality of life for humans and other living things.
- The teacher leads students in a discussion on the moral and ethical values underlying the development of some modern inventions. This activity may lead to controversial issues (e.g., genetic engineering, weapons technology), and teachers should use discretion in leading discussions so that they comply with Catholic education guidelines.

Days 2 and 3: Timeline Activity

- The teacher introduces students to the concept of timelines and asks them to draw a horizontal line, measuring 20 cm, on a piece of paper. Students then place a mark on the line for every centimetre. The start of the line represents the year they were born. Each mark after that represents one year. Students recall some of the most memorable achievements in their lives thus far and record them on the timeline above or below the appropriate year. Is there something recorded for every year since they were born?
- Students form groups of three to four and develop a timeline to trace the technological developments throughout history in one of the following areas: agriculture, health and medicine, communication technology, transportation, entertainment and amusement, weaponry, architecture, music and the arts, etc. Teachers should encourage students to examine the contributions of Canadians and/or women or minority groups. The World Wide Web has many sites on inventions and their inventors. The timelines could be computer-generated with clip art, hand-drawn images, or pictures cut out from magazines depending on student abilities.
- The stories behind the inventions and their inventors are as fascinating as the inventions themselves. How inventors get their inspirations for their ideas is considered in the next activity. Students make notes of resources that provide the stories behind the inventions; they will prove useful in Activity 2: Life Cycle of a Product.

Assessment & Evaluation of Student Achievement

Students are assessed on their ability to research and prepare a timeline showing the technological advancements throughout history in a field of their choice. Informal assessment takes place during class discussions as to the amount and quality of student participation. An assessment rubric has been provided in Appendix 3.2 to evaluate the process.

Accommodations

This activity can be adapted as to amount of individual research required and degree of effort required in completing the timeline:

- Students can be given the choice of completing the timelines individually or in small groups.
- The technology timeline could be completed as a class and displayed around the room using poster paper.
- Students with artistic abilities may choose to paint a mural in the technology lab, Library/Resource Centre, or main lobby of the school.
- In researching the inventions, individual students may be paired with students with more advanced knowledge or skills in communications or computer applications.
- Teachers may allow hand illustrations or pictures cut from magazines in place of computer-generated images or allow extra time to complete the computer imaging deliverable.
- Teachers should consult student IEPs.

Resources

Websites

The Canada Science and Technology Museum – www.science-tech.nmstc.ca/

The Leonardo Museum – www.leonet.it/comuni/vincimus/invinimus.html
A website dedicated to the inventions of Leonardo DaVinci

www.inventorsmuseum.com/
Lists all sorts of inventions and their inventors. Provides brief accounts of the stories behind the inventions.

National Inventors' Hall of Fame Index of Inventions – www.invent.org/book.book-index.html
American website that lists all inventions and inventors in an index organized alphabetically.

http://inventors.about.com/science/inventors
A website that is dedicated to past, present, and future inventors. It contains links to famous inventions and inventors as well as recognizes Black, Canadian, Chinese, and women inventors and their inventions.

Software

The New Way Things Work. 1994. ISBN 0-7894-3896-8 – a CD-ROM developed by David Macaulay based on the popular book *The Way Things Work*. This CD-ROM provides students with the opportunity to learn about the latest technologies, promotes active learning, and allows students to test their knowledge of scientific principles. It serves as an excellent reference for students when investigating the scientific principles behind inventions.

Glakslar – compact- Inventions. 2000. ISBN 1-892898-12-8 – a CD-ROM developed by Mega Systems USA that contains 3-D animations, detailed illustrations, and text written by experts on inventions in transportation, energy, communications, etc. The CD-ROM comes equipped with a knowledge browser to assist students in locating their invention. It also contains an Internet research function to further assist in researching the invention. The software provides information on why and when inventions took place, as well as information on who was responsible for the inventions.

Activity 2: Investigating the Life Cycle of a Product

Time: 300 minutes

Description

Whereas the previous activity examined the impact of modern inventions on society, this activity is designed to teach students how an idea for an invention is developed into a marketable product. Students select a product or process and identify the major steps in its development – idea generation, design process, patents, research, testing, manufacturing, marketing, advertising, and distribution. Students use and integrate the Catholic faith tradition in selecting a product that clearly supports the development of a just and compassionate society. Students also investigate the requirement for standards in Canada as well as industry testing for various products. Students gain the necessary skills for developing their own ideas in subsequent activities and are introduced to a variety of career possibilities in the design industry.

Strand(s) & Learning Expectations

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

Overall Expectations

TFV.01 - demonstrate an understanding of how the design process is used to create products or services for the marketplace;
TFV.04 - describe manufacturing and construction materials and techniques related to their projects;
ICV.04 - describe design-related careers and their educational requirements.

Specific Expectations

TF2.02 - describe materials that are appropriate for the manufacture or construction of given projects;
TF2.03 - describe appropriate methods of manufacture or construction for given projects;
SP1.04 - create displays of the finished products using computer graphics, posters, or multimedia productions;
IC1.02 - identify design issues, such as production costs, instructional materials for assembly and use, special design needs related to controls and instrumentation, safety issues in handling products, and product durability;
IC2.01 - identify alternative environmentally friendly materials that could be used to produce specific products;
IC2.02 - explain various methods of handling materials and reducing waste;
IC3.01 - identify a variety of design-related careers.

Ontario Catholic School Graduate Expectations

CGE2b - reads, understands, and uses written materials effectively;
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;
CGE4g - examines and reflects on one's personal values, abilities, and aspirations influencing life's choices and opportunities;
CGE5b - thinks critically about the meaning and purpose of work;
CGE5h - applies skills for employability, self-employment, and entrepreneurship relative to Christian vocation.

Prior Knowledge & Skills

A working knowledge of computer operations such as word processing, creating graphics, printing, and file management is required. It is assumed that students have some knowledge of Internet research techniques. Students must be familiar with computer usage regulations as defined at the local level. Students with little or no knowledge in computer operations should be paired with students who have expertise.

Planning Notes

- Teachers need to ensure that students have access to a variety of resources. Resources include access to the Library/Resource Centre and computer lab equipped with Internet capabilities. Examples of flowcharts depicting the development of a product should be prepared in advance as a reference for students. Examples of flowcharts can be found in assembly instructions for a variety of products, science textbooks (water cycle), computer programming texts, etc. Teachers provide students with poster board, scissors, glue, and some old magazines.
- A local inventor could be contacted and invited to speak at your school. Canadian patents are a matter of public record and contain the name(s) of the individual(s) to which the patent is registered as well as the date of expiry. The name of the individual can then be located in the local phone book.
- Teachers need to familiarize themselves with the patent process in Canada. The website http://cipo.gc.ca provides an on-line tutorial for completing and submitting a patent application. Criteria for patent application can also be found on the website. Teachers should prepare copies of the patent application in advance for students to practise before going on-line.

Teaching/Learning Strategies

- The teacher introduces students to the concept of flowcharts by having them complete a flowchart together as a class. A flowchart is a combination of words, symbols, and pictures used to show the steps involved in a particular process. A flowchart helps make it easier to understand the process and also helps in the planning process to help meet deadlines. A flowchart can identify where a process may be stopped because an important step could not be completed. Flowcharts are particularly useful if there is a language barrier. Consider, for example, the instruction pamphlets for preparing for an emergency landing of an airplane.
- The teacher asks students how to make a ham and cheese sandwich, wooden chair, or some other item. Identify the first step and write it on the board. Give this first step a symbol. Next, draw an arrow to indicate moving on to the next step. Continue to do the same for the remaining steps until the process is complete. Examine the flowchart. Are the steps in a logical order? Are there any steps missing? Is there a step for inspecting the product? Can the process be communicated without using any words? Is the flowchart easy to understand?
- Students then select a product or process and identify the major steps in its development – idea generation, design process, patents, research, testing, manufacturing, marketing, advertising, and distribution. In addition to the processes involved, students should try to identify as many careers as possible involved in the development of the product of their choice. The flowchart should be in the form of a poster and list the possible careers associated with each step in the process.
- Students present their flowchart to the rest of the class.

