

OCTE 2012 – Elementary Conference Workshops

GRADE 4 | UNDERSTANDING MATTER AND ENERGY LIGHT AND SOUND

OPEN PERISCOPE DESIGN CHALLENGE

OVERALL EXPECTATIONS

By the end of Grade 4, students will:

- investigate the characteristics and properties of light and sound.

SPECIFIC EXPECTATIONS

2. Developing Investigation and Communication Skills

By the end of Grade 4, students will:

- 2.1 follow established safety procedures for protecting eyes and ears (e.g., use proper eye and ear protection when working with tools)
- 2.4 use technological problem-solving skills (see page 16) to design, build, and test a device that makes use of the properties of light (e.g., a periscope, a kaleidoscope) or sound (e.g., a musical instrument, a sound amplification device) Sample guiding questions: How might you use what you know about sound or about light and mirrors in your device? Which properties of light or sound will be most useful to you in your device? What challenges might you encounter, and how can you overcome them?
- 2.6 use appropriate science and technology vocabulary, including natural, artificial, beam of light, pitch, loudness, and vibration, in oral and written communication
- 2.7 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes (e.g., create a song or short drama presentation for younger students that will alert them to the dangers of exposure to intense light and sound)

Learning Goals

- Students will follow established safety procedures for protecting eyes and ears (e.g., use proper eye and ear protection when working with tools).
- Students will use technological problem-solving skills (see page 16) to design, build, and test device that makes use of the properties of light (e.g., a periscope...).
- Students will use science and technology vocabulary such as natural, artificial, beam of light, in oral and written communication.
- 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 light, as well as, used tools and materials safely and appropriately in building/using an open periscope (K&U, 1);
- the student understands content (e.g., concepts, ideas, and processes) that address her/his open periscope (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 an open periscope (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., natural, artificial, beam of light) 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 open periscope (e.g., to direct a natural light source into an unlit area, or split an artificial light source so part of the beam is directed into an unlit area) (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;
- hammer, one for every 3-5 projects (used with nail holder and finishing nail to start holes for screw eyes),
- corrugated cardboard strips with a split in the end, one for every hammer that is made available; this is used to hold finishing nails at a safe distance from the students' fingers (you can purchase manufactured nail guides at <http://www.busybeetools.com/products/NAILS-GUIDE.html>).
- 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 all joints except where the mirrors are joined to the dowels (a glue gun, or strong tape such as duct tape or packing tape can be used for this task);**
- 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,
- 5/32"(4mm) hardwood dowel (<http://kidder.ca/>), 12" (30 cm) per project,
- screw eye holders 9/64" (<http://kidder.ca/>), 4 per project,
- triangle card stock gussets 10-12 per project (have students bring in cereal boxes, or see <http://kidder.ca/>);

- acrylic mirror squares; **for safety reasons, avoid glass mirror pieces** (<http://kidder.ca/>);
- sand paper, medium to fine grit, 1 sheet for every 5 projects;
- 1 roll of duct tape or packing tape, for the class;
- finishing nails, one small package;
- 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:

- a simple version to base your design on
<http://www.pitara.com/activities/craft/online.asp?story=111>
- a good one that includes directions on how to cut acrylic mirror strips to size
<http://www.sciencetoy maker.org/periscope/assembl.html>
- 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 clip about periscopes <http://www.learn360.com/ShowVideo.aspx?ID=150319>
 - the full video the clip was taken from provides details on how light is energy as well as the information/demonstration above
<http://www.learn360.com/ShowVideo.aspx?ID=132649>

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.

Tape may be wound around the ends of the dowel rods to create a snug fit in the screw eyes.

Students should not install the mirrors until after the dowel rods are in place.

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) an open periscope. The periscope must allow the user to view an area from behind an obstruction, and reflect a beam of natural or artificial light into an unlit area.

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.

Minds On/Hands On

1. Whole class, hold up two mirrors and ask class how they can be used to see over or around objects that block peoples vision.
2. Turn and talk, students discuss possible solutions.
3. Whole class, briefly discuss your students' ideas and record them on your board.
4. Whole class, hold up the same two mirrors and ask the class hot they can be used to direct light into an unlit space.
5. Turn and talk, students discuss possible solutions.
6. 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 the use mirrors in building periscopes.
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 open periscope using the materials and tools provided.
14. Students test their open periscope 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. If improvements are necessary, and if time permits, students should redesign their prototype and re-test it to determine if the changes were successful.
16. Students, brainstorm, research, and record information and ideas involving periscopes and their connections to individuals, society, the economy, and the environment.
17. 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 16; 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 open periscopes (e.g., to direct a natural light source into an unlit area, or split an artificial light source so part of the beam is directed into an unlit area).
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: _____

Open Periscope Design Challenge

You (or your team) will research, design, and build an open periscope. Only the materials and tools listed/provided may be used to complete this challenge. The periscope must allow the user to view an area from behind an obstruction, and reflect a beam of natural or artificial light into an unlit area.

