

## **GIFTS: Engaging First-Year Mechanical Engineering Students in Spreadsheets and Programming**

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## Introduction

In a course focused on introducing first-year mechanical engineering students to spreadsheets and programming, there are many challenges to engaging students in the material. By nature, introductory programming courses are considered difficult by students [1] and student learning can depend on the strategies employed to support the learning process [2]. This paper focuses on the MEE 114L Introduction to Programming course at the University of Dayton and changes to the course structure designed to improve student engagement and learning.

## Changes to Course Structure

The Introduction to Programming course is a 1 credit hour course for mechanical engineers focused on building foundational skills in use of spreadsheets, plotting, data manipulation, and basic programming through two software tools: Microsoft Excel and MATLAB. The course is taught in a flipped classroom format with students learning new concepts outside of the classroom through an interactive online textbook [3] and class sessions devoted to time for students to work on problems in the online textbook and software-based projects with applications to mechanical engineering with assistance from peers and instructors.

In the initial implementation of this course, students spent most weeks in the semester working solely in the online textbook and completed software-based projects during 4 dedicated project weeks distributed throughout the semester. Both the instructors and students observed challenges with this structure that were related to limiting direct exposure to the software tools to 4 weeks during the semester. Students were not able to make connections between the textbook problems and the software and therefore, student engagement and understanding of the software was low.

In the Spring 2022 semester, changes were made to address these challenges by reorganizing the course structure to engage the students with the software tools each week of the semester through weekly software-based project activities and implementing weekly quizzes to assess learning. Through these changes, students were able to engage in the software weekly and improvements in student engagement with the software were observed by the instructors. Assessment of student performance on the quizzes was strong with an average of  $90.8 \pm 11.1$ . Future course offerings will continue to implement changes aimed at improved student engagement and learning.

## References

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