OCTE 2012 – Elementary Conference Workshops

GRADE 5 | UNDERSTANDING EARTH AND SPACE SYSTEMS
CONSERVATION OF ENERGY AND RESOURCES

SOLAR POWERED FAN DESIGN CHALLENGE

OVERALL EXPECTATIONS

By the end of Grade 5, students will:
2. investigate energy transformation and conservation.

SPECIFIC EXPECTATIONS

2. Developing Investigation and Communication Skills
By the end of Grade 5, students will:

2.1 follow established safety procedures for using tools and materials (e.g., use hand drills correctly when making holes in wood)
2.3 use technological problem-solving skills (see page 16) to design, build, and test a device that transforms one form of energy into another (e.g., create a child's toy that uses the electrical energy from a battery or solar cell to move across the floor [kinetic energy] and make a noise [sound energy]), and examine ways in which energy is being "lost" in the device Sample guiding questions: Describe the energy transformations that are taking place in your device. What challenges did you encounter in making these transformations take place? As one form of energy is being transformed into another, where is energy being lost in your device? How might you minimize that loss?
2.4 use appropriate science and technology vocabulary, including energy, heat, light, sound, electrical, mechanical, and chemical, in oral and written communication
2.5 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes (e.g., in a small group, discuss ways in which technological innovations increase and/or decrease our ability to conserve energy)

Learning Goals

1. Students will follow established safety procedures for using tools and materials (e.g., use hand drills correctly when making holes in wood).
2. Students will use technological problem-solving skills (see page 16) to design, build, and test device that transforms one form of energy into another (e.g., a solar powered fan); as well as examine ways in which energy is being lost in the device.
3. Students will use science and technology vocabulary such as heat, light, sound, electrical, and mechanical, in oral and written communication.
4. Students will use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate their design challenge solutions to their teacher and classmates.

Assessment and Evaluation

- You may differentiate your assessment by offering your students a variety of these items as "choices", while making other items mandatory.
- Please see Appendix B for this unit's assessment rubric (assessment of learning).
- Please see Appendix C for this unit's Grade Sheet (assessment of learning).

- Please see Appendix D for the Continuum for Technological Problem Solving rubric (assessment for/as learning).
- Please see Appendix E for the Assessment As Learning, Student Self-Assessment Log" (assessment **as** learning).
- Please see Appendix F for the Teacher's Record, Assessment **For** Learning sheet.
- **For Additional Assessment and Evaluation support, please see Appendix G**

Success Criteria

Knowledge and Understanding (K&U), please see "Appendix B" for corresponding evaluation items:

- the student acquired a knowledge of facts and terminology related to the transformation of energy in a solar powered fan and sources of energy loss in the device, as well as, used tools and materials safely and appropriately in building/using a solar powered fan (K&U, 1);
- the student understands content (e.g., concepts, ideas, and processes) that address her/his solar powered fan (K&U, 2);

Thinking and Investigation (T&I), please see "Appendix B" for corresponding evaluation items:

- the student identified and located relevant resources, developed hypotheses, regarding potential solutions to his/her design challenge, and developed a suitable set of plans - based on the research and hypotheses noted above (T&I, 3);
- the student used processing skills and strategies (e.g., performing and recording, gathering evidence and data, observing, manipulating materials and using equipment safely, ... proving) to design and fabricate a solar powered fan (T&I, 4);
- the student used critical/creative thinking processes, skills, and strategies (e.g., analysing, interpreting, problem solving, evaluating, forming and justifying conclusions on the basis of evidence) to complete a fair test, to determine if her/his prototype meets the design requirements for this task (T&I, 5).