Assessment & Evaluation of Student Achievement

Students are assessed on their ability to access and find information on the life cycle of a product. Assessment is similar to timeline activity – evaluation of poster board.

Evaluation	
Research Skills	/10
Organization	/10
Content	/10
Use of Diagrams	/10
Presentation	/10
Total	**/50**

Accommodations
This activity can be adapted as to the amount of individual research required and time commitment required in completing deliverables. Teachers may opt to provide more guidance or define requirements for simpler designs. Individual students may be paired with students with more advanced knowledge or skills in communications or computer applications.

Resources
Canadian Intellectual Property Office – http://cipo.gc.ca
Provides information on obtaining patents for newly developed products. Offers an on-line tutorial for completing a patent application.

Industry Canada – www.ic.gc.ca
Provides information on employment opportunities in the technology industry. Contains link to the SchoolNet Youth Employment Initiative – a program established by the national government to help students find employment in industry. Offers an online tutorial for completing a resume and submitting it to an employer.

The Learning Partnership. *We CAN Invent! 10 Practical Steps to Invention*.
www.tlp.on.ca/telephone 416 204-4478

www.howthingswork.com
A website that describes how everyday objects work.

Activity 3: Protecting Our Children: Safety Design Challenge
Time: 600 minutes

Description
In this group activity, students investigate the safety issues around existing products related to children according to the standards of the Canadian Standards Association (CSA). Students identify safety hazards in the home, school, and workplace and are required to design age-appropriate safety solutions. Students are required to fully document and research the development of their solutions and develop appropriate methods for testing these solutions in compliance with CSA standards. In researching their solutions, students investigate the principles on which patents are granted as well as the patent process in Canada. All groups demonstrate their solutions.

Strand(s) & Learning Expectations
Strand(s): Theory and Foundation, Skills and Processes, Impact and Consequences

Overall Expectations
TFV.03 - determine appropriate solutions to design problems;
ICV.01 - identify factors that must be considered when designing for the consumer marketplace (e.g., costs, materials, safety, durability);
ICV.02 - identify environmental concerns related to the development, use, and disposal of manufactured goods.

Specific Expectations
TF1.01 - describe user requirements, design criteria, and ways of developing and testing solutions;
TF1.02 - justify design decisions that involve alternative approaches;
TF2.02 - describe materials that are appropriate for the manufacture or construction of given projects;
TF3.02 - evaluate solutions based on given design criteria;
SP1.03 - fabricate models and prototypes for analysis and testing using standard safety procedures;

SP2.01 - produce appropriate design briefs based on their analysis of user needs and on consumer product research;
SP2.03 - evaluate design solutions to determine how well they suit the design criteria;
IC1.01 - assess project solutions in terms of safety, ergonomics, and efficiency;
IC1.02 - identify design issues, such as production costs, instructional materials for assembly and use, special design needs related to controls and instrumentation;
IC1.03 - describe problems that can result from improper design.

Ontario Catholic School Graduate Expectations
CGE1d - develops attitudes and values founded on Catholic social teaching and acts to promote social responsibility, human solidarity, and the common good;
CGE3b - creates, adapts, and evaluates new ideas in light of the common good;
CGE3c - thinks reflectively and creatively to evaluate situations and solve problems;
CGE4f - applies effective communication, decision-making, problem-solving, time, and resource management skills;
CGE5a - works effectively as an interdependent team member;
CGE5c - develops one's God-given potential and makes a meaningful contribution to society;
CGE7i - respects the environment and uses resources wisely.

Planning Notes

- Students design and fabricate their own safety inventions or alterations thereof. As a result, they are required to develop testing procedures to ensure that their products meet certain standards. Students can gain a better appreciation of this testing process if they see its application in the real world and are exposed to alternative career options. The Canadian Standards Association is an organization that tests all sorts of products to meet industry standards before they enter the market. The CSA head office is located in Etobicoke, ON (phone 416-747-4000). Teachers may wish to call in advance to organize a class visit or have a CSA representative come to the school.
- The CSA website (www.csa-international.org) contains an extensive list of the types of products that CSA certifies. There are many options for product certification available and CSA provides a step-by-step on-line tutorial to help you get products certified according to current industry standards. Teachers should ensure that students have access to computers with Internet capabilities so this information may be accessed.
- In the event that students elect to produce a safety video or computer-generated prototype, teachers make arrangements in advance to ensure that the appropriate resources are available (e.g., video camera, television, video editing equipment, digital camera, photo-editing software, etc.).
- Teachers should have examples of safety devices on display in the classroom. Safety goggles, ear protection devices, welding masks, rubber gloves, hard hats, safety shoes, and safety posters are some examples. Other examples include devices for childproofing the home. There are local merchants who are devoted specifically to this end and can be found in the local phone book. There are also merchants, available on-line, who provide pictures and detailed descriptions of their products.
- Students should be given the opportunity to visit the CSA website to obtain information on product testing and certification. Teachers may wish to download the information ahead of time and make copies for students. Links entitled "Products we certify" and "How to get your product certified" should prove helpful.

Teaching/Learning Strategies

Day 1

- In order to help students develop inventive thinking, the teacher provides students with examples of stories behind some important inventions. Students may share stories from their research in the previous activity. After reading or listening to the stories, ask students "How did the inventors get their ideas? How did they make their ideas a reality?" Discuss the following statement: "Necessity is the mother of invention." What does this mean? Does this apply to all inventions?
- Next, ask students "If you could invent anything in the world, what would it be? Is this invention possible? What are some of the obstacles in the way of the development of your invention? Has this invention already been invented? How will you find out?"

Day 2

- The teacher introduces students to the patent process. The Canadian Intellectual Property Office defines a patent as "a government grant giving you the right to exclude others from making, using, or selling your invention." The website (http://cipo.gc.ca) has information on obtaining patents for newly developed products. It outlines specific criteria for patenting an invention and also offers an on-line tutorial for completing a patent application. Students need to have access to the computer lab. The teacher prepares copies of the patent application in advance so students can practise before going on-line.
- Students look around the room for inventions. Most tools and machines have a patent number on them. Ask students to record the inventions and their patent numbers. Patents can be researched to find out to whom the patent is registered and the date the patent expires. The patent numbers can then be researched on Canadian and American websites. In some cases, patent offices from other countries may have to be contacted.

Day 3

- The teacher reviews with students the technology lab safety policies and procedures. A discussion as to why the policies and procedures are in place may be required. The discussion could extend to identifying safety hazards in school or in the workplace. Students could identify safety hazards associated with some of the careers they discovered in Activity 2: Life Cycle of a Product. Students can survey family members and neighbours about accidents they have witnessed in the workplace. Some students may have participated in the "Take Our Kids To Work" program in Grade 9 and may wish to share their experiences. Teachers may wish to contact a representative from the Worker's Compensation Board to come to the school to speak about some of the safety hazards that exist in the workplace. At this time the Design Brief and criteria are presented and students are given time to start generating ideas. The teacher makes copies of Appendix 3.3 – Protecting Our Children: The Safety Design Challenge. This design brief provides students with a clear description of what is required and how they are to be evaluated.

Days 4 to 8

- Students are given class time to work on their designs, test ideas, and conference with the teacher.

Day 9

- Students share their idea solution with the class in the form of a brief oral presentation. Students should be given the choice of whether they would like to work in groups or individually. Groups should consist of a maximum of four students.

Assessment & Evaluation of Student Achievement

Students are assessed based on the marking scheme provided in Appendix 3.3 – Protecting Our Children: The Safety Design Challenge. Students are assessed on their ability to complete a written report documenting the development of their solution, and on the solution itself. The solution is evaluated on the functionality of its design and the aesthetics of the finished prototype. Students are required to demonstrate their solution and are evaluated on their ability to work safely during the development of their prototype.

Accommodations

- This activity can be adapted to amount of individual research required and time commitment required in completing deliverables. Teachers may opt to provide more guidance or define requirements for simpler designs. Individual students may be paired with students with more advanced knowledge or skills in communications or computer applications.
- It is important that students, when designing any product, take into account safety considerations around their product. Since the focus of the activity is on the design process, some students may be given the option to develop a detailed drawing of their solution, using manual or CAD drawing techniques, without fabricating their design. Other groups or individuals may devote more time to developing an actual prototype.

