

- criteria

Lesson 6

Evaluating the Design of a Structure

Learning Outcomes

After completing this lesson you will be able to

- evaluate different types of couches using the design process

Every day, consumers must make decisions about which products to buy. When a consumer has investigated and researched his or her options, then he or she can feel confident about making a choice. The design process allows people to make sound choices.

For example, Goldilocks (from *Goldilocks and the Three Bears*) didn't know anything about buying furniture, but she did have a set of **criteria** in mind when it came to chairs and beds. She tested out the products available to her, and determined which ones she preferred. One chair was too soft; another too hard and tall. But when she came to the one that was "just right," structural stability became an issue. The chair couldn't withstand her weight, suffered structural fatigue, and eventually, structural failure (it collapsed).

In this lesson you will use the design process to determine which type of sofa to purchase for a rec room.

Learning Activity: Which Sofa?

Step 1: Identify the Problem

Imagine that your parents want to buy a new sofa for the rec room. Since you will be using the rec room to sit in and to watch TV, they would like your input in the decision. The sofa must be under \$1000, and big enough to seat at least three adults. The walls and rug of the basement are all green in colour. With a baby sister and the probability of having teenage friends over for pizza and pop, the material of the sofa must have a stain guard, or be made with a washable fabric like polyester or nylon.

Step 2: Criteria

To determine which sofa to purchase, you must take several factors — called criteria — into consideration. Sometimes, certain factors have more importance, or play a more significant role, in the decisions you make. For example, the sofa cannot cost more than \$1000.

The chart below lists some of the criteria you must consider as you conduct your research. Using the numbers 1–7 (1 being the most important and 7 being the least important), rank the criteria in the order you think is most important. You may need to refer back to these ratings to help in your final decision.

Criteria	Ranking of Importance
• the colour matches the green walls and rug	
• the fabric is easy to clean	
• the sofa can structurally withstand the weight of three people — the frame contains braces and/or blocks to ensure stability	
• the size — the sofa can seat at least 3 adults	
• the comfort	
• the cost	
• the warranty	



Step 3: Research and Gather Information

Your parents have decided to shop online, and have the sofa delivered to the house. They have narrowed down their choices to the following sofas:

Sofa #1

Truscott Green Sofa, \$600.00

Fabric: 80% Olefin, 20% Polyester

Frame: Kiln-dried hardwood frame — glued and stapled with 15 cm corner blocks

Seats: 3 adults

Foam: Seat — 15 cm thickness, Back — 2 cm thickness, Arm — 0.5 cm thickness

Warranty: 10 years on frame and spring mechanism; 2 years on cushion core

Sofa #2

Los Pinos Green Patterned Sofa, \$650.00

Fabric: 100% Nylon

Frame: Kiln-dried hardwood frame — glued and stapled with 15 cm corner blocks

Seats: 3 adults

Foam: Seat — 15 cm thickness, Back — 2 cm thickness, Arm — 0.5 cm thickness

Warranty: 10 years on frame and spring mechanism; 2 years on cushion core

Sofa #3

Pipkin Beige Sofa, \$800.00

Fabric: 100% Olefin, with stain guard treatment

Frame: Fully setup kiln-dried hardwood frame, generously blocked, cross-braced, glued and stapled to withstand maximum usage demands

Seats: 3 adults

Foam: Seat — 20 cm thickness, Back — 2.5 cm thickness, Arm — 1.0 cm thickness

Warranty: 10 years on frame and spring mechanism; 2 years on cushion core, 1 year on fabric, foam, and labour

Sofa #4

Tobermorry Navy Sofa, \$800.00

Fabric: 100% Olefin

Frame: Fully setup kiln-dried hardwood frame, generously blocked, cross-braced, glued and stapled to withstand maximum usage demands

Seats: 4 adults

Foam: Seat — 20 cm thickness, Back — 2.5 cm thickness, Arm — 1.0 cm thickness

Warranty: Lifetime on frame and spring mechanism; 2 years on cushion core, 1 year on fabric, foam, and labour and workmanship

Sofa #5

Hawaii Green Sofa, \$999.00

Fabric: 41% Polyester, 32% Acrylic, 25% Polypropylene, 3% Nylon

Frame: Fully setup kiln-dried hardwood frame, generously blocked, cross-braced, glued and stapled to withstand maximum usage demands

Seats: 4 adults

Foam: Seat — 20 cm thickness, Back — 5 cm thickness, Arm — 2.0 cm thickness

Warranty: Lifetime on frame and spring mechanism; 2 years on cushion core, 1 year on fabric, foam, and labour and workmanship

Decision

Use your results from the table you completed to decide which sofa to recommend to your parents. If the results are very close, look back at your ranking of the importance of each criteria and use this information to help you decide.

