NHERI

Natural Hazards Engineering Research Infrastructure

NHERI Wall of Wind Experimental Facility
Florida International University

Summary: This lesson plan will teach students about the Engineering Design Process in a fun interactive way. Students will learn about how different fields of engineering interact with each other to innovate for a better tomorrow. By the end of this lesson, students will learn how engineers create and innovate products.

Engineering Connection: This lesson connects to engineering by teaching students about the design process. This process is used in almost every field of engineering. During instruction, we will mainly be focusing on structural engineering and natural hazards engineering.

Audience: This lesson plan is geared toward high school students, mainly first and second-year students. This lesson can also apply to other high school or middle school students (mostly 7th and 8th grade) interested in learning more about engineering.

Lesson Objectives: Students will learn about the engineering design process, structural engineering, and natural hazards engineering, particularly hurricane engineering.

Educational Standards: We will be following the standards of the Archidosie of Miami; this lecture is modeled after the standards of Cardinal Gibbons High School in Fort Lauderdale, Florida.

Materials List: For this lesson, you will need popsicle sticks (around 2500 per class should suffice), a clear tub/basin, water, a spray bottle, sand, a hydraulic pump, a fan, and wood glue.

Introduction/Motives: The motivation behind this lesson plan is to teach high school students interested in engineering about the engineering design process. This way, they have insight into the engineering field and how engineering design processes work.

Procedure:

- Background: The engineering design process is a procedure that engineers typically use to design and innovate products that we use every day. This series of steps may be used to design and reconstruct any and every product. These steps are as follows: ask, research, imagine, plan, create, experiment, and improve (as necessary). The first step, ask, is where engineers identify certain problems and issues that they wish to solve. After the problem is identified, engineers then go on to research the problem. During this research

phase, engineers are typically looking for work that has already been done pertaining to the question they are trying to answer. After they finish the research phase, engineers will move on to brainstorm solutions to the problem they are trying to answer. The fourth step in this procedure is where engineers plan how they want to approach the problem they wish to solve. Next, the engineers create a model and then test the model. Finally, if the product/prototype needs some adjustments, they will be made in this step.

Stiltsville is a community of houses in Miami, Florida. These houses are located in water and are resting on wooden stilts. These houses are important culturally and for tourism, but are extremely vulnerable to hurricanes, and this issue needs to be solved.

- Before the activity: Students will learn about the engineering design process and some background information about Stiltsville. Instructors will build a base model of a house for each group of students; the houses will be very basic so as not to take away from the student's own design. We will make each base model as identical as possible so as not to give students unfair advantages.

- During the activity: Students will make stilts using the popsicle sticks for their given model house. This allows students to think freely and walk through the engineering design process. Students will plan, design, model, and test their model home with stilts. They will then fill their tub with sand and water and ground their stilts in the sand with the model resting securely on top to begin testing. The models, particularly the stilt design, will be tested for their ability to withstand a hurricane, which will be simulated through the use of a hydraulic pump.

- After the activity: Students will evaluate the results of their testing. Instructors should create an open discussion for students to discuss their keep takeaways and what they learned from this activity.

Assessments: Instructors should create an open discussion for the students to express what they learned. If students are having trouble understanding certain steps, instructors kindly ask where they are confused and have other students answer. This discussion section is mainly for students to learn from each other, as engineers would in the real world.

Wrap-up: Thank the students for participating in the activity. Follow this with a mini-lecture; in this mini-lecture, reinforce to the students that what they did in the classroom today is typically what goes on in the engineering field.