Communication (Com.), please see "Appendix B" for corresponding evaluation items:

- the student completed an oral, visual, or written report that was organized in a clear, logical manner, and included diagrams and models where appropriate (Com., 6);
- the student's report accurately described the steps taken to solve the design challenge, as well as, the learning that he/she acquired from the unit; the student used an appropriate oral, visual (media), and/or written form for the selected audience e.g., teacher, or teacher and classmates (Com., 7);
- the student included the correct use of scientific vocabulary and terminology (e.g., as heat, light, sound, electrical, and mechanical) in her/his report (Com., 8);

Application (App.), please "Appendix B" for corresponding evaluation items:

- the student followed established safety practices for using apparatuses, tools, and materials (App., 9);

○ the student listed beneficial and non-beneficial aspects of his/her design regarding people, other living things, and the environment, and suggested ways to lessen any of the design's undesirable impacts (App., 10);

○ the student proposed courses of practical action that involved the use of her/his solar powered fan (e.g., address energy consumption issues [brownouts and blackouts] that happen during heat waves by providing an "off grid" alternative, to reduce pressure on our energy systems) (App., 11).

Curriculum Connections and Additional Assessment Opportunities

Language:

- Oral Communication, Overall Expectations 2 and 3 (select from specific expectations 2.2 - 2.7, and 3.1);
- Writing, Overall Expectations 1, 2, 3, and 4 (select from specific expectations 1.3, 1.4, 1.5 1.6, 2.1, 2.4, 2.5, 2.6 - 2.8, 3.1 - 3.8, and 4.1);
- Media Literacy, Overall Expectations 3 and 4 (select from specific expectations 3.2 - 3.4, and 4.1).

Materials and Tools List

Tools:

- CSA approved safety glasses/goggles, one pair per person (parent volunteers included);
- an approved eyewash station; this can be two eyewash bottles containing approved eyewash fluid that has not reached its expiry time limit after decanting, or an installed system (an actual eyewash station, or approved faucet attachment);
- a first aid kit (please see your Board's Health and Safety Regulations if one is being purchased for your classroom);
- basic hacksaws (junior saws), or coping saws, minimum one for every 3 projects (local hardware stores, www.kidder.ca or www.busybeetools.com),
- bench hooks, minimum one for every 3 projects (www.kidder.ca),
- 3" C-clamps, minimum one for every 3 projects (local hardware stores, www.kidder.ca or www.busybeetools.com),
- a ruler, one per project;
- if you wish to have your students include adjustable positioning of the fan and/or solar cell, the following tools will be needed;
    - manual hand drill (closed, non-powered), 3 per class (www.kidder.ca),
    - drill bits, one for each drill, match to the size of the nut, bolt, and washer combinations you will be using (see your local hardware store);
    - a small adjustable wrench (to tighten nuts onto stove bolts),
    - a flat head screwdriver (to hold stove bolt while the nut is being tightened) please note that if other bolts are being used, you may need a different screwdriver head;
- wire strippers, if wires do not have enough bare material to make proper connections or joints (pliers with a side cutter section will work, or even scissors; however, they are more likely to cut the wire during stripping than actual wire strippers), one for every six projects;
- scissors, one pair for every project (students may supply their own);
- low heat glue guns (one for every five projects);
    - **please note that white glue can be used instead of glue guns for making joints between wood pieces;**

- work gloves, 1 pair per low heat glue gun;
- aprons, 1 per low heat glue gun.

Materials:

- basswood strips 24" x 1/2" x 1/2" (12mm x 12mm x 61cm), http://kidder.ca/, 3 per project,
- triangle card stock gussets 8-10 per project (have students bring in cereal boxes, or see http://kidder.ca/);
- solar cell, one per project (http://kidder.ca/);
- low inertia DC motor, one per project (http://kidder.ca/);
- solar fan propeller, one per project (http://kidder.ca/);
- sand paper, medium to fine grit, 1 sheet for every 5 projects;
- red and black, thin diameter braided copper wire (see http://kidder.ca/); have about three meters of each on hand in case students need to extend the length of a wire to make a connection;
- 2 rolls of electric tape for the class (used at wire joints, and to attach the motor to the wood strip);
- if adjustable positioning is to be included the following items are needed;
    - up to 2 stove bolts per project (3/16" x 1 1/2"),
    - up to 2 metal flat washers per project (3/16" hole),
    - up to 2 metal lock washers per project (3/16" hole),
    - up to 2 hex nuts (or wing nuts - easier to use but more expensive) per project (3/16" hole),
- low heat glue sticks, one per project;
    - if using white glue, have about 300ml on hand for the class.

