5 Steps to Flipping Your Engineering Classroom

A step-by-step guide to get started
Flipped Classroom models are all the rage in academia, but what exactly does it mean to “flip” your classroom? In this eBook, we’ll explore what a flipped classroom is, why it works, and a step-by-step guide to get started.

TEACHING A NEW GENERATION

There are two major forces changing the way engineering education is currently taught:

1. **Student expectation of how they acquire knowledge has changed:** The current generation of students has had access to a wealth of information via the Internet. If a student wants to learn how to create an extrude in a 3D computer-aided design (CAD) tool for example, it is likely their first approach will be to Google® the question or search on YouTube for a video tutorial.

2. **Massive open online courses:** Universities and academics across the globe are facing the stark realization that the advent of Massive Open Online courses, or MOOCs, will ultimately provide access to a traditional education online, on demand, and, in some cases, free. A MOOC is an online course aimed at unlimited participation and open access via the web.

These forces have led to most universities embracing the concept of a flipped classroom. In fact, in a 2013 survey from the Center for Digital Education and Sonic Foundry® estimated that over half of university faculty members had flipped their classrooms or plan to in the next year.

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“Lecturing is one-sided and not effective; students tend to tune out. The content is everywhere. Now I think of a way that they can work on problems collaboratively in class with me there to guide them, ask questions, and steer them. The main ingredient is the meaningful activities you develop for class to help students assimilate new knowledge they’ve been exposed to in that content.”

— Lorena Barab- Associate Professor of Mechanical and Aerospace Engineering at George Washington University

1. The Center for Digital Education conducted a survey of higher education faculty members to better understand flipped classroom adoption. In total, 309 responses were collected from the members of the Education Exchange, in an online survey during August to October 2013.
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THE FLIPPED CLASSROOM

WHAT IS A FLIPPED CLASSROOM?

Flipped classrooms or flip teaching is a form of blended learning that has become a prominent new trend within the last ten years. In a flipped setting, students learn new content outside of class via online lectures and make notes of questions or concerns they may have. The traditional ‘homework’ normally done at home is then completed in the next class session where instructors can provide students with more interaction, personalized guidance, and opportunities to apply what they learned in their homework.

We have taught students to be sedate and to absorb information like a sponge. We are more interested in having them learn how to learn. You have studied something, now you have to apply it.”

— Tyler Reimschisel, Assistant Professor of Pediatrics and Neurology & VP of Education at the Vanderbilt School of Medicine
Instructors teaching engineering face the challenge of balancing fundamental engineering theory with the knowledge of the tools to perform these tasks. Instructors are forced to:

- Teach the latest and greatest software \(\rightarrow\) But never sacrifice the fundamentals
- Increase class enrollment and grow these programs \(\rightarrow\) But growing programs leads to reduced contact time between professor & students

As a technology provider to over 27,000 customers, we know the rate at which the industry is changing, and that for educators, keeping up with these changes is difficult. Balancing the need for teaching new product development skills with the basic tool knowledge needed to complete them is echoed by those in the industry. John Mannisto, Director of Technology from Whirlpool, stated, “It surprises me to see engineering students that see CAD as something for advanced or grad students. They don’t see it as a mainstream process and we really need to make sure they understand that.”

So how can you use a flipped classroom format to not only teach the necessary software skills, but ensure your students graduate with the skills demanded from the industry?
WHY FLIP YOUR ENGINEERING CLASSROOM?

Rate and responsibility of learning: By having lectures available online, students are able to go back and review topics that they might not fully understand. This format allows students to have more power over their own learning and more responsibility when they may have missed a class period to ensure they stay on course.

Real-time feedback: Getting real-time feedback in class helps students avoid misperceptions early on. Plus, online learning management and assessment tools, such as PTC University eLearning, lets students have their parts and assemblies graded instantly.

More time to offer new skills and curriculum: This format allows students to learn to think, access information, and process that information. By having the basic but necessary instruction put online or at a distance, you free up the class time to develop engaging in-class activities on new skills, technology, and educational topics.

Engaged class time and focused 1-1 instruction: Flipped classrooms provide instructors with the opportunity to not just talk at students, but to talk with students. By utilizing a more interactive learning management system, you can gain further insight into your students and engage with them 1-1 during the class period. This allows you to learn their names and learning nuances, and see if they truly understand, and are absorbing the materials.

I’m able to spend less time in the lab teaching the students the ‘picks-and-clicks’ of software and more time developing strategies for creating robust models and really making them better modelers.”
5 STEPS TO FLIPPING YOUR ENGINEERING CLASSROOM:

1. Be confident in the decision to flip your classroom: Understand that by flipping your classroom you are not sacrificing traditional lecturing time, but making that time more interactive with your students and providing them a means for course mastery. Be sure to explain this methodology to your students and how it will provide them with better access to support and assess their needs. Make sure they understand where they need to find lectures, notes, videos, and how they will be graded going forward.

2. Decide on the technology to use: Obviously the technology used is a big piece to this flipped classroom puzzle, and it often causes the most apprehension. Building your course or getting your content online can take time if done manually without the use of a learning management tool. There are several options for hosting your own materials and videos online, including services provided by on-campus tools or something as simple as using YouTube. But if you are looking to develop your own custom courses, pull pre-made engineering curriculum into your own courses, and utilize a learning management system to monitor and test your students online, you can learn more here.

3. Develop the in-class activities: Once you have your lectures online and they’re being watched or read outside of class, what do you do with your traditional lecturing period? This time is essential to making sure that your students truly absorbed the material that was watched or read outside of class, and seeing if more clarification is needed. Through developing in-class activities, group collaboration, or CAD exercises, your students will have a deeper understanding of the information they covered the evening before and you will have more time to answer any questions, ensure they fully understand, and have a more interactive class period. A full example of what it looks like to put CAD curriculum online and then use in-class activities can be seen here.
4. Seek student feedback: The flipped classroom model is only as successful as your students’ willingness to participate. It’s important to ask feedback to ensure your students prefer this model and that it gives them a deeper understanding of the topics. You can then modify the course work and layout as needed. Dr. Holly Ault, Associate Professor of Mechanical Engineering from Worcester Polytechnic Institute, implemented online technology and a learning management system into her CAD course and “over 40 percent of the students felt that the online tutorials helped them to be more productive during the lab periods.” You can read all of her findings in her whitepaper.

5. Extend your curriculum: Being able to offer basic software lessons online or at a distance will allow you to extend the curriculum in your class periods. You’ll be able to not only offer fundamental engineering theories, but by developing more engaging in-class projects you can ensure your students are graduating with new product development knowledge. You can now have the time to teach needed skills such as global collaboration, learning the environmental impacts of designs, how to design more cost effectively, designing for manufacturing, and even rapid prototyping—topics you may not have had the time or ability to cover in a traditional classroom set-up.
'Flipped classrooms' is a continually growing edutrend that doesn’t seem to be slowing, and while some may see it as a threat to traditional learning methodology or a means to increase enrollment while lessening contact time with students, at its core it’s all about evolving to adapt to a new generation of learners. Flipped classrooms will ensure that students graduate with the knowledge they need to succeed and will allow educators to be more hands-on and do what they love… teaching the engineers of the future.

Is eLearning right for you? Use this checklist to find out

To learn more about flipped classrooms, please contact an Academic Advisor.