

# Automated Feedback for Engineering: Assistance in Achieving Learning Goals



## The Need to Automate



Professor Firmani identified that he needed assistance in researching the best technical solution to automate feedback to students. Often students make similar mistakes and offering individualized and detailed feedback was impossible due to the volume of students. By automating feedback, professors could provide a more detailed response to students on common errors than currently possible. Therefore, this research aimed to bridge the gap between demands on professors and the needs of learners. By researching common mistakes, we can provide the support students need without delay.

### With automation we can:

- Increase student performance in activities [1]
- Support instructors in correcting exercises [1]
- Provide unique solutions for every student [2]
- Assess students work and generate a custom auto-response quickly [2]

## Finding Common Errors

We researched errors in three ways. First, we communicated with professors and students to determine types of common mistakes. In addition, we conducted research to better understand the capability of software to deliver desired outcomes. Lastly, we tested software with students and received feedback that it worked well for common mistakes that may be hard to spot.

## What We Learned

Some universities have increased enrollment in some areas resulting in a greater number of students in each class. This led to researching easier ways to offer students feedback as a part of the assessment process [2]. We aimed to find a solution that provides standardized feedback to minimize the need for manually graded assignments and provide the same standard as individualized feedback.

## Developing Feedback

After compiling common errors and what was possible in terms of coding, we developed different types of feedback that can be used for specific types of problems. While some work must be done with each new problem, the base code provides an easy template for problem generation.

### Our feedback can:

- Notify students of the nature of a mistake for one or multiple specific inputs
- Give unique messages when multiple scenarios coincide
- Provide sheer force graphs for each student based on their individual numbers
- Offer written solutions

## Outcomes included:

- Creating code that generates graphs for each student as seen in Figure 1.
- Coding to identify common mistakes and provide automated feedback about the error based on student input
- Ensuring that the code is reusable for new problem generation
- Created the opportunity for professors to dedicate their time to other instructional tasks and for students to have a better learning experience.

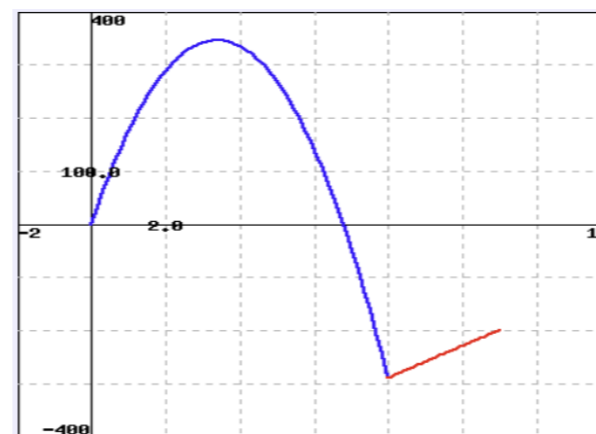


Figure 1

## References

- [1] A. P. Cavalcanti, A. Barbosa, R. Carvalho, F. Freitas, Y.-S. Tsai, D. Gašević, and R. F. Mello, "Automatic feedback in online learning environments: A systematic literature review," *Computers and Education: Artificial Intelligence*, vol. 2, 2021.
- [2] F. Firmani, private communication, July 2022.
- [3] University of Victoria, *UVic.ca*. [Online].