Lesson Summary:
In this lesson, students build a structure able to withstand a simulated earthquake. Students begin the activity with a Pre-Assessment job application. Use this information to formulate groups and determine which students within the groups might need additional training. Students research earthquakes, earthquake measurement, and society’s preparation for and reaction to them. Finally, students build models and present them to the class, along with appropriate research.

This lesson brings together technology and science and is designed for the middle school classroom. If the curriculum aligns, the technology teacher could teach the construction and engineering concepts while the science teacher could cover the earth science concepts.

Estimated Duration: 12-15 hours

Commentary:
This lesson follows up a unit on plate tectonics. Students should already understand the layers of the Earth and the forces that drive plate tectonics. Students should also be familiar with the geologic zone in the Pacific Ocean known as the “Ring of Fire.” They learn about earthquakes and how they result from plate motion. This lesson also offers an opportunity to discuss mechanical waves.

This lesson offers a real-life, hands-on approach to understanding how science and technology work together. Students see how energy travels through waves and is transferred from the waves through structures. By changing frequency and displacement of the waves, different types of damage occur to structures on the Earth’s surface.

Pre-Assessment:
- Administer job applications to all students.
- Collect the job applications.
- See Attachment A, Pre-Assessment.
Earthquake Proof Structures - Grade Eight
Interdisciplinary Lesson

Scoring Guidelines:
The pre-assessment evaluates students’ prior knowledge of concepts needed to participate in the lesson and concepts to be learned in the lesson. Use this Pre-Assessment to place students into groups, identifying those students needing a review of knowledge and skills and determining lesson extensions for groups who require a higher level of challenge.

Post-Assessment:
In cooperative teams, students accomplish the following:
• Based on their research, students design an earthquake-proof structure from spaghetti to withstand shaking for 10 seconds on an earthquake simulator;
• Students present a written design portfolio with sources cited;
• Students make brief presentations to the class explaining how they built their structures and the information helpful in the design process;
• Students test their model structure with an earthquake simulator.

Scoring Guidelines:
Use the rubric to assess student work (see Attachment D, Post-Assessment Rubric). The rubric does not include categories for group cooperation or use of materials and cleanup. Consider including this on a separate rubric.

Instructional Procedures:
Day One
1. Hand out the job application (Attachment A, Pre-Assessment) and have students complete it in class.
3. Show a videotape of earthquake and earthquake damage. Describe structural damage that has taken place. Prompt students to consider the materials used in building structures and how these materials affect a building’s stability in an earthquake. Consider showing the video again after instructing students to look for specific things. Many videos show earthquakes taking place as well as earthquake damage.
4. Define the term “earthquake.” Have students relate examples of earthquakes they have seen, heard about or experienced. Students may research a particular
Earthquake Proof Structures - Grade Eight
Interdisciplinary Lesson

4. Explain the sequence of events leading up to an earthquake. Students could draw a diagram on the board describing what happens in the earth before and during an earthquake.

Day Two
5. Discuss various forces acting on a structure and how energy is either transferred through or absorbed by the material.
6. Have students experiment with a variety of forces acting on a wooden stick, metal clothes hanger and plastic clothes hanger.
   - Set a protractor on the table. Use it to measure each of the objects bent at 25, 45 and 90 degrees.
   - Bend each object to each of the three different angles and record how the object behaves.
   - Discuss questions such as these:
     - How do the different objects compare in elasticity or their ability to bend without breaking?
     - Which properties of these objects would be best for building in an earthquake-prone area?

Day Three
10. Using spring toys, demonstrate p-waves and s-waves. Emphasize the connection between the type of wave and the energy transfer. Use a parachute or large fabric sheet with a glove to demonstrate surface waves. (Place the glove in the center of the parachute and have students observe the movement of the glove as they shake the parachute.)
11. Discuss other characteristics of earthquakes, including elastic rebound and deformation.
12. Demonstrate the earthquake simulator to be used to test student structures in the final assessment. Help students identify and describe the types of forces and resulting motion which takes place; ask students to predict what these forces might do to a variety of
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objects such as small cup of water, different heights of stacked blocks or short and tall metal or wooden rods. Change the frequency and displacement so students can see that different combinations have a variety of impacts.