Resources

Canadian Standards Association – www.csa-international.org
Official website offers information on testing procedures for new products.

Canadian Intellectual Property Office – http://cipo.gc.ca
Provides information on obtaining patents for newly developed products. Offers an on-line tutorial for completing a patent application.

Activity 4: Technology, Amusement, and Leisure

Time: 720 minutes

Description

The previous activities provided students with a serious look at technology's ability to transform society. In this culminating activity, students develop an appreciation for the ways in which technology has been used in the past and present to provide amusement and leisure to children and adults of all ages. Students design and fabricate a device that provides amusement and/or leisure for a specified age group. Students have the choice of developing a board game, carnival game, a Rube Goldberg gumball machine, or their own idea. The devices are developed around a theme appropriate for the chosen age group and are displayed throughout the classroom.

Strand(s) & Learning Expectations

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

Overall Expectations

TFV.01 - demonstrate an understanding of how the design process is used to create products or services for the marketplace;
TFV.03 - determine appropriate solutions to design problems;
SPV.02 - fabricate projects or displays using hand and power tools safely;
SPV.04 - evaluate solutions against design criteria;
ICV.03 - use tools and materials safely to fabricate products.

Specific Expectations
TF2.01 - use technical illustrations, drafting, computer graphics, and models to present ideas and solutions effectively;
TF2.02 - describe materials that are appropriate for the manufacture or construction of given projects;
TF2.03 - describe appropriate methods of manufacture or construction for given projects;
SP1.03 - fabricate models and prototypes for analysis and testing using standard safety procedures;
SP1.04 - create displays of the finished products using computer graphics, posters, or multimedia production;
IC1.01 - assess project solutions in terms of safety, ergonomics, and efficiency;
IC1.02 - identify design issues, such as production costs, instructional materials for assembly and use, special design needs related to controls and instrumentation, safety issues in handling products, and product durability.

Ontario Catholic School Graduate Expectations
CGE1d - develops attitudes and values founded on Catholic social teaching and acts to promote social responsibility, human solidarity, and the common good;
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;
CGE3b - creates, adapts, and evaluates new ideas in light of the common good;
CGE3c - thinks reflectively and creatively to evaluate situations and solve problems;
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;
CGE4f - applies effective communication, decision-making, problem-solving, time, and resource management skills;
CGE5a - works effectively as an interdependent team member;
CGE7g - respects and understands the history, cultural heritage, and pluralism of today's contemporary society;
CGE7i - respects the environment and uses resources wisely.

Prior Knowledge & Skills
Students should complete the previous activities before commencing Activity 4. In completing the activities, students have gained knowledge in generating ideas for inventions, documenting and designing their invention, and establishing criteria and testing procedures for determining the success of their idea. Students should have an understanding of how to use tools, machines, and materials safely. Students should have knowledge of simple machines (e.g., wheel and axle, lever, inclined plane, screw, pulley, etc.).

Planning Notes
- Since this activity revolves around the design and fabrication of a toy or game that provides amusement, teachers need to gather examples of old toys and games. A visit to a local thrift store should provide many examples at a low cost. Students could be asked to survey their parents and grandparents and bring in a toy that belonged to their parents.
- Examples of Rube Goldberg machines can be found on the website www.rube-goldberg.com/ - a website dedicated to Rube Goldberg, an engineer and cartoonist who drew his "inventions" as contraptions that satirized the new technology of the day. The website lists rules and regulations as well as tips for designing and making an effective Rube Goldberg machine.
- Teachers should ensure that students have access to sufficient tools, machines, and materials required to carry out the fabrication of their invention. Teachers reserve the Library/Resource Centre and computer lab for research purposes. Design briefs are prepared in advance to clearly outline the purpose and parameters of the activity.

Teaching/Learning Strategies

Day 1: Introduction

- The teacher begins by leading a discussion on toys and games that students played when they were younger. Students also investigate the ways in which their parents and grandparents amused themselves when they were younger. Students note the changes and trends in the toy and game industry over the years. The teacher asks, "What were the hottest toys last Christmas, and this year? What are the popular toys and games of the day? Why are they popular? How much do they cost? For which age levels are these toys appropriate?" The discussion allows students to generate ideas for their own inventions of a toy or game.
- Students may design and fabricate a carnival game. Ask students if they have ever been to a carnival, fair, or amusement park. The Canadian National Exhibition and Paramount Canada's Wonderland are excellent examples and perhaps the most recognizable by most students. Some students may have stories about similar attractions from their native country. Ask them what they liked and disliked about the carnival. What sorts of things can one do at a carnival? What types of games and attractions can be found at a carnival that can't be found anywhere else? The focus of this activity is not to design an amusement ride but rather a game of skill or chance.
- The teacher introduces students to Rube Goldberg machines by having them visit the website or providing an example of a Rube Goldberg cartoon. For an example of a Rube Goldberg machine in action, the teacher may show students a video clip from the movie *Back to the Future Part 1*. It takes place at the beginning of the movie and illustrates a series of inventions that operate in a logical sequence to complete the task of opening up a can of dog food, placing its contents in a dish, and cooking breakfast (toast and eggs) at the same time. It may be an example which is beyond the abilities of some students but others may be inspired to use electronics, mechanics, pneumatics, and hydraulics in the fabrication of their own Rube Goldberg machine.

Day 2: Group Formation and Brainstorming

- Once students have been introduced to the three activities above, they are required to select one or their own alternative. Students then form groups based on similar interests. Take students to the computer lab and/or Library/Resource Centre to further research their ideas.

Day 3: Written Proposal and Materials List

- Each group prepares a written proposal clearly outlining what they wish to make. The written proposal must be accompanied by dimensioned drawings and a list of required materials and tools. Once proposals are submitted, the teacher issues a patent to each group preventing other groups from making a similar game or toy. This relates back to Activity 3.2: Life Cycle of a Product. Students must submit their design ideas and a materials list for the teacher's approval before they begin fabrication.

Days 4 to 9: Fabrication Process

- Students work together to develop their designs and fabricate their solutions. The teacher provides students with the materials required for completing the projects. The teacher demonstrates new techniques and machines as required.

Day 10: Testing

- Students are responsible for developing appropriate testing procedures for their invention. Students may have already tested their invention during the fabrication process.

Day 11: Modifications

- Students use this time to make any last-minute adjustments to their invention based on their test results.

Day 12: Activity Day

- Students display their projects around the classroom and demonstrate their inventions.

The teacher encourages students to be creative and have fun developing their invention. The teacher guides students to the completion of their project, distributes materials and equipment, introduces new technologies, and demonstrates safe operation of tools and equipment as required.

Assessment & Evaluation of Student Achievement

Focus should be placed on the designing and fabrication processes. Students are assessed on their final product and presentation to the class with the use of a rubric (Appendix 3.6). A design report is not required. However, students are required to keep a daily log to record their progress (Appendix 3.5). Students are also evaluated on the other aspects involved in the development of the projects, such as their written proposal, materials list, etc. (Appendix 3.4).

Accommodations

- As an extension for students who decided to design a carnival game, they could use the games that they design in planning an activity day at the school. The proceeds could be donated to charity or used to improve the school in some fashion. This activity can be combined with the next unit in which students are required to draw up a site plan of a fair.
- Ensuring that students have plenty of choices for the type of game they design and how they fabricate the model also helps all students be successful. Students can choose designs and fabrication techniques based on their skill level and strengths. Also providing construction kits can be a challenging substitute for many special needs students.

Resources

www.rube-goldberg.com/
A website dedicated to Rube Goldberg, an engineer and cartoonist who drew his "inventions" as contraptions that satirized the new technology of the day. This website lists rules and regulations as well tips for designing and making an effective Rube Goldberg machine.

The Incredible Machine – game on CD-ROM that teaches students to develop solutions to a variety of challenges using simple machines and devices. Students arrange the devices accordingly and then immediately test their solutions. The challenges range from simple to complex. There is no one correct solution for a particular challenge, allowing for a variety of possible solutions.

