OCTE 2012 – Elementary Conference Workshops

GRADE 1 | UNDERSTANDING MATTER AND ENERGY, ENERGY IN OUR LIVES

SOUND ENERGY DESIGN CHALLENGE

OVERALL EXPECTATIONS
By the end of Grade 1, students will:
2. investigate how different types of energy are used in daily life.

SPECIFIC EXPECTATIONS
2. Developing Investigation and Communication Skills
By the end of Grade 1, students will:

2.1 follow established safety procedures during science and technology investigations (e.g., keep work spaces neat and tidy by putting all tools, materials, and equipment back where they belong)
2.3 design and construct a device that uses energy to perform a task (e.g., a kite that flies using the wind; a musical instrument that uses human energy to make sounds)
2.7 use appropriate science and technology vocabulary, including explore, investigate, design, energy, and survival, in oral and written communication
2.8 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes (e.g., use labelled diagrams to show what happened when plants were grown in varying light conditions)

Learning Goals

1. Students will follow established safety procedures during science and technology investigations (e.g., keep work spaces neat and tidy by putting all tools, materials, and equipment back where they belong).
2. Students will design and construct a device that uses energy to perform a task (e.g., ... a musical instrument that uses human energy to make sounds).
3. Students will use appropriate science and technology vocabulary, including explore, investigate, design, energy, ... in oral and written communication.
4. Students will use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes (e.g., orally explain their choices of materials and design decisions when presenting their structures).

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 how energy is used in everyday life, as well as, used tools and materials safely and appropriately in building and using a musical shaker (K&U, 1);

- ○ the student understands content (e.g., concepts, ideas, and processes) that address her/his musical shaker (K&U, 2);

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

- ○ the student developed ideas, regarding potential solutions to his/her design challenge, and developed a suitable plan for solving it (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 musical shaker (T&I, 4);

- ○ the student used critical/creative thinking processes, skills, and strategies to test her/his musical shaker, and determine if her/his prototype met the design challenge requirements (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, 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., explore, investigate, design, energy, ...) in his/her report (Com. 8);

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

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

- ○ the student listed beneficial aspects of his/her design regarding people, other living things, and the environment (App. 10);

- ○ the student proposed courses of practical action that involved the use of her/his musical shaker (e.g., to help those in society who can not play music to join in using a simple percussion instrument) (App. 11).

Curriculum Connections and Additional Assessment Opportunities

Language:

- Oral Communication, Overall Expectation 2 (select from specific expectations 2.3, 2.4, and 2.7);
- Writing, Overall Expectations 2, and 3 (select from specific expectations 2.1, 2.4, and 3.3);

Materials and Tools List

Tools:

- CSA approved safety glasses/goggles, one pair per person (parent volunteers included),
- a first aid kit (please see your Board's Health and Safety Regulations if one is being purchased for your classroom),
- scissors, minimum one pair for every 2 projects (students may supply their own),
- two or three funnels per class (opening should fit a water bottle top),
- small scoops or measuring cups for transferring materials into the funnel.

Materials:

- send home a note in advance of this activity asking caregivers to collect and send in items from the list below;
- found items such as the following;
    - 1 per project, small plastic bottles (rinsed, dried, and with caps),
    - OR paper roll tubes, 1 per project,
        - empty snack bags, washed, to cap the end of the tube (e.g., chips, cheezies, etc.), one per project.
- if using paper roll tubes for construction you will need the following,
    - two elastic bands per project, to hold the chip bag pieces in place over the ends (helps with the taping);
    - 18" (45 cm) of tape per project (e.g., masking tape, Scotch tape, electric tape, etc.);
- if using a plastic bottle, 6" (15 cm) of tape is needed to secure the cap in place;
- any combination of clean sand, rice, or popcorn kernels works best; however, other dried vegetables (lentils, beans, etc.) will work as well; about 4 tablespoons, or 1/4 cup is needed per shaker; however, you can experiment with the quantities.

Internet Resources to Get You Started (always stay on the main page)

- water bottle maracas http://www.education.com/activity/article/cincodemayomaracas_kindergarten/
- water bottle maracas 2 http://www.busybeekidscrafts.com/Water-Bottle-Maraca.html
- paper tube maracas http://familycrafts.about.com/cs/musicalcrafts/a/blricearaca.htm
- paper tube maracas (go to page 3 of 6) http://pdfs.nbnbooks.com/ah/_le/ah_lesson_plan_first_music_k.pdf
- ADVANCDED - rain stick http://www.enchantedlearning.com/crafts/music/rainstick/

Background Knowledge

Maracas are percussion instruments that are composed of a shell that contains small hard particles (traditionally dried beans and/or seeds). True maracas have a handle; the ones in constructed in this activity do not.

The students' maracas will convert human energy to sound energy. This is accomplished by shaking the maraca, which causes the contents to strike against the shell. Larger particles produce sounds with lower, course texture; smaller particles produce sounds that a higher finer texture.

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

Activity Description

Design Challenge:
Teachers and students work collaboratively to identify an environmental challenge regarding the use of cardboard and plastic. The group will then collaborate on a solution by suggesting ways to make an instrument from plastic bottles and/or cardboard tubes. From there the teacher will narrow down the choices to the type and number suited to the group's capabilities. In this case the focus will be on reusing small plastic bottles, and cardboard tubes to make maracas/shakers.