Day Four
13. Ask students to create a qualitative scale for gauging earthquake intensity. Then students share their scales in groups. Have students choose or modify one of the scales within their group to make it more meaningful.
14. Introduce the Modified Mercalli Intensity (MMI) Scale to students. Discuss how their scales compare to the Mercalli Scale.
15. Introduce the Richter Scale. Discuss similarities and differences between the Mercalli and Richter scales.
16. Discuss the importance of both scales to earthquake measurement.
17. Have students plot focuses and epicenters of earthquakes using the s-p method. The s-p method is a quick way to determine the distance from a location to the origin of a seismic wave by taking the difference of arrival time from the p-wave to the s-wave in seconds and multiplying by 8 kilometers per second.

Instructional Tip:
Here’s a good way to find an earthquake's epicenter:
  1) Collect several seismograms of the same earthquake from different locations.
  2) Plot them on a time distance graph.
     The vertical axis tells how much time passed between the start of an earthquake and the arrival of seismic waves at a station.
     The horizontal axis tells the distance between a station and the earthquake's epicenter.

Many examples of seismograms from various earthquakes are available from the USGS. References: http://courses.smsu.edu/ejm893f/creative/glg110/earthquakes.html#page383 www.cdli.ca/CITE/earthquakes_measurement.htm

Day Five
18. Place students in cooperative teams.
19. Hand out Attachment B, Introduction Letter. Identify yourself as the construction manager. The Introduction Letter describes to students the general nature of the project. Students learn they must follow a design brief to build a structure made of spaghetti and glue. The letter explains the structure must fall within the following parameters:
   • Be able to withstand at least 10 seconds on an earthquake simulator without breaking;
   • Have a 10 centimeter by 10 centimeter base;
   • Be at least 20 centimeters high.
   It must also conform to the following constraints:
   • Be made of spaghetti and school glue;
   • Have a mass of 50 grams or less.
20. Review the Design and Technology Portfolio, Attachment C, with students.
21. Review the Post-Assessment Rubric, Attachment D, with students.
22. Review procedures with the students for equitable assignment of tasks within the group.

**Instructional Tip:**
Students may demonstrate a higher level of prior knowledge during the lesson than on the Pre-Assessment. For this reason, wait until the fifth day to place students in cooperative groups.

**Day Six**
23. Begin class by asking these essential questions:
   - Why do earthquakes affect structures on the surface of the Earth?
   - What makes a structure strong enough to withstand an earthquake?
24. Next, ask the SLMS to guide students to relevant print and Internet resources. Include terminology such as base isolator, elasticity and tension. As students research, conduct mini-lessons for students on strategies for capturing relevant information. Students then focus on useful information or are redirected immediately, making the most of their time.
25. Have students research Internet and print materials for information about making structures strong enough to withstand an earthquake. Students should look for information on how energy travels underground through waves and affects surface structures. They should also look for materials with elasticity or devices which can achieve that effect.
26. Have students generate possible ideas for their structures from materials gathered.

**Days Seven through Nine**
27. At the beginning of days seven through nine, use class discussions to focus students on the task. Center the discussions on issues of mass (e.g., the difference between wet and dried glue) and the views of an isometric drawing from top, front and side. Remind the class that with all the cross-members drawn, it might be difficult to see the features. At this time, discuss distribution and collection of materials. Let students know the available materials, project storage and expectations for clean-up.
28. Students continue research via Internet and printed materials with help.
29. Students continue to generate possible solutions.
30. Require students to select a single solution based on their research. Remind students that they must support their choice using information they gathered during their research. Before students begin working on the actual structure, require they sign off on the plan. This allows students to build the structure according to their specifications, and not use any other group’s ideas.
31. Model and test the designs.

**Day 10 Student Presentations**
32. During presentations, students offer the results of their research, show the preliminary designs and demonstrate how the designs apply the research. After each presentation, students test models on the earthquake simulator. Each student project must include a bibliography.
33. Have students complete Attachment D, *Post-Assessment Rubric.*
Day 11
34. Have students discuss changes they could make in their design and encourage more time for reflection.

**Instructional Tip:**
Consider videotaping the structures as they fall. Have students view the videotape one frame at a time to see where the weaknesses lie. This knowledge can inform the redesign of their structures.

**Differentiated Instructional Support:**
Instruction is differentiated according to learner needs, to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s).

- If students have difficulty physically manipulating spaghetti sticks, substitute toys made of colored wooden dowels and round blocks with holes to achieve a similar product.
- Place students having difficulty in groups with students able to assist them.
- Assign students less capable of design to take charge of navigating the Internet.
- Have visual learners work in groups to create posters that explain plate tectonics, s- and p-waves, faults, elastic rebound and the MMI and Richter Scales.
- Students who have achieved the specified indicator can vary the frequency and magnitude of the simulator.
- Students who have achieved the specified indicator can design a structure of their choice to withstand an earthquake and devise a testing method.
- Students who have achieved the specified indicator can design the tallest freestanding structure that will survive an earthquake on the simulator.
- Students who have achieved the specified indicator can design an earthquake simulator.