Electronic Resources to Get You Started

Internet Resources - always stay on main page:

- this resource explains the system and set up well http://www.makeitsolar.com/science-fair-ideas/11-solar-motor.htm
- this resource includes a good explanation, as well as, extension activities http://www.goldmine-elec.com/solar-powered-boat/user-guide.pdf
- an image that inspires simple design http://www.allthingsgreen.net/marketplace/eco-friendly-solar-powered-desk-fan-kit-p-5450.html

Background Knowledge

Please see Internet Resources (listed above).

Be sure to locate your Board's safety policy and documentation procedures. Train your students in the use of the saws, clamps, and bench hooks, (following your Board's requirements) and document this instruction accordingly.

Students will tend to ignore the use of gussets to join pieces of wood. Encourage them to use this strengthening technique, as they build their geared crank fan. A card stock (or cereal box) triangle should be placed on both sides of a joint where possible.

Students will need to join wires to complete the circuit. To do this, place the bare ends of the wires beside each other, facing the same direction. Hold the pair of wires directly below the bare sections; twist the bare ends until they are wound around each other repeatedly. Wrap the bare section of completed joint in electrical tape.

If the motor does not have connecting wires, usually there are two tabs with holes in them, extending from the back of the motor. Students can carefully thread the bare ends of the wires from the solar panel 2/3 of the way through these holes (please note that tab selections for the red and black wires will effect which way the motor spins). Once completed the cut end should be wound back around the bare section of the main wire, repeatedly, to form a joint that is secure and connected tightly to the tab.

See "Appendix H: Samples" for a picture of student work.

Activity Description

Design Challenge:

Students will research, design, and build (using the materials and tools provided) a solar powered fan that transforms solar/electric energy into kinetic energy. Students will investigate the system to determine where energy is lost during the transformation.

Students will record their results, make modifications and re-test (if time permits), and complete a report on the steps they took to solve the design challenge, and the results of the investigation.

Minds On/Hands On

1. Show one or both of the learn 360 video clips below to introduce the concept of converting solar energy to electrical/kinetic energy. Learn360 is licenced through the Ministry of Education (See OSAPAC). If you do not have a username and login, please contact your Board's information services department and request one.
   a. a clip about a solar car race in Japan
      http://www.learn360.com/ShowVideo.aspx?ID=334462
   b. history uses and advancements in photovoltaic cells
      http://www.learn360.com/ShowVideo.aspx?ID=350391.
2. Turn and talk, instruct students to discuss what they have seen and how photovoltaic technology can be used in their lives.
3. Whole class, briefly discuss your students' ideas and record them on your board.

Action

1. Teacher, introduces and distributes the design challenge (Appendix A) to individuals, partners, or small groups, discusses all items with the class, and ensures students understand what must be done.
2. Teacher, distributes the student self-assessment log (Appendix E), and delivers instructions on how it is to be used. As your proceed through the unit, re-address and clarify content items from the logs, prior to having your students address them.
3. Teacher and students, co-construct success criteria (what would make a good open periscope) based on curriculum expectations and prior learning. For recommended curriculum suggestions see "Success Criteria" above.
4. Teacher, displays tools and materials that are available for the design challenge.
5. Teacher reviews, or provides instruction on, Learning Skills related to this type of task (e.g., safety [teacher follows his/her Board's protocol for instruction regarding the safe use of tools and materials], research, problem solving, collaboration, and responsibility).
6. Teacher follows her/his Board's protocol for documenting student attendance during safety training.
7. Students research different applications where solar power is used to run fans.
8. Students form hypotheses (based on research) regarding potential solutions to their design challenge and investigation.

9. Students list their top ideas for solving the design challenge, sketch out the two that seem the most promising, record reasons for picking them (e.g. aesthetics, function, environmental impact) and submit these items to their teacher for approval.
10. Teacher, reviews sketches for safety and feasibility; students with approved sketches move on to the next step.
11. Students, complete a set of plans for creating an open periscope, and develop a fair test for their prototype.
12. Teacher, reviews plans and tests for feasibility; students with approved plans and tests move on to the next step.
13. Students create their solar powered fan using the materials and tools provided.
14. Students test their solar powered fan and determine if its components function together to perform the required task. Students record observations, data, and results as they carry out their investigation.
15. Students investigate their solar powered fan to determine where there is energy loss (e.g., heat energy, sound energy, friction, etc.).
16. If improvements are necessary, and if time permits, students should redesign their prototype and re-test it to determine if the changes were successful.
17. Students, brainstorm, research, and record information and ideas involving solar fans and their connections to individuals, society, the economy, and the environment.
18. Students, record all final data, observations, research, and insights, then begin working on their reports.