The Even More Incredible Machine – the successor to the original game on CD-ROM with new and exciting challenges and devices.

Pinball Science – a CD-ROM developed by David Macaulay that allows students to build their own exciting pinball games using a variety of objects and mechanical devices. Before using the objects, students are required to visit the "Inventor's Journal" to learn the science behind the invention. This game can serve as a fun way of generating ideas for their own inventions. The CD can be purchased by contacting DK Interactive Learning 95 Madison Avenue, New York, NY 10016 or www.dk.com

The New Way Things Work - a CD-ROM developed by David Macaulay based on the popular book *The Way Things Work.* This CD-ROM provides students with the opportunity to learn about the latest technologies, promotes active learning, and allows students to test their knowledge of scientific principles. It is an excellent reference for students when investigating the scientific principles behind inventions.

Rube Goldberg Inventions 30 Postcards. 1996. ISBN 1-55670-524-7

Video

Back to the Future Part 1. 1985.

Appendix 3.1

Design Brief for Timeline Activity

Introduction
Throughout history, advancements in technology have had a profound impact on society and have changed the way in which we live. A timeline provides us with a visual representation of the speed with which technology has influenced society. In this activity, your group selects a particular area and develops a timeline to show how technology has changed this area over time.

Problem
Students form groups of three to four and develop a timeline to trace the technological developments throughout history in one of the following areas:

- Agriculture and Food Processing
- Health and Medicine
- Communication Technology
- Transportation
- Entertainment and Amusement
- Weaponry
- Music and the Arts
- Construction and Architecture
- Manufacturing
- Sports and Leisure

Limitations and Specifications

- Groups are to consist of a maximum of four students.
- One group per topic.
- A minimum of ten major events is required.
- Three of the events must be contributions by Canadian and/or women or minority groups.
- Exact dates and names of persons are preferred but not required.
- Completed timelines should be in the form a poster or paper banner.
- Pictures of the inventions are preferred but not required.

Evaluation

Organization	/10
Content	/10
Use of Diagrams	/10
Presentation	/10
Total	**/40**

Appendix 3.2

Assessment Rubric for Timeline Activity

	Level 1 (50 – 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Knowledge/ Understanding TVF.01, TF1.03	- demonstrates limited understanding of the historical development of designed products and services	- demonstrates some understanding of the historical development of designed products and services	- demonstrates considerable understanding of the historical development of designed products and services	- demonstrates thorough and insightful understanding of the historical development of designed products and services
Thinking/ Inquiry ICV.02, IC1.03, IC2.01	- demonstrates limited understanding of the impact of inventions on humans and the environment	- demonstrates some understanding of the impact of inventions on humans and the environment	- demonstrates adequate understanding of the impact of inventions on humans and the environment	- demonstrates insightful understanding of the impact of inventions on humans and the environment
Finished Product SPV.02, SP1.04	- finished timeline shows limited evidence of research	- finished timeline is clearly presented and provides evidence of some effort	- finished timeline is clearly presented and provides evidence of creative software use	- finished timeline is presented with professional quality

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

Appendix 3.3

Protecting Our Children: The Safety Design Challenge

Problem Situation
Dangers of many kinds threaten children the world over. Children's health and safety are a common concern. Children of the world face different sorts of problems, environmental hazards and the results of technological developments. Hazards include traffic accidents, illnesses, dangers from household products, and even toys.

Design Brief
Design and develop a solution to protect a child from a problem, danger, and/or hazard of your choice. This danger can be found in the home, playground, at school, or in a vehicle. Your solution can be something entirely new or a modification of an existing product. The solutions can range from ingeniously simple to complex and sophisticated and use locally available resources to reduce the risk of harm to children.

Specifications and Limitations
1. Identify a problem.
2. Develop a problem statement to fit the chosen problem.
3. Develop a design brief to fit the chosen problem.
4. Specify the age level of the children and the current safety standards related to the problem.
5. Use a design process to document the process.
6. The solution must be safe and usable by the intended audience.
7. The solution should be appropriately tested, if time permits.
8. The solution can be a modification or improvement of an existing idea.

Documentation
Include:
- title page;
- table of contents;
- identification of the problem;
- brainstormed ideas;
- investigation and research notes;
- selection and development of solution (e.g., fabrication process);
- standards and results of testing;
- evaluation of solution with suggested improvements.

Evaluation

Written Report	/35
Functionality of Design	/25
Finished Prototype/Aesthetics	/15
Demonstration of Solution	/15
Safety Work Habits	/10
Total	**/100**

Appendix 3.4

Design Brief for Technology, Amusement, and Leisure

Situation
Throughout history, humans have always strived to find ways of improving the quality of life. Archaeologists have uncovered many clues about the ways in which past civilizations gathered food, built shelters and socialized with one another. They have found weapons, tools, utensils, and even primitive games to support their findings. As humans became more technologically advanced, less time was spent doing work. Less work meant more spare time. Thus the need to occupy this spare time arose and so did ways in which to occupy that time.

Problem
Design and construct a device or game that provides amusement and/or leisure for a specified age group. Select from one of the following:

- Develop a board game with complete rules, game pieces, and board.
- Develop a carnival game or other game of skill or chance.
- Develop a child's toy.
- Develop a Rube Goldberg gumball machine.
- Other (must be approved by teacher).

Specifications and Limitations

1. The age group for the device must be specified.
2. The device must be designed around a theme appropriate for the age group.
3. Students must submit a written proposal describing their device (patent process).
4. A materials list, including all required tools, machines, and materials, must be submitted.
5. A complete list of rules and/or instructions must accompany the device.
6. The device or game MUST be original or an ingenious modification of an existing product.

Evaluation

Written Proposal	/10
Materials List	/10
Functionality of Design	/25
Finished Prototype/Aesthetics	/20
Demonstration of Solution	/10
Safety Work Habits	/10
Daily Log	/15
Total	**/100**

Appendix 3.5

Student Checklist for Daily Work Habits

Name:

Course:

Teacher:

	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F
I arrived to class on time.															
I was prepared for class (materials, pen, uniform, etc.).															
I observed all safety rules and procedures.															
I utilized all tools properly.															
I used resources wisely (recycled materials).															
I cooperated with the teacher and other students.															
I completed my task set out for the day.															
I helped someone with his/her project.															
I put away all tools and materials that I used.															
I helped clean up the classroom.															
Daily Total /10															
														Unit Total	**/150**

Appendix 3.6

Assessment Rubric – Technology, Amusement, and Leisure

Categories	Level 1 (50 – 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Knowledge/ Understanding Knowledge of scientific principles and facts around the development of toys, games, and other amusement devices. TFV.01	- demonstrates limited evidence of grasping the terminology and scientific concepts behind amusement devices	- displays some knowledge and some of the concepts involved in the development of amusement devices but has difficulty applying this knowledge	- demonstrates considerable understanding of most of the scientific concepts presented and is able to articulate the terminology of the concepts and apply knowledge to a considerable extent	- clearly demonstrates an understanding of the concepts and is able to transfer this understanding to other areas of concern
Research and Planning Research specific individual needs around amusement and leisure and develop a plan of action to help students manage their time effectively. TF2.01, TF2.02, TF2.03, TFV.03, IC1.02	- limited or no evidence of research around amusement devices	- investigates a some of resources with a view to creating an identifiable solution	- investigates a wide range of possibilities	- demonstrates a clear knowledge of the resources available
Use of tools and materials Constructing a model or prototype of an amusement device that is effective and demonstrates the wise use of materials. SPV.02, SP1.03, ICV.03	- exhibits few of the necessary skills to achieve the solution; skills with tools require more time and practice; shows limited regard for wise use of materials	- has mastered some of the necessary skills; shows some regard for wise use of resources	- demonstrates a mastery of most of the skills required to implement the plan	- uses and develops skills to create the solution as planned; displays accuracy with all the tools used

Categories	Level 1 (50 – 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Testing and Evaluation Formulating fair and honest testing criteria based on CSA standards with a view to future developments. TF1.01, SPV.04, SP1.03, IC1.01	- considers very limited criteria for testing according to CSA standards	- considers some of the criteria in testing the solution and the materials used in accordance with CSA standards	- gives a fair and honest evaluation of the solution which meets most CSA standards	- a fair and honest means of testing and evaluating their solution while meeting CSA standards
Presentation Oral and/or visual presentation clearly demonstrates the function of their amusement device. SP1.04	Quality of presentation indicates lack of preparation by most members and limited knowledge of the operation of their amusement device. The presentation generates limited class interest.	Some members contribute to the development of the presentation. Some knowledge of the operation of their amusement device are evident. The presentation generates some class interest.	Most members contribute and participate in the presentation. A clear attempt is made to utilize at least two presentation techniques. The presentation elicits moderate class interest and excitement.	All members participate in the group presentation. A variety of presentation methods are used effectively to clearly demonstrate an understanding of their amusement device. The presentation and device clearly elicit complete class involvement and excitement.

