

4 The Anti-Hunchback Backpack

The Ontario Curriculum, Grades 1–8: Science and Technology, 2007 (Revised)

Code	Specific Expectations
Relating Science and Technology to Society and the Environment	
1.2	evaluate the impact of ergonomic design on the safety and efficiency of workplaces, tools, and everyday objects, and describe changes that could be made in personal spaces and activities on the basis of this information

The Ontario Curriculum, Grades 1–8: Language, 2006 (Revised) — Media Literacy

Code	Specific Expectations	Teacher Prompts
1.6	Identify who produces various media texts and determine the commercial, ideological, political, cultural, and/or artistic interests or perspectives that the texts may involve	Identify the perspective evident in this media text. Who or what company might be interested in promoting this text? Would there be more than one potential commercial interest (i.e. chiropractic services and backpack manufacturers)? For what other uses might this media text be used?
3.2	Identify an appropriate form to suit the specific purpose and audience for a media text they plan to create and explain why it is an appropriate choice.	Think of a product that you use everyday that could be redesigned. What media form would you use to promote your findings? What would make that form an effective way to present your message to your audience? Who would be your audience?

Opening Scenario

Students and backpacks are inseparable. Yet a great number of students experience back, shoulder and neck pain, even tingling in their arms and hands because of those backpacks. An overweight pack causes a strain between the shoulder and back muscles. This strain pulls on the collar bone and eventually pinches the nerves between the collar bone and first rib. The result? Numbness and tingling in the hands. Scary stuff, indeed.

Two things are consistent with student back pain: the weight of their backpack and the amount of time a student wears it.

Ideally, pack weight should not exceed 10 to 15 percent of body weight.

Many well-designed backpacks have wide shoulder straps which help absorb the load. Waist and chest straps help keep the backpack load near the body. This way the hips and back carry the load, maintaining a balance.

It's natural to sling a pack off one shoulder or have it hang down the back but the danger is a hunched-over walk, bad posture and a pain in the neck, shoulder and back, even scoliosis, an excessive curvature of the spine.

This video features Dr. Dan Yaron who will offer advice on choosing a

well-designed backpack as well as how to wear one to eliminate many of these backpack problems.

Big Ideas

- Structures have a purpose.
- The form of a structure is dependent on its function.

In this Unit, the Big Ideas have been further developed to include the following:

- Everyday products have been designed to perform a particular function but sometimes at the expense of our comfort and physical well-being.
- The science of designing safe, comfortable and efficient products is ergonomics.
- A well-fitted backpack is comfortable to wear and eliminates back, shoulder and neck pain.

Viewing the Video

1. Before viewing the video, discuss the following with the students to help determine their prior knowledge about the subject content of the media text
 - What are some of the advantages of using a backpack to carry your school gear back and forth to school?
 - What are the disadvantages? (*back pain, shoulders hurt, weighs too much,*)
 - What design features would make the ideal backpack?
2. Help students focus on the video as they view it with the following questions:
 - Listen for two problems that cause students shoulder and back pain (*sitting too long, not getting enough exercise to strengthen bodies, and carrying an ill-designed backpack or too much weight in that backpack*).
 - What percentage of body weight should you carry in your backpack? (*not more than 10-15 %*). How much weight should you carry?
 - Watch the model of the spine as Dr. Yaron shows what happens when you carry too much weight on your back. What happens to the spine and neck?
 - As you watch Dr. Yaron point out the features of a well-designed backpack, think of the features of your backpack. How does it measure up?
3. Show the video **The Anti-Hunchback Backpack** to the Students.
4. Hand out a copy of the video scripts provided in the appendices to students who may require ESL/ELD help.

Thinking and Investigation

In this Investigation, students will learn that ergonomics is the science of making workplaces, tools, and everyday objects fit people instead of asking people to fit things. They will examine products that are well designed and those that are not. They will consider also how some products can be improved. Students will work in groups to produce a media presentation on their findings.

