TDJ3M

Technological Design

Unit 4 Hydraulics – Pick N' Place Activity

Abstract

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TABLE CONTENTS (TO BE UPDATED – FOR FINAL)

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PROJECT OVERVIEW

The prime directive in design is problem solving. Design begins with identifying a situation or problem that relates to a need or a change in need. An important aspect is the continual process of testing, rationalizing, and analysing to ensure the best solution to a given problem is developed. This course provides students with opportunities to apply the principles of technological design processes using a problem solving process to develop solutions to challenges, processes and process controls in order to solve a variety of manufacturing and engineering challenges. In this activity, students are introduced to product research, design, and planning. Using the design process and engineering standards, students will demonstrate their knowledge of concepts required to design, prototype, analyze, plan and prepare a product idea for production. A strong emphasis will be placed on project management and product development. The skills and knowledge acquired in this activity can then be applied to other projects in the following units.

PROJECT CHALLENGE

Your design team has been approached by the Government of Ontario to design a robotic crane prototype capable of moving hazardous waste barrels from one area to another.

In order to prepare for this challenge, you will be completing a series of sub-tasks and labs in order to understand, and be able to apply the properties, terminology, and working concepts of mechanical movement, simple machines, and Fluid Power in the design of your prototype.

CONNECTIONS

SEF Component 2 Classroom Leadership Connections

Indicator 2.1- Collaborate with construction/manufacturing teachers in establishing team-teaching opportunities or joint lesson planning in the context of a design/build approach.

Differentiated Instructions (DI)

Provide an open-end approach when having students select a product. Have students choose their own product. A choice board with examples may help.

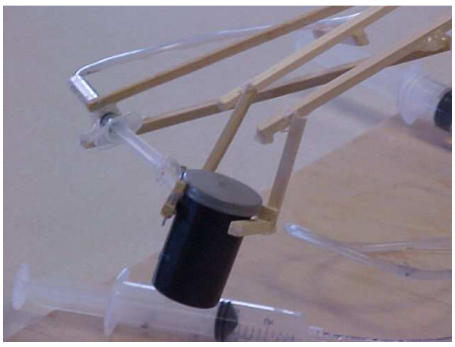
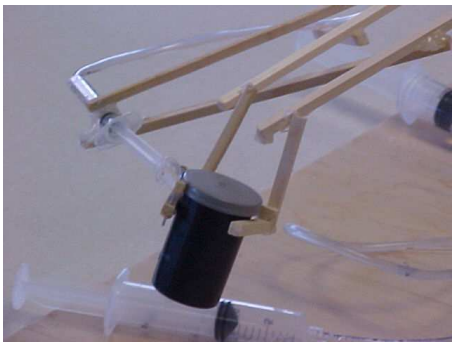
The recommended material is noted as wood. Provide some enrichment by challenging some students to research alternate material based environmental considerations.

Ontario's Equity and Inclusive Education Strategy

As a strategy in applying equity and inclusion, engage community partners that reflect the diversity of the local community and work towards representation of diverse groups within this potential ICE initiative. As an example, design culturally based hardscape design that can be built and installed at a local cultural centre.

SEF Component 6: Home, School and Community Partnerships

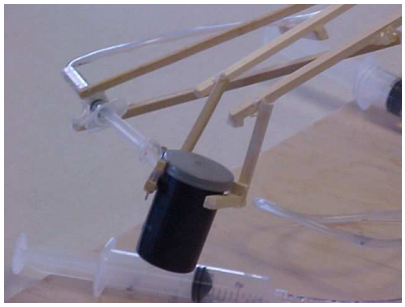
Indicator 6.3-The school and community build partnerships to enhance learning opportunities and well-being for students

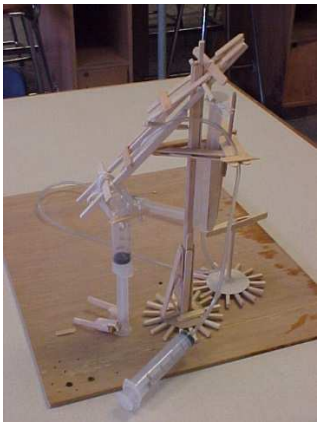
LEARNING OBJECTIVES	**EXAMPLES**
After this activity, students should be able to: • Identify the steps of the engineering design process. • Recognize the steps of the engineering design process as they design and build. • Represent solutions to a design process in multiple ways. • Describe and explain features and purpose of a design. • Explain the basic concepts of hydraulic and pneumatics.	
PROJECT CRITERIA	**EXAMPLES**
See Appendix A – Design Challenge Your **Prototype** Robotic Crane (Pick and Place) final design must incorporate the following components: 1. At least 2 Simple Machines (gears, levers, pulleys,etc.) 2. At least one hydraulic or pneumatic component 3. A <u>vertical</u> movement of at least 10 cm 4. A <u>horizontal</u> movement of 15 cm from the middle position to the right and left 5. All control systems\devices for your crane must be attached to the base 6. Must be able to lift and move the hazardous waste barrels <u>accurately</u> from one location to another. 7. Be at a scale of 1:20 – weight proportional 8. Have the abilith to rotate the tower/base 360 degrees (base does not need to move – raadially or laterally) 9. Utilize a system of pneumatic/hyraulic nature. 10. NOT change shape – deflect, twist, distort – more than 5 mm in any dirction on application of the load <u>Project Requirements</u> ▪ Working Prototype ▪ Design Brief – Sketches	 

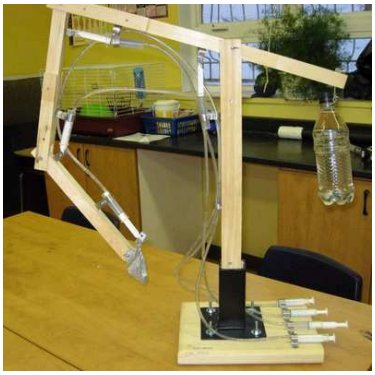
- Engineering Log
- Sketches – Thumbnail, Detailed
- Technical Drawings – Assembly Drawing – Detailed Part Drawings
- Technical Report – See Appendix

PERFORMANCE INDICATORS

1. Work directly with the forces inheret in a structural system
2. To experience problem- solving through an empirical approach. (i.e. experimentation, observation, conclusion)
3. To evaluate one's intuitive understanding of structural behaviou against structural theory.
4. The student will identify the forces that act upon structures.
5. To apply knowledge about structures, materials, fabrication, mechanisms, energy and function to your design.
6. To apply principles of pneumatics/hydraulics in the solution.







WEBSITE SAMPLES

https://www.youtube.com/watch?v=yp4_-laU_ms
http://jefenry.com/main/MechanicalArm.php
https://www.youtube.com/watch?v=wTM6Zik_tww
http://www.instructables.com/id/Easy-hydraulic-Robotics/
https://www.teachengineering.org/activities/view/wpi_hydraulic_arm_challenge
https://www.scribd.com/doc/93124305/Hydraulic-Arm-Project

PROJECT SYNOPSIS and TIMELINES

Activity #	Activity Title/Name	Time (hrs.)	Curriculum Expectations	Assessment & Evaluation	Connections?
1	Developing A Focus : Project Research and Information Gathering	5.0	A1, A2, A5 A1.1, A1.2, A1.3, A1.4 A2.1 A5.3	▪ K/U ▪ T/I ▪ C	▪ Ontario Curriculum ▪ Growing Success ▪ DI ▪ SEF ▪ Think Literacy ▪ Equity Inclusive… ▪ FNMI ▪ OSP
2	Selecting Best Solution : Project Development (Sketching/Working Drawings)	5.0	A3, A5 A3.1, A3.2, A3.3 A5.1	▪ K/U ▪ T/I ▪ A ▪ C	▪ Ontario Curriculum ▪ Growing Success ▪ DI ▪ SEF ▪ Math Literacy ▪ Think Literacy ▪ FNMI ▪ OCTE Resources
3	Tool Safety Hand/Power Tools (if applicable)	2.0	A4, B3, A4.2, B3.1	▪	Essential Skills Passport, SafeDocs, and SafetyNet documents. Essential Skills Passport link http://www.skills.edu.gov.on.ca/OSP2Web/EDU/DisplayEssentialSkills.xhtml

4	Modelling : Prototype Construction	5.0		▪ A	
5	Evaluation - Documentation Project Portfolio	3.0	A5 A5.1, A5.2, A5.3	▪ K/U ▪ T/I ▪ C ▪ A	▪ Ontario Curriculum ▪ Growing Success ▪ SEF ▪ Think Literacy

CONNECTIONS RESOURCE LIST

1	The Ontario Curriculum, Grade 11-12, Revised 2009	http://www.edu.gov.on.ca/eng/curriculum/secondary/2009teched1112curr.pdf
2	Growing Success	http://www.edu.gov.on.ca/eng/policyfunding/growSuccess.pdf
3	Student Success: Differentiated Instructions Educator's Package, 2010(DI)	http://www.edugains.ca/resourcesDI/EducatorsPackages/DIEducatorsPackage2010/2010EducatorsGuide.pdf
4	School Effectiveness Framework, 2013 (SEF)	http://www.edu.gov.on.ca/eng/literacynumeracy/SEF2013.pdf
5	Think Literacy	http://www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy/
6	Leading Math Success	http://www.edu.gov.on.ca/eng/document/reports/numeracy/numeracyreport.pdf
7	Ontario First Nations, Metis, and Inuit Education Policy Framework (FNMI)	http://www.edu.gov.on.ca/eng/aboriginal/fnmiFramework.pdf
8	Ontario's Equity and Inclusive Education Strategy	http://www.edu.gov.on.ca/eng/policyfunding/equity.pdf
9	Ontario Skills Passport (OSP)	http://www.skills.edu.gov.on.ca/OSP2Web/EDU/DisplayEssentialSkills.xhtml
10	OCTE Resources: SafeDocs, SafetyNet	http://www.octelab.com/

Activity 1 – Developing A Focus : Project Research and Information Gathering

Criteria and Instructions

Themes/Styles

- research and describe a variety of examples of pneumatic and hydraulic real life examples, particularly in crane/tower applications. Include a variety of ways to present your research. e.g., notes, images, photos, illustrations. (Note and use the Design Notebook and Technical Report template/examples)
- note any connections with your previous/current science units
- key word searches: hydraulics, pneumatics, levers, simple machines, syringes, gears, pulleys, towers, grippers

Technical Report

- Review the Problem Solving process that your school/department has adopted. Review the Situation (Problem or Focus), Investigation, Construction and Evaluation stages briefly. Students should have completed or be aware of a Technical Report (see Appendix) and Design Notebook prior to this project. If this will be the first Challenge involving the Problem Solving Process and Reporting, then add 2 – 5 hours to the project.

