OCTE 2012 – Elementary Conference Workshops

GRADE 7 | UNDERSTANDING LIFE SYSTEMS INTERACTIONS IN THE ENVIRONMENT

Cylindrical Ant Farm and Ecosystem Investigation Design Challenge

OVERALL EXPECTATIONS

By the end of Grade 7, students will:

2. investigate interactions within the environment, and identify factors that affect the balance between different components of an ecosystem;

SPECIFIC EXPECTATIONS

2. Developing Investigation and Communication Skills

By the end of Grade 7, students will:

2.1 follow established safety procedures for investigating ecosystems (e.g., stay with a partner, wash hands after investigating an ecosystem)
2.2 design and construct a model ecosystem (e.g., a composter, a classroom terrarium, a greenhouse), and use it to investigate interactions between the biotic and abiotic components in an ecosystem Sample guiding questions: What are some biotic components of this ecosystem? What are some abiotic components? How do these components affect each other (abiotic and abiotic; biotic and biotic; abiotic and biotic)? What are some of the interactions that are occurring in the model ecosystem?
2.4 use appropriate science and technology vocabulary, including sustainability, biotic, ecosystem, community, population, and producer, 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., design a multimedia presentation explaining the interrelationships between biotic and abiotic components in a specific ecosystem)

Learning Goals

1. Students will follow established safety procedures for using tools, handling materials, and investigating ecosystems.
2. Students will use the technological problem solving process to design and fabricate a model ecosystem, and will use it to investigate interactions between its biotic and abiotic components.
3. Students will use appropriate science and technology vocabulary including sustainability, biotic, abiotic, ecosystem, community, population, and producer, in oral and written communication.
4. Students will use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate their progress through the technological problem solving process to their teacher, and classmates.

Assessment and Evaluation

For Assessment and Evaluation support, please see Appendix G.

- Check items you wish to evaluate during the completion of this unit. Skip items that do not apply to your current program needs.
- 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.

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 ecosystems including sustainability, biotic, abiotic, ecosystem, community, population, and producer, as well as, used tools and materials safely and appropriately in building and investigating her/his cylindrical ant farm (K&U, 1);

- ○ the student understands content (e.g., concepts, ideas, and processes) that involve interactions between biotic an abiotic components of the ant farm ecosystem (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 cylindrical ant farm (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 an investigation of the interactions within and between biotic and abiotic components of her/his ant farm ecosystem (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 in his/her report including sustainability, biotic, abiotic, ecosystem, community, population, and producer (Com., 8);

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

○ the student followed established safety practices for using apparatuses, tools, materials, and investigating ecosystems (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 society, and how their cylindrical ant farms can be used to engage students who are learning about interactions within ecosystems (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).

The Arts:

- Drama, Overall Expectation B1 and B2 (select from specific expectations B1.1 - B1.3, B2.1, and B2.3);

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);
- pointed scissors, to start holes pop bottles and cut them; SAFETY NOTE when students are poking holes in their pop bottles to start their cuts make sure they understand that force must be applied to the point of the scissors in a manner that will direct it away from all their body parts, and anyone else, if the scissors slip (one pair for every two projects - students can use their own scissors for this task);
- one ruler per project.

Materials:

- one clear 2L pop bottle per project;
- one smaller container that will fit inside the 2L bottle per project (e.g., a tin can, a 1L plastic bottle etc.);
- one white plastic bag, or sufficient black material/paper to cover the inner bottle (creates contrast to help view the tunnels);
- two sheets of black paper per project (to make an outside cover for the 2L bottle - darkness simulates underground conditions);
- glue (to glue the black paper cover together);
- one pail of sand per class;
- one funnel for every 5 projects (small tip, wide top);
- 1m of packing tape per project;
- one push pin for every 3 projects;
- ants 30-60 per project (to keep costs down have students gather their own, if this is not possible, they can be purchased from Canadian suppliers).

Electronic Resources to Get You Started

Internet Resources - always stay on main page:

- this video provides a complete explanation of the process
  http://www.howcast.com/videos/222184-How-To-Make-an-Ant-Farm
- go to page 4 and view the information in the left hand column
  http://www.outdoorscience.org/sites/default/files/color/August%202011_0.pdf
- simple instructions, go to last page of document to view
  http://lhsfoss.org/fossweb/teachers/parents/pdfs/InsectsHOMEEng.pdf

Print Resources

Please refer to any Trillium list (Ministry approved) Grade 7 Science Text to find definitions and examples of the required vocabulary (e.g., sustainability, biotic, abiotic, ecosystem, community, population, and producer). These textbooks will also provide information about investigating interactions within ecosystems.

Background Knowledge

Please refer to the internet resources listed above, and your school's science textbooks.

The ant farm design challenge provides numerous examples of interactions within ecosystems. Here are a few examples.

Abiotic/abiotic: The container (abiotic) is needed to keep the sand (abiotic) in place.
Abiotic/abiotic: The sand (abiotic) absorbs and stores water (abiotic).
Abiotic/abiotic: Air circulation (abiotic) causes water (abiotic) to evaporate in place.
Biotic/biotic: Ants (biotic) need to eat vegetable pieces (abiotic) and seeds (abiotic) to survive.
Biotic/abiotic: Ants (biotic) need water (abiotic) to drink; ants (biotic) tunnel in the sand (abiotic) to build their home.
Abiotic/biotic: Temperature (abiotic) affects the activity level of the ants (biotic).

See "Appendix H: Samples" for pictures of student work.

Activity Description

Design Challenge and Investigation:
Students will research, design, and build a cylindrical ant farm. They will use their ant farms to conduct an investigation of interactions within its ecosystem. Students will learn and use vocabulary such as sustainability, biotic, abiotic, ecosystem, community, population, and producer.