Formulated with information from: Day, et al. *By Design: Technology Exploration and Integration.*

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

Unit 4: Applications of Design

Time: 35 hours

Unit Description

In this culminating unit, students apply learned communication, decision-making, and problem-solving skills to challenges in theatre and film production design. Students explore the development of design solutions through the development of technical drawings, illustrations, models, test models, fabricated products, proposals, and reports. Skills developed in this unit can be applied to a wide variety of careers in architecture, industrial design, and fashion or theatre/film production.

Unit Synopsis Chart

Activity	Time	Expectations	Assessment	Tasks
4.1: Reproducing History for Film or Video	15 hours	TFV.02, TFV.03, TF1.03, TF2.01, TF2.02 SPV.01, SPV.02, SP1.01, SP1.02, SP1.03 ICV.03, IC2.03	Knowledge Inquiry Communication Application	Generate artefacts or costumes from a historical period as portrayed in film or video.
4.2: Theatre Set Design and Production	20 hours	TFV.01, TFV.02, TFV.03, TF1.01, TF1.02, TF2.01 SPV.01, SPV.02, SPV.03, SP1.01, SP1.02, SP1.03, SP2.03 ICV.03, IC1.01, IC1.02, IC2.03	Knowledge Inquiry Communication Application	Design and construct a theatre or video set.

Activity 1: Reproducing History for Film or Video

Time: 900 minutes

Description

Students develop drawings and models of costumes or props, based on a selected time period, for a film or TV production. This activity includes historical research, illustration, technical drawing, model building, and fabrication techniques. Skills acquired in this activity can be used in such fields as film or TV production, fashion, theatre production, or architectural restoration.

Strand(s) & Learning Expectations

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

Overall Expectations

TFV.02W - create effective technical drawings using standardized drawing practices;
TFV.03W - determine appropriate solutions to design problems;
TFV.04W - describe manufacturing and construction materials and techniques related to their projects;
SPV.01W - illustrate their design solutions effectively using a variety of technical drawing methods that conform to industry drafting conventions;
SPV.02W - fabricate projects or displays using hand and power tools safely;
ICV.03W - use tools and materials safely to fabricate products.

Specific Expectations
TF1.03W - describe the historical development of a variety of designed products and services;
TF2.01W - use technical illustrations, drafting, computer graphics, and models to present ideas and solutions effectively;
TF2.02W - describe materials that are appropriate for the manufacture or construction of given projects;
SP1.01W - draw appropriate technical illustrations using industry-standard practices, including lettering techniques, scales, and symbols;
SP1.02W - produce correct orthographic or pictorial technical drawings (e.g., floor plans, perspectives and elevation views, section and assembly drawings) using traditional or computer-based methods;
SP1.03W - fabricate models and prototypes for analysis and testing using standard safety procedures;
IC2.03W - handle tools and materials safely.

Prior Knowledge & Skills

This activity builds on knowledge and skills obtained in previous activities. Students should know basic research techniques, modelling, drawing conventions and techniques (both manual and computer-based), basic material properties, and safe fabrication techniques. Safety should be reinforced throughout the activity.

Planning Notes

- A commercial film depicting a specific time period is chosen and reviewed by the teacher before initiating the activity. Example genres may include westerns, medieval times, or films based on specific decades, such as the 1930s or 1960s. The teacher must review films beforehand to ensure suitability and select specific scenes to use. The teacher should also consult the Drama Department or community theatre groups for possible curricular tie-ins. Books or magazines related to the time period may be collected before initiating activity.
- The teacher determines the project focus (e.g., costumes, transportation vehicles, furniture, or public structures). The focus could include medieval armour, historical uniforms, early Canadian kitchenware, and 1800s farm implements. The teacher also predetermines the activity deliverables (e.g., the extent or scope of technical drawings and models, amount of required research, and whether the final products are scale models or full size). Artistic licence is allowable; the main idea is to retain the "flavour" of the time period.
- This activity can be used as the culminating performance task for the course. Teachers may decide to complete this activity after or during Unit 4, Activity 2. (Activity 2 is group-based and may make individual marking problematic). This project could be integrated into Activity 2. The teacher should ensure that students have individual deliverables to evaluate term marks.

Teaching/Learning Strategies

- The teacher previews a commercial film depicting a particular time period and may, in the interest of time, find clips that best illustrates the time period and the selected design elements (e.g., architecture, costumes, transportation devices, etc.).
- The teacher initiates discussion of the task of historical re-creation and how designers examine past designs to make effective designs in the present. The teacher discusses how elements in past designs are being incorporated in present and future designs, e.g., post-modern architecture (AT&T Building, New York) or car design (Chrysler PT Cruiser).
- The teacher describes the selected task and presents the design brief (Appendix 4.1A). Students view the film or film clips, having been instructed to pay close attention to details of fashion and design of the time period. After initial viewing, students are given the opportunity to continue to review selected film clips. The use of video capture to print scenes would be helpful, if available.

- Students either work independently or are divided into partners or small teams. Students are given the challenge to reproduce, in drawings and models, elements of the historical time as shown in the film. A detailed description of this challenge is presented (Appendix 4.1A). Students are instructed to pay close attention to materials, joinery, and fabrication techniques specific to the original and to the reproduction or model. Students must verbally discuss the materials used historically as part of their assessment/evaluation.
- The teacher establishes a timetable of required element completion to ensure timelines and activity pacing are maintained. A possible timeline may be:
  - Stage 1 (2 hrs): Research, thumbnails, and initial rough sketches;
  - Stage 2 (8 hrs): Presentation of drawings, pattern, plan layouts, and CAD drawings;
  - Stage 3 (5 hrs): Model making is completed.

Stage 1: Research (approximately 2 hours, individual task)
- Students watch video clip(s), sketch items, and compare their sketches to others.
- The class discusses the chief characteristics of the time period.
- Students are directed to reference materials including films, books, and on-line information sources.
- Students choose an item to design.
- Students develop individual Design Brief/Proposal.
- The teacher conducts a review of sketching techniques, including thumbnails, roughs, comprehensives, and presentation drawings.
- Students begin sketching details, including rough dimensions of model or artefact.

Stage 2: Presentation Drawings (approximately 8 hours, team work if desired)
- Students prepare colour presentation sketches.
- Students prepare initial layouts of CAD or board drawings (may include flat patterns for garments, section drawings and/or fully dimensioned working drawings for the vehicles or artefact).

Stage 3: Model Building (approximately 5 hours, team work if desired)
- CAD drawing standards are reviewed; pattern-making and material layouts are discussed.
- The teacher approves sketches, test models, and drawings before students move to the artefact development phase;
- Students build models of artefacts using working drawings; students sew or tape costumes using flat patterns.
- Students assemble their portfolios, including design brief, rough sketches, presentation drawings, models, and/or finished products.

Students present and showcase their work. The teacher discusses features and evaluates student work.

Assessment & Evaluation of Student Achievement

Assessment should reflect completion of all elements and processes required. Portfolio elements include all thumbnails, roughs, and related research. Assessment and evaluation are based on, evidence of depth of research, and quality of portfolio. Costumes and props should reflect time period accurately, referenced to their research. Model construction should reflect attention to detail and scale. Presentation drawings, working drawings, and sketches are evaluated for attention to detail, evidence of research and attention to standards. The rubric (Appendix 4.1B) should be used in evaluating individual student work.