Minds On/Hands On

1. Whole class, project or hand out copies of Appendix A: Cardboard and Plastic, and hand out Appendix E: Assessment As Learning, Student Assessment Log.
2. Small groups, ask students to discuss what they see and what they think about the pictures, and how people have tried to reduce the amount of waste they put out for collection.
3. Whole class, briefly discuss your students' comments and record main ideas.
4. Whole class, inform your students that coming activity will help them to keep some plastic bottles and cardboard tubes out of garbage piles (like the ones they have just seen).

Action

1. Teacher introduces the design challenge and has the materials and tools on display. A sample introduction is as follows:
    a. Now we understand that plastic bottles and waste cardboard are causing a problem. Today we are going to think of ideas that will help to keep some of these plastic bottles and cardboard tubes out of the garbage by using them to make musical instruments. Our challenge is to make instruments change movement energy, into sound energy. This means when we move the instrument it makes a sound.
    b. After receiving instructions and clarification, students fill out item A on the Student Self-Assessment Log (Appendix E).
2. Teacher informs students that they are to turn and talk to see what kind of instruments they can think of building using the tools and materials provided. This is followed by a whole class discussion of the ideas generated, led by the teacher. Students complete item B on the Student Self-Assessment Log.
3. Teacher leads a whole class discussion that narrows the choices down those that reflect a maraca/shaker design. Teacher further narrows the options based on the tools and materials available, and the students' capabilities. Students complete item C on the Student Self-Assessment Log.
4. Teacher reviews, or provides instruction on, Learning Skills related to this type of task (e.g., safety, problem solving, collaboration, and responsibility).
5. Teacher leads discussion/brainstorming session on what makes a good maraca/shaker (co-constructs success criteria) and records items that reflect the curriculum goals. Students complete item E on the Student Self-Assessment Log.

6. Students select either a plastic bottle, or the cardboard tube to work with. Students create a set of plans (labeled pictures and oral description) for making a maraca/shaker using the tools and materials available. Teacher reviews plans for feasibility. Students with approved plans move on to the next step. Students complete item D on the Student Self-Assessment Log.
7. Students follow their plans to fabricate their maraca/shaker. Students complete item F on the Student Self-Assessment Log.
8. Teacher reviews/discusses the two types of energy being investigated (movement and sound) and how one can be transformed into the other (e.g., a playing musical instrument).
9. Students test their maraca/shaker and determine if it solves the design challenge as required.
10. Teacher supports students as they record observations, and results as they carry out their tests. Students complete items G and H on the Student Self-Assessment Log.
11. If improvements are necessary, and if time permits, students should redesign their prototype and re-test it to determine if the changes were successful.
12. Students, make note of all final observations and insights, then begin working on their reports.

Consolidation

13. 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. Students complete items I - J on the Student Self-Assessment Log.
14. In groups, students discuss/debate how their maracas/shakers are good for them in some ways, as well as how they might be bad for them in others. Students complete item K on the Student Self-Assessment Log.
15. Students, create an oral report that is supported by a labeled drawing or drawings and some written sentences to explain what the design challenge was, and how successfully they solved it. Students should strive to include as many vocabulary words as possible (e.g., including explore, investigate, design, and energy). Students complete item M on the Student Self-Assessment Log.
16. Students, present an oral report that is supported by a labeled drawing or drawings and some written sentences to explain what the design challenge was, and how successfully they solved it. Students complete item L on the Student Self-Assessment Log.

Appendix A: Cardboard and Plastic

Source: http://www.stuff.co.nz/manawatu-standard/news/5157683/Recycled-paper-mountain-is-re-used

Source: http://inhabitat.com/pomadas-recycled-cardboard-furniture-gives-scrap-tubes-a-second-life/

Source: http://kedelltd.files.wordpress.com/2010/02/recycled-plastic-bottles.jpg

Source: http://upcycleus.blogspot.ca/2011/08/other-way-of-upcycling-plastic-bottles.html

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 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 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 (e.g. identifying the problem and developing plans)	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... data, observing, manipulating materials and using equipment safely, ... proving) to design and fabricate a maraca/shaker.	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/creativ e 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 includes 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 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., explore, investigate, design, energy, ...) 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., to help those in society who can not play music to join in using a simple percussion instrument)	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

Targets for Grades 1-3 are in the Beginning to Exploring range.

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	with support, designs, builds, and tests (on the basis of pre-	designs, builds, and tests (on the basis of pre-determined	designs, builds, and tests (on the basis of pre-determined

device or an object to solve the problem	determined criteria) a device or an object to solve the problem	criteria) a device or an object to solve the problem	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

Name:_____ Teacher:_____ Class: _____

These descriptors reflect skills that have reached the Beginning/Exploring levels on the "Continuum for Technological Problem-Solving Skills."

Circle the correct thumb to let your teacher know how you are doing.

 I'm doing great!  I'm doing okay.  I need some help with this.

A. I know what problem I have to solve.

B. With some help, I can share ideas for shakers that will solve the problem.

C. With some help, I can pick a good idea for a shaker that will solve the problem.

D. With some help, I can tell you my plan and make a drawing of the shaker I will build.

E. With some help, I understand what will make a good shaker.

F. With some help, I can follow my plan.

G. With some help, I can design build and test my shaker.

H. I can use sentences and drawings to show you how my shaker works.

I. I can tell you what is good about my shaker, and if it solved the problem.

J. I can tell you something that will make my shaker better.

K. I can tell you some things about my shaker that are good for me, and some things about it that may not be good for me.

L. I can tell you about the design problem and how my shaker solved it by talking, using pictures I have drawn, and sentences I have written.

M. I can use the science words we have learned such as explore, investigate, design, and energy.

Parent/Guardian's Review

1. Signed:_____ Date: _____

2. Signed:_____ Date: _____

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