I would recommend that my parents purchase this sofa:

because _____

Questions: Design Process

1. Were you surprised at your results? If yes, explain why.



2. Do you think this process would be helpful when making a large purchase? Why or why not?

Notes



Lesson 7

Constructing a Stable Structure

Learning Outcomes

After completing this lesson you will be able to

- design, test, and construct a model that will withstand the application of a particular magnitude and direction of force

**Assignment #3: Design Process**

Use the design process to complete the following assignment.

Note that this assignment will be graded by your tutor/marker. Do your best!

Imagine that you are the head of an engineering firm, and prospective customers have approached you with plans to design and construct three different structures. Each structure is in a different location, and each location has special factors that will affect the design of the structure.

Read through the following list of structures and choose **one** structure for which you will design and create a model. The Design Project Report and Sales Pitch must be submitted to the company board (your tutor/marker) for assessment. Use the Design Project Report sheets provided to record your work.

Structure 1: an apartment block in Vancouver where slight earthquakes have recently occurred. The developer and the future renters want the structure is safe to live in during such earthquakes. (**Hint:** Your design should be able to remain standing through the shaking of a table that it is placed upon.)

Structure 2: a ski chalet built on the side of a mountain. The area where it is to be situated has heavy snowfalls and its design needs to prevent large amounts of snow from collecting on the roof. (**Hint:** Test your structure with real snow or something that simulates snow.)

Structure 3: microwave towers for Churchill, an area that experiences some of the strongest winds in the province. (**Hint:** You will need to simulate windy conditions when you test this structure, using either a hair dryer or a small fan.)

The following steps will guide you through the process. Read through them carefully before you begin.

Step 1

Decide which of the three structures you will construct. On the Design Project Report form that has been provided, record the relevant Problem/Design Challenge and the criteria.

Step 2

Decide what materials you will use and provide an explanation as to why you chose the materials you did. These are numerous materials that you might select for construction, for example:

- popsicle sticks
- straws
- cardboard
- heavy paper
- plastic or styrofoam cups or plates

You must also decide how you will join your materials during construction, what shapes you want to use, and whether you will need to do something to make the materials stronger or reinforce the structure with struts, braces, etc. (**Note:** Do NOT use items that are already constructed, such as milk cartons or tissue boxes, or commercial construction materials such as LEGO®.)

Step 3

Finalize your thoughts on what type of design to use. Use the Prototype #1 space to draw a labelled diagram of your design. This will serve as your initial plan or your starting point for construction. It is very important that you record this “before” diagram of your plan so that you can compare it to your “after,” or final drawing (Prototype #2).



Step 4

Determine what tests you will need to conduct in order to decide if your model meets the criteria. Describe the tests in the space provided. Ensure that you are conducting a “fair test” (refer to Module 1, Lesson 2 for information about fair tests).

Step 5

Construct your prototype, using the materials you identified in Step 2 and the diagram you produced in Step 3.

Step 6

Test your prototype to ensure it meets all criteria. Accurately record your test results on the Design Project Report.

Step 7

Make any revisions that are needed, and then test the prototype again. Remember, it is expected that some modification(s) will be needed.

Step 8

Complete the Prototype #2 diagram, showing your final design. Explain how your prototype differs from your original plan and why those adjustments needed to be made. This explanation is very important. It is doubtful that your final design will be exactly the same as the original plan, and you can show your understanding of the task by talking about what modifications you needed to make to your prototype, and why.

Step 9

Complete the “Sales Pitch.” This should include the following components:

- Photographs of your final prototype, or a detailed hand-drawn illustration.
- A persuasive paragraph highlighting the strengths of your design (the sales pitch). Try to convince your client that you have come up with the best design. Use the following terms in your paragraph: *strengths, design, materials, joints, shape, strength, stability, force.*

Step 10

Complete the self-assessment portion of the “Design Project Report: Assessment” sheet. You will submit this, along with your Design Project Report, to your tutor/marker.

Once you have completed your design project, put the following items in an envelope for mailing:

- the completed Design Project Report
- the completed Design Project Report: Assessment

Mail to:

Tutor/Marker Grade 7 Science
Distance Learning and Information Technologies Unit
Manitoba Education, Training and Youth
555 Main Street — Main Plaza
Winkler, Manitoba
R6W 1C4

Don't forget to include the Assignment #3 cover sheet, found in the course introduction.