Research Sources

- Use a variety of resources in collecting your information…. magazine, newspaper, design books, Internet, and any other sources available. You must show proof that a variety of sources were used for full marks
- be sure to site all sources of information
- Set up a Google Doc or Word Doc to begin the formal Technical Report submission. This will be an ongoing document that you will add to at each stage of the problem solving model. Detail and time spent early in the project will save you valuable time and increase marks in the final submission.

Report presentation – Due at End of Research and Information Gathering

- Minimum 5 Thumbnail Sketches of Brainstorming Ideas
- Minimum 3 Detailed Sketches of solutions
- Setup and Developing the Design Notebook
- Setup and Developing the Engineering Log – Notes
- One Detailed Assembly Drawing – complete with individual components material list and sizing
- report must be presented in a structured format with cover sheet, page numbers, headers and footers
- note that you'll be asked to include portions of this report in your final portfolio so be sure you keep a working portfolio as you complete this activity and future activities

Activity 1 Project Research and Information Gathering

Activity Description:

Just like engineers, students in this activity work in teams and follow the steps of the engineering design process. Engineers develop hydraulic arms for a variety of reasons. Hydraulic arms can be used in situations that are too difficult or dangerous for people to deal with directly or in automated systems. Examples include arms that lift heavy weights and arms that hold a load and unload them into a specific position.

A hydraulic system has four major advantages, which makes it quite efficient in transmitting power.

1. Ease and accuracy of control: By the use of simple levers and push buttons, the operator of a hydraulic system can easily start, stop, speed up and slow down.
2. Multiplication of force: A fluid power system (without using cumbersome gears, pulleys and levers) can multiply forces simply and efficiently from a fraction of a pound, to several hundred tons of output.
3. Constant force and torque: Only fluid power systems are capable of providing a constant torque or force regardless of speed changes.
4. Simple, safe and economical: In general, hydraulic systems use fewer moving parts in comparison with mechanical and electrical systems. Thus they become simpler and easier to maintain.

In this activity, you are asked to research this system and incorporate it into a scaled working Crane (Pick and Place) project. *(Terminology – title may be modified depending on the Grade level)*

MINDS ON

ENGAGING PRIOR KNOWLEDGE

Activity 1 PRIOR KNOWLEDGE	CONNECTIONS
Prior Knowledge Required The student will have: ▪ group work skills and group expectations from a prior activity ▪ research skills and ability to use a variety of resources (Internet, magazines, interviews, etc.) ▪ skills in co-operative learning techniques (effective interpersonal skills) and an understanding of personal responsibilities and commitment required for group activities; ▪ basic skills in word processing used for journals/log entries; ▪ respect for the rights, responsibilities, and contributions of self and others; ▪ knowledge of research report formats based on grade 10 TDJ2OI and TDJ3M courses. ▪ Science background – grade 8 Simple Machines, Science Grade	**Teacher Tips** It may be a good idea to review report format and specific word processing features. E.g., inserting tables, headers, footers, cover page, etc. Encourage setting up a Google Group or Classroom. Establish a Google Calendar.

9/10 simple machines, basics of hydraulics	
Activity 1 PLANNING NOTES	**CONNECTIONS**
▪ Check all recommended resources prior to beginning lesson and activity. ▪ Be sure that all computers are in working order and that Internet access is available. ▪ Check school WiFi for accessibility. ▪ Review all activities and prepare all resources (handouts and materials) necessary for the delivery of content. ▪ This activity is ideal for allowing students to use their own personal devices in their research. ▪ It is recommended that all resources be posted to your board collaboration system (Google Classroom/Groups) to avoid too many handouts and to ensure full accessibility. ▪ If using collaboration software, be sure that all posts are updated and ready for student interaction. ▪ This is an excellent opportunity to set up a Google Classroom section dedicated to this project. Having the whole course on Google Classroom would be recommended.	**SEF Component 3 Student Engagement** **Indicator 3.4:** Community partnerships fostered through ICE programs can provide positive peer, teacher, school and community relationships **SEF Component 1 Assessment for, as and of Learning** **Indicator 1.7:** Describe what students are expected to learn. Provide students a clear vision. All communication about assessment must be personalized, clear, precise and meaningful. A system (e.g., classroom website, learning management system, blog) is in place to allow educators, students and parents to continuously monitor student progress.

ACTION INTRODUCE OR ENTEND LEARNING

Activity 1 Instructional Strategies	**CONNECTIONS**
TEACHER The Challenge ▪ Introduce the design challenge **(Appendix A)** ▪ Review the Project Management – Timelines (Appendix B) ▪ Students should be given a Design Notebook outline and templates .**(Appendix D).** Prior to beginning this activity, ask students to define some key terms for homework. Terms may include design brief, portfolio, brainstorming, thumbnail sketches, design engineering, presentation drawings, working drawings, etc.	**The Ontario Curriculum, Grade 11-12, Revised 2009** Overall Expectations: A2 Specific Expectations: A2.1 **FNMI** To address the FNMI document, schools will strive to "employ instructional methods designed to enhance the learning of all First Nation, Métis, and Inuit students", it is recommended that students research some First Nation, Métis, and Inuit natural hardscape designs.

The Design Team

- Have students establish design teams of 2-3. Teacher may choose or modify the teams depending on individual strengths and weaknesses.
- Keeping the number to 2 or 3 is recommended. Avoid allowing individual project completion. Refining Groupwork and team dynamic skills is a major learning expectation.
-
- Discuss best practices regarding group work.

Project Management

- introduce lesson on project management **(Appendix B)**
- describe the project planning part as one of the initial stages of the project
- place emphasis on the importance of project management in the "real" world and how project management skill set differs from day-to-day manufacturing management
- graphic organizers and **GANTT** chart lessons to follow
- as a design team, a schedule of activities must be created to manage their time and document the shared responsibilities within their group
- In order to stay organized and consistent as well as aligning the management piece of this project to design standards, have students use design notebooks **(Appendix C).** Explain the importance of the notebook in terms proprietary information and patent documentation
- The design notebook template **(Appendix D)** should be used throughout the process, from research to design development. It will become part of their final design portfolio.

The Research

- Introduce activity and criteria. Discuss the link with the grade 11 course.
- Describe what students are expected to learn and how their learning will help with the overall project. Provide students a clear vision of where this activity will lead.
- Tell students, at the outset of instruction, what the learning goals are. Refer frequently to the learning goals and design process during instruction
- Demonstrate as a class by using the 'design theme' as the central topic.
- Explain that the mind map must be part of their final portfolio
- Show students previous exemplars to better help them understand activity expectations, particularly scale and various complexities. If this is the first time through the project, use the research examples. Be sure to take photos of various stages of the project for outlining the Design Process.

  *(**Exemplar Note**. It is recommended they see a finished project in the project introduction stage and then the project out of sight and access. Students tend to duplicate engineering examples without doing a proper investigation and research of all the*

Ontario Skills Passport

Literacy skills in reading, writing, oral communications, document and computer use.
Thinking skills in decision making, finding information, and critical thinking

SEF Component 1 Assessment for, as and of Learning

Indicator 1.1 and 1.3: Describe what students are expected to learn. Provide students a clear vision of where they are going by describing the design process as setting direction and guidelines to the final product.

The design challenge provides meaningful tasks, activities and experiences that will foster thinking and metacognition – build on students' diverse perspectives, knowledge and experiences.

Think Literacy

Reading (research) Strategy: Engaging in Reading

- Sorting Ideas Using a Concept Map can be used in documenting their research on themes and styles
- 'Making Notes' strategy is applicable for this activity

SEF Component 3 Student Engagement

Indicator 3.1: Learning experiences are engaging, promote collaboration, innovation and creativity (i.e. are clear, meaningful, challenging, productive and include problem solving and critical thinking on a variety of issues). Ongoing feedback between students and teachers enables students to refine both thinking and products.

SEF Component 4 Curriculum Teaching and Learning

Indicator 4.2-Instruction in all content areas supports clear connections among reading, writing, oral and digital communication and media literacy.

different and successful possibilities. There is no reason why there should not be a different strategy from each group…and encouraged.)

Student:

- Establish design team of 2-3.
- Participate in collaborative/cooperative learning through group research.
- They will create a GANTT chart identifying timelines and responsibilities.
- List, describe and document a number of themes and styles based on research.
- Analyze their research and select a theme and style for their product.
- Research a variety of hydraulic and actual pick n' place principles.
- Select a design/product that best suits their needs.
- Produce a report of their research and final design choice.
- Use exemplars to help understand what quality work looks like and to develop or refine their understanding of success criteria. (See previous Exemplar Note)

Sort and analyze information from a variety of sources. ❖ Summarize and synthesize in order to understand what they read, hear and see. ❖ Understand, acquire, build on and apply oral communication, reading, writing and media literacy knowledge and skills.

Indicator 4.4-Students are engaged in exploring real-world situations/issues and solving authentic problems. Critical thinking skills are taught, modelled, practised and developed.

Indicator 4.5-Students are grouped and regrouped, frequently and flexibly. Learning groups are based on prior assessment of student learning, strengths and needs, interests and/or learning preferences. Choices are provided based on prior assessment of student learning, interests and/or learning preferences.

