

OCTE 2012 – Elementary Conference Workshops

GRADE 7 | UNDERSTANDING EARTH AND SPACE SYSTEMS HEAT IN THE ENVIRONMENT

Texting Mitts Design Challenge

OVERALL EXPECTATIONS

By the end of Grade 7, students will:

- investigate ways in which heat changes substances, and describe how heat is transferred;

SPECIFIC EXPECTATIONS

2. Developing Investigation and Communication Skills

By the end of Grade 7, students will:

- 2.1 follow established safety procedures for using heating appliances and handling hot materials
- 2.3 use technological problem-solving skills (see page 16) to identify ways to minimize heat loss
Sample problem: Use the materials provided to create a product (e.g., ... a piece of winter clothing, ...) that will minimize heat loss
- 2.5 use appropriate science and technology vocabulary, including heat, temperature, conduction, convection, and radiation, in oral and written communication
- 2.6 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes (e.g., using the conventions of science, create a labelled diagram to illustrate convection in a liquid or a gas)

Learning Goals

- Students will follow established safety procedures for using tools, and handling materials.
- Students will use the technological problem solving process to design, fabricate, and test a pair of texting mitts that control the transfer of heat by conduction, convection and radiation. The mitts must include a precision component that allows texting on a keyboard, or touch screen, while being worn by the user.
- Students will use appropriate science and technology vocabulary including conduction, convection, radiation, and insulator, in oral and written communication.
- 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 heat transfer including conduction, convection, radiation, and insulation, as well as, used tools and materials safely and appropriately in building and using her/his crane boom (K&U, 1);
- the student understands content (e.g., concepts, ideas, and processes) that involve insulating mitts so that they control heat transfer by conduction convection and radiation (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 pair of mitts that can be worn while texting, and also insulate against the three forms of heat transfer (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 that will determine if her/his texting mitts meet 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 in his/her report including insulation, conduction, convection, and radiation (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 society, and how people can use their electronic devices more effectively, and comfortably in extremely cold environments (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),
- a first aid kit (please see your Board's Health and Safety Regulations if one is being purchased for your classroom),
- one ruler per project,
- one sewing needle per project (projects can be individual or team - teacher's choice),
- one needle threader for every four projects,
- one thimble per project,
- 20 straight pins per project,
- one pair of fabric scissors for every four projects,
- one pincushion for every two projects,
- four instant read thermometers,
- access to a refrigerator, freezer, cooler with ice in it, etc., if the temperature outdoors is above 0° C.

Materials:

- four sheets of legal sized paper per team,
- thread (students supply their own),
- fabric that blocks wind, addresses heat loss by convection (students supply their own),
- material that insulates, addresses heat loss by conduction (students supply their own),
- material that is light coloured (white) or shiny, addresses heat loss by radiation (students supply their own),

- elastic, Velcro, snaps, or zippers to close cuff, also addresses heat loss by convection (students supply their own),
- precision surface for operating keyboard, (students supply/design their own).

Electronic Resources to Get You Started

Internet Resources - always stay on main page:

- heat transfer, a simple explanation <http://www.peaktoprairie.com/?D=204>
- clothing and heat transfer
<http://windowoutdoors.com/WindowOutdoors/Staying%20Warm%20-%20Interesting%20Observations%20on%20Heat%20Loss.htm>
- clothing and heat transfer <http://www.survivaltopics.com/survival/how-body-heat-is-lost>
- sewing mitts (simple) <http://www.sewing.org/html/letsmittens.html> You can access some good information from the upper left menu, see "Sewing Education" and click on "Guidelines for Sewing"
- types of handsewn stitches and their uses
http://www.sewing.org/files/guidelines/22_140_hand_stitches.pdf

Background Knowledge

See links above regarding clothing components related to controlling heat loss by conduction, convection, and radiation.

See links above for sewing tips.

Through research, students should discover that multiple layers of fabric and closure devices are needed to address the insulating task successfully. Recommended items include the following:

- wind resistant material for the outer layer (reduces transfer by convection),
- a closure item for the cuff such as fabric elastic, Velcro, a zipper, a thin bungee cord, etc. (reduces transfer by convection),
- an inner layer that insulates such as fleece or pile (reduces transfer by conduction),
- a shiny layer and/or white coloured fabric for the liner (reduces transfer by radiation).

Troubleshooting and safety:

- students tend to cut their pieces too small (they seem to base their measurements on finished mitt dimensions); those who decide not to "go big" often end up with a cuff that will only allow three fingers to fit inside it, or a thumb that is too narrow when the seams are turned in; students should cut templates from legal sized paper, staple the seams, and test fit their hands before they cut their material;
- students must use a thimble to push the needle through the fabric; when sewing through multiple layers, friction can cause the thread end of a needle can pierce a student's skin;
- use a pin cushion to store all pins and needles that are not in use;
- use straight pins to keep pieces of fabric in the correct position while sewing, arrange in a liner manner; place them far enough in from the edge to allow for the selected stitch;
- straight pins must point away from (not towards) the direction the student is sewing in;

- straight pins must be removed and placed in the pincushion before the student sews past the point;
- students should be aware that they might not see what is in the path of their needle when they pull a long piece of thread through their material (e.g., extending their arms above their heads, on an angle); extra caution must be observed so that others are not injured by a student's needle.

