

Flipping Across the First Year Workshop

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Erin is a Research Assistant Professor and Lecturer in the Engineering Fundamentals Program at the University of Tennessee. She completed a postdoctoral/ lecturer position split between the General Engineering program and the Engineering & Science Education Department and a Ph.D. in Bioengineering from Clemson University. Erin's research interests include preparing students for their sophomore year, minority student engineering identity development, and providing mentoring relationships to help foster student growth and success.

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Workshop for the FYEE 2023 Conference

Abstract

The use of a flipped classroom pedagogy has gained significant momentum in engineering education over the past decade. More instructors are taking on the challenge of transitioning their courses to a flipped classroom pedagogy to allow for more active learning and support during class time. While there are many benefits to the use of flipped classrooms in engineering courses, there are many challenges associated to the implementation and sustainability of this approach. Additionally, first year educators may be hesitant to transition their courses to a flipped classroom model due to fears that students may not be ready for such a dramatic shift in classroom approach.

The Engineering Fundamentals Program in the Tickle College of Engineering at the University of Tennessee Knoxville is a common, student success-based first year program that teaches engineering physics, introduction to computer programming, design, teamwork and communication to over 1000 students per semester. In Spring 2018, our unit began an initiative to flip all courses associated with our program. In previous years, one course had attempted flipping a portion of the content in the course to provide more time for active learning. While performance data showed an improvement due to the flip [site paper], student feedback was negative towards a mid-semester shift in learning approach due to increased demands for adapting to the new style. In Spring 2018, the EF team decided to commit to flipping the program in an effort to provide a more positive experience for students in the transition to a new classroom environment.

Workshop Overview

In this workshop, members of our team will conduct an active workshop on how instructors can approach the process of flipping an entire course. We will also share lessons learned as we worked through flipping a sequence of courses. Attendees are encouraged to bring course documents and ideas to the workshop, as working time will be encouraged and feedback will be provided by facilitators. The workshop will consist of the following parts:

Part 1: Motivation for Flipped Classrooms (5 Minutes)

The first part of the workshop will consist of a brief overview of literature regarding the benefits of flipped classrooms. We will also share our own motivations related to moving to this approach in our program.

Part 2: Designing Flipped Classroom Modules (20-25 Minutes)

In the second part of the workshop, we will share an overall structure we have used when designing flipped classroom modules in our courses. The overall structure consists of:

- Learning Objectives
- Learning Content: Readings and Videos
- Interactive elements

- Knowledge Test Questions
- Assessments of Review Needs

The structure has proved useful in providing consistency across courses while also allowing flexibility to our teaching teams across the different courses that we teach. We will provide examples of how this structure is used for each of our courses. We will end part 2 with working time and discussion from workshop participants on how they can apply this structure to their own course.

Part 3: Creating Flipped Classroom Modules (20-25 Minutes)

In the third part of the workshop, our team will discuss how to move from design to creation of a learning module in their course. We will review and discuss resources such as:

- Video recording tools
- Online textbook resources
- Adaption of existing content

We will provide examples of our use in each of these areas. We will end this part with working time and a discussion of how these ideas fit in with the attendee's context.

Part 4: Designing in Class Sessions and Activities (20-25 Minutes)

Now that learning content has been developed and moved to outside of class learning modules, the next part of our workshop will focus on the deliberate design of in-class learning activities. Our team will begin by sharing pitfalls we experienced in our initial efforts with flipped classrooms. We will then discuss the different ways we approach in class sessions in different courses, including:

- Quick Review
- Addressing muddiest point(s)
- In Class Activities
 - TPS/conceptual MC
 - Problem solving
 - Mini-labs
- Leading to the full assignment

We will finish this section with working time and discussion on the development of a learning activity for attendees.

Part 5: Expectations and Lessons Learned (10 Minutes)

In the final part of our workshop, our team will discuss expectations instructors should have when starting this process as well as lessons we have learned over several years of transition and steady implementation of flipped classrooms. These discussions will include:

- Time to implement/long term planning for flipped classroom transition
- Resources needed
- Managing student adoption/resistance

Facilitation Team

The facilitation team include:

Dr. Richard Bennett is an Instructor in the Engineering Fundamentals program and a Professor of Civil and Environmental Engineering. He was Director of the Engineering Fundamentals Program for 13 years and oversaw the initial development of the flipped classrooms in EF courses.

Dr. Rachel Ellestad is the Director of the Engineering Fundamentals Program. Rachel was on the original team that piloted the use of flipped classrooms in EF courses. She helped develop learning modules and activities in the first and second semester physics courses (EF 151 and EF 152).

Dr. Kevin Kit is Director of the Cook Grand Challenge Honors Program and Associate Professor of Materials Science and Engineering. He has been co-teaching the honors versions of the EF physics courses (EF 157/158) for 10 years and worked to fully flip these courses in the 2021-2022 academic year.

Dr. Erin McCave is a Lecturer and Research Assistant Professor in the Engineering Fundamentals Program. Erin currently coordinates the EF141/142 course sequence for non-calculus ready students. This course sequence implements the flipped classroom model established in the program to focus on problem solving methodology and processes to help better structure learning time and incorporate more support for students that need the extra help.

Dr. Andrey Puretskiy is a Lecturer in the Engineering Fundamentals Program. Andrey currently coordinates EF 105, a course that focuses on the use of computing and programming skills for solving Engineering problems. He received his Ph.D. in Computer Science from the University of Tennessee.