Consolidation

1. In groups, students discuss what went well with their designs and tests, what changes were made, why they were needed, and what they would do differently if given another opportunity. This material should be added to the students' reports.
2. In groups, students discuss/debate the findings and insights they have recorded for item 17; new insights are to be added to the students' reports.
3. In groups, students propose courses of practical action that involve the use of their solar powered fans (e.g., address energy consumption issues [brownouts and/or blackouts] that happen during heat waves, by providing an "off grid" alternative to reduce pressure on our energy systems).
4. Students, complete and hand in a written report, or present an oral and/or media report that addresses all the design challenge items selected by their teacher (see Appendix A).

Appendix A: Student Design Challenge and Investigation

Name:_____ Teacher:_____ Class: _____

Solar Powered Fan Design Challenge

You (or your team) will research, design, and build (using the materials and tools provided) a solar powered fan that transforms solar/electric energy into kinetic energy. Once your fan has been constructed you will conduct an investigation to find where energy is lost when it is running.

Work through the following sequence of tasks as you complete this design challenge:

- record and review the tools and materials that are available for this design challenge;
- research and record information on forms of energy, as well as, the use and design of solar powered fans;
- form hypotheses, based on your research, regarding potential solutions to your design challenge/investigation;
- list your top ideas for solving the design challenge, sketch out the two that seem the most promising, record reasons for picking them (e.g. how it looks, how it works, and its environmental impact) and submit these items to your teacher for approval;
- design a set of plans for building a solar powered fan, and a develop a fair test for your product;
- build your solar powered fan using the materials and tools provided;
- carry out your test and determine if the parts of your solar powered fan work together well enough to solve the design challenge; record your observations (using most of your five senses), and results as you carry out your investigation;
- investigate you system to find and record where energy is lost during its operation;
- if improvements are necessary and if time permits redesign your solar fan and retest it; record all final observations, and results;
- in groups, discuss and record what went well with your design processes and tests, what changes were made, why they were needed, and what you would do differently if given another opportunity.

Following this process, you will be required to complete further research and submit or present a report to your teacher. Your report must address all items checked off below.

- ○ Use scientific and technological vocabulary that includes heat, light, sound, electrical, and mechanical.
- ○ List the parts of your solar powered fan, and describe how they function together.
- ○ Brainstorm, research, and record information and ideas involving the use of solar powered fans and their connections to individuals, society, the economy, and the environment.
- ○ Propose a course of action that could be taken, using your solar powered fan, to help problems involving the overconsumption of energy during heat waves. Be sure to identify what some of the problems are.
- ○ Report on the following items:
  - what went well during your technological problem solving process and your test;
  - what changes were made (if any), why the changes were needed (if applicable);
  - what you would do differently if you could try this again (if applicable).
- ○ Your teacher will select one or more of the tasks listed below for you to complete:
  - a written report,
  - an oral presentation,
  - a media presentation.

Appendix B: Assessment Rubric (Assessment **of** Learning)