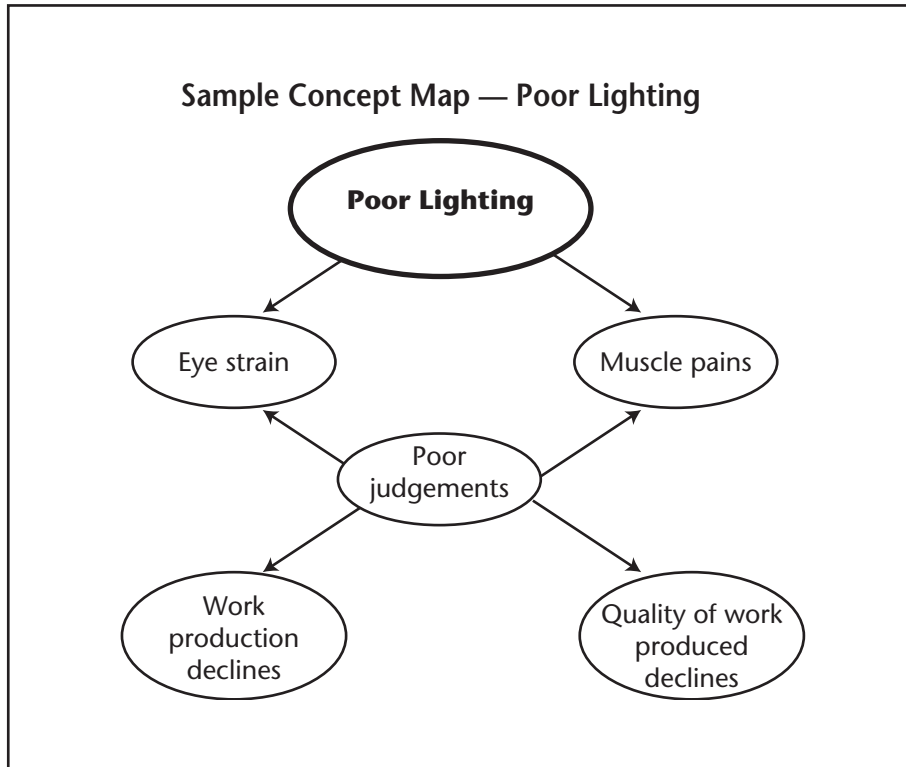
1. Collect a variety of common objects such as garden hand tools (a weeder), kitchen tools (can openers), cell phones, staplers etc. Students might like to bring in their own objects to compare. This activity works best if you have more than one example of each product (i.e., two different brands of cell phones).
2. In groups, have the students examine 2 -3 types of objects. If two samples of an object are not available, have them go through catalogues from Lee Valley Tools or Canadian Tire or other stores to find comparisons. The product descriptions often include the design features.
3. Have the students complete a Comparison Chart for each pair of objects they are examining (see chart below).

Comparison Chart		
Well-Designed Product	Product	Poorly Designed Product
Shaped to fit my hand	Garden Weeder (Well-designed – Brand x) (Poorly-designed – Brand y)	Handle is at an awkward angle
Light weight		Rather heavy
No unnecessary sharp edges		Handle is rough

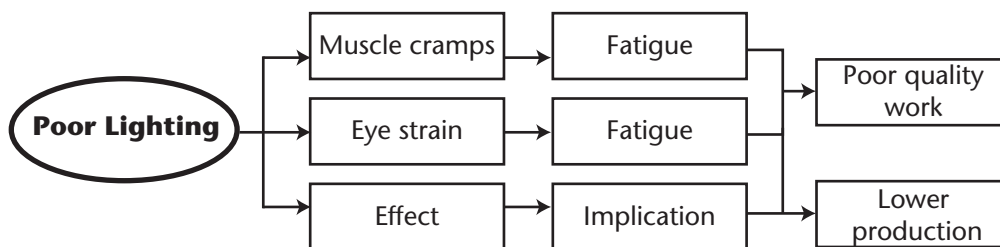
4. When they have completed the Comparison Chart, ask students to review it to find the common characteristics amongst the various items in each category (e.g., designed to fit specific body parts, small – or large – enough for the function, feels uncomfortable etc.).
5. Have each group share its findings with the class, completing a T-chart in which all groups compare the characteristics of well-designed and poorly designed products. See sample below:

T-Chart to Compare Well Designed and Not-so-well designed Products	
Ergonomically Designed	Not Ergonomically Designed
<i>Takes into account the shape of the human body</i>	<i>Awkward to hold</i>
<i>Can use repeatedly without strain</i>	<i>Becomes uncomfortable to use in a short while</i>

6. Have the students brainstorm some of the issues in a workplace using poorly designed products. They might consider office situations (lighting, chairs, and desks); vehicles (dashboards, placement of controls); factories (tools, plant design); and the school itself.
7. Assign each group a product or situation and have them complete a Concept Map or a Cause and Effect Chart as they discuss the potential problems of using those poorly designed products. See the examples below



Cause and Effect Chart



8. Have each group investigate the particular product or workplace situation further, using the Internet, product catalogues and/or library resources, adding to the charts as necessary. If possible, they could interview users of the products, asking them about the pros and cons of the products or pieces of equipment.
9. As students conduct their research, they should consider the following:
 - the improvements they could suggest for the product or workplace.
 - the effect of an ergonomic design on the final cost of the item.
 - the ergonomic factors that should be considered in the design of the product.

- the changes that could be made to the product to make it more ergonomic.
 - the changes that could be made to the product to make it more ergonomic for those facing physical challenges.
 - the reasons a manufacturer might choose **not** to integrate the principles of ergonomic design into a product.
 - the reasons a consumer might prefer a non-ergonomically designed product (i.e., the ‘cool factor’ overrides the comfort issue).
10. Students will present their findings by way of a media presentation (See Appendix 9 – Media Presentation).