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 the use of mirrors in building periscopes;
- 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 an open periscope, and a develop a fair test for your product;
- build your open periscope using the materials and tools provided;
- carry out your test and determine if the parts of your open periscope work together well enough to solve your design challenge; record your observations (using most of your five senses), and results as you carry out your investigation;
- if improvements are necessary and if time permits redesign your open periscope and test it again to see if your changes were successful; 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 natural, artificial, and beam of light.
- List the parts of your open periscope and describe how they function together.
- Brainstorm, research, and record information and ideas involving the use of light and mirrors and their connections to individuals, society, the economy, and the environment.
- Propose a course of action that could be taken, using your open periscope, to help reduce people's impacts on the environment.
- 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 forms listed below to include in your report:
 - a written report,
 - an oral presentation,
 - a media presentation.

Appendix B: Assessment Rubric (Assessment Of Learning)

This rubric was developed from the <u>Ontario Curriculum Grades 1-8 Science and Technology, Revised 2007</u> 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 periscopes and light; 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 periscopes and light)	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 an open periscope that allows the user to see around obstacles, and direct light into an unlit area	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., ... natural, artificial, beam of light) 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., reduce energy consumption in lights by using their device to direct light that is already available into unlit areas)	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 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 problem
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: _____

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.

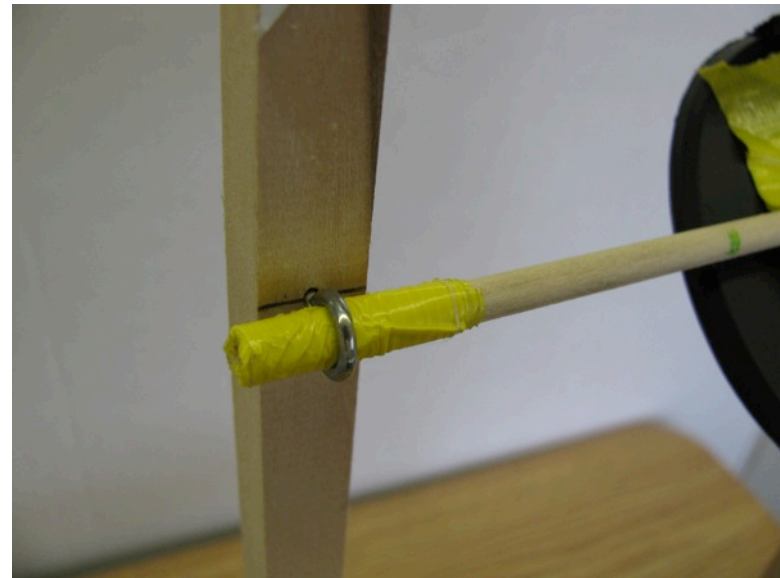
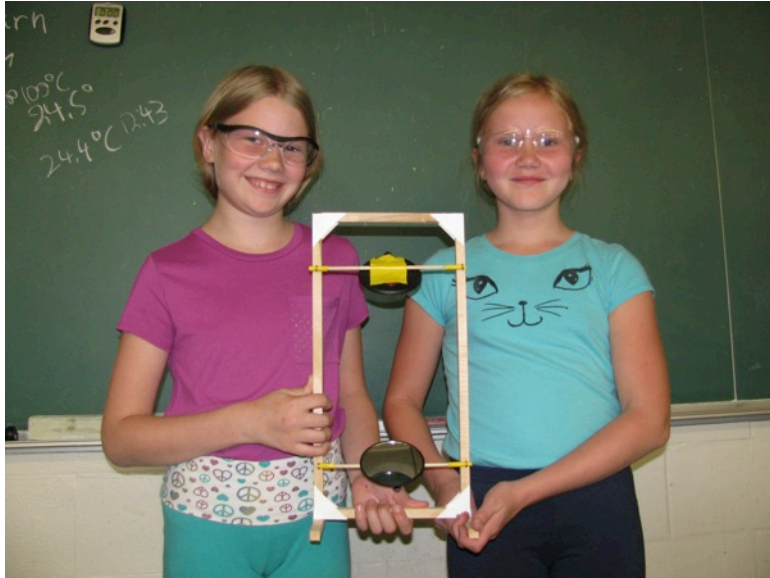
A summary of the three forms of assessment addressed in the Ministry of Education's Growing Success (2010) document is as follows:

- 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