This rubric was developed from the Ontario Curriculum Grades 1-8 Science and Technology, Revised 2007 document.				
	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding (K&U) – Subject-specific content acquired in each grade (knowledge), and the comprehension of its meaning and significance (understanding)				
	The Student:			
1. Knowledge of content (e.g., facts and terminology related to the transformation of solar energy to kinetic energy; safe use of tools and materials)	demonstrates limited knowledge of content	demonstrates some knowledge of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
2. Understanding of content (e.g., concepts, ideas, and processes involving the transformation of solar energy to kinetic energy)	demonstrates limited understanding of content	demonstrates some understanding of content	demonstrates considerable understanding of content	demonstrates thorough understanding of content
Thinking and Investigation (T&I) – The use of critical and creative thinking skills and inquiry problem solving skills and/or processes				
	The Student:			
3. Use of initiating and planning skills and strategies (identify appropriate items to research, and locate resources that are relevant to the investigation and design challenge)	uses initiating and planning skills and strategies with limited effectiveness	uses initiating and planning skills and strategies with some effectiveness	uses initiating and planning skills and strategies with considerable effectiveness	uses initiating and planning skills and strategies with a high degree of effectiveness
4. Use of processing skills and strategies (e.g., performing and recording, gathering evidence and data, observing, manipulating materials and using equipment safely, ... proving) to design and fabricate a solar powered fan that transforms solar energy to kinetic energy	uses processing skills and strategies with limited effectiveness	uses processing skills and strategies with some effectiveness	uses processing skills and strategies with considerable effectiveness	uses processing skills and strategies with a high degree of effectiveness
5. Use of critical/creative thinking processes, skills, and strategies (e.g., analysing, interpreting, problem solving, evaluating, forming and justifying conclusions on the basis of evidence) to complete a fair test to determine if the prototype meets the design requirements for this task	uses critical/creative thinking processes, skills, and strategies with limited effectiveness	uses critical/creative thinking processes, skills, and strategies with some effectiveness	uses critical/creative thinking processes, skills, and strategies with considerable effectiveness	uses critical/creative thinking processes, skills, and strategies with a high degree of effectiveness
Communication (Com.) – The conveying of meaning through various forms				
	The student:			
6. Expression and organization of ideas and information in oral, visual, and/or written forms (e.g., complete a report that is	expresses and organizes ideas and information with limited	expresses and organizes ideas and information with some	expresses and organizes ideas and information with	expresses and organizes ideas and information

organized in a clear, logical manner and include diagrams and models where appropriate)	effectiveness	effectiveness	considerable effectiveness	with a high degree of effectiveness
7. Communication for different audiences and purposes in oral, visual, and/or written forms (accurately describe the steps taken to solve the design challenge and the learning that he/she acquired from this unit and use an appropriate form for the selected audience, e.g., teacher, or teacher and classmates)	communicates for different audiences and purposes with limited effectiveness	communicates for different audiences and purposes with some effectiveness	communicates for different audiences and purposes with considerable effectiveness	communicates for different audiences and purposes with a high degree of effectiveness
8. Use of conventions, vocabulary, and terminology (e.g., heat, light, sound, electrical, and mechanical) in oral, visual, and/or written forms	uses conventions, vocabulary, and terminology with limited effectiveness	uses conventions, vocabulary, and terminology with some effectiveness	uses conventions, vocabulary, and terminology with considerable effectiveness	uses conventions, vocabulary, and terminology with a high degree of effectiveness
Application (App.) – The use of knowledge and skills to make connections within and between various contexts				
	The student:			
9. Application of knowledge and skills (e.g., concepts and processes, use of equipment and technology, investigation skills) in familiar contexts	applies knowledge and skills in familiar contexts with limited effectiveness	applies knowledge and skills in familiar contexts with some effectiveness	applies knowledge and skills in familiar contexts with considerable effectiveness	applies knowledge and skills in familiar contexts with a high degree of effectiveness
10. Making connections between society, science, technology, and the environment regarding the design solution selected and its impacts on people, other living things, and the environment	connects science, technology, society, and the environment with limited effectiveness	connects science, technology, society, and the environment with some effectiveness	connects science, technology, society, and the environment with considerable effectiveness	connects science, technology, society, and the environment with a high degree of effectiveness
11. Proposing courses of practical action to deal with problems relating to science, technology, society, and the environment (e.g., address energy consumption issues [brownouts and/or blackouts] that happen during heat waves, by providing an "off grid" alternative to reduce pressure on our energy systems)	proposes courses of practical action of limited effectiveness	proposes courses of practical action of some effectiveness	proposes courses of practical action of considerable effectiveness	proposes highly effective courses of practical action

Appendix C: Assessment **of** Learning, Grade Sheet.