Assessment and Evaluation

1. During the Investigation, students will learn one or more of the following:
 - a) Ergonomics is the science of making workplaces, tools, and everyday objects fit people instead of asking people to fit things.
 - b) Something that is ergonomic is designed for safe, comfortable, and efficient use
 - c) Ergonomic design must consider:
 - Differences among people – their size, age, physical condition and limitations, and preferences
 - The work environment – air quality, temperature, lighting, space
 - The task - tools and equipment, frequency, time available for completion
 - Furniture requirements - work surfaces, technology, chairs, storage needs
2. Choose applicable Rubrics from Appendices 5-8 with the above to assess students’ knowledge and skills.
3. Use Appendix 9 for the Media Presentation Assessment.

Tell Me More — Big Fingers + Little Buttons = COOL

Literacy Strategy: Reacting to Reading: Responding to Text (Graffiti)

Background Information

Graffiti is a learning strategy that can be used 'before reading' to determine students' understanding of the topic or 'after reading'. This activity is for 'after reading'. Students work in groups, recording and generating ideas on chart paper. Groups of four students per group are best. Use the questions below or generate your own based on the Tell Me More. Write one question or topic on each piece of chart paper. Use as many pieces of chart paper as there are groups. Set up multiple sets of questions if necessary; in a class of 16 with four questions, you would have four groups of students. If you have 24 students in a class, you could increase the number of questions to six ($6 \times 4 = 24$) or decrease the number of questions to three and have two sets of three questions ($(2 \times 3) \times 4 = 24$).

Before Reading

1. Determine the number of groups and set up the 'stations'. Each station will have a chart paper with a question and a different-coloured marker.
2. Assign the reading to students, reviewing specific vocabulary that might prove difficult (ergonomics, efficient, implications, subjective, adjustable, components).
3. Introduce the strategy, asking students to apply the term 'graffiti' to this activity ('scribbling on walls in public places').
4. Explain the process to students: each group will start at a different 'station'/chart paper with a question. One student will record the responses of his/her group with the marker.
5. Have the students number 1-4 in their groups (See Numbered Heads in Unit 3); assign #1 to be the recorder for the first station.

During Reading

1. At the end of a set time (2-3 minutes), students will move to the next 'station'/chart paper, taking their marker with them and leaving the chart paper behind.
2. It is important to move through these stations quickly; staying too long at any one station will mean fewer responses for following groups.
3. Give students a warning that they will be moving soon; e.g., "Finish the word you are writing"; "15 more seconds" etc.

Literacy Strategy:
Reacting to Reading:
Responding to Text
(Graffiti) (adapted from
Think Literacy: Cross-
Curricular Approaches
Grades 7-12 (2003)
(pp. 66 - 69)

4. A new recorder will record the responses to the next question, using the same coloured marker (so that they can find their responses when finished).
5. At each new 'station', have the new recorder read the responses already on the chart paper, asking other group members for their reactions (add a check mark if they agree, an 'x' if they disagree and a '?' if they do not understand why something was included). Groups add their own responses, using their coloured markers.
6. Continue through each of the different questions. Monitor student activity; as students move to charts with many responses, they might not be able to add many more new ideas but they do need to assess what has been recorded by previous groups.
7. Groups will conclude with their starting question.

After Reading

1. Continue using Numbered Heads to ensure that all students are involved.
2. Have the students review the responses to the original question. As a group, determine the five or six most interesting responses and circle them on the chart paper.
3. Choose a Numbered Head to display the chart and another to report the five or six most interesting responses to the rest of the class.
4. If you have more than one set of questions, compare the results from both sets.
5. Round Robin: Conclude the class by having group members share with each other one concept/fact/idea that they found most interesting from this activity.
6. One Minute Bulletin Board: Select one Numbered Head per group to share his/her response with the rest of the class.
7. Variation: Passport Out of the Classroom – students must tell teacher (or designated students) what this most interesting fact/concept was as they leave the classroom.

Graffiti Questions

1. What are some items you use where the 'cool factor' is more important than the principles of ergonomic design?
2. What are some considerations that manufacturers must consider to have an ergonomically designed product?
3. What classroom items have been designed to be used effectively and efficiently? In what ways?
4. What pieces of classroom furniture would you redesign to be ergonomically sound? Sketch and label your redesign.

Differentiated Learning – Responding to Text (Graffiti)

ESL/ELD/Remedial

- Select words from the text that are unfamiliar to students and pre-teach.
- Put selected words on the Word Wall. See *Think Literacy Cross-Curricular Approaches Grades 7-12 Science and Technology, Grades 7-8 Science, Grade 9 Applied 2004*.
- When working in groups, pair struggling students with students who will be able to support them if called upon to report.

Enrichment

- Encourage students to check out additional resources on the topic of the ergonomics (See Appendix 16).
- Using the checklist for SCAMPER, have the students redesign an existing product. Developed by Bob Eberle, the changes SCAMPER stands for are:

S – Substitute: components, materials, people

C – Combine: mix, combine with other assemblies or services, integrate

A – Adapt: alter, change function, use part of another element

M – Modify/Maximize/Minimize: increase or reduce in scale, change shape, modify attributes (e.g. colour)

P – Put to another use

E – Eliminate: remove elements, simplify, reduce to core functionality

R – Reverse or Rearrange: turn inside out or upside down