Ontario's Equity and Inclusive Education Strategy (ESL Components)

The equity and inclusive education is addressed in this research project where students become aware of the cultural influences on landscape designs which are especially evident in a multi-cultural nation like Canada. There are numerous examples of hardscape designs that represent cultural diversity.

FNMI

To address the FNMI document, schools will strive to "employ instructional methods designed to enhance the learning of all First Nation, Métis, and Inuit students", it is recommended that students research some First Nation, Métis, and Inuit natural hardscape designs.

Differentiated Instructions (DI)

Flexible Learning Groups In a differentiated classroom, students are grouped and regrouped, frequently and flexibly based on their; readiness to learn a concept; interest in a concept earning preferences in working with or thinking about a concept; or environmental or social sensitivities

	Ontario Skills Passport Literacy skills in reading, writing, oral communications, document and computer use. Thinking skills in decision making, finding information, and critical thinking **SEF Component 1** **Assessment for, as and of** **Learning Connections** **Indicator 1.1** Students will actively plan for and set team goals that relate to project and curriculum expectations. Through the design process, students will engage in authentic and relevant performance tasks that are connected to expectations.
Activity 1 Assessment and Evaluation	**Connections**
Assessment strategies and tools in this activity will include opportunities in monitoring students' achievement levels as well as learning skills. **Knowledge and Understanding** • To assess students on their knowledge and understanding, teachers will evaluate students' research report content relating to themes and styles **Thinking and Inquiry** ▪ To assess students on their thinking skills, teachers will evaluate students' research report in terms of using a variety of resources. **Communications** ▪ The research report will be assessed in terms of format, content and overall appearance **Learning Skills** ▪ Through observation and conferencing, students will be assessed formally or informally. ▪ The teacher will document the following: - the student' s skills pertaining to conflict management skills; - student's ability to work effectively as a team member; - student's initiative, leadership and participation in a group. ▪ Conferencing assessment can take place on a daily basis. Be sure to provide encouragement and praising effort, as tasks are complete building on a positive self-image. **Assessment Tools:**	**PROVIDING DESCRIPTIVE FEEDBACK** Feedback provides students with a description of their learning. The purpose of providing feedback is to reduce the gap between a student's current level of knowledge and skills and the learning goals. Descriptive feedback helps students learn by providing them with precise information about what they are doing well, what needs improvement, and what specific steps they can take to improve. According to Davies (2007, p. 2), descriptive feedback "enables the learner to adjust what he or she is doing in order to improve." (Growing Success, p 34) Growing Success Performance Standards – The Achievement Chart Chapter 3, page 25 - to establish rubric Teachers use a variety of assessment strategies to elicit information about student learning. These strategies should be

• Rubric **(Appendix M, P)**	triangulated to include observation, student-teacher conversations, and student products. Teachers can gather information about learning by: • designing tasks that provide students with a variety of ways to demonstrate their learning; • observing students as they perform tasks; • posing questions to help students make their thinking explicit; • engineering classroom and small-group conversations that encourage students to articulate what they are thinking and further develop their thinking. (Growing Success, p. 34) **SEF Component 1** **Assessment for, as and of Learning Connections** **Indicator 1.6-** The final rubric for this activity addresses the 'assessment of learning' which is based on the performance standards set out in the Achievement Chart. The assessment criteria of this activity align with the overall expectations and form the basis of assessment of learning. Students use the rubric the assessment of learning results to set new goals and strategies for the next phase of their design. Learning skills and work habits are evaluated regularly through monitoring and progress and regular conferencing with individual students. **Indicator 2.2**- Provide explicit feedback about their engagement and learning as educators and advocate for what they need as learners Assessments will include communications, observation, performance assessment, and conferencing. Homework tasks designed to help students practice and consolidate new learning can also provide assessment information that both teachers and students can use to adjust instruction and focus learning. (Growing Success, p. 34)

Activity 1 Accommodations	**Connections**
▪ Teachers are to be familiar with ESL student levels and exceptional students' Individual Education Plans (IEPs) for legislated accommodations and consult with the appropriate staff. By doing this, teachers will be aware of and can implement prescribed modifications and accommodations. ▪ Teaching Strategies for students with special needs may include: – grouping design teams with varied abilities to allow for peer support. The teacher may choose or modify the teams depending on individual strengths and weaknesses; – providing a list of designs and suggestions where enrichment and challenge is needed, allowing students to be peer tutors/mentors; – pairing experienced students with those who are not yet familiar with the techniques.	**SEF Connections** Accommodations are to be made so students do not lose dignity because of disability, poverty, lack of success, linguistic diversity or race. Teachers foster a positive atmosphere accepting of individual's uniqueness, values, and needs. English Language Learners ESL and ELD Programs and Services http://www.edu.gov.on.ca/eng/document/esleldprograms/esleldprograms.pdf **SEF Component 1** **Assessment for, as and of Learning Connections** **Indicator 1.2 & 1.4:** Reviewing student profiles, learning portfolios, IEPs and assessment data will inform decisions regarding assessment tools and strategies. In this activity, a variety of assessment strategies and tools are used to improve learning and inform instructional decisions (e.g., observations, presentations, work samples, regular conferencing, and reports of student work). **SEF TIP** It is recommended that there is regular collaboration in the development of assessment tasks, tools (e.g. rubrics) and practices supports consistency of practice in and between grades, departments and courses. This is especially important with when working with identified students.

CONSOLIDATION & CONNECTIONS

Provide Opportunities for Reflection

Activity 1.1 ENGINEERING LOG – TECHNICAL REPORTING	CONNECTIONS
ENGINEERING LOG: Complete the Engineering Log/Daily Journal Sheets handed out by the instructor. Instructors may evaluate the logs daily. Have them complete the logs in the last 10 minutes and bring them to you for checking. Mark out of 5 – 10 and recorded. • Submit an **individual** engineering log (point form) for each day of project (include what was done, successes, failures, and planning for next day) - **Instructor will hand out blank *Daily Journal Sheets.***	**SEF Component 2 Classroom Leadership Connections** **Indicator 2.2-** input, through the reflection papers will help refine instruction to improve student learning **DI Connections** The student completes a daily Engineering Log to demonstrate their learning. This will provide an informal measure of how well students understood design concepts in terms of research and information gathering. Teaching strategies may need to be changed based on student feedback.

Activity 1.2 ACTIVITY EXIT CARD	CONNECTIONS
Have students fill out exit cards at the end of this activity. Be sure questions are broad in nature but specific enough to measure student learner. Prepare half-slips of paper with typed questions or write questions on the whiteboard for students to answer. Have students complete exit cards during the final 5 minutes of the class period. Since exit cards must be turned in before students leave class, it is best if the prompts are specific and brief. Often they refer directly to the content that was studied, but they can also be general in nature such as: ▪ List three things you learned in completing this activity.	**SEF Component 2 Classroom Leadership Connections** **Indicator 2.2-** input, through the reflection papers will help refine instruction to improve student learning **DI Connections** The student completes an exit card to demonstrate their learning. This will provide an informal measure of

▪ What questions, ideas and feelings have been raised by this lesson? ▪ What was your favourite part of this activity? Why? What was your least favourite part of this activity? Why? ▪ Evaluate your participation in class today. What did you do well? What would you like to do differently next time.	how well students understood design concepts in terms of research and information gathering. Teaching strategies may need to be changed based on student feedback.

MATERIALS, TOOLS and RESOURCES

Activity 1 Websites:
▪ Grade 12 Technological Design Curriculum Document - English Language Learners ESL and ELD Programs and Services ▪ http://www.edu.gov.on.ca/eng/document/esleldprograms/esleldprograms.pdf
Activity. 1 Publications:
▪ Design magazines
Activity. 1 COMPUTER SOFTWARE
▪ Word Processing ▪ Internet
Activity. 1 HUMAN RESOURCES
▪ Science Department Staff ▪ Local Community – Engineer
Activity. 1 OTHER
▪ Board computer policies
Activity. 1 APPENDICES
Appendix A: Design Challenge Appendix B: Project Management - Timelines Appendix C: Design Notebook Appendix D: Design Notebook Template

- Appendix E: Project Management

Activity 2– Selecting the Best Method : Project Development

Activity Description:

In this activity students will develop a design drawing package of their product. The package will include planning, design sketches, presentation drawings and working drawings. As part of a design team, the student will develop thinking, problem-solving and graphic communications skills through brainstorming and sketch development of design ideas. This activity is designed to introduce students to a variety of drawing techniques used in the design industry. Students are shown how to sketch objects or ideas using oblique, isometric, perspective and orthographic representation. Emphasis is placed on understanding the differences among these techniques and when they should be used. Through proper dimensioning of the drawings, students will also identify production control monitoring strategies. The completed design portfolio can then be used in the production/modeling phase of the process.