**Hand-in
Assignment:**
Pages 61-66 must
be handed in to
your tutor/
marker.



Design Project Report

Name: _____

Date: _____

Problem/Design Challenge:

Criteria:

Materials List:

Explanation for Choice of Materials:

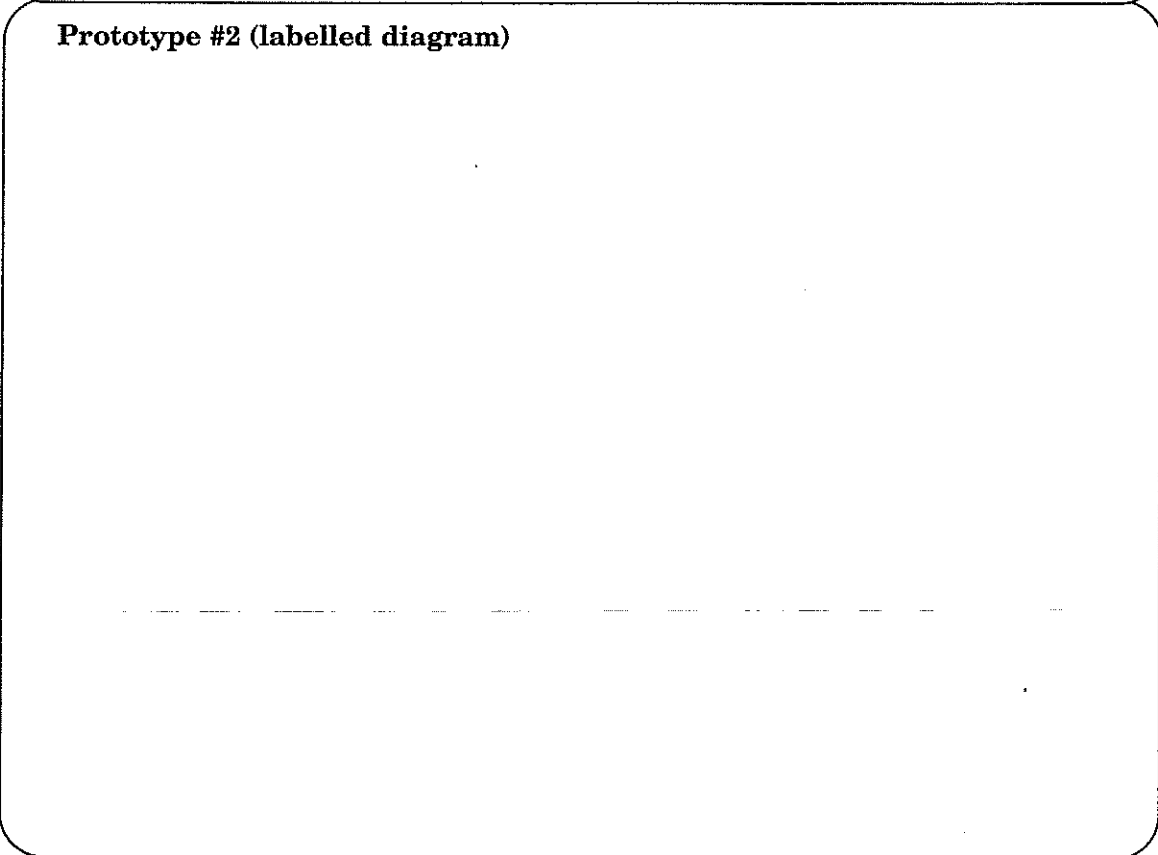
Prototype #1 (labelled diagram)

(continued)

Testing:

Criteria:	Test to be used
Test Results	

Prototype #2 (labelled diagram)



(continued)

Explanations of changes to original design (refer back to Prototype #1):

Sales Pitch

Provide the photos or hand-drawing on a separate page.

Persuasive Paragraph (make sure to use the required terms):

Design Project Report: Assessment			
Name _____			
Date _____			
Criteria	Possible Marks	Self- Assessment	Tutor/Marker Assessment
Step 1 Identifies Problem/Design Challenge and Relevant Criteria	2		
Step 2 Materials listed and explanation provided for choices	5		
Step 3 Prototype #1 diagram completed and includes labels	3		
Step 4 Tests/evaluations relating to all of the criteria clearly identified and clearly described	5		
Step 5 n/a	n/a	n/a	n/a
Step 6 Results of tests accurately recorded	3		
Step 7 n/a	n/a	n/a	n/a
Step 8 Prototype #2 diagram completed and includes labels. Explanation provided for how original plan changed.	3 6		
Step 9 Sales Pitch includes: <ul style="list-style-type: none"> • photographs or a hand-drawn illustration • persuasive “sales pitch” using required terms 	3 10		
Total Marks	40		
Comments (use the other side of this page, if necessary)			

Notes