Students will present or submit a report on their progress through the Technological Problem Solving Process and their investigation of their ant farm ecosystems.

Minds On/Hands On

1. Show the following video clip http://www.youtube.com/watch?v=mKucprXVGMU&feature=related display using full screen, start at 8 seconds, and stop at 2:09 minutes to avoid advertisements. This clip has some excellent sayings that support effective teamwork.
2. Ask students to turn and talk about which items from the clip were living, or non-living, and how they interacted together.
3. Conduct a whole class discussion regarding the above.
4. On your board, record students' insights that support the learning goals for this design challenge.

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), delivers instructions on what this resource is and 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 based on curriculum expectations and prior learning (recommended teacher suggestions are listed in this document, see "Success Criteria" listed above).
4. Teacher displays tools and materials that will be used to complete this 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 brainstorm ideas on how to construct their ant farms using the materials and tools provided.
8. Students research record information to confirm or modify their brainstorming ideas on constructing a pop bottle ant farm.
9. Students research and record information the required vocabulary for this challenge (sustainability, biotic, abiotic, ecosystem, community, population, and producer).
10. Students form hypotheses (based on research) regarding potential solutions to their design challenge and investigation.
11. 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.
12. Teacher reviews sketches for safety and feasibility; students with approved sketches move on to the next step.

13. Students complete a set of plans with a list of materials and instructions for building a cylindrical ant farm.
14. Teacher reviews plans, materials, and tests for feasibility; students with approved plans and tests move on to the next step.
15. Students build and populate their ant farm.
16. If improvements are necessary, and if time permits, students should redesign their prototype and determine if the changes were successful.
17. Students will investigate the interactions within their ecosystems, identify biotic and abiotic components, as well as, interactions within and between them (e.g., biotic/abiotic, biotic/biotic, abiotic/abiotic).
18. Students, brainstorm, research, and record information about the role ants play in our ecosystem and how they are connected to individuals, society, the economy, and the environment.
19. 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 investigations, 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 18; new insights are added to the students' reports.
3. 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: _____

Cylindrical Ant Farm and Ecosystem Investigation Design Challenge

To complete this challenge you will research, design, and build a cylindrical ant farm. You will use your ant farm to conduct an investigation of interactions within its ecosystem. You will learn and use vocabulary that is used to describe the different parts of an ecosystem and present or submit a report on your progress and findings.

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

- record a list of tools and materials that will be made available to you for this challenge;
- brainstorm ideas on how to construct your ant farms using the materials and tools provided;
- research record information about constructing a pop bottle ant farm;
- research and record information about the required vocabulary for this challenge (sustainability, biotic, abiotic, ecosystem, community, population, decomposer, and producer);
- form hypotheses (based on your research) regarding potential solutions to the design challenge and 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. aesthetics, function, environmental impact) and submit these items to your teacher for approval;
- complete a set of plans with a list of materials and instructions for building a cylindrical ant farm and submit these items to your teacher for approval;
- build and populate your ant farm;
- if improvements are necessary, and if time permits, redesign your prototype and determine if the changes were successful;
- investigate the interactions within your ecosystems, identify biotic and abiotic components, as well as, interactions within and between them (e.g., biotic/abiotic, biotic/biotic, abiotic/abiotic);
- record all final data, observations, research, and insights, then begin working on your reports.

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 vocabulary that includes the correct use of scientific and technological terms that address the three forms of heat transfer (conduction, convection, and radiation) and their control.
- ○ List the components of your cylindrical ant far and describe how they function together.
- ○ Brainstorm, research, and record information about the role ants play in our ecosystem and how they are connected to individuals, society, the economy, and the environment.
- ○ Research and propose a course of action that will help to correct a current problem being suffered by an ecosystem that will improve the condition of its environment.
- ○ Report on 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), and what you would do differently if given another opportunity (if applicable).

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, terminology, and definitions related to ecosystems sustainability, biotic, ecosystem, community, population, and producer, as well as, used tools and materials safely and appropriately in building and investigating her/his cylindrical ant farm)	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) that involve interactions between biotic an abiotic components of the ant farm ecosystem	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 cylindrical ant farm	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 an investigation of the interactions within and between biotic and abiotic components of her/his ant farm ecosystem	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 (complete a report that is organized in a clear, logical manner and include diagrams and models where appropriate)	expresses and organizes ideas and information with limited effectiveness	expresses and organizes ideas and information with some effectiveness	expresses and organizes ideas and information with considerable effectiveness	expresses and organizes ideas and information 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 used 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 of the discipline (e.g., sustainability, biotic, ecosystem, community, population, and producer) 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 (e.g., list beneficial and non-beneficial aspects of the design regarding people, other living things, and the environment, and suggest ways to lessen any of the design's undesirable impacts)	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 society (e.g., suggest how cylindrical ant farms can be used to engage students who are learning about interactions within ecosystems)	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.

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 explain how it will work, look and impact the environment.

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

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

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

E. I can contribute ideas on how solutions to this design problem should be graded.

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

F. I can carry out my plan independently.

   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, technical drawings, labeled diagrams, graphs, and/or charts.

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

I. I can explain how well I solved the design problem, using what I observed (qualitative data), and/or what I measured (quantitative data). I can also suggest possible changes to the criteria 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 and my testing process, how to improve my solution to the design problem, and can give reasons for the changes.

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

K. I can identify the effects of my solution on myself, others, and/or the environment (including cost, materials, time, and/or space), and I can suggest ways to lessen or eliminate any undesirable effects my solution may have.

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