MINDS ON

ENGAGING PRIOR KNOWLEDGE

Activity 2 PRIOR KNOWLEDGE	CONNECTIONS
Prior Knowledge Required; The student will have: ▪ group work skills; ▪ skills in co-operative learning techniques (effective interpersonal skills) and an understanding of personal responsibilities and commitment required for group activities; ▪ basic skills in word processing used for journals/log entries; ▪ respect for the rights, responsibilities and contributions of self and others; ▪ experience from the Grade 11 Technological Design activities. This experience will provide students with knowledge of basic sketching and drawing standards as well as an understanding of Computer Aided Design and Drafting; ▪ technical drawing skills – students would have completed the Unit on Sketching, Scale, Orthographic and Isometric drawing ▪ having taken art courses can also be an asset; ▪ Experience with hand/power tools – pre-requisite in Construction Grade 9/10 ▪ mathematical skills relevant to drawing accuracy, measurement	**Teacher Tips** It may be a good idea to create diagnostic assessment tools to determine specific prior knowledge. This could include a simple questionnaire, defining technical terms, sketching exercises, etc. **SEF Component 4 Curriculum Teaching and Learning** **Indicator 4.2-**Numeracy specific concepts are explicitly used to deepen student learning and understanding in all subjects. **Ontario Skills Passport** Numeracy skills in measurement and calculations.

units, geometric shapes as well as Cartesian Plane used in learning CAD.	
Activity 2 PLANNING NOTES	**CONNECTIONS**
▪ Prior to beginning this activity, ask students to define some key terms for homework. Terms may include project management, GANTT charts, design brief, portfolio, brainstorming, thumbnail sketches, design engineering, presentation drawings, working drawings, etc. ▪ Create sketching exercises that will establish student sketching abilities. It is assumed that the students have completed a unit on Technical Drawing and have the concepts of Thumbnail Sketching, Sketching to Scale, Orthographic, Isometric and Detail/Assembly drawings. ▪ Be sure that all computers are in working order and that the CAD software is functional. ▪ Inventory scales, rulers, set-squares, protractors, circle templates (or drawing compasses) ▪ Review all activities and prepare all resources (handouts, tools, and materials) necessary for the delivery of content. Suggested Handouts: Project Outline, Technical Report Template, Technical Report Rubric/marking checklist, Project Checklist, Sample Timelog, Sample Engineering Log, Technical Handouts on Hydraulics/Pneumatics. (see Teacher Tip regarding group handouts) ▪ .If using collaboration software (Google Classroom / Moodle /Edmodo), be sure all documentation is uploaded and ready on above platforms or School Server for student reference and elimination of handouts. ▪ This activity should be split into several stages (Appendix). The Developing a Focus through project introduction, research assignments focused on the activity, introduce students to design briefs and sketching techniques. Then Developing a Framework through idea development (sketches) and choosing the Best Solution stage. Students then progress to the presentation drawing stage where they develop pictorial sketches of their design proposal and detail the design proposal through the development of a working and assembly drawings complete with dimensions and material lists. The two stages would be the scheduling of Construction and Evaluation. ▪ Teachers should consult the Art Department in the school for texts on sketching techniques and books on principles and elements of design if none are available in their own department. Ask Art instructors' to describe their perspectives on the use of principles and elements of design. ▪ Consultation with the Science teachers can also be helpful in understanding simple machines, hydraulics, testing apparatus; ▪ Create and/or gather teaching aids to Activity as visual aids when introducing orthographic views. A box with hinged sides will help in discussions of orthographic view development.	**SEF Component 2 Classroom Leadership Connections** Indicator 2.1 Collaboration with other teachers will inform instructional practices to meet the needs of students. **TEACHER TIPS** It is recommended that all resources be posted to your board collaboration system or Google Classroom to avoid too many handouts and to ensure full accessibility. Collaborate with Tech Design teachers within your school, Board or province to establish best practices and curriculum improvements. Become a member of the Ontario Council for Technology (OCTE) where tech teachers can network and collaborate on common challenges and resource development. Only distribute one copy of each handout per group of 2. Generally this project would be based on a group of 2 or 3 students. The importance is to be sure work can be distributed evenly and not just one person doing the bulk. Group Evaluation/Peer Evaluation strategies could be incorporated. Before setting the Unit start date, be sure that you have facilities available if you have a Construction facility. Consult with the construction teacher for room availability; suggest a room switch for Construction classes to do a CAD or research project. Team teach with the Construction teacher supervising the Tech Design Class and Tech Design teacher doing a mini CAD unit. Suggest a co-unit with the Construction Class as this would fit their curriculum expectations as well. Book an Art Room with table arrangement for model building if your facility is not adequate. Simple tools may be used for the construction.

- Organize a safe and secure storage system/facility for building materials and paperwork. Students tend to collect extra components from other groups for safe keeping.
- A variety of simple objects such as wooden blocks cut in geometric shapes can also help. Solicit help from the Construction Technology teachers and students to create these visual aids.
- Demonstration of drawing techniques can be very helpful. Use whiteboard or projection system.
- Prepare handout activities for each stage of the portfolio development.
- Create posters of examples illustrating these techniques and put them up around the room so students always have something to refer to.
- When introducing sketching techniques, teachers should introduce the techniques in progression starting with simple two-dimensional shapes progressing to three-dimensional representation and the final addition of value and texture. Students should have several practice exercises through each progression.
- Graphic communication requires a lot of practice exercises to develop drawing skills, some of which may be completed for homework.
- When working on practice exercises be sure to select components that allow a progression of activities for the same drawings. The student will sketch the part, dimension it, add size tolerances and add geometric tolerances.
- Have students complete practice exercises individually. The final portfolio may be completed as design teams considering the number of drawings necessary.
- As a supplemental activity, the teacher may arrange for guest speaker(s) and a field trip to a local manufacturer, construction site or engineering firm.

Be sure to have a safe, secure storage system for paperwork, modelling components and in-progress models. Students tend to borrow components and partly built models when in panic mode.

Discourage the model being built at home. This gives you more of a sense of the group dynamics, timing issues and individual emphasis on the final product. Considerations for the near the end of the project may be given. Encourage coming in at lunch or after school on pre-set days.

SEF Component 2 Classroom Leadership Connections

Indicator 2.1 Collaboration with other teachers will inform instructional practices to meet the needs of students. A collaborative learning culture (e.g., a commitment to continuous improvement, a collective focus on student learning for all, deprivatization of practice and reflective dialogue) is evident. Evidence-based teaching practices, modelled in professional learning, are used in classrooms. ❖ Collaborative learning, inquiry, co-planning and/or co-teaching inform instructional practices to meet the needs of students.

Professional Learning Communities

Learning teams provide teachers with opportunities to work together to identify challenges and discuss classroom strategies. Actively participating in these communities can help contextualize content. As an example, discuss principles and elements of design teaching strategies with the Art Dept.

Growing Success

Diagnostic assessment: Develop a set of sketching/drawing exercises that will determine level of drawing proficiencies. This would be considered a strategy in addressing an assessment for learning.

ACTION INTRODUCE OR ENTEND LEARNING

Activity 2 Instructional Strategies	Connections
TEACHER Timelines ▪ This project should be set up with strict timelines and evaluation checkpoints. Timelines should be strictly enforced for the Situation, Focus, and Investigation stage. With such an open ended project, students lose themselves in the trial and error and construction stages. However, by professional judgment, adding time to construction or documentation stages should be considered if possible. The group work ethics should dictate this decision. (i.e. if groups are working extraordinarily hard and results are promising.) Design Team ▪ Introduce 'Discussion Etiquette" in preparation for brainstorming design ideas. Students must learn to work cooperatively. Discuss how this team work approach is a vitally important in careers related to design. Design Concepts ▪ Review 'Design Concepts' based on TDJ3M course Be sure to discuss how the design process will be applied to this project. ▪ Introduce 'Reverse Engineering' and discuss how it will specifically apply to this project in terms of design alterations/improvements/enhancements. Design Brief ▪ Based on the Activity 1, design teams should now have a design brief established. Conference with teams to ensure the design brief has been created. ▪ As a next step, they will need to create layouts and idea developments of their design. An emphasis should be placed and design improvements or modifications as per design concepts. Design Layouts and Idea Development ▪ Review principles and elements of design and discuss how they are useful in presenting design layouts and ideas. Describe how the expectations for this year's idea development sketches will	**The Ontario Curriculum, Grade 11-12, Revised 2009** Front Matter of this document describes problem solving methods and approaches that include the design process and reverse engineering **Think Literacy** Oral Communications-Whole Class Discussion-Discussion Etiquette http://www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy/files/Oral.pdf page 176 **SEF Component 2 Classroom Leadership Connections** **Indicator 2.5:** By introducing students to 'Discussion Etiquette', classroom practice reflects safe, accepting, inclusive, caring, respectful and healthy learning environments. The learning environment supports the diversity of learners. **DI TIPS** Selecting groups at your discretion. If the class has had success with selecting their own groups then continue with that process with suggestions and monitoring on your end. Selecting members based on individual strengths and weaknesses is also feasible. Know the dynamics of your class. The major factor of success and completing the project is based on the group selection. Keeping the number to 2 or 3 is recommended. Avoid allowing individual project completion. Refining Groupwork and team dynamic skills is a major learning expectation. Consider tiering the assignment to suit individual destinations and needs based on pre-assessment.

include an emphasis on value, texture and colour.

- Review the different drawing types**.** Be sure to identify the difference between presentation drawings and working drawings and discuss where in the design package they belong;
- Emphasize the fact that sketches can be developed using any type of drawing techniques from two-dimensional orthographic representation to three-dimensional pictorial representation;
- Discuss simple sketching techniques for drawing shapes (squares, rectangles and circles) and assign practice exercises for homework as an option and based on any diagnostic assessments.(Appendix K)
- Demonstrate how these shapes can then be converted to three-dimensional geometry using oblique, isometric and perspective representation standards**.**
- Review sectional and special views. Emphasis should be placed on the sectional and special views to distinguish this project from the grade 11 project. Students should provide a number of sectional, enlarged and exploded view of the hardscape.
- Through design team format, have students use all the learned techniques to develop design layouts and ideas for their hardscape.

Material Selection – List

- Discuss different types of materials that are available for the challenge and distribute Materials List – Bill of Materials. (Appendix L)
- Describe how to select materials based on design criteria, costs, and environmental consideration

Each group needs: (subject to Instructor/Grade Level Interpretation)

- plastic syringes; Syringe Sources: Kidder Manufacturing TSC Stores. See note below
- plastic tubing, such as from hardware, Canadian Tire, and pet supply stores for; see note below
- jinx wood- 5 mm x 5 mm, popsicle sticks (either/or/combo)
- pulleys, gears
- 1 wooden base
- glue, fasteners, etc
- wooden dowel
- gusset corners
- plastic straws
- elastic bands
- paper clips
- string
- sketching paper
- bolts, screws, nuts, washers (if applicable)

Teacher Tips

It is important that students have a sound understanding of how reverse engineering is applied to this design challenge. It is recommended that there are constant reminders of reverse engineering and design concepts, especially the design process.

