

ENGINEERING OR EXTINCTION: DESIGNING SURVIVAL SUPPLIES



LESSON OVERVIEW

Grade Levels: 6-8 & 9-12

In the book *The Testing* by Joelle Charbonneau, Cia is forced to adapt and build in order to survive. In this activity students will design different prototypes in order to solve different problems. Using the engineering design process, students will work in teams to discuss, design, build, and test their prototypes. Students will then vote as a team on the prototype that best solved the problem presented in order to see who would survive The Testing.

STANDARDS

NGSS MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
NGSS MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
NGSS MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
NGSS MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
CCSS ELA SL8.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
CCSS ELA SL9-10.4	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
CCSS ELA SL11-12.4	Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

OBJECTIVES

- Students will discuss techniques that may be effective in the creation of their prototype.
- Students will design a prototype using the engineering design process.
- Students will build and test their prototypes.
- Students will discuss and vote on a prototype that best solved the problem.

MATERIALS

- Engineering Design Process handout
- Paper for sketching
- Writing/ Drawing utensils
- Paper (construction paper, newspaper, etc.)
- An inventory kit containing any of the following: pipe cleaners, boxes, string, craft supplies, and other random objects (plastic cups, wire hangers, paper tubes, paper clips, rubber bands)
- Duct tape, masking tape
- Scissors

PROCEDURE

- STEP 1:** In *The Testing* by Joelle Charbonneau, the candidates had to use available materials to design solutions to survival problems.
- What kind of survival problems did the candidates encounter in *The Testing*?
 - What common materials were available to the candidates?
 - What inventions did the candidates build?
 - Did the candidates' inventions always work?
- STEP 2:** Review the Engineering Design Process and discuss with students each step and how it relates to *The Testing*.
- STEP 3:** Students will form groups and will create a prototype to solve one of the following survival problems:
- Shelter
 - Hunting/food supply
 - Defense
 - Transportation
- STEP 4:** Provide one inventory kit for each group of students. The kits should contain an assortment of items (cardboard, boxes, cord/string, wire hangers, plastic cups, etc.) and the kits should all be different.
- STEP 5:** Give the groups 5 minutes to review the contents of their inventory kit and discuss their prototype design. The students could make sketches of how the design will be built.
- What problem will they solve?
 - How will they use what is in their kit?
 - What would be useful to have if they could get it from another group?
 - What do they currently have that is not useful to them that they could trade away?
- STEP 6:** Give the groups 5 minutes to trade materials with other groups. Remind the students that other groups may not want to trade!
- STEP 7:** Groups will then have 15 minutes to build and test their prototypes.
- STEP 8:** Have a table where the groups can set up their prototypes along with a description card that explains the problem and how the prototype works.
- STEP 9:** The students will view the other groups' creations and discuss which prototype they believe was most effective at solving the stated problem. The groups then vote as a group for one prototype; groups may not vote for their own invention.

ENGINEERING DESIGN PROCESS



IDENTIFY THE PROBLEM

What is the problem, and why is it important?

RESEARCH AND BRAINSTORM

Research: What has been done to solve this problem? Who is affected by this problem? What current solutions are available?

Brainstorm: What sort of things can be used to solve this problem? How can current solutions be improved? What materials will you need? Create concept designs.

BUILD

Decide upon your best design, gather your materials, and build your prototype.

TEST

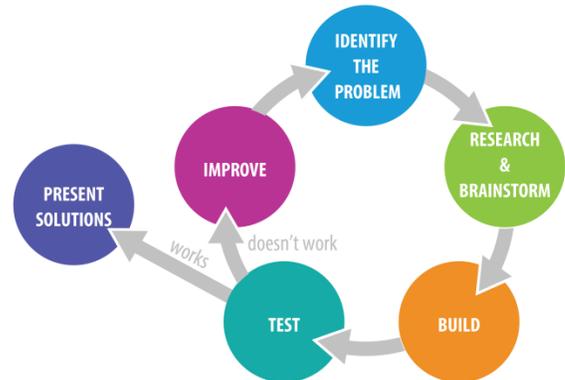
Test your prototype to determine its challenges, problems, and level of effectiveness.

IMPROVE

If the prototype does not work, repeat the process by identifying problems with the prototype design, conducting more research and brainstorming possible improvements, modifying or rebuilding the prototype, and performing additional testing until a solid solution is found.

PRESENT SOLUTIONS

Once an effective solution is discovered, present your work to others. Possible forms of presentation include a project board or multimedia presentation at a meeting or conference, documentation made accessible to those who can benefit from the work, and electronic communication of the solution via email, social media, blogs, websites, digital signs, videos, etc.



RUBRIC

	Target (3)	Meets (2)	Partially Meets (1)	Does Not Meet (0)
PROTOTYPE DESIGN	Does a great job showing an understanding of design for a purpose.	Does an okay job with showing an understanding of designing for a purpose.	Tries but has great difficulty showing an understanding of the design process.	Does not show an understanding of design process.
DESCRIPTION CARD	Description card is clear and uses evidence to support reasoning.	Description card is clear.	Description card is a little difficult to understand but include critical components.	Description card is difficult to understand and missing several components or is incomplete.
COLLABORATION	Works well with others and discusses ideas in a fair, respectful, encouraging way and is considerate of the feelings of others.	Works okay with others and discusses ideas in a fair, respectful way, but may not be encouraging. Considers the feelings of others.	Works with others, but does not contribute a fair share of work OR is discouraging and does not consider the feelings of everyone.	Does not work well with others and/or discusses ideas in an unfair, disrespectful way.
REQUIREMENTS	Meets all of the requirements for the project.	Meets most of the requirements for the project.	Meets some of the requirements for the project.	Does not meet the requirements for the project.
DEMONSTRATION OF KNOWLEDGE OF CONTENT IN DISCUSSIONS AND ACTIVITIES	Does a great job showing an understanding of the content covered in class.	Does an okay job with showing an understanding of the content covered in class.	Tries but has a difficult time showing an understanding of the content covered in class.	Does not show an understanding of the content covered in class.
Total				/15