Accommodations

- The teacher may provide varying levels of requirements of research or project ideas, (e.g., could be more or less prescriptive in tasks, products could be prescribed or left open to proposals). The teacher may provide more direction to students in selecting and detailing assignments, particularly with respect to historical details. Drawing and/or modelling details and research reference requirements can be reduced or increased in scope and number to suit student abilities.
- The teacher should ensure that students with disabilities have access to specific equipment and tools to perform required tasks (e.g., table-top power tools, simplified modelling or drawing equipment or resources).
- For enrichment, students design and produce promotional material, such as posters for a proposed sequel, or artefacts requiring mechanisms for movement (including physical or engineering parameters). Activity deliverables may include artefact models that are functional (e.g., a catapult that works, a carriage that has moving wheels and a steering mechanism).

Resources

Books

Cummings, V. *The Visual History of Costume Accessories*. London: BT Batsford, 1998.

Hill, M. *The Evolution of Fashion: Pattern and Cut from 1066 to 1930*. New York: Reinholt, 1967.

Hollen, Norma. *Pattern Making by the Flat Pattern Method,* 4th ed. Minneapolis, Minn.: Burgess Publishing Co., 1975.

Jackson, S. *Costume For Stages*. New York: New Amsterdam Press, 1978.

Motley. *Designing and Making Stage Costumes*. London: Studio Vista, 1978.

Peacock, J. *Costume 1066-1966*. London: Thames & Hudson, 1986.

Peacock, J. *The Chronicle of Western Fashion: From Ancient Times to Present Day*. New York: McGraw Hill Ryerson, 1991.

Kenton, W. *Stage Properties and How To Make Them*. New York: Pitman, London, 1978.
ISBN 0910482977

Video

Please preview all films carefully. There may be some situations and language that are not acceptable in the classroom. Several commercial films that would be useful for this challenge, followed by possible design products that could be researched and modelled from these films include:

- *Young Sherlock Holmes* (costumes, carriages)
- *The 3 Musketeers* (costumes, carriages)
- *Those Magnificent Men and Their Flying Machines* (costumes, aircraft)
- *Dragonheart* (costumes, tents, armour)
- *Robin Hood* (costumes, carriages)

Websites

Theatre Set Design Links – http://www.artslynx.org/theatre/design.htm

http://www.theatron.co.uk

Theatre Technical Glossary – http://www.ex.ac.uk/drama/tech/glosslx.html

http://collectorspost.com/catalogue/medramalinks.htm

Activity 2: Theatre Set Design

Time: 1200 minutes

Description

Students design and build a theatre stage set (or stage set elements), based on the film examined in Activity 1 or a school or community-based play. Students research specific play requirements, previous stage work, and the director's requirements. Students draft working drawings, build models, and construct props and required structures. Students learn construction and design techniques specific to the stage and applicable to a wide variety of architectural and industrial design problems.

Strand(s) & Learning Expectations

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

Overall Expectations

TFV.01 - demonstrate an understanding of how the design process is used to create products or services for the marketplace;
TFV.02 - create effective technical drawings using standardized drawing practices;
TFV.03 - determine appropriate solutions to design problems;
SPV.01 - illustrate their design solutions effectively using a variety of technical drawing methods that conform to industry drafting conventions;
SPV.02 - fabricate projects or displays using hand and power tools safely;
ICV.03 - use tools and materials safely to fabricate products.

Specific Expectations

TF1.01 - describe user requirements, design criteria, and ways of developing and testing solutions;
TF1.02 - justify design decisions that involve alternative approaches;
TF2.01 - use technical illustrations, drafting, computer graphics, and models to present ideas and solutions effectively;
SP1.01 - draw appropriate technical illustrations using industry-standard practices, including lettering techniques, scales, and symbols;
SP1.02 - produce correct orthographic or pictorial technical drawings (e.g., floor plans, perspectives and elevation views, section and assembly drawings) using traditional or computer-based methods;
SP1.03 - fabricate models and prototypes for analysis and testing using standard safety procedures;
SP2.03 - evaluate design solutions to determine how well they suit the design criteria;
IC1.01 - assess project solutions in terms of safety, ergonomics, and efficiency;
IC2.03 - handle tools and materials safely.

Prior Knowledge & Skills

This activity builds on knowledge and skills obtained in previous activities. Students should know basic research techniques; modelling, drawing, and testing conventions and techniques; basic material properties; and safe fabrication techniques. Safety should be reviewed before initiating workshop activities.

Planning Notes

- When possible, the teacher should co-ordinate this activity with the Drama Department or local community theatre groups. The teacher may choose to continue Activity 1 by adapting this activity to commercial film or TV production sets, or students may develop sets for video productions in Communications Technology.

- The teacher must decide on the scope of the activity and the budget; a play may require several sets or set changes. The teacher may decide to have all students develop the same set in a comparative or competitive situation or may ask individual teams to build separate sets for individual acts in a play, depending on the time and resources available. The teacher may also elect to limit the deliverables to scale models of the stage set or to specific elements of a stage set, such as backdrops to increase affordability or reduce storage requirements. The important aspect of this activity is that students develop an awareness of designing for the unique world of stagecraft, which provides a series of quick problem-solving challenges that can be applied to a wide variety of industrial and architectural situations.
- The teacher may decide to develop specific props or other devices such as camera dollies or lighting rigs that can be used annually by the Drama Department or community theatre group. It is important to note that this activity does not specify such elements as lighting plots, screen painting, or curtain designs, as developing these elements would take much longer than the time allotted. For example, the teacher should prearrange the painting of backdrops, (based on design students' drawings), to the Art or Drama Department if time or project scale does not permit the completion.
- The teacher should be aware of storage requirements and waste produced in project materials. Proper design should include take-down methods, moving, waste reduction, and storage considerations.
- It is important that students understand the terminology and techniques in set design (see Resources). The teacher should prearrange a visit by the Drama teacher or a local personality involved in theatre, TV, or film production at the outset of the activity. If this activity is based on a specific play or production set, students should be directed to research the artistic style of the play, mood to be evoked, director's vision of the set, etc., through discussions with directors and/or art directors.
- Students initiate a daily log of their project activities, (if not already started). This is used during discussions with students on their progress and assessment/evaluation. Students develop a portfolio of their work, (if they have not already done so), collating all important sketches, photographs, videos, etc.

Teaching/Learning Strategies

The teacher provides the Design Brief (Appendix 4.2A) and discusses the challenge. The teacher describes to students the situation and requirements for the activity, including deliverables and timelines. Students participate in discussions on set designs from example movies, plays, or concerts. The teacher introduces the principal terminology of the stage and design criteria that must be considered in the specific project (see Appendix 4.2B). The teacher presents and discusses a checklist of considerations or design criteria (see Appendix 4.2C). The teacher arranges for a visit from the play's director, or other production staff, as required.

Stage 1: Research and Proposals (approximately 4 hours, individual and team assignment)

- The teacher organizes students into design teams.
- Student teams study the specific scene requirements and brainstorm possible set layouts.
- Students prepare thumbnail sketches, rough detail sketches and/or presentation drawings of set proposals. Ideas and sketches are shared among the class. Sketches and drawings should be posted on the classroom walls, and drama or production personnel should be invited to hear student proposals.
- After design decisions are made, each student provides a written proposal, outlining the proposed role in the set production, the team the student is working with, and details of a plan of action.
- The proposal must detail the process used to arrive at possible solutions, such as how to determine requirements, how to test for functionality and optimal solutions, and how to adapt solutions through the procedure.

Stage 2: Drawing and Modelling (approximately 8 hours, individual and team assignments)

- Students are assigned individual responsibilities. They are given the task of developing designs from initial idea generation in Stage 1.
- Students develop dimensioned and/or scaled drawings of design solutions, along with any models or maquettes necessary to test and work out ideas. (Models can be constructed of paper, cardboard, modelling clay, etc.)
- Working drawings detailing part dimensions, joinery details, and assembly details are prepared.
- Drawings include industry standard symbols and details. These drawings may also be produced in tandem with the fabrication stage, outlined in Stage 3.
- The teacher should ensure that every student has been assigned to produce CAD or board drawings for evaluation.
- Drawings, or detail sketches, are examined for accuracy and approved before students begin fabrication.