Ontario Skills Passport

Literacy skills in reading, writing, oral communications, document and computer use.
http://www.skills.edu.gov.on.ca/OSP2Web/EDU/DisplayEssentialSkills.xhtml

Think Literacy

Developing and organizing ideas: have students use mind-mapping techniques when brainstorming ideas

The Ontario Curriculum, Grade 11-12, Revised 2009

Front Matter of this document describes the Fundamental Technological Concepts

Teacher Tips

It is recommended that all resources be posted to your board collaboration system (LMS) to avoid too many handouts and to ensure full accessibility.

SEF Component 2 Classroom Leadership Connections

Indicator 2.1 Collaboration with other teachers will inform instructional practices to meet the needs of students.

Professional Learning Communities Connection

Learning teams provide teachers with opportunities to work together to identify challenges and discuss classroom strategies. Actively participating in these communities can help contextualize content. As an example, discuss principles and elements of design

- other APPROVED materials
- 1 empty film canister or pill bottles – check with Art (photography) courses or dollar stores

Note about syringes and tubing: In this activity, all the syringes must be exactly the same and it is important that the plastic tubing fits snugly on the tip of the syringe. A good option is a 50 or 60 cc plastic manual syringe with a tapered tip. It may be helpful to purchase the syringes first and then bring one to a hardware or pet supply store to find appropriate sized plastic tubing.

You may opt to allow a certain number of each size of Syringe. 5, 10, 20, 30, 50, 60 as students will use smaller syringes for the gripper and are able to cut down on weight, mass, etc.
(A quantity of 2 -4 of three sizes are recommended)

To share with the entire class:

- power tools
- hand tools
- glue guns (instititute a max number of glue sticks)
- Exacto-knives
- sciccors

Joining – Syringe – Tubing Methods

- Discuss joining thermal, chemical, and mechanical joining methods. (Appendix G and H)
- Describe different types of threaded and non-threaded fasteners
- Explain how to select your project fasteners based on your design criteria and exposure to the environment
- Based on lessons and examples, have students select materials and joining methods for their hardscape.

Presentation Drawings

- Have design team create one final presentation drawing of their final design
- Be sure students add texture, value, colour and other design elements to their proposals by emphasizing the importance of presentation in demonstrating their creative thinking skills.

Working Drawings

- Introduce students to working drawings orthographic representation and assign practice exercises for homework based on diagnostic assessments.
- Discuss proper dimensioning standards for the working drawings.

Drawing Package

- Give students an overview (with criteria and instructions) of the drawing requirements for the drawing package.

teaching strategies with the Art Dept.

Teacher Tips

Note that joining methods and material selection lessons can be delivered while students are working on their design layouts. This will allow opportunities for just-in-time delivery of content.

FNMI

When describing material selection, describe some aboriginal concerns for our environment in terms of natural resources.To address the FNMI document, schools will strive to “employ instructional methods designed to enhance the learning of all First Nation, Métis, and Inuit students”, it is recommended that students research some First Nation, Métis, and Inuit natural hardscape designs.

SEF Component 1- Curriculum Connections

Indicator 1.1:

Overall Expectations: A3

Specific Expectations: A3.1, A3.2, A3.3

SafeDocs/SafeNet/Safety Videos

Computer station and ergonomic safety awareness.

Teacher Tips

Note that joining methods and material selection lessons can be delivered while students are working on their design layouts. This will allow opportunities for just-in-time delivery of content.

Math Literacy Connections

Students must become familiar with imperial vs imperial units, fractions,

STUDENT

Design Team

- Students will listen actively and critically to learn, understand and apply discussion etiquette when working as a team.

Design Concepts

- Students will be able to list and apply design concepts.
- They will use reverse engineering after selecting an existing product. Design teams will analyze the aesthetic and functional of the product in order to make informed decisions on design changes based on design concepts

Design Brief

- Design teams will create a design brief outlining design modifications, criteria and constraints in preparation for the next phase of the design process **(Appendix O Technical Report Outline)**

Design Layouts and Idea Development

- At this stage of the design process, teams will create a number of design layouts of their project. These sketched layouts will include the use of elements and principles of design with a focus on value, texture and colour.
- The layouts will also include a variety of drawing types with emphasis on exploded assemblies and sub-assemblies, sectional views and special views.
- All layouts will be created on design notebook templates and will include annotations as well as sketch developments
- Independently and as a group, students will be able to identify, describe, and apply; design concepts, elements and principles of design, drawing types, sectional and special view types.

Material Selection and Joining Methods

- Through research, design teams will select materials and joining methods for their designs

Presentation Drawings

- Design teams will analyze their ideas and select the best design.
- They will apply their reasoning in solving the design challenge by writing a one paragraph rationale of how they came about choosing their best design.
- Using pictorial representation and principles of design, the team will present final design proposal.

Working Drawings

- Students will become familiar with drafting standards allowing them to develop engineering drawings of their design proposal.
- Design teams will develop a portfolio package containing simple calculations, etc. in the context of product design

Math Literacy

Establishing A Positive Classroom Climate Valuing Mathematics Valuing mathematics implies being productively disposed towards the subject. It involves seeing mathematics as sensible, useful, and worthwhile, and seeing oneself as able to learn and use it. Teachers must create a climate whereby all students can make sense of the mathematics they are learning and gain confidence in their mathematical ability. Introduce most skills and concepts through problem solving. Building math literacy capacity is a strong component of this project.

SEF Component 1 Assessment for, as and of Learning Connections

Indicator 1.5: Students are encouraged to participate in the collection and development of personal documentation of learning (e.g., portfolios, journals, design notebooks) that assist in informing the next steps in their learning. This is especially important as they look forward to post-secondary opportunities where they can showcase these personal documents that demonstrate learning.

Literacy Connections

Developing and organizing ideas: have students use mind-mapping techniques when brainstorming ideas.

Engineering – Daily Logs and continuation of Technical Report.

presentation drawings and detail working drawings of their proposal. ▪ They will independently work on team specified individual drawings which will then be assembled as a drawing package. ▪ All hand drawings and sketches will be duplicated as formal drawings using CAD software. <u>Drawing Package</u> ▪ Design teams will assemble the design brief, criteria/constraints, idea development sketches, hand drawings and CAD drawings in a package to be submitted as per instructions	**Think Literacy** **Sketch development and formal CAD drawings Graphic Communications** <u>CAD Software (see Note on Free CAD)</u> This is an opportunity to work in a Unit on CAD. Incorporation of another Activity before the Unit Challenge/Activity is introduced. Google SketchUp is an effective, short learning curve software to produce individual components and the eventual Assembly Drawing. If AutoCAD or facsimile was introduced earlier, then students would be expected to use this software and standards for the Technical Drawing requirements. Autodesk : Free Student and Instructor Software http://www.autodesk.com/education/free-software/all Emphasis on sketching is encouraged in the Project Research and Information Gathering activity.
Activity 2 Assessment and Evaluation	**Connections**
Assessment strategies and tools in this activity will include opportunities in monitoring students' achievement levels as well as learning skills. **Application** ▪ Students are assessed on their ability to draw a given object using sketching techniques and engineering standards learned. Using a checklist format, teachers can check the hand drawn detailed drawings of the wind powered generator. The checklist may also be used in assessing the homework exercises. ▪ The completed CAD drawings will be evaluated individually or as a package using a rubric assessment tool. The purpose of this assessment is to gauge the student's ability in applying their communication skills graphically using engineering standards. **Thinking and Inquiry** ▪ To assess students on their thinking and inquiry skills, teachers will evaluate students' design brief, student developed criteria and constraints, idea development sketches and the written rationale in selecting their best design. A rubric tool may be used in the evaluation of this package; ▪ Upon completion of all drawings, students will be assessed on their knowledge and understanding through a written test containing true/false, multiple choice and fill in the blank type	**Growing Success** Using checklists allow for assessment as learning, also have conversations with the student about their progress to keep the process transparent. Final evaluations should not occur until the student has had verbal feedback along the way – assessment as learning. Learning Skills and Work Habits – Growing Success Pages 10 – 11. (Responsibility, Organization, Independent Work, Collaboration, Initiative, self-regulation) Assessment Categories K/U (30%), T (30%), A (30%), C (10%) **Differentiated Instructions (DI)** Tiering: Consider weighting summative activities according to destination (i.e., weigh the application higher for trade/college bound students…T/I & C higher for university

questions. Knowledge and understanding assessment will also take place through a practical CAD test where students are asked to convert a hand drawing to a CAD drawing; **Communications** ▪ Reflections: Students will self-assess their experiences through a reflective journal entry. The journal entries are evaluated through a rubric evaluation format. (Appendix B of the Grade 10 Manufacturing Technology Profile). **Learning Skills** ▪ Through observation and conferencing, students can be assessed formally or informally. Checklists, anecdotal comments or the Learning Skills rubric will serve to help assess students. The teacher will document the following: - the student' s skills pertaining to conflict management skills; - student's ability to work effectively as an interdependent team member; - student's initiative, leadership and participation in a group ▪ Conferencing assessment can take place on a daily basis. Be sure to provide encouragement and praising effort, as tasks are complete building on a positive self-image.	bound students) **SEF Component 1 Assessment for, as and of Learning Connections** **Indicator 2.2**- Provide explicit feedback about their engagement and learning as educators and advocate for what they need as learners Assessments will include communications, observation, performance assessment, reflection, conferencing and tests/quizzes. Assessment tools will include marking schemes for the activities, rubric assessments, tests, checklists and anecdotal comments. input, through the engineering logs and exit cards will help refine instruction to improve student learning
Activity. 2 Accommodations	**Connections**
▪ Teachers are to be familiar with exceptional students', ESL students and Individual Education Plans (IEPs) for legislated accommodations and consult with the appropriate staff. By doing this, teachers will be aware of and can implement prescribed modifications and accommodations. ▪ accommodations are to be made so students do not lose dignity because of disability, poverty, lack of success, linguistic diversity or race. Teachers foster a positive atmosphere accepting of individual's uniqueness, values, and needs. ▪ Teaching Strategies for students with special needs may include: ▪ grouping design teams with varied abilities to allow for peer support. The teacher may choose or modify the teams depending on individual strengths and weaknesses; ▪ providing a list of topics and suggestions where enrichment and challenge is needed, allowing students to be peer tutors/mentors; ▪ pairing experienced students with those who are not yet familiar with the techniques. Some students have obtained knowledge of drawing techniques in previous art and/or technology courses. ▪ having students enhance their design portfolio by adding more difficult pictorial type drawings (isometric, oblique or perspective). This can be done free hand or using CAD modeling options; ▪ challenging students by having them develop isometric exploded	Assessment for Learning and As Learning – Growing Success. Page 31 Table 4.1 The Purposes of Assessment, the Nature of Assessment for Different Purposes, and the Uses of Assessment Information **Differentiated Instructions (DI)** Challenge students by having them prepare for and write the CAD Certification Exam. The preparation will need to be completed independently. Encourage teams to select group members on their strengths, thus one group member would be responsible for CAD drawings, Project Management, Technical Reporting, etc. Although you do not encourage each member to take the entire process on, they would become the coordinator of each. It is required that all students participate or contribute to each of the stages of the Design Process.