**Extensions:**
- Have students research Ohio earthquakes and identify areas of Ohio most prone to earthquakes.
- Have students research what, if anything, is done to buildings in those areas to reinforce them against earthquakes.
- Have students contact the Ohio Geological Survey to determine where geologists in Ohio focus their research and how they use that information to benefit Ohioans.
- Have students research how concepts used to construct buildings apply also to bridges.
- Have students research mythology focusing on earthquakes. Many cultures have varying explanations for the natural phenomenon and represent them through mythology.
- Ask students to create a myth explaining earthquakes.
- Have students create a journal entry of a young adult who has just experienced an earthquake. The entry should detail the sights and sounds, people’s reactions and the writer’s feelings.
Home Connections:
- Have students discuss earthquake preparedness with family or friends and create a family plan if an earthquake were to strike.
- Ask students to find out which family members or friends have experienced an earthquake firsthand.
- Have students ask family members or friends what they were doing when a major earthquake struck and how they reacted to the news of the quake.

Interdisciplinary Connections:
Science
Earth and Space Sciences

Benchmark E
Describe the processes that contribute to the continuous changing of Earth’s surface (e.g., earthquakes, volcanic eruptions, erosion, mountain building and lithospheric plate movements).
Indicator 10
Explain that most major geological events (e.g., earthquakes, volcanic eruptions, hot spots and mountain building) result from plate motion.

Materials and Resources:
The inclusion of a specific resource in any lesson formulated by the Ohio Department of Education should not be interpreted as an endorsement of that particular resource, or any of its contents, by the Ohio Department of Education. The Ohio Department of Education does not endorse any particular resource. The Web addresses listed are for a given site’s main page; therefore, it may be necessary to search within that site to find the specific information required for a given lesson. Please note that information published on the Internet changes over time; therefore, the links provided may no longer contain the specific information related to a given lesson. Teachers are advised to preview all sites before using them with students.

Note: Some Web sites contain material that is protected by copyright. Teachers should ensure that any use of material from the Web does not infringe upon the content owner's copyright.

For the teacher: computer projector, VCR, videotape on earthquakes and earthquake destruction, large fabric sheet, glove, earthquake simulator

For the students: extended polystyrene trays, spaghetti, school glue, Internet accessibility, heat lamps or hair dryers, wooden sticks, metal clothes hanger, plastic clothes hanger, index cards

The Instructional Management System (IMS) offers a valuable pool of standards-based resources. Listed below are lessons that can support Technology ACS implementation.
Earthquake Proof Structures - Grade Eight
Interdisciplinary Lesson

Suggested IMS linked lessons:
- Waves – Grade Eight, Science, Physical Science
- Products to Solve Problems – Grade Eight, Science, Science and Technology

**Vocabulary:**
- base isolator
- compressional wave
- deformation
- elasticity
- epicenter
- focus
- mechanical wave
- Mercalli (MMI) Scale
- p-waves
- Richter Scale
- s-waves
- seismic waves
- seismograph
- seismology
- tectonics
- transverse wave

**Library Connections:**
In 2003, the State Board of Education and the Ohio Department of Education established library guidelines that represent a standards-based education approach to school library programs. Entitled Academic Content Standards K-12 Guidelines Library, Ohio’s library guidelines provide a variety of content-specific, grade-level indicators describing information literacy, literacy linked to library-based technologies, and media literacy experiences for students. Featured on pages 204-219 are sample activities for making library connections across academic content standards and disciplines. Also included are grade-band models for student research and specific information concerning copyright and fair use of materials laws. K-12 teachers are encouraged to utilize the library guidelines and collaborate with the school library media specialist whenever possible. Ohio’s library guidelines can be found under the heading of Library at www.ode.state.oh.us, keyword search Library.

**Library Information Literacy**

**Benchmark E**
Conduct research and follow a research process model that includes the following: develop essential question; identify resources; select, use and analyze information; synthesize and generate a product; and evaluate both process and product.
Indicator 6
Analyze information, finding connections that lead to a final information product.

Indicator 12
Revise and edit the information product.