Teacher's Record: Assessment **Of** Learning Use with the Assessment Rubric	Teacher: ____________________ Class: ______ Unit: __________________________ Date: ___/___/___										
	Knowledge and Understanding		Thinking and Investigation			Communication			Application		
Student's Name	1	2	3	4	5	6	7	8	9	10	11

Appendix D: Assessment For Learning
Continuum For Technological Problem Solving

Beginning > Exploring > Emerging > Competent > Proficient			
Initiating and Planning			
The student:			
(A) recognizes a practical problem in a given context	identifies practical problems to solve in the immediate environment	identifies practical problems to solve in the local community	identifies practical problems to solve
(B) with support (e.g., as a class or in small groups), brainstorms possible solutions to a practical problem	with support (e.g., as a class or in small groups), generates a list of possible solutions to a practical problem and determines which are realistic in the classroom and/or the real world	identifies possible solutions to a practical problem and explains how each might solve the problem	identifies possible solutions to a practical problem and prioritizes them with regard to their potential for solving the problem
(C) with support (e.g., as a class or in small groups), selects one possible solution to implement	selects a possible solution to implement	selects a possible solution to implement, and provides reasons for the choice	selects a possible solution, and provides reasons for the choice that take into account considerations such as function, aesthetics, environmental impact
(D) with support (e.g., as a class or in small groups), makes a simple plan to carry out the solution	makes a simple plan (individually or in small groups), including simple drawings and/or diagrams, to carry out the solution	outlines (individually or in small groups) the steps of a plan, including labeled drawings and/or diagrams, to solve the problem	outlines in detail, including technical drawings and/or diagrams, each step of a plan to solve the problem
(E) with support (e.g., as a class or in small groups), establishes a limited number of criteria for evaluating proposed solutions to the problem	with support (e.g., as a class or in small groups), establishes a limited number of criteria for evaluating proposed solutions to the problem	contributes to establishing general criteria for evaluating objects or devices designed to solve the problem	contributes to establishing general criteria for evaluating objects or devices designed to solve
Performing and Recording			
The student:			
(F) with support (e.g., as a class or in small groups), carries out the pre-determined plan	with support (e.g., as a class or in small groups), carries out the pre-determined plan	carries out the pre-determined plan (individually or in pairs or small groups)	carries out the pre-determined plan
(G) with support, designs, builds, and tests (on the basis of pre-determined criteria) a device or an object to solve the problem	with support, designs, builds, and tests (on the basis of pre-determined criteria) a device or an object to solve the problem	designs, builds, and tests (on the basis of pre-determined criteria) a device or an object to solve the problem	designs, builds, and tests (on the basis of pre-determined criteria) a device or an object to solve the problem

(H) records results using pictures and/or tally charts	records results in a variety of ways, such as sentences, simple drawings, diagrams, and/or charts, and/or charts	records results in a variety of ways, such as sentences, drawings, labelled diagrams, graphs	records results in a variety of ways, such as sentences, technical drawings, labeled diagrams, graphs, and/or charts
Analyzing and Interpreting			
The student:			
(I) with support, identifies how well the chosen solution solved the practical problem, using the pre-determined criteria	identifies how well the chosen solution solved the practical problem, using the pre-determined criteria	explains how well the chosen solution solved the practical problem, and suggests possible changes to the criteria and the solution	explains how well the chosen solution solved the practical problem, using qualitative and/or quantitative data, and suggests possible changes to the criteria and the solution
(J) with support, suggests something that might be changed about the solution to the problem identifies some things that could be done differently to improve the solution to the problem	identifies and explains what changes could be made to the plan and how to improve the solution to the problem, and gives reasons for the changes	identifies and explains what changes could be made to the plan and the testing process, and how to improve the solution to the problem, and gives reasons for the changes	identifies and explains what changes could be made to the plan and the testing process, and how to improve the solution to the problem, and gives reasons for the changes
(K)	identifies some possible beneficial and non-beneficial impacts of the chosen solution for himself/herself or others	identifies the effects of the chosen solution on himself/herself, others, and/or the environment, considering things such as cost, materials, time, and/or space	identifies the effects of the chosen solution on himself/herself, others, and/or the environment, considering things such as cost, materials, time, and/or space, and suggests ways in which undesirable effects could be lessened or eliminated
Communicating			
The student:			
(L) describes orally, and/or using drawings, pictures, and/or simple sentences, the problem and how he or she solved it	describes orally, and/or using drawings, pictures, and/or simple sentences, the problem and how he or she solved it	describes orally, and using labelled drawings and diagrams, charts, graphs, and/or written descriptions, the problem and how he or she solved it	describes orally, and using labelled drawings and diagrams, charts, graphs, and/or written descriptions, the problem and how he or she solved it
(M) uses grade-appropriate science and technology vocabulary correctly	uses grade-appropriate science and technology vocabulary correctly	uses grade-appropriate science and technology vocabulary correctly	uses grade-appropriate science and technology vocabulary correctly