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

Activity Description

Design Challenge:

Students will research the three forms of heat transfer, then design and fabricate a pair of texting mitts that control heat transfer by conduction, convection, and radiation. To be texting mitts, they must also have precision surfaces that allow the user to wear their mitts and text using their choice of a touch screen or a keyboard.

Students will design a fair test to determine how well their mitts control the three forms of heat transfer.

Students will present or submit a report on their progress through the Technological Problem Solving Process.

Minds On/Hands On

1. Ask students to turn and talk regarding the comfort of their hands when texting outdoors in cold weather.
2. Conduct a whole class discussion regarding the above.
3. Record suggestions students may have regarding solutions to these problems.

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 you 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 discusses requirements for material choices (e.g., no hazardous materials, no inappropriate graphics, no inappropriate text).
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 and record methods of controlling heat transfer by conduction, convection, and radiation (the three types of heat transfer).
8. Students research and record information about clothing design and performance in cold weather, regarding the three types of heat transfer.
9. Students research and record information about creating patterns for mitts, and information about different styles and applications of hand-sewn stitches.

10. Students experiment with various materials to test potential precision texting attachments for their mitts.
11. Students form hypotheses (based on research) regarding potential solutions to their design challenge and investigation.
12. 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.
13. Teacher reviews sketches for safety and feasibility; students with approved sketches move on to the next step.
14. Students complete a set of patterns, and a list of materials for sewing their texting mitts, as well as, devise a fair test for their product (e.g., ability to control the three types of heat transfer, and texting performance when being worn by the user).
15. Teacher reviews plans, materials, and tests for feasibility; students with approved plans and tests move on to the next step.
16. Students create a prototype pattern using legal sized paper, staple or glue the seams, and test the size to see if they can get their hand through the cuff, and if the thumb fits properly.
17. Students transfer their finalized patterns onto their materials, cut out the pieces, and sew them together.
18. Students record observations, data, and results as they carry out their tests.
19. If improvements are necessary, and if time permits, students should redesign their prototype and re-test to determine if the changes were successful.
20. Students, brainstorm, research, and record information and ideas about insulating clothing and their connections to individuals, society, the economy, and the environment.
21. 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 20; 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: _____

Texting Mitts Design Challenge

Your task is to research and design a pair of mitts that will reduce heat loss by convection, conduction, and radiation. Your mitts must also have an attachment that allows the person wearing them to text from either a keyboard or a touch screen without exposing their thumbs or fingers to the cold.

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

- research and record methods of controlling heat transfer by conduction, convection, and radiation (the three types of heat transfer);
- research and record information about clothing design and performance in cold weather, regarding the three types of heat transfer;
- research and record information about creating patterns for mitts, and information about different styles and uses of hand-sewn stitches;
- experiment with various materials to test texting attachments for your mitts;
- form hypotheses (based on your research) regarding solutions to your design challenge;
- 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 patterns, and a list of materials for sewing your texting mitts; remember, your choices must avoid hazardous materials, inappropriate images, and inappropriate text;
- devise fair tests for your mitts that address their ability to control the three types of heat transfer, and texting performance while being worn by the user;
- create a prototype pattern using legal sized paper, staple or glue the seams, and test the size to see if you can get your hand through the cuff, and if your thumb fits properly;
- transfer your finalized patterns onto your materials, cut out the pieces, and sew them together;
- record your observations, data, and results as you carry out your tests;
- if necessary, and if time permits, items that require improvement, and re-test your mitts to determine if the changes were successful;
- record all final data, observations, research, and insights, then begin working on your report.

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 texting mitts and describe how they function together.
- Brainstorm, research, and record information and ideas about specialized insulating clothing and how these items are connected to individuals, society, the economy, and the environment.
- Propose a course of action that addresses problems faced by individuals who rely on using texting devices in cold climate conditions.
- 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 <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, terminology, and definitions related to heat transfer including conduction, convection, radiation, and insulation, as well as, used tools and materials safely and appropriately in sewing her/his texting mitts)	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 insulating mitts so they control heat transfer by conduction convection and radiation	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 pair of mitts that can be worn while texting, and also insulate against the three forms of heat transfer	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 that will determine her/his texting mitts meet 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 (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., insulation, conduction, convection, and radiation) 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 texting mitts will allow people to use their electronic devices more effectively, and comfortably in extremely cold environments)	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.

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: _____

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