assemblies and sub-assemblies. This drawing illustrate how components are assembled (similar to do-it-yourself-kits drawings);	*In order to improve student learning and help students become independent learners, teachers need to make a committed effort to teach these skills and provide all students in all grades with opportunities to practise them. Teachers need to scaffold this learning for students, using a model of gradual release of responsibility for learning, as follows: • demonstrate the skills during instruction; • move to guided instruction and support; • have students share in the responsibility for assessing their own work; • gradually provide opportunities for students to assess their own learning independently. The ultimate goal of the process is to move each student from guided practice to independent practice, based on the student's readiness.* *(Growing Success, p. 35)*

CONSOLIDATION & CONNECTIONS

Provide Opportunities for Reflection

Activity 1 ENGINEERING LOG – TECHNICAL REPORTING	**CONNECTIONS**
ENGINEERING LOG: Complete the Engineering Log/Daily Journal Sheets handed out by the instructor. Instructors may evaluate the logs daily. Have them complete the logs in the last 10 minutes and bring them to you for checking. Mark out of 5 – 10 and recorded. • Submit an **individual** engineering log (point form) for each day of project (include what was done, successes, failures, and planning for next day) - **Instructor will hand out blank *Daily Journal Sheets.***	**SEF Component 2 Classroom Leadership Connections** **Indicator 2.2-** input, through the reflection papers will help refine instruction to improve student learning **DI Connections** The student completes a daily Engineering Log to demonstrate their learning. This will provide an informal measure of how well students understood design concepts in terms of research and information gathering. Teaching strategies may need to be changed based on student feedback.
Activity. 2 EXIT CARD	**CONNECTIONS**

Have students fill out exit cards on days where lessons are delivered. Be sure questions are broad in nature but specific enough to measure student learner. Prepare half-slips of paper with typed questions or write questions on the whiteboard for students to answer. Have students complete exit cards during the final 5 minutes of the class period. Since exit cards must be turned in before students leave class, it is best if the prompts are specific and brief. Often they refer directly to the content that was studied, but they can also be general in nature such as: ▪ List three things you learned in class today. ▪ What questions, ideas and feelings have been raised by this lesson? ▪ What was your favorite moment of class? Why? What was your least favorite part of class? Why? ▪ Evaluate your participation in class today. What did you do well? What would you like to do differently next time	**DI Connections** The student completes and exit card to demonstrate their learning. This will provide an informal measure of how well students understood design concepts. Teaching strategies may need to be changed based on student feedback

MATERIALS, TOOLS and RESOURCES

Activity. 2 Websites:

- Think Literacy Document: Cross-Curriculum Approaches-Grades 7-12: http://www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy/files/Oral.pdf
- Ontario Association of Certified Technicians and Technologists-http://www.oacett.org/
- Association of Professional Engineers-http://www.apegga.com
- Grade 12 Technological Design Curriculum Document
- Differentiated Instruction – Ministry Site
- http://www.edugains.ca/resourcesDI/EducatorsPackages/DIEducatorsPackage2010/2010EducatorsGuide.pdf.
- Carpenito, K. and E. Chilton. Hydraulic Arms Challenge. Posted January 2006. Accessed November 7, 2011. (activity inspiration) https://docs.google.com/View.aspx?docid=ah7pxzjtrzfd_baddp39ndp3dv
- Hydraulic Arm Research. Posted January 27, 2006. Beebe School of Engineering. Accessed November 7, 2011. (a list of references to support this activity, including info on the arm joint and the engineering design process)
- http://k12engineering.blogspot.com/2006/01/hydraulic-arm-research.html
- Brain, Marshall. How Hydraulic Machines Work. How Stuff Works. Accessed November 7, 2011. http://science.howstuffworks.com/hydraulic.htm

- https://www.gates.com/~/media/files/gates/automotive/4287153-intro-to-hydraulics_101-manual.pdf

Activity. 2 Publications:

- French E., Svensen C., Helsel J., Urbanick B., Mechanical Drawing, CAD-Communications, (Twelfth Edition), Peoria, Illinois: Glencoe, McGraw-Hill, 1997.
- ISBN 0-02-667958-2 (Student Text)
- ISBN 0-02-677959-0 (Teacher's Resource Binder)
- ISBN 0-02-667961-2 (Student Workbook)
- Negus M. Introduction to Drafting. Toronto: McGraw-Hill Ryerson Ltd., 1983.
- Quilan C. Orthographic Projection Simplified. Toronto: McGraw-Hill Ryerson Ltd., 1996. ISBN 0-02-677320-1
- Ragan, Rosalind, Arttalk, Third Edition, Glencoe, McGraw Hill, ISBN 0-02-662434-6
- Spence W. P. Drafting Technology and Practice. Peoria, Illinois: Glencoe,1991. ISBN 0-02-676290-0
- Todd R., Todd K., McCrory D., Introduction to Design and Technology, Thomson Learning Tools, 1996.
- ISBN 0-538-64465-6 (hard cover Student Text),
- ISBN 0-538-64466-4 (soft cover Teacher's Resource Guide),
- ISBN 0-538-64465-6 (soft cover Portfolio & Activities Resource),
- Wallach P., Metric Drafting. California: Collier Macmillan Publishers, 1979.

Activity. 2 VIDEO RESOURCES

- Visual Design, Elements and Principles, 20 minutes, Classroom Videos, Unit C, 9005 Centaurus Circle, Burnaby, BC V3J 7N4, Canada, (604) 420-3066
- Search for You Tube or other video resources for subject specific supports.

Activity. 2 COMPUTER SOFTWARE

- CAD Software (Google Sketchup, AutoCAD, Solid Edge)
- Word Processor
- Google Apps.
- Autodesk : Free Student Software http://www.autodesk.com/education/free-software/all

Activity. 2 HUMAN RESOURCES

- Guest speakers: local professionals (survey class for parents, friends and family employed in manufacturing sector)
- Special Education/Resource staff
- Art/Math/Science teachers
- Computer Technician

Activity 2 OTHER

- Board computer policies
- Local manufacturing industry for tours and guest speakers
- Canadian Professional Engineering Association for guest speakers

- Ontario Certified Engineering Technician and Technologist association for guest speakers
- Skills Ontario-select students to participate in Mechanical CADD category

Activity. 2 APPENDICES

- Appendix F: Pneumatic Hydraulic Systems Work Sheet
- Appendix G: Pneumatics 101
- Appendix H: Control Technology
- Appendix I: Prototype Performance Assessment
- Appendix J: Design Concepts - Sketches
- Appendix K: Intro To Sketching
- Appendix L: Material List – Bill of Materials
- Appendix M: Prototype Evaluation
- Appendix N: Technical Report Writing
- Appendix O: Technical Report Outline
- Appendix P: Technical Report Evaluation Rubric

Activity 3 Tool Safety – Hand/Power Tools : Construction

Activity Description:

To demonstrate to students the safe and correct methods of using small hand and power tools. This Activity should be covered before any Activity 4 Prototype Construction is undertaken in a classroom or Construction Lab.

Safe Activity Foundation In Education (SAFEdoc):
http://www.octelab.com/sites/default/files/safedoc_host_0.pdf
Technological Design

This ***SAFEdoc*** was designed to provide safety data sheets, posters, safety passports, and safety resources for all technology educators. While originally developed as a resource for the Course Profiles, it is available for any grade level or any technology education environment.

Activity 3 Criteria and Instructions

Hand/Power tools safety and correct method of Use to be covered but not exclusive:

- Dremel Tool
- Drill Press
- Hand Saw
- Mitre Saw
- Scroll Saw
- Modelling Knives (Exacto)
- Hot Glue Gun
- Paints Sealants and Finishes

MINDS ON

ENGAGING PRIOR KNOWLEDGE

Activity 3 PRIOR KNOWLEDGE	CONNECTIONS
Prior Knowledge Required; The student will have: ▪ Previous experience with small hand tools in TDJ Course ▪ respect for the rights, responsibilities and contributions of self and others; ▪ experience in hand/power tool use in grade 9 TTI or Grade 10 Construction	

Activity 3 PLANNING NOTES	CONNECTIONS
▪ Check all recommended resources prior to beginning lessons and activity. ▪ Do an inventory of all tools and equipment. ▪ If possible, secure the Construction or Art Room Lab for model building space. ▪ Review all activities and prepare all resources (handouts, and materials) necessary for the delivery of content. ▪ If using collaboration software, be sure that SAFEDoc passports and aid sheets are updated and ready for student interaction.	**Teacher Tips** It is recommended that all resources be posted to your board collaboration system to avoid too many handouts and to ensure full accessibility. This activity is ideal for allowing students to use their own personal devices in their research. Teachers are encouraged to add to this ***SafeDOC*** with data sheets, tests or other materials on an ongoing basis. Additions or revisions to this document will be posted on the **Ontario Council for Technology Education (OCTE)** website (http://www.octe.on.ca) periodically. This document is a practical safety resource that compliments and elaborates on other recommended resources for technical teachers. See the appendix for linking information such as **Live Safe! Work Smart!**, the **Young Worker's Awareness Program**, and industry associations dedicated to safe working practices. It is imperative that all students are made aware of the issues of health and safety particular to your class, and that you have assessed and evaluated their understanding before they are allowed to work in a shop environment or on specific procedures or tools. The use of Safety Passports, Safety Agreements, and Safety Tests (provided in this document) is highly recommended.