Specific examples of how library resources can be used to support this lesson are listed below:

- Students use the Internet to research information on types of structures and how they are built to withstand an earthquake.
- The SLMS can instruct students on appropriate Internet searching strategies.
- The SLMS can work with students on correct documentation of resources.
- The SLMS may act as an intervention specialist for struggling or gifted students and can assist students with extension projects as the classroom teacher continues to work with the class.

Research Connections:

1. Nonlinguistic representations help students think about and recall knowledge. This includes the following:
   - Creating graphic representations (organizers);
   - Making physical models;
   - Generating mental pictures;
   - Drawing pictures and pictographs;
   - Engaging in kinesthetetic activity.

2. Cooperative learning has a powerful effect on student learning. This type of grouping includes the following elements:
   - Positive interdependence;
   - Face-to-face promotive interaction;
   - Individual and group accountability;
   - Interpersonal and small group skills;
   - Group processing.

3. Generating and testing hypotheses engages students in one of the most powerful and analytic of cognitive operations. It deepens students’ knowledge and understanding. Any of the following structured tasks can guide students through this process:
   - Systems analysis;
   - Problem solving;
   - Historical investigation;
   - Invention;
Earthquake Proof Structures - Grade Eight
Interdisciplinary Lesson

• Experimental inquiry;
• Decision making.


Authentic experiences help students develop real-world knowledge and skills and apply their learning in ways that prepare them for their careers and lives beyond school.


Inquiry-based learning helps students to become resourceful, effective investigators and problem-solvers. Research reports that with effective teacher facilitation, student-centered inquiry projects can reverse patterns of underachievement. Inquiry-based projects can build learning communities that foster communication skills, interpretive abilities and an understanding of issues from a variety of perspectives.


Standards-based student assessment supports the systematic, multi-step process of collecting evidence on student learning, understanding and abilities and using that information to inform instruction and provide feedback to the learner, thereby enhancing learning. Students should be assessed often using a variety of tools and methods. The design of student assessments should follow set principles, such as utilizing authentic assessment that provides students the opportunity to demonstrate their knowledge and abilities in real-world situations. Note: the complete publication and other resource materials are available online at the Ohio page of the ITEA Center to Advance the Teaching of Technology and Science [CATTS] web link: http://www.iteaconnect.org/EbD/CATTSresources/CATTSresourcesOH01.htm

General Tips:
• These lessons use 50-minute class periods.
• Use uniformly-sized pasta. Use the thickest type of spaghetti or linguine possible, weighing approximately one gram per stick.
• Use some of the procedures as homework and discuss later in class (e.g., creating a qualitative scale for gauging earthquake intensity or changing the shape of a 3” x 5” card to support 50 pounds).
• Consider giving students a certain amount of building materials. Announcing the subtraction of points from the final presentation for additional materials might eliminate waste.
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- Frequently discuss the project in class with the students. Begin the class each day with a discussion to focus students on the task.
- When considering an earthquake simulator, either purchase one or create one. An earthquake simulator could be something as simple as sliding a piece of wood with laminate on it across a table with a similar surface. There are so many choices when creating a simulator. To design the one that is best for one’s classroom (given time and budget constraints), do an Internet search using keywords – “earthquake,” “simulator” or “shake table.”
- Use expanded polystyrene trays available at most grocery stores in the meat department for platforms. This allows for uniform bases of equal weight.
- A cost-cutting substitution for glue could be cornstarch and water. (It is a good idea to experiment with this ahead of time to get the right consistency.)
- Use only 15 to 20 seconds to dry glue if using heat lamps. Remind students to use caution with heat lamps.
- Use a hairdryer for an alternative heat source, set on the lowest setting and far enough away from the structure to prevent breakage.

**Attachments:**
Attachment A, *Pre-Assessment*
Attachment B, *Introduction Letter*
Attachment C, *Design and Technology Portfolio*
Attachment D, *Post-Assessment Rubric*
Attachment E, *Ohio Research Model Skills (Grades 6-8)*
APPLICATION FOR EMPLOYMENT

QUAKER ARCHITECTURAL FIRM
500 SHAKY BOULEVARD
SAN FRANCISCO, CALIFORNIA 98527
798.432.2950
Fax 798.432.2951

<table>
<thead>
<tr>
<th>Name (last, first, middle)</th>
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<tbody>
<tr>
<td>Street Address</td>
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<td>Apt. Number or P.O. Box</td>
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<td>City</td>
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<tr>
<td>Zip</td>
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<td>Date of Birth</td>
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Daytime Phone ( ) -
Evening Phone ( ) -
Cell Phone ( ) -

EDUCATION

<table>
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<tr>
<th>INSTITUTION NAME AND ADDRESS</th>
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<tr>
<td>GRAMMAR SCHOOL</td>
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<td>MIDDLE SCHOOL</td>
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In order to determine the knowledge of our applicants, we ask that the following questionnaire be completed. Please answer the questions to the best of your ability. This information could be used to determine if we can assist you with additional training.

