

Developing data literacy and problem solving in first year engineering students

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Computation is fundamental. It is the basis for understanding and apply knowledge to real world problem. By emphasizing computation in a first year engineering course at the University of Houston, students are expose to how the mathematical fundamentals they have learned or are learning connect to solving engineering problems. MATLAB is used a medium for bridging the gap between mathematical fundamentals and application for students. It is vital that students early in their undergraduate education realize that the knowledge being obtained are tools that can be used in various environments. Knowledge does not live in a bubble of individual classes or contexts but should be used and adapted moving forward. MATLAB is one of those tool. Through exposure to basic computational skills through MATLAB, first year engineering student develop problem solving skills that are necessary for success in later classes and as a professional engineer. MATLAB is a tool used to problem solve and apply familiar computational concepts to unfamiliar contexts. In addition, computational skills help students begin thinking about process, not just the correct answer. It is in this first year of engineering that students are not given how to get from given values to the final result. Instead, by using computational skills with MATLAB, students begin to focus on the process and developing the logic and algorithm to get from the givens to the final result. The challenge is not longer getting the correct answer but how to develop a process to get the correct answer no matter the scenario. It is through that realize that students realize the power of computation and the power of programming tools like MATLAB.

When I took over as coordinator for the freshman Computing and Problem Solving course, my goal was to emphasize basic computational concepts, how they apply to real world engineering problems, and use MATLAB as a tool to execute this knowledge. However, with freshman students in particular, I believe developing comfort with computation starts with an understanding of data. In particular, understanding the different kinds of data, where data can be found, and identifying quality data. While many of our students come into college with a working knowledge of literature references and writing papers, few have experienced the challenge of find useful data that can be use to better understand a larger topic. This was the motivation for developing a semester-long project. Centered around the National Academy Grand Challenges, students begin a journey that takes them through the process of identifying a challenge facing engineers today then search through public domains to find datasets that will allow for them to investigate and inform the public. All while using MATLAB as a medium to execute the computation and produce the results. Through various checkpoint during the semester, students develop goals for their computation, an algorithm, and a final code. Given the space to discover and apply the basic MATLAB skills they learn throughout the class, students have built confidence in their ability to tackle larger issues and use their foundational knowledge. In addition, as a final task, students are required to present their work in the form of a poster and video tutorial where they can develop communication skills and learn to receive critical feedback on their work. It is through the entire process that students become comfortable with computation through MATLAB without even realizing how far they have come.