

THE BUZZ ON THE FUZZ: YOU SOLVE THE PROBLEM

PBL FRAMEWORK

These project-based learning activities based on *Fuzzy Mud* by Louis Sachar are designed to connect the concepts in the book to real-world problems and ideas. Each prompt allows students to work collaboratively to explore one of the following topics: alternative fuels, alternative transportation, invasive species, or anti-bullying.

To address the problems presented in each prompt, students will work in small groups to research, brainstorm, design, and create solutions. Students can choose how they communicate their solution. End product suggestions can be found in the final products section below. Student groups can share solutions and final products on STEM Read (stemread.com).

STANDARDS

CCSS.ELA-LITERACY.W.7.7	Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
CCSS.ELA-LITERACY.W.7.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
CCSS.ELA-LITERACY.W.7.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
CCSS.ELA-LITERACY.W.7.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CCSS.ELA-LITERACY.W.7.6	Use technology, including the Internet, to produce and publish writing and link to and cite sources as well as to interact and collaborate with others, including linking to and citing sources.
NGSS HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
NGSS HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
NCSS C3 FRAMEWORK D4.6.8-12	Draw on multiple disciplinary lenses to analyze how a specific problem can manifest itself at local, regional, and global levels over time, identifying its characteristics and causes, and the challenges and opportunities faced by those trying to address the problem.

OBJECTIVES

By completing this project, students will be able to—

- Discuss key issues related to the driving questions.
- Explore possible solutions to the identified problem through research and brainstorming.
- Design a solution to their chosen problem based on research.
- Select the appropriate format to communicate their solution.
- Produce a final product to communicate their solution to a wide audience.

PROCEDURES

1. In groups, have students research the topic related to one of the prompts below.
 - Feedback Opportunity - Students can share their research notes with the teacher for feedback on research strategies.
2. Using what they learned through their research, students should then brainstorm how they would solve this problem or address the issue presented.
 - Feedback Opportunity – Students document the brainstorming process using paper/pencil or technology tools.
3. In their groups, students will select a solution to explore.
 - Feedback Opportunity – Students document their decision-making process and justify why they chose to explore the selected solution or design.
4. Students outline their solution and produce a final product that will communicate their findings.
 - Feedback Opportunity - Students share draft versions of their final product for review.
5. Have each student present their solution using the product of their choice. (See Final Products section for ideas).

ENGINEERING DESIGN PROCESS OVERVIEW

Even though these are not necessarily engineering design problems, it is still useful to understand problem-solving process used by engineers. Students can use a similar process as they work through the challenges.

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

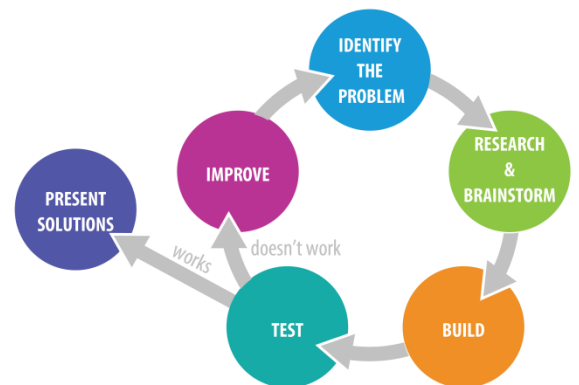
Test your prototype to determine its challenges, problems, and level of effectiveness.

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.



PROMPTS

- **Alternative Fuels**

In *Fuzzy Mud*, researchers studying alternative fuels created “Biolene,” a microorganism designed to serve as a new fuel source. Today, researchers are exploring a wide variety of alternative fuels. Much like “Biolene” many these alternative fuels have both positive and negative aspects of production and use. Researchers are constantly looking for ways to overcome these challenges as they explore new resources for powering our world. **Driving Questions:** What resources are abundant in your area? What are scientists doing to harness these resources? What could your town do to collect or incorporate alternative energies?

- **Alternative Transportation**

Part of the energy crisis is caused by the need for transportation. Alternative fuel is one way to solve the energy crisis, however, rethinking how we travel is another way. Researchers today are exploring alternative ways for us to get from one place to the other. From bike-sharing programs to new forms of public transportation, alternative transportation can help us shrink our carbon footprint.

