

Phase I – Research and Planning – Aaron Minard

1. Identify the “Big” concept to be covered by the engineering design challenge.

How can the engineering design process benefit us in solving problems in our daily lives?

2. Research appropriate learning standards associated with the topic.

CCSS	Mathematical Practice Standards
Math.Practice.MP1	Make sense of problems and persevere in solving them.
Math.Practice.MP2	Reason abstractly and quantitatively.
Math.Practice.MP4	Model with mathematics.
Math.Practice.MP5	Use appropriate tools strategically.
Math.Practice.MP6	Attend to precision.
Math.Practice.MP7	Look for and make use of structure.
Math.Practice.MP8	Look for and express regularity in repeated reasoning.

NGSS	Engineering Design & Technology Standards
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.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
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.
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.

3. Identify and discuss the different types of problem solving and declarative/procedural knowledge needed.

Declarative Knowledge:	Procedural Knowledge:
What is Engineering? What is a design process?	How to use the engineering design process to create a solution to an everyday problem.
Time Management	How to create and use a Gantt Chart as a time management tool.
Record Keeping	How to create and use an Engineering Notebook.
Identify a problem.	How to eliciting problem-solving ideas that need a solution. How to construct a problem statement.
What are constraints and criteria?	How to determine criteria and constraints based on a problem.
What is research?	How to conduct research.
Brainstorming	How to sketch.
Plan, Materials, Procedures	How to measure using a ruler and how to make a blueprint. How to create a list of procedures.
Model, Prototype	How to use fasteners (glue, screws, nails, etc.) How to use cutting tools (drills, saws, etc.) How to use hand tools (hammers, clamps, etc.) How to work safely in a shop.
Test, Variable, Data, Analyze.	How to test a prototype. How to collect data. How to analyze data.
Redesign, Improve	How to redesign or improve upon a solution based on collected data and analysis.
Communicate Results	How to present your solution. How to conduct an interview.

4. Explore objectives and ancillary concepts/content covered by the project.

- Students will define criteria and constraints of a real-world design problem.
- Students will gather relevant information from print and/or digital sources to serve as research based on self-generated questions to promote further exploration.
- Students will develop a solution model to generate data for iterative testing and modification of a chosen design problem.
- Students will improve upon their design by testing and analyzing their design solutions to better meet their established criteria.
- Students will construct appropriately a scaled 2D and/or 3D technical drawing to support their design problem solution with the help of computer-aided drafting software.
- Students will introduce a topic (design solution) clearly, previewing what's to follow, organize ideas, concepts, and information including formatting (e.g., headings), and graphics (e.g., charts, tables) on a display board to present at an Engineering Fair.

5. Identify possible activities.

1. On the moon activities:
 - a. Launch It
 - b. Touchdown.
 - c. Roving the Moon.
 - d. Heavy Lifting.
 - e. On Target
2. Design Squad Activities:
 - a. Air Cannon
 - b. Build a Better Lunchbox
 - c. Hovercraft
 - d. Paper Table
 - e. Rubber Band Car
 - f. Watercraft
 - g. Zip line
3. Students will design and create a solution to an everyday problem of their own choosing.

6. Select the best activity for your classroom.

My Pre-Engineering II students are always asking me if they can choose their own problem to solve rather than me choosing it for them. I have created an Engineering Design Challenge activity that allows them choice in the problem that they solve and provided them an opportunity to share their solution at an Engineering Fair. I've decided that I too will come up with a problem-solving solution to a real-world problem with the use of the engineering design process.