ACTION INTRODUCE OR ENTEND LEARNING

Activity 3 Instructional Strategies	Connections

Teacher:

- SAFEdocs – OCTE Website

Teachers must be aware of their Board Safety Documents that outline safety procedures for machinery, tools, equipment, and procedures by completing advised Board Training. Use of Board Safety Documents is required as the minimum basis for safety instruction. Enhancements and additions to these documents are permitted to meet program needs. Students and employees must receive instructions on the safe and proper operating procedures for specific machinery and equipment by a qualified Technological Education Teacher before permission is given to use tools, machinery, and equipment.

Teachers are responsible for ensuring the safety of students during technology lab, shop, and classroom activities. Health and safety issues must also be addressed when learning involves cooperative education and other workplace experiences. Teachers need to encourage and motivate students to assume responsibility for their own safety and the safety of others, and they must help students develop the knowledge and skills needed for safe participation in all

technology-related activities.

Teachers must pocess

- the knowledge necessary to use the materials, tools, and procedures involved in science and technology safely
- the skills needed to perform tasks efficiently and safely

Note: Teachers supervising students using power equipment such as drills, sanders, and saws need to have specialized training in handling such tools. This specific training requirement applies to listed equipment in all areas of technology education specialization.

Teachers of Technological Education courses must carefully maintain records of student attendance and records of safety instruction given.

Teachers are expected to be able to provide documentation:

The Ontario Curriculum, Grade 11-12, Revised 2009

Overall Expectations: A4, B3,
Specific Expectations: A4.2, B3.1

SEF Component 1 Assessment for, as and of Learning Connections

Describe what students are expected to learn. Provide students a clear vision of where they are going

Ontario Skills Passport

Literacy skills in reading, writing, oral communications, document and computer use.

Literacy Connection

Reading (research) Strategy: Engaging in Reading

- Sorting Ideas Using a Concept Map can be used in documenting their research on themes and styles
- 'Making Notes' strategy is applicable for this activity

Safe Activity Foundation In Education (SAFEdoc):
http://www.octelab.com/sites/default/files/safedoc_host_0.pdf
Technological Design

1. that the student was present on the date each safety lesson was taught (dated lesson plans, attendance records clear and unambiguous) 2. of the safety lesson that was delivered (e.g., PowerPoint, note taking, signed safety pledge, pre-printed sheets, successful passing on an announced written test that is dated and stored by the teacher, correction of errors completed) OCTE SAFEdoc HOST SAFEdoc Page 8 HOST 3. that indicates student understanding of the safety lesson (e.g., completed evaluation tool, student notes) 4. of how students are reminded of safe practice throughout the course (e.g., notation in teacher daybook) 5. that the work and learning environments are kept safe, tidy, and in good condition (e.g., photos, focus on machines with guards in place, maintenance records, safety inspections, cleanup procedures, student safety stewards, modeling of best practices), and that the Head Caretaker is informed of any maintenance issues 6. that students' different learning styles and needs are taken into account, both during the delivery of the safety lessons and during any follow-up evaluation (e.g., use of visuals, opportunities to demonstrate understanding orally) 7. that safety procedures are explained using various strategies such as verbal explanation, demonstrations through modeling, and accompanied by both written and pictorial explanations that are posted throughout the work and learning environments 8. that accommodations and, if necessary, modifications are made to the curriculum and included in the Individual Education Plan (IEP) in the event that the student cannot manage all curriculum expectations safely 9. that each student has signed the annual acknowledgment form, stating that he/she has been informed of the safety procedures **Student:**	

▪ Students demonstrate that they have the knowledge, skills, and habits of mind required for safe participation in Science and Technology activities when they: ▪ maintain a well-organized and uncluttered workspace ▪ follow established safety procedures ▪ identify possible safety concerns ▪ suggest and implement appropriate safety procedures ▪ carefully follow the instructions and example of the Teacher ▪ consistently show care and concern for their own safety and that of others ▪ that each student has signed the annual acknowledgment form, stating that he/she has been informed of the safety procedures	
Activity 3 Assessment and Evaluation	**Connections**
Learning Skills ▪ Through observation and conferencing, students will be assessed formally or informally.	**SEF Component 1 Assessment for, as and of Learning Connections** **Indicator 2.2**- Provide explicit feedback about their engagement and learning as educators and advocate for what they need as learners Assessments will include communications, observation, performance assessment, and conferencing.
Activity 3 Accommodations	**Connections**
▪ Teachers are to be familiar with exceptional students', ESL students and Individual Education Plans (IEPs) for legislated accommodations and consult with the appropriate staff. By doing this, teachers will be aware of and can implement prescribed modifications and accommodations.	**SEF Connections** Accommodations are to be made so students do not lose dignity because of disability, poverty, lack of success, linguistic diversity or race. Teachers foster a positive atmosphere accepting of individual's uniqueness, values, and needs.

MATERIALS, TOOLS and RESOURCES

Activity 3 WEBSITES

- Safe Activity Foundation In Education (SAFEdoc): http://www.octelab.com/sites/default/files/safedoc_host_0.pdf Technological Design

Teachers should make use of all available and relevant resources to make students sufficiently aware of the importance of health and safety. These resources include:

Live Safe! Work Smart! – website (http://www.livesafeworksmart.net/) and related resources

- Passport to Safety – website (http://www.passporttosafety.com/) and related resources • Workplace Safety and Insurance Board (WSIB) – website (http://www.wsib.on.ca/splash.html) and related resources

Teachers should also be aware of the Occupational Health and Safety Act, Regulations 857, Amended to O. Reg. 352/91. The Occupational Health and Safety Act can be found at: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900857_e.htm

Activity 4 Modelling – Prototype Construction

Activity Description:

To safety and accurately construct the Pick and Place Prototype given the materials listed. Students will work as a group/team to complete one successful prototype for testing. See Project Management Timelines. (Appendix B – Project Management Timelines)

Activity 3 – Tool Safety may be incorporated into the start of this Activity.

Safe Activity Foundation In Education (SAFEdoc):
http://www.octelab.com/sites/default/files/safedoc_host_0.pdf
Technological Design

This ***SAFEdoc*** was designed to provide safety data sheets, posters, safety passports, and safety resources for all technology educators. While originally developed as a resource for the Course Profiles, it is available for any grade level or any technology education environment.

Activity 4 Criteria and Instructions

Using the Technical Drawings and Materials List previously completed, use the available Hand/Power tools safety and correctly to model the prototype.

Prototype - See Appendix A – Design Challenge

Your **Prototype** Robotic Crane final design must incorporate the following components:

1. At least 2 Simple Machines (gears, levers, pulleys etc.)
2. At least one hydraulic or pneumatic component
3. A vertical movement of at least 10 cm
4. A horizontal movement of 15 cm from the middle position to the right and left
5. All control systems\devices for your crane must be attached to the base
6. Must be able to lift and move the hazardous waste barrels accurately from one location to another.
7. Be at a scale of 1:20 – weight proportional
8. Have the abilith to rotate the tower/base 360 degrees (base does not need to move – raadially or laterally)
9. Utilize a system of pneumatic/hyraulic nature.
10. NOT change shape – deflect, twist, distort – more than 5 mm in any dirction on application of the load

MINDS ON

ENGAGING PRIOR KNOWLEDGE

Activity 4 PRIOR KNOWLEDGE	**CONNECTIONS**
Prior Knowledge Required; The student will have: ▪ group work skills; ▪ skills in co-operative learning techniques (effective interpersonal skills) and an understanding of personal responsibilities and commitment required for group activities; ▪ knowledge and basic skills of small hand/power tools ▪ knowledge of fastening methods and techniques ▪ respect for the rights, responsibilities and contributions of self and others;	
Activity 4 PLANNING NOTES	**CONNECTIONS**
▪ Secure large work space facility, art room, construction lab for building	

▪ Establish a safe and secure storage area for group modelling projects – individual access if possible. ▪ Secure all controlled building materials for instructor distribution ▪ Confirm that all groups have completed the required documentation and checklist in order to secure materials ▪ Confirm that all students have completed the necessary safety tests, passport and checklist requirements for hand/power tool use.	

ACTION INTRODUCE OR ENTEND LEARNING

Activity 4 Instructional Strategies	**Connections**
Teacher: ▪ Review Prototype Evaluation **(Appendix M)** ▪ Describe what students are expected to learn and how their learning will help with the overall project. Provide students a clear vision of where this activity will lead. ▪ Review the Project Management – Timeline (Appendix B) <u>Material Selection and Joining Methods</u> ▪ Review that the students through Project Research and Information Gathering have selected materials and are aware of the joining methods for their designs ▪ **Student:** ▪ organize portfolio and prepare to present their design	**The Ontario Curriculum, Grade 11-12, Revised 2009** Overall Expectations: A4, B3, Specific Expectations: A4.2, B3.1 **SEF Component 1 Assessment for, as and of Learning Connections** Describe what students are expected to learn. Provide students a clear vision of where they are going **Ontario Skills Passport** Literacy skills in reading, writing, oral communications, document and computer use. **Literacy Connection** Reading (research) Strategy: Engaging in Reading ▪ Sorting Ideas Using a Concept Map can be used in documenting their research on themes and styles ▪ 'Making Notes' strategy is applicable for this activity
Activity 4 Assessment and Evaluation	**Connections**
Assessment strategies and tools in this activity will include opportunities in monitoring students' achievement levels as well as learning skills. (App	

Thinking and Inquiry ▪ To assess students on their thinking skills, teachers will evaluate students' research report in terms of using a variety of resources. **Communications** ▪ The research report will be assessed in terms of format, content and overall appearance. **Learning Skills** ▪ Through observation and conferencing, students will be assessed formally or informally. ▪ The teacher will document the following: - the student' s skills pertaining to conflict management skills; - student's ability to work effectively as a team member; - student's initiative, leadership and participation in a group. ▪ Conferencing assessment can take place on a daily basis. Be sure to provide encouragement and praising effort, as tasks are complete building on a positive self-image. **Assessment Tools:** ▪ Rubric **(Appendix M, P)**	**Growing Success** Assessment Categories T (70%), C (30%) **SEF Component 1 Assessment for, as and of Learning Connections** **Indicator 2.2**- Provide explicit feedback about their engagement and learning as educators and advocate for what they need as learners Assessments will include communications, observation, performance assessment, and conferencing.