Driving Questions: What transportation issues exist in your area? What type of program could you propose to help people get where they need to go in a way that would save fuel?

- **Invasive Species**

The fuzzy mud in the book was an invasive microorganism that did not belong in the woods. As it grew or was tracked into its non-native environment it began to do harm to the living things that called the woods home. In our world, there are many examples of plants, animals, or other organisms that somehow end up in an environment that is not their own. As they try to survive, they may cause damage to native organisms. Their presence can simply act as a nuisance or cause irreversible damage to the native eco-system. Look at responses to Milfoil and Asian Carp for examples. <http://www.invasive.org/illinois/SpeciesofConcern.html>

Driving Questions: What non-native species are in your area? How did they get there (natural spread vs. human spread)? What impact do they have on the environment? How can you stop the spread of these species?

- **Anti-Bullying**

Bullying is a major theme in *Fuzzy Mud* and a persistent issue in today’s schools. Many schools are looking to student led initiatives to help address bullying in the schools.

Driving Questions: Where have you witnessed or experienced bullying (survey?). Why do you think it happens? What resources do people who are being bullied need? What interventions might help bullies change their ways? Design an anti-bullying campaign and program that could be used in schools or online.

FINAL PRODUCTS

Students can choose the best means for communicating their solution to one of the problems above.

All final products should include the following—

- Statement of problem
- Summary of research that lead to their solution
- Description of solution

Optional content

- Discussions of design and brainstorming process
- Examples of solutions discussed by the group but not selected and reasons for not selecting those options

Examples of final products can include but are not limited to—

- Design Document – Students explain their proposed solution in a written report. Design Documents are used in industry as a way to outline a proposed solution before it is implemented. A Design Document may include the following.

- Executive Summary –An overview of the proposed solution (one page or less).
- Background and Research – A summary of the problem and the research conducted to learn more about possible solutions.
- Proposed Solution – An outline of the proposed solution. This may include visuals.
- Poster – Students present their research and proposed solution on a poster like those found in science fairs and research conferences. Posters can be constructed using art materials or created digitally. Infographics are another poster option.
- Multi-media presentation – Students use appropriate digital tools to create a stand-alone presentation such as a movie, animation, or narrated presentation.
- 3-D Model or Prototype - Students construct or virtually model their solution. This option could accompany any of the other options listed above.

RUBRIC

The following is a sample rubric that can be used to assess the outcomes of the PBL projects.

	Target (3)	Meets (2)	Partially Meets (1)	Does Not Meet (0)
Conceptual Design	Effectively demonstrates understanding of conceptual design for a specific purpose.	Demonstrates some understanding of conceptual design but some elements do not reinforce the purpose.	Attempts to demonstrate understanding of conceptual design but the design provides limited evidence of this knowledge.	Does not demonstrate understanding of conceptual design.
Use of Materials in Prototyping	Inventively and successfully chooses materials that produce visual interest and serves to support the project's purpose.	Appropriately chooses materials that serve to support the project's purpose.	Chooses materials but some work against the purpose of the project.	Does not choose appropriate materials.
Collaboration / Discussion	Works well with others and discusses ideas in a fair, respectful, and 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 have been encouraging. Considers the feelings of others.	Works with others, but did not contribute a fair share of work OR was discouraging and did not consider the feelings of everyone.	Did not work well with others and/or discusses ideas in an unfair, disrespectful way.
Prototype	The prototype is thoughtfully constructed to accomplish the assigned task.	The prototype is constructed to accomplish the assigned task but has minor flaws.	The prototype was constructed but has major flaws in accomplishing the assigned task.	The prototype was not constructed to accomplish the assigned task.
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 Curricular Content in Discussions and Activities	Demonstrates an advanced understanding of the curricular content covered in class related to this project.	Demonstrates an adequate understanding of the curricular content covered in class related to this project.	Demonstrates limited understanding of the curricular content covered in class related to this project.	Does not demonstrate an understanding of the curricular content covered in class related to this project.
Total				/18