Stage 3: Fabrication (approximately 8 hours, individual and team assignments)

- After approval of design details and dimensions, students fabricate structures and props based on models and drawings.
- Sets should be tested with actors on an ongoing basis to ensure viability of designs. Some modifications to designs may have to be incorporated based on this user testing.
- The teacher assesses and evaluates students' progress during fabrication.

Assessment & Evaluation of Student Achievement

The daily log helps in determining the individual student's achievement in team/group work. The teacher evaluates students' performance through individual discussions and evaluating individual contribution to drawings and products. Key assessment/evaluation considerations are quality, cleanliness, adherence to standards in drawings; demonstration of an application of a methodical design procedure; effort in research, effort and safe procedures in fabrication. The rubric (Appendix 4.2D) and the checklist (Appendix 4.2C) should be used in evaluating individual student work.

Accommodations

- The teacher may provide varying levels of requirements of tasks (e.g., could be more or less prescriptive; end product requirements can be reduced or increased in scope and number to suit student abilities). The teacher may limit this activity to a model building task. Written reports may be given to reinforce concepts and process understanding. 3-D modelling may be added as an enrichment activity (e.g., walk-through presentations using programs such as *Lightwave* or *3D Studio Max*, or modelling programs such as *Rhino* or *TurboCad*.)
- The teacher ensures that students with disabilities have access to specific equipment and tools to perform required tasks (e.g., table-top power tools, simplified modelling or drawing equipment or resources). The teacher ensures that activities involving lifting large or heavy objects or involving heights are fully supervised at all times.

Resources

Books

Kenton, W. *Stage Properties and How To Make Them*. New York: Pitman, London, 1978. ISBN 0910482977

Miller, J. *Small Stage Sets on Tour*. Colorado: Meriwether Publishing Ltd., 1978. ISBN 0030894468

Parker, O. and H. Smith. *Scene Design and Stage Lighting*. New York: Holt, Rinehart & Wilson, 1974. ISBN 0030894468

Websites

DMOZ Open Directory: Stagecraft (pages of links on all aspects of theatre set design) – www.dmoz.org/Arts/Performing_Arts/Theatre/Stagecraft/

Theatre Set Design Links – www.artslynx.org/theatre/design.htm

Theatre Technical Glossary – www.ex.ac.uk/drama/tech/glosslx.html

Other

Drama Department teachers

Local amateur theatre organizations

Local community groups and childcare facilities

Appendix 4.1A

Designing for Film

Sample Student Handout

Title: Historical Reproduction
Activity: Students design and build an artefact or costume for a period film.
Course: Grade 11 Technological Design Workplace
Time Required: 15 periods
Date:

Situation
You have been hired to design and build a _____ for a sequel of the film: _____. The director has asked that this work be of the utmost historical accuracy, including materials used and fabrication techniques employed.

Challenge
You must examine how this [artefact or costume] was constructed in the time period of this film. You must then construct this artefact (or model thereof) within the time constraints allocated.

Criteria & Constraints
- Research notes must be included, including bibliography of references.
- Design sketches must be completed, including thumbnail sketches and rough layouts.
- Presentation drawings are prepared complete with colour and all pertinent detail.
- Dimensioned CAD drawings of pattern pieces or constructed components of project are prepared.

Evaluation

No.	Deliverable	Time Limit (periods)	Mark (%)	Notes
1	Design brief/proposal	2	20	
2	Sketches/presentation drawings	5	20	Evidence of research
3	Completed model or artefact	6	40	As directed by teacher
4	Working drawings	2	20	
	TOTALS	**15**	**100**	

Appendix 4.1A (Continued)

Sample Student Handout

Notes
Considerations in Design (identify and be prepared to comment on each):

- History and social significance of project
- Materials (historical accuracy)
- Materials (ease of manufacture, assembly, strength of structure, durability, finishes, etc.)
- Historical accuracy

Project Steps

Step	Student Activities
1	Stage 1: Situation Analysis (approximately 2 periods) (Individual) • Watch the film clip and make the required sketches. • Read design scenario. • Analyse requirements and research current and historic solutions. • Develop list of possible themes for design criteria. • Hand in personal Design Brief/Proposal.
2	Stage 2: Sketches, Presentation Drawings (approximately 5 periods) (Individual or Teams) • Discuss and brainstorm design criteria, and possible solutions. • Develop thumbnails, roughs, and detailed sketches of possible solutions. • Choose appropriate design features for further work. • Prepare detailed presentation drawings including multiple views, cross sections, and colour. • Seek teacher approval for continuation.
3	Stage 3: Implementation (approximately 6 periods) (Individual or Teams) • Determine team responsibilities and assign a Project Manager. • Fabricate structure to accurate scale and proportions. • Assemble and record.
4	Stage 4: Working Drawings (2 periods) (Teams and Individual) • Produce drawings including multiple views and isometric views. • Exterior elevations only, c/w proper dimensions. • Hand in Report/Portfolio.

Appendix 4.1B

Assessment/Evaluation Rubric – Designing for Film

Categories	Level 1 (50 – 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Knowledge/ Understanding Knowledge of historical facts and materials TFV.04, TF1.03, TF2.02	- reflects limited attention to historical accuracy - demonstrates limited knowledge of materials used in historical artefact	- reflects some historical accuracy in shape, form or material - demonstrates some knowledge of materials used in historical artefact	- reflects considerable historical accuracy through shape, form and material - demonstrates considerable knowledge of materials used in historical artefact	- thoroughly reflects historical accuracy and attention to detail - demonstrates thorough knowledge and quality research in materials used in historical artefact
Thinking/ Inquiry Design analysis TFV.03 Material Analysis IC1.02	- demonstrates limited rationale of solution of design problem - demonstrates limited research into historical methods and materials	- demonstrates some rationale for solution of design problem - demonstrates some research into historical methods and materials	- demonstrates considerable rationale for solution of design problem - demonstrates considerable research into historical methods and materials	- demonstrates thorough rationale and in-depth research for solution of design problem - demonstrates in-depth analysis of typical construction materials and methods of time period
Communication Drawing Conventions TVF.02, TF2.01, SPV.01, SP1.01, SP1.02	- presentation drawings and models reflect time period in limited way - CAD or board drawings are dimensioned in limited fashion	- presentation drawings and models somewhat reflect time period details - CAD or board drawings are dimensioned with few minor inaccuracies	- presentation drawings and models accurately reflect time period through use of colour and finishing details - CAD or board drawings are dimensioned accurately	- presentation drawings and models reflect time period with a high degree of accuracy through use of colour and finishing details - CAD or board drawings are dimensioned accurately to industry standards

Categories	Level 1 (50 – 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
	- CAD or board drawings follow few CSA standards	- CAD or board drawings follow some CSA standards	- CAD or board drawings follow most CSA standards	- CAD or board drawings follow all CSA standards
Application Safe model or artefact fabrication work habits SPV.02, SP1.03, ICV.03, IC2.03	- artefact construction shows limited care and attention to detail - requires constant supervision to maintain focus and work safely in a limited way - uses procedures, technology, and equipment safely and correctly in a limited way	- artefact construction shows care and attention to detail - maintains focus and work safely some of the time - uses procedures, technology, and equipment safely and correctly with some frequency	- artefact is neatly constructed with care and attention to detail - usually maintains focus and work safely - uses procedures, technology, and equipment safely and correctly	- artefact is constructed with a great deal of care and attention to detail - always maintains focus and helps maintain safe practices and facility - 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 4.2A

Theatre Set Design

Title: Theatre Set Design

Activity: Students design and build a set from a movie or play.