Appendix E: Assessment As Learning, Student Self-Assessment Log

What Can I Do Well? What Can I Do Better? What is My Plan?

Name:_____ Teacher:_____ Class: _____

Self-Assessment (SA):
1. I have reached this goal.
2. I am getting there.
3. Help! I am struggling with this.

Peer-Assessment (PA):
1. You have reached this goal.
2. You are getting there.
3. You have not reached this goal.

Responsibility For Learning (RFL).
1. No assistance is needed. I have achieved what this task requires.
2. I will reach this goal by asking for direct support from my teacher.
3. I will reach this goal by asking for support from my peers.
4. I will reach this goal by asking for support from my caregiver(s).
5. I will reach this goal by working on it independently.

These descriptors reflect skills that have reached the Competent level on the "Continuum for Technological Problem-Solving Skills."

A. I can identify a practical design problem that needs to be solved.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

B. I can come up with some solutions to the design problem, and I can organize them from first choice to last.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

C. I can pick my best idea and give reasons for my choice.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

D. I can make a set of plans that describes each step needed to build my project, and my plans include labeled diagrams and/or diagrams where needed.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

E. I can contribute ideas on how my project should be graded.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

F. I can carry out my plan individually, in pairs, or in groups.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

G. I can design build and test a device that solves my design problem.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

H. I can record my results in a variety of ways, such as sentences, drawings, labeled diagrams, graphs, and/or charts.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

I. I can explain how well I solved the design problem, as well as, suggest possible changes to the design challenge requirements, and my solution to the design problem.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

J. I can identify and explain what changes could be made to my plan, how to improve my solution to the design problem, and give reasons for the changes.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

K. I can identify the good and bad effects of my solution on myself, others, and/or the environment (including cost, materials, time, and/or space).

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

L. I can give an oral presentation that describes what my design problem was and how I solved it. I can include labelled drawings and diagrams, charts, graphs, and/or written descriptions in my presentation.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

M. I can use the science and technology vocabulary we have learned, correctly.

SA:_____ PA:_____ RFL:_____ Date Achieved:_____

Notes:

Appendix F: Assessment **For** Learning, Tracking Sheet

Teacher's Record: Assessment **For** Learning, Technological Problem Solving Skills Continuum	Teacher: ______________________ Class: ___________ Unit: ___________________________ Date: ____/____/____ Suggested Assessment Codes: B - beginning, Ex - exploring, Em - emerging, C - competent, P - proficient												
	Initiating and Planning					Performing and Recording			Analysing and Interpreting			Communicating	
Student's Name	**(A)**	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**	**(K)**	**(L)**	**(M)**

Appendix G: Support for Assessment and Evaluation

Assessment as/for/of Learning

It is the goal of the OCTE Elementary Committee to support their members in the development of these skills. This year the focus is on providing feedback (assessment for and as learning) using the Ministry's "Continuum for Technological Problem Solving Skills" (Science and Technology Grades 1-8, pp. 17-18) Please note that only the Ministry's "Achievement Chart -- Science and Technology, Grades 1-8" (Science and Technology Grades 1-8, pp. 26-27) is to be used for assessment of learning.

