

1.5 Teams and Engineering Design Process Part 1 – Understand: Problem and Design Statements

Summary

Students learn why teaming is so important to successful engineering. They practice writing good Problem and Design Statements and decide on a problem to which they will apply the Engineering Design Process.

Learning Objectives

After this class, students will be able to:

- Demonstrate rules for effective teaming and restate their importance.
- Write good problem and design statements that will not bias the design.

Materials

- Ring, ball, string, and pedestals for Focus Ring activity

Time

80 minutes

Procedure/Pacing

Engineering Teams

1. Review the rules for effective teaming:
 - a. Assign clear roles and work assignments.
 - b. Accept and commit to personal responsibility.
 - c. Good communication within team.
 - d. Share leadership responsibilities.
 - e. Make team decisions by consensus.
2. Divide class into groups of 4 – 8. Have groups complete the Focus Ring task (link in the Resources section).
3. After the activity, ask students to identify how each of the rules became important for them to work effectively as a team while performing the task.

Problem and Design Statements

1. Practice writing a good Problem and Design Statement as a class, using the scenarios below, or one of your own, as inspiration. Reminder: The

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Problem Statement should clearly and concisely state the problem without including anything that might bias the solution. The Design Statement should focus the direction that the design should take, but should also not bias the design. For example, take the following situation:

SCENARIO: I love to make cookies for my neighbor. Her favorite kind of cookies is thick, chewy chocolate chip cookies. I have tried several recipes with varying ratios of brown sugar, butter, flour, and eggs, but my cookies always turn out flat and crispy.

GOOD PROBLEM STATEMENT: “I cannot make thick and chewy chocolate chip cookies.” **POOR PROBLEM STATEMENT:** “I don’t have a good recipe for making thick and chewy chocolate chip cookies.” This statement assumes that the recipe is the problem, which may or may not be the case.

GOOD DESIGN STATEMENT: “I need to design a new method for making cookies so that they are thick and chewy.” **POOR DESIGN STATEMENT:** “I need to design a new oven in which to bake, so that my cookies are thick and chewy.” This design statement also biases the direction of the design towards a focus on the oven, which may not be the preferred direction. However, if one were working for an appliance manufacturer, and the aim is to develop a novel oven, this design statement may be appropriate.

POSSIBLE SCENARIOS FOR DESIGN AND PROBLEM STATEMENT WRITING

- a. Once upon a time there was a girl named Dorothy who was caught up in a tornado and magically transported to the world of Oz. Upon her arrival, her house, in which she traveled, lands on the Wicked Witch of the East, killing her. This occurrence causes the Munchkins, who had been ruled by the witch, to be grateful to her, but engenders the wrath of the witch’s sister, the Wicked Witch of the West, who vows to “get her”. Glinda, the Good Witch of the North, gives the ruby slippers belonging to the dead witch to Dorothy and tells her to find the Wizard of Oz if she wants to go home.
- b. I have Band for first period in the band room on the first floor. For second period, I have Math held on the third floor, on the other end of the school. After putting away my trumpet, and going to my locker to get my math books, I am always late for math class.

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- c. Joe works as a plumber. As a part of his job, he frequently gets small cuts on his hands. In order to avoid infection and promote healing, he applies an adhesive bandage when he gets one of these cuts. However, with the frequent exposure to water his hands get, these bandages rarely stay affixed where he places them.
 - d. Your favorite lunch is hot chicken noodle soup with a cold salad and milk. You pack your favorite lunch in the morning in your trusty lunch box. However, by lunchtime, your soup has become lukewarm, your salad is wilted, and your milk is warm.
 - e. I would like to study the concentration of particulates (small bits of solid or liquid matter) in the atmosphere as a function of altitude. Current solutions either rise too quickly for good sampling or mix the air too much to get an accurate sample at a specific altitude.
2. Have students work in pairs to write a Problem and Design Statement for one of the above scenarios, or another of your choosing. Compare statements and discuss them as a class.

Design-Your-Life Problem Selection

1. As a class, select a problem the students would like to solve. This problem could be drawn from their lives, their experience at school, or something they see as a problem for their community. This problem will serve as a framework for students to learn and gain experience with the Engineering Design Process and may be only taken through the simple prototype phase. If the problem chosen allows, students may continue further in the Engineering Design Process as time and class resources permit.
2. Divide the class into teams of 2-3 students.
3. As a class, write a Problem Statement for the selected problem. In teams, have students write a Design Statement. (Assignment 1.5i)

In-Class Assignment

Assignment 1.5i: Problem and Design Statements

Resources

Focus Ring Activity

http://www.teachmeteamwork.com/teachmeteamwork/2006/12/teambuilding_ga_2.html

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How to build a Focus Ring

<http://www.teachmeteamwork.com/teachmeteamwork/files/FocusRingHTML.pdf>

Homework

Assignment 1.6h: Research

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