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Bungee Action Figure Activity used to Gently Introduce Students to Excel and the MATLAB IDE (Resource Exchange)

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Dr. Lynn Albers is an Assistant Professor in Mechanical Engineering of the Fred DeMatteis School of Engineering and Applied Science at Hofstra University. Her previous academic contribution was as one of the founding five faculty/staff at Campbell University, helping the newly formed School of Engineering grow and establish roots in the community. A proponent of Hands-On Activities in the classroom and during out-of-school time programs, she believes that they complement any teaching style thereby reaching all learning styles. She earned her doctorate in Mechanical Engineering from North Carolina State University specializing in thermal sciences where her dissertation research spanned three colleges and focused on Engineering Education. Her passions include but are not limited to Engineering Education, Energy Engineering and Conservation, and K-20 STEM Outreach. Prior to matriculating at NCSU, she worked at the North Carolina Solar Center developing a passion for wind and solar energy research while learning renewable energy policy. She combined these passions with K-20 STEM Outreach while a National Science Foundation Fellow with the GK-12 Outreach Program at NCSU where she began Energy Clubs, an out-of-school-time program for third, fourth and fifth graders to introduce them to renewable energy.

Bungee Action Figure Activity used to Gently Introduce Students to Microsoft Excel and the MATLAB IDE (Resource Exchange)

Introduction

The Bungee Barbie and Kamikaze Ken activity was developed in 1995 [2] and designed to teach linear mathematical modeling while helping students build collaboration and cooperation skills. The activity was not created by the author, however, she has changed the title to be more inclusive and created a series of three lessons to gently introduce students to Microsoft Excel, the MATLAB IDE (Integrated Development Environment), and teach the importance of linear mathematical modeling using the data collected from the activity. The activity and corresponding lessons are used in local high schools (eleventh or twelfth grades) and a first-year programming course for engineers at Hofstra University. Therefore, the lessons are also designed to fill gaps in math backgrounds. Altogether, the activity and three lessons take approximately four hours and can stretch over three, ninety-minute lectures at the university. This translates into approximately 6-10 high school classes over a two- to three-week period.

Background

This activity and corresponding lessons are part of the redesign of a first year programming for engineers course at Hofstra University. The pedagogy has been redesigned using an activity centric model [1]. This course is also offered in four local high schools as part of the K-12 outreach program, Pathways to Engineering, sponsored by the School of Engineering. Teachers received professional development and use the curriculum to teach classes of 15-28 students. The students have the option to take the course for three credits and receive an official transcript from the university.

Materials

The materials needed can be found on the original activity developed at Indiana University, Bloomington and funded in part by the National Science Foundation and Indiana University 1995. For convenience, they are referenced here: one bag of rubber bands, qty 1000, will ensure that all rubber bands were manufactured in the same batch and therefore be more likely to be the same size, thickness, and perform equally. The action figures should all be of equivalent size however, do not have to be Barbie, Stacie, Ken, Stephen figures per se. Marvel, anime, or BTS figures may be very timely

but potentially expensive. In any case, choose 8-10 figures of equivalent weight and size and refer to them as "action figures." Soft tape measures, such as those used for sewing, are easily attached to the wall and needed to measure the distance the action figure falls. It is recommended to hang the tape measure, metric side out with 0 at the top and the bottom edge touching the floor.

Resources

The order of the lessons is important. PowerPoint slides for Lectures 1-3 were converted into PDF so as to easily share via QR code (See Figure 1.) and are provided as guidance for each lecture; reviewing linear mathematical modeling and gently introducing students to Excel and the MATLAB IDE. The objective is to help students overcome the fear factor associated with using both applications. The original worksheet has been modified and can be accessed as a PDF via QR code (See Figure 2.)

Figure 1: QR code to PDF of PowerPoint slides for Lectures 1-3

Figure 2: QR code to PDF of Bungee Action Figure Worksheet

References

[1] Lynn A. Albers and Richard J. Puerzer. "Board 108: Development of an Activity Centric Engineering Course to Teach Excel, MATLAB, and Engineering Math for High School Students (Work In Progress)". In: *2019 ASEE Annual Conference & Exposition*. 10.18260/1-2–32180. https://peer.asee.org/32180. Tampa, Florida: ASEE Conferences, June 2019.

[2] Indiana University - Bloomington. *Bunge Barbie and Kamikaze Ken*. 1995. URL: `http://www.indiana.edu/~hmathmod/doc/bungeeb5.doc`. (accessed: 2016).