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Farzad Taghaddosi

University of Kentucky, farzad.taghaddosi@uky.edu

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Incorporating Collaborative Technology in Engineering

Farzad Taghaddosi

*Department of Mechanical Engineering
College of Engineering
University of Kentucky*

I should start by saying that participation in the Teaching Innovation Institute provided me a great opportunity to learn about new approaches in teaching and learning, especially for online and hybrid modalities. As a result of participation in this training, I gained valuable experience using various technology tools, learned from the experiences of a very diverse community of participants, and perhaps more importantly, became more receptive to the use of technology as both a teaching and a learning tool and more open to exploring different possibilities for my courses.

Goals and Strategies

My plans for implementing new teaching strategies in the fall 2020 semester were based on the use of Microsoft OneNote platform for collaboration and communication. All students have access to this app, which is part of the productivity suite offered by the university. The software is an ideal platform for note-taking and drawing (among other features) in a shared environment. While the

software could be used by individual students as a standalone app, I implemented my plan by creating a OneNote Class Notebook that could be accessed both from within Canvas and through OneNote app on the user's computer. The use of Class Notebook was an essential part of the learning process in my course in that it facilitated the effective distribution of content among students. It also allowed them to share their notes with each other in real time or asynchronously.

My target course for implementation was an engineering class (EM 221-Statics) that almost all engineering majors take in their sophomore year. The course is a fundamental course and is typically considered the first "real" engineering course that students take in the program. I chose this course for implementation because a solid understanding of the course content is essential for success in future course work. My plan was focused on the use of technology within a collaborative learning environment which is known to have a significant positive impact on student learning and understanding. Within that context, my initial plan consisted of using OneNote for the following purposes:

- *Drawing concept maps:* A concept map provides an overview of the material recently learned and shows how it relates to previously learned material or course objective(s). It is called a map because it helps students figure out where they are in the course and creates a connection between previous knowledge and new learning. Establishing such links and connections are strongly correlated with student overall learning and retention. Asking students to draw a concept map at the end of a major teaching session takes a minimal amount of time (2-3 minutes) but is a great help for student learning.
- *Planning solution strategy:* An essential part of an engineer's job is problem-solving. This process involves multiple steps, such as understanding the problem, knowing what you have and what you are trying to find, and a step-by-step process for solving the problem—which I call solution strategy. The solution strategy does not involve any calculations. It is basically an exercise in writing clearly and concisely the steps to be followed to solve the problem.
- *Drawing free-body diagrams (FBDs):* The first step in the mechanical design of a system involves determining the loads applied to it, which is done by drawing a free-body diagram. Therefore, drawing a correct FBD is an essential first step in the solution process. Ideally, students would need a laptop/tablet with a stylus to do this exercise. However, those without those technological tools can still participate since the diagrams are rather simple and they could use a mouse as a drawing tool, as well.

Implementation

While the Smart Campus Initiative at UK equipped all incoming students with iPads and Apple Pencils, in fall 2021 a survey of my class at the start of the semester showed that only about 50% of them had access to such equipment (whether personally owned or supplied by the university). As a result, I had to change the implementation plan since lack of proper equipment would create a major

disadvantage for almost half of the class. The COVID-19 pandemic also impacted my plans for implementation. The classes were held online and recorded. While about 60-70% of the class participated in online lectures live, the rest watched the recorded lectures. This meant the collaborative learning approach I had planned could not be realized given the circumstances and I had to revise the original plan.

In the updated plan, I still used OneNote Class Notebook as the technology platform. However, it was used to distribute a set of fundamental problems (two problems per set) for various concepts I taught during the semester. Students with an iPad or a tablet were encouraged to complete their work by writing directly on their OneNote app, while others did their work on paper and submitted it as a PDF file. Although due to COVID-19-related constraints and exemptions, the full benefits of the original plan could not be realized, it was still a good exercise on the use of Class Notebook for teaching and learning. Students greatly benefitted from their interactions with the instructor and classmates. They could easily share their work with others while having access to it from everywhere including on their mobile device. This ability to share work and collaborate was particularly helpful in an online course when interaction with others can be difficult to foster.

Future Plans

Although the objectives of the original plan were not fully realized due to unexpected events resulting from the pandemic, the lessons learned through the implementation phase were still very valuable. Building on that experience, I plan on using Class Notebook in spring 2021 as a collaborative learning tool for an assignment that students would otherwise submit individually on Canvas. Pre-COVID-19, I used to break up the class into small groups of three students that would sit in class together and would discuss, collaborate, and help each other during the lecture. I stopped using this approach in the past two semesters because the logistics of doing this online was just not straightforward, to say the least.

Given the strong need for students to not just socialize but also not feel isolated in these special circumstances, I plan to introduce the groups again in all three of my classes. The idea is to require group participation and submission of an assignment which I call an “Engagement Activity.” These assignments involve questions that are meant to help students connect more deeply with the course content, help them learn about real-world applications, and discover new trends and processes, etc. Students will be required to work on these assignments as a group. In my experience, the following are some of the major benefits of using OneNote for instruction:

- The assignment can be easily distributed to the entire class through Microsoft OneNote Class Notebook;
- Group members can simultaneously access/edit the content, collaborate, brainstorm, etc.;

- OneNote identifies the author of each contribution, making it clear to the instructor how each student participated (something that is often difficult to measure with collaborative assignments). This accountability can also encourage group members to contribute equally;
- Students can contribute using any device;
- There is nothing to be submitted since everything is online in a shared environment;
- The organization of the Class Notebook allows for ease of grading and feedback, reducing instructor workload substantially; and
- Students are able to see the feedback from the instructor on their device right away.

This new implementation plan is, of course, only one example of what is possible in terms of creative use of technology. As I gain more experience and explore other technologies, more inspiration follows. Lastly, I would like to recognize the role CELT played in supporting me as I developed these new activities and tools to use in my course. The diverse community of scholars and teachers they facilitated helped to foster creativity and a willingness to try new pedagogical approaches.

Media

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