Course: Grade 11 Technological Design, Workplace Preparation

Time Required: 20 periods

Date:

Situation

Your company has been selected to design the stage set for the latest production of .
Your task is to research previous productions, talk to the producer and/or art director about requirements, and propose a design for the production by next week. If approved by the client, you then develop working drawings for set production and assist in the construction of the set design.

Challenge

Research, sketch, propose, plan, develop drawings, and build a set design for a play or movie/video production.

Criteria and Constraints

- The play or movie must be carefully analysed to accurately portray the story.
- The director and/or art director have requirements regarding the production.
- You need to take into account set transportation, movement of stage elements, movement of actors, lighting, durability, and storage of sets.
- Initial sketches of your research and ideas must be prepared, reflecting identified themes of the play, use of symbols and concepts, and initial ideas for the set layout.
- Detailed presentation drawings, including information on dimensions, must be completed.

Evaluation

No.	Deliverable	Time Limit (periods)	Mark (%)	Notes
1	Design brief/proposal	4	15	Must be approved before next stage
2	Sketches/working drawings	8	45	Must use CSA standards for drawings
3	Completed set elements	8	40	Individual effort and quality of work
	TOTALS	**20**	**100**	

Appendix 4.2A (Continued)

Sample Student Handout

Notes
Considerations in Design (identify and comment on each):

- End user requirements (director, art director, actors, stage hands);
- Theme, stylistic interpretation;
- Materials (durability, ability to masquerade as another material);
- Materials (effect of lighting, ability to be painted, hung, cleaned, reused);
- Shape/style (symbolism, location, size, use of colour/graphical elements, and material considerations);
- Functionality of set (actors' ability to move about, speed and ease of set-up by stage crew, storage, ability to be dismantled for storage).

Project Steps

Step	Student Activities
1	Stage 1: Research and Proposals (approximately 4 periods) (Individual) • Analyse given scene(s) and read carefully. • Read design scenario and interview director, art director, actors, etc. • Research current and historic solutions. • Develop list of possible themes and ideas for design criteria. • Hand in personal Design Brief/Proposal.
2	Stage 2: Drawings and Modelling (approximately 8 periods) (individual and teams) • Discuss and brainstorm design criteria and possible solutions. • Develop thumbnails, roughs, detailed sketches, and models of possible solutions. • Choose appropriate design features for further work. • Prepare detailed, dimensioned drawings including appropriate views. • Seek teacher and/or director's approval for continuation.
3	Stage 3: Fabrication (approximately 8 periods) (individual and teams) • Determine team responsibilities and assign a Project Manager. • Fabricate set according to working drawings. • Test and correct as required.

Appendix 4.2B

Handout: Definitions and Terms

Some Criteria for Stage Set Design
Performers define a theatrical performance as a presentation of ideas to an audience. Set design is a critical ingredient to communicating these ideas. Students evaluate the criteria list below and incorporate these criteria in their solutions.

Functions of Set Design
Functions include conveying such things as:

Action:	Set design must accentuate, not detract from, the action in the presentation.
Characterization:	Set design should reflect characters' personalities and circumstances.
Time & Place:	Sets should authentically reflect the time and place in which the presentation is set.
Mood:	The mood of the presentation should be clear. (Lighting is also critical in establishing mood.)
Reinforcing the Theme:	All aspects of the set should reinforce the presentation's theme.
Staging:	Sets must incorporate economy and efficiency for movement and placement during performances.

Principles of Set Composition
Initial designs and layouts of a set should include elements of composition (i.e., how the set pieces are put together to achieve a desired function or effect):

Harmony & Balance:	Bringing order to disorder, ensuring that everything on stage fits together and 'flows' in the eyes of the audience.
Contrast:	Contrasts in shape and colour create and accentuate form.
Variation:	Care in not repeating too many elements, as repetition is bland, boring.
Pattern/Rhythm:	Borders and backdrops used to 'frame' a scene.
Centre of Interest:	Ensure a focal point is achieved where needed.

Types of Constructed Sets

Wing & Drops:	Drapery and cloth hanging from battens. The drops can be easily lifted out or lowered into place as necessary. Cloth or translucent material in drops can be painted to reflect stylized or illusionary backgrounds.
Box Sets:	Scene sets are framed with wood and constructed to support itself. Wall sections may include operating doors and/or windows. Sections often fold together as screens for easy set up on stage during set changes.
Platforms & Stairs:	Raise and lower stage appearance.
Set Pieces:	Props constructed for set décor such as free form (irregular shapes such as rocks or trees with surface contours).
Wire Frame & Covering:	Useful in creating masks, historical artefacts, stylized animals and plants.
Wood & Metal Replications:	Historic armour and weapons.
Skeletal Set:	Wire frame only (not covered).

Appendix 4.2C

Assessment/Evaluation Checklist

Student:

Class:

Theatre Set Design	Level 1 limited	Level 2 moderate	Level 3 considerable	Level 4 exceptional
Considered lighting				
Considered movement of actors				
Considered interaction with actors				
Considered director's requests				
Tested end-user				
Considered play requirements				
Considered movement of scenes/props				
Considered transportation of sets				
Considered joinery methods				
Considered striking of sets				
Considered storage of sets				
Considered wear and tear				
Considered strength of structure				
Considered economy of materials				
Considered safety in handling/installation				
Considered fire safety				
Considered tripping/falling hazards				
Considered mood				
Considered colour				
Considered symbolism				
Considered harmony/balance				
Considered focal point				
Considered pattern/rhythm				
Considered contrast				
TOTALS				

Appendix 4.2D

Assessment/Evaluation Rubric – Theatre Set Design

Categories	Level 1 (50 – 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Knowledge/ Understanding Design Methods TFV.01, TF1.01	- articulates limited knowledge of the process to arrive at effective solutions - demonstrates limited understanding of theatre set requirements	- articulates some knowledge of the process to arrive at effective solutions - demonstrates some knowledge of theatre set requirements	- articulates considerable knowledge of the process to arrive at effective solutions - demonstrates considerable knowledge of theatre set requirements	- articulates insightful knowledge of the process to arrive at effective solutions - demonstrates in-depth understanding of theatre set requirements
Thinking/ Inquiry Developing solutions TFV.03, TF1.02, SP2.03, IC1.01	- demonstrates limited rationale for solution of design problem - demonstrates limited development of alternative approaches and decision making skills - demonstrates limited attention to issues of safety, ease of use, and efficiency of operation of sets	- demonstrates some rationale for solution of design problem - demonstrates some effort to develop alternative approaches; shows promise in decision making - demonstrates moderate attention to issues of safety, ease of use, and efficiency of operation of sets	- demonstrates considerable rationale for solution of design problem - demonstrates considerable development of alternative approaches; demonstrates effective decision making - demonstrates considerable attention to issues of safety, ease of use, and efficiency of operation of sets	- demonstrates thorough rationale for solution of design problem - demonstrates thorough analysis and considerable development of alternative approaches; demonstrates highly effective decision making - demonstrates thorough and insightful attention to issues of safety, ease of use, and efficiency of operation of sets, illustrates effort to apply concepts to wider situations

Categories	Level 1 (50 – 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Communication Drawing Conventions TFV.02, TF2.01, SPV.01, SP1.02	- drawings convey necessary information, but limited detail - drawings are dimensioned in limited manner; follows few CSA standards	- drawings adequately convey all necessary information - drawings are dimensioned; follows most CSA standards	- drawings effectively convey all necessary information - drawings are dimensioned accurately; follows CSA standards	- drawings effectively and creatively convey all necessary information, including detail - drawings are dimensioned accurately to industry standards; follows all CSA standards
Application Safe model or artefact fabrication work habits SPV.02, SP1.03, ICV.03, IC2.03	- artefact construction uses limited care and attention to detail - seldom maintains focus and work safely - uses procedures, technology, and equipment safely and correctly	- artefact construction uses moderate care and attention to detail - requires reminders to maintain focus and work safely - sometimes uses procedures, technology, and equipment safely and correctly	- artefact constructed with care and attention to detail - generally maintains focus and work safely - usually uses procedures, technology, and equipment safely and correctly	- artefact is constructed with thorough care and attention to detail - always maintains focus and helps maintain safe practices and facility - always demonstrates and promotes 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.