1. How is energy transferred?

2. Name two (2) types of mechanical waves.

3. Define elasticity and give an example of something that has this property.
4. What do you know about how waves travel?

___________________________________________________________________
___________________________________________________________________

5. Give an example of compression. _________________________________
   Give an example of tension. _______________________________________

6. Why do you think some earthquakes are stronger than others?
   __________________________________________________________________
   __________________________________________________________________

7. How are earthquakes detected?
   __________________________________________________________________
   __________________________________________________________________

8. Why could an earthquake have several different intensity values?
   __________________________________________________________________
   __________________________________________________________________

9. What technologies help make buildings more earthquake resistant? (You may draw these technologies to help explain your answer.)
Dear Applicant,

After careful consideration of your application, we have selected you to be a member of our design team. For your first assignment, you will design a building model made entirely of spaghetti sticks and glue with a group of colleagues. This model will be tested on an earthquake simulator, which simulates the type of movements and stress that occur within the earth during an earthquake. You and your teammates must also submit a design portfolio at the end of the project. Keep this portfolio in a designated work area for the duration of the project as it will be frequently inspected by the construction manager. Certain parameters and constraints for this project are described below. Please note a wealth of resources and unlimited Internet access are available to you. When using the Internet, consider searching such key words as earthquake resistant, structures, building design and other related terms. Be sure to keep track of your sources because they need to be properly cited in your design brief.

Naturally, the best designs will be chosen as the models for new clients. Continually refer to the assessment rubric to ensure your model fulfills the building code. Constant communication with each other is important. Good Luck!

PARAMETERS

- Structure must be able to withstand at least 10 seconds on an earthquake simulator without breaking.
- Structure must have a 10 centimeter by 10 centimeter base.
- Structure must be at least 20 centimeters high.

CONSTRAINTS

- Structure may only be made of spaghetti and school glue.
- Structure can weigh up to 50 grams.
Technological Project

Design & Technology Portfolio

<table>
<thead>
<tr>
<th>Design Team</th>
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<th>Project start date</th>
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<table>
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<th>Class period</th>
<th>Project grade</th>
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Design Brief

Write a short description of the problem you are to solve in the box above.

Developed from materials provided by Staffordshire County Council, Stafford, U.K. and the Ohio Model Technology Systems Project.
**Team Member Assignments**

The team should plan specific tasks to be completed by each team member.

<table>
<thead>
<tr>
<th>Task</th>
<th>Name</th>
<th>Task to perform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigation &amp; Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ideas and Proposals</td>
<td></td>
<td></td>
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<tr>
<td>Developing &amp; Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabricating</td>
<td></td>
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<tr>
<td>Redesigning</td>
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<tr>
<td>Testing</td>
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<tr>
<td>Evaluation</td>
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</tbody>
</table>
Parameters and Constraints

What is the goal of the design?

What must the design be able to do?

Under what conditions must the design function?

What must the design not do?
Sketch an isometric drawing of the idea and label its major parts or features.

Explain the basic operation of the design. Include idea number and the names of those submitting the design.
Materials Selection

List the materials and quantities required to fabricate your prototype:

Explain why you chose those materials. What other materials may be substituted if your first selection is unavailable or turns out to be undesirable? Record all sources in proper bibliographic form.
Earthquake Proof Structures - Grade Eight
Interdisciplinary Lesson
Attachment D
Post-Assessment Rubric

Building A Structure: Earthquake Proof Structure

<table>
<thead>
<tr>
<th>Teacher Name:</th>
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<tbody>
<tr>
<td>Student Name:</td>
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</table>