CONSOLIDATION & CONNECTIONS

Provide Opportunities for Reflection

Activity 4.1 ENGINEERING LOG – TECHNICAL REPORTING	**CONNECTIONS**
ENGINEERING LOG: Complete the Engineering Log/Daily Journal Sheets handed out by the instructor. Instructors may evaluate the logs daily. Have them complete the logs in the last 10 minutes and bring them to you for checking. Mark out of 5 – 10 and recorded. • Submit an **individual** engineering log (point form) for each day of project (include what was done, successes, failures, and planning for next day) - **Instructor will hand out blank *Daily Journal Sheets.***	**SEF Component 2 Classroom Leadership Connections** **Indicator 2.2-** input, through the reflection papers will help refine instruction to improve student learning **DI Connections** The student completes a daily Engineering Log to demonstrate their learning. This will provide an informal measure of how well students understood design concepts in terms of

	research and information gathering. Teaching strategies may need to be changed based on student feedback.

MATERIALS, TOOLS and RESOURCES

Activity 4 APPENDICES
▪ Appendix M: Prototype Evaluation

Activity 5 Evaluation – Documentation Project Portfolio

Activity Description:

Your final design portfolio sums up the work that your team has completed. It needs to showcase the breadth of your project, your skills in resolving the challenge, and how you generate and execute ideas. It basically describes your whole creative process.
When done well, the portfolio should impress the viewer, demonstrating how your team collaborated on a design that meets or surpasses all expectations.

There are lots of varying opinions on exactly what a design portfolio should contain (especially what format it should take). In this activity, students will be introduced to a variety of portfolio options. Using all of their work produced throughout the design process, teams will present their design using a portfolio format.

Although, a great deal of technical drawings was initiated and completed in Activity 1 and 2, the final CAD drawings would be part of the Activity 5 because of the numerous design changes between Activty 2 and 5. Allow the students to complete all CAD drawings in this Activity. However, all thumbnails,

sketched to scale concepts and orthographics will not be modified. This allows the student to see how the design stage evolves and changes throughout each Activity. It allows for reflection on trial and error, successes and failures. This is also noted in their Design Notebook. Instructors should be aware of the time restraints and add or subtract required views and drawing types. It could focus on only completing the Tower Structure or Detail the Gripper.

Use the 3D computer model (AutoCAD,Inventor, Sketchup) and the Presentation File to create a fully dimensioned, annotated set of working drawings, including orthographic, isometric, section, and detail drawings, with an exploded view and parts list.

The set of working drawings should have enough information to enable someone to build the project

Activity 5 Criteria and Instructions
The Design Portfolio Will include: ▪ Challenge Statement ▪ Design Brief ▪ Research and Information Gathering ▪ Idea Development ▪ Presentation Drawings ▪ Reflection/Concluding Remarks

MINDS ON

ENGAGING PRIOR KNOWLEDGE

Activity 5 PRIOR KNOWLEDGE	**CONNECTIONS**
Prior Knowledge Required; The student will have: ▪ group work skills; ▪ skills in co-operative learning techniques (effective interpersonal skills) and an understanding of personal responsibilities and commitment required for group activities; ▪ intermediate skills in word processing used for journals/log entries; ▪ respect for the rights, responsibilities and contributions of self and others; ▪ knowledge of report formats based on grade 11 TDJ3M course prerequisite	**Teacher Tips** It may be a good idea to review report format and specific word processing features. E.g., inserting tables, headers, footers, cover page, etc.
Activity 5 PLANNING NOTES	**CONNECTIONS**
▪ Check all recommended resources prior to beginning lessons and activity.	**Teacher Tips**

▪ Be sure that all computers are in working order and that Internet access is available. ▪ Check school WiFi for accessibility. ▪ Review all activities and prepare all resources (handouts, and materials) necessary for the delivery of content. ▪ If using collaboration software, be sure that all posts are updated and ready for student interaction.	It is recommended that all resources be posted to your board collaboration system to avoid too many handouts and to ensure full accessibility. This activity is ideal for allowing students to use their own personal devices in their research.

ACTION INTRODUCE OR ENTEND LEARNING

Activity 5 Instructional Strategies	**Connections**
Teacher: ▪ Review portfolio types **(Appendix V)** ▪ Introduce activity and criteria **(Appendix X)**. Discuss the link with the grade 11 course. ▪ Describe what students are expected to learn and how their learning will help with the overall project. Provide students a clear vision of where this activity will lead. ▪ review portfolio types (Appendix G) and describe differences **Student:** ▪ organize portfolio and prepare to present their design ▪ Create a 3-view orthographic drawing and isometric drawing of the assembled model. ▪ Create and dimension orthographic and isometric drawings for each part such that all information to make the part is included ▪ generate a parts list ▪ Include hidden lines in orthographic views of parts; include centerlines for circular and cylindrical features.	**The Ontario Curriculum, Grade 11-12, Revised 2009** Overall Expectations: A5 Specific Expectations: A5.1, A5.2, A5.3 **SEF Component 1 Assessment for, as and of Learning Connections** Describe what students are expected to learn. Provide students a clear vision of where they are going **Ontario Skills Passport** Literacy skills in reading, writing, oral communications, document and computer use. **Literacy Connection** Reading (research) Strategy: Engaging in Reading ▪ Sorting Ideas Using a Concept Map can be used in documenting their research on themes and styles ▪ 'Making Notes' strategy is applicable for this activity
Activity 5 Assessment and Evaluation	**Connections**
Assessment strategies and tools in this activity will include opportunities in monitoring students' achievement levels as well as	

learning skills. (App **Thinking and Inquiry** ▪ To assess students on their thinking skills, teachers will evaluate students' research report in terms of using a variety of resources. **Communications** ▪ The research report will be assessed in terms of format, content and overall appearance. **Learning Skills** ▪ Through observation and conferencing, students will be assessed formally or informally. ▪ The teacher will document the following: - the student' s skills pertaining to conflict management skills; - student's ability to work effectively as a team member; - student's initiative, leadership and participation in a group. ▪ Conferencing assessment can take place on a daily basis. Be sure to provide encouragement and praising effort, as tasks are complete building on a positive self-image. **Assessment Tools:** ▪ Rubric **(Appendix M, P)**	**Growing Success** Assessment Categories T (70%), C (30%) **SEF Component 1** **Assessment for, as and of Learning Connections** **Indicator 2.2**- Provide explicit feedback about their engagement and learning as educators and advocate for what they need as learners Assessments will include communications, observation, performance assessment, and conferencing .
Activity 5 Accommodations	**Connections**
▪ Teachers are to be familiar with exceptional students', ESL students and Individual Education Plans (IEPs) for legislated accommodations and consult with the appropriate staff. By doing this, teachers will be aware of and can implement prescribed modifications and accommodations. ▪ Teaching Strategies for students with special needs may include: – grouping design teams with varied abilities to allow for peer support. The teacher may choose or modify the teams depending on individual strengths and weaknesses; – providing a list of designs and suggestions where enrichment and challenge is needed, allowing students to be peer tutors/mentors; – pairing experienced students with those who are not yet familiar with the techniques.	**SEF Connections** Accommodations are to be made so students do not lose dignity because of disability, poverty, lack of success, linguistic diversity or race. Teachers foster a positive atmosphere accepting of individual's uniqueness, values, and needs.

CONSOLIDATION & CONNECTIONS

Provide Opportunities for Reflection

Activity 5.1 LEARNING SKILLS SELF-ASSESSMENT	CONNECTIONS
Learning Skills Self-Assessment Have students complete a self-assessment form **(Appendix Z).** This will increase responsibility for students' own learning as a result of more opportunities for self-reflection.	**SEF Component 1 Assessment for, as and of Learning Connections** **Indicator 1.5-** Students are explicitly taught and regularly use self assessment skills to monitor, improve, and communicate their learning.
Activity 5.2 ENGINEERING LOG – TECHNICAL REPORTING	**CONNECTIONS**
ENGINEERING LOG: Complete the Engineering Log/Daily Journal Sheets handed out by the instructor. Instructors may evaluate the logs daily. Have them complete the logs in the last 10 minutes and bring them to you for checking. Mark out of 5 – 10 and recorded. • Submit an **individual** engineering log (point form) for each day of project (include what was done, successes, failures, and planning for next day) - **Instructor will hand out blank *Daily Journal Sheets.***	**SEF Component 2 Classroom Leadership Connections** **Indicator 2.2-** input, through the reflection papers will help refine instruction to improve student learning **DI Connections** The student completes a daily Engineering Log to demonstrate their learning. This will provide an informal measure of how well students understood design concepts in terms of research and information gathering. Teaching strategies may need to be changed based on student feedback.

MATERIALS, TOOLS and RESOURCES

Activity 5 COMPUTER SOFTWARE

- Word Processor
- Internet
- search for YouTube or other video resources for subject specific supports

Activity 5 APPENDICES

- Appendix N: Technical Report Writing
- Appendix O: Technical Report Outline
- Appendix P: Technical Report Evaluation Rubric
- Appendix Z: Learning Skills Self-Assessment