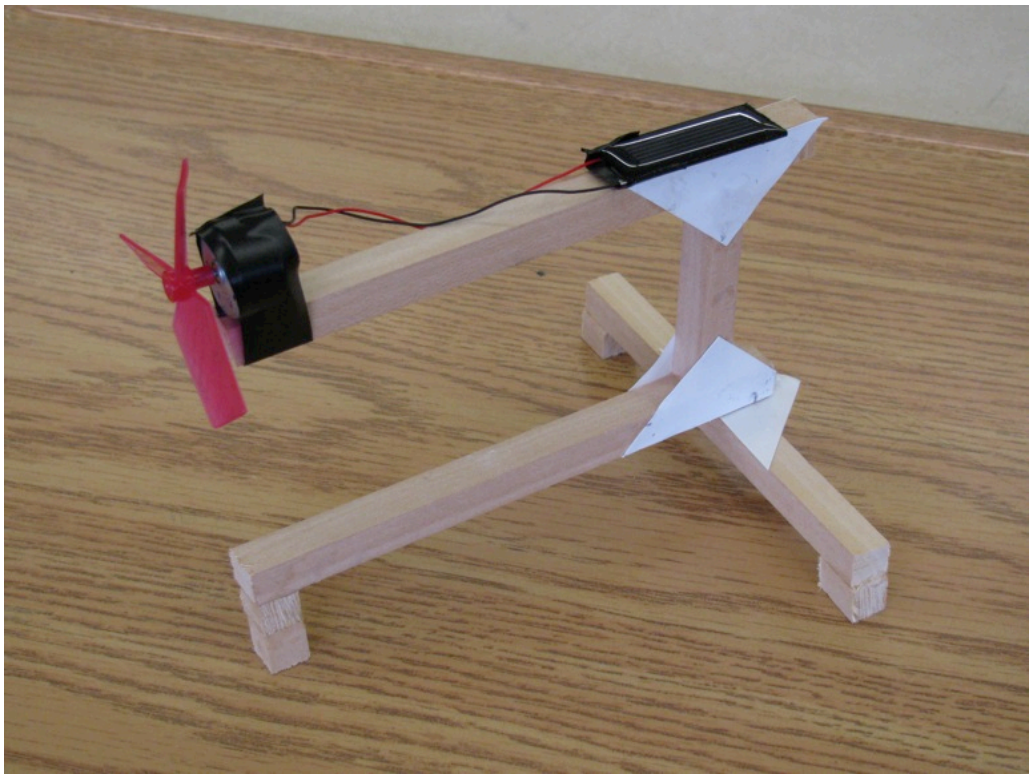
A summary of the three forms of assessment addressed in the Ministry of Education's Growing Success (2010) document is as follows:

- assessment for learning involves generating feedback about your students' progress that is shared with them before assessing for report card grades;
- assessment of learning is when you generate marks/levels for your report cards;
- assessment as learning, when developed fully, is when students provide their own feedback and assessment (peer and/or self) regarding their learning; students use this information to set learning goals, and to select appropriate learning strategies for their success.

Here are some suggestions to support the implementation of "Assessment as Learning" in your program; they are as follows:

1. Provide your students with a copy of "Appendix E: Assessment as Learning, Student Self-Assessment Log" and refer to applicable statements (see statements A-M) for discussion, before each of these items are addressed.
2. Ensure that the learning goal for each item is clearly understood by your students. Use student friendly language wherever possible.
3. Provide opportunities for self/peer assessment (move from structured to student directed as your students develop this skill).
4. Discuss or refer to successful and unsuccessful work (exemplars, or student generated materials) to provide benchmarks for your students' self/peer assessments.
5. Collect and review your students' "Assessment as Learning, Student Self Assessment Log." Make note of who needs additional support. Schedule time for these students into your next lesson (or provide opportunities for extra help, if possible).
6. Use your students' self/peer assessments to determine if a task requires modification to support successful learning.
7. Refer to pp. 27-36 in the Growing Success document for complete details. Reference: Ontario. Ministry of Education. (2010). *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, First Edition, Covering Grades 1-12.* Toronto: Author. ISBN 978-1-4435-2284-7 (Print), ISBN 978-1-4435-2285-4 (PDF) (Rev.), ISBN 978-1-4435-2286-1 (TXT), © Queen's Printer for Ontario.

Appendix H: Samples



Photographs by: Darren Foy