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Gathering</td>
<td>Accurate information taken from at least one print, two multimedia and three online sources. Clear evidence of this information used in project.</td>
<td>Accurate information taken from at least one print, one multimedia and two online sources. Clear evidence of this information used in final project.</td>
<td>Accurate information taken from at least three sources, but not used in the final project.</td>
<td>Information taken from less than three sources or information is not accurate.</td>
</tr>
<tr>
<td>Plan</td>
<td>Drawing is neat with clear measurements and labeling for all components.</td>
<td>Drawing is neat with clear measurements and labeling for most components.</td>
<td>Drawing brief provides clear measurements and labeling for most components.</td>
<td>Drawing does not show measurements clearly or is otherwise inadequately labeled.</td>
</tr>
<tr>
<td>Construction - Care Taken</td>
<td>Great care taken in construction process so that the structure is neat, well-built and follows plans accurately. Meets all parameters and constraints.</td>
<td>Construction was careful and accurate for the most part, but one or two details could have been refined for a better built product. Parameters and constraints are addressed.</td>
<td>Construction partially followed the plans and three or four details could have been refined for a better built product. Some parameters and constraints have been addressed.</td>
<td>Construction appears careless or haphazard. Many details need refinement for a strong, well-built product. No evidence that parameters and constraints were consistently addressed.</td>
</tr>
<tr>
<td>Modification/Testing</td>
<td>Clear evidence of troubleshooting, testing and refinements based on data or scientific principles. Clear explanation included.</td>
<td>Clear evidence of troubleshooting, testing and refinements.</td>
<td>Some evidence of troubleshooting, testing and refinements.</td>
<td>Little evidence of troubleshooting, testing or refinements.</td>
</tr>
</tbody>
</table>
Earthquake Proof Structures - Grade Eight
Interdisciplinary Lesson

<table>
<thead>
<tr>
<th>Design Portfolio – Content</th>
<th>Portfolio provides a complete record of planning, construction, testing, modifications, reasons for modifications and some reflection about the strategies used and the results (possible ways technology could be transferred into other areas).</th>
<th>Portfolio provides a complete record of planning, construction, testing, modifications and reasons for modifications.</th>
<th>Portfolio provides quite a bit of detail about planning, construction, testing, modifications and reasons for modifications. Some detail missing or not complete.</th>
<th>Portfolio provides very little detail about several aspects of the planning, construction, testing and modification process.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Knowledge - waves transfer energy, vibrations in the earth may produce earthquake waves that spread away from the source in all directions.</td>
<td>Explanations by all group members indicate a clear and accurate understanding of scientific principles underlying the construction and modifications.</td>
<td>Explanations by all group members indicate a relatively accurate understanding of scientific principles underlying the construction and modifications.</td>
<td>Explanations by most group members indicate relatively accurate understanding of scientific principles underlying the construction and modifications.</td>
<td>Explanations by several members of the group do not illustrate much understanding of scientific principles underlying the construction and modifications.</td>
</tr>
<tr>
<td>Structure Durability</td>
<td>Structure lasted at least 10 seconds on the earthquake simulator without breaking. Structure is at least 20 centimeters high and does not weigh more than 50 grams.</td>
<td>Structure lasted at least 10 seconds on the earthquake simulator without breaking. Structure is at least 20 centimeters high but weighs more than 50 grams.</td>
<td>Structure lasted between five and 10 seconds on the earthquake simulator without breaking. Structure is at least 20 centimeters high.</td>
<td>Structure lasted between one and five seconds on earthquake simulator without breaking. Structure is not 20 centimeters high.</td>
</tr>
</tbody>
</table>
Earthquake Proof Structures - Grade Eight
Interdisciplinary Lesson
Attachment E
Ohio Research Model Skills (Grades 6-8)
Ohio Technology Academic Content Standards Lesson

Decide: Formulate an essential question to guide the research process.

Find: Identify and evaluate relevant information and select pertinent information found in each source. Expand search strategies by using Boolean logic. Narrow or broaden the search topic/question according to how many resources are located. Seek information from a variety of viewpoints.

Use: Analyze information, finding connections that lead to a final information product. Demonstrate how to determine copyright issues when creating new products (e.g., permissions to use articles and graphics, credit information to be included). Use a teacher or district designated citation-style manual to credit sources used in work (e.g., MLS Style Manual, APA Guidelines). Examine diverse opinions and points-of-view to develop and modify own point-of-view (e.g., view culture, background, historical context). Take notes, organize information into logical sequence, and create a draft product (e.g., report, research paper or presentation). Digitize the information for archiving and future use (e.g., creating an electronic portfolio of the curricular projects).

Check: Revise and edit the information product. Communicate, publish and disseminate findings to multiple audiences in a variety of formats (e.g., report, speech, presentation or Web site). Evaluate the final product for its adherence to project requirements (e.g., recognize weaknesses in the process and product and find ways to improve).

Adapted from Ohio K-12 Library Guidelines, 2004 pg. 198.
Source: Office of Curriculum and Instruction. Ohio K-12 Library Guidelines Columbus, OH: Ohio Department of Education; 2004