Teaching Philosophy

My concepts of understanding and learning have evolved significantly throughout my experiences in undergraduate and graduate school. As an undergraduate student, learning was directly coupled to grades, motivating me to seek good scores to prove that I understood course material. However, after assisting in the instruction of several courses in graduate school, I came to realize that the relationship between grades and understanding can be complex and oftentimes indirect. In engineering, to truly learn or master a concept is to be able to transfer and apply it to a multitude of systems and more importantly, to utilize that knowledge in solving real world problems. Whether this translates into good grades depends heavily on the types of assessment and instruction a student receives. It was then that I appreciated the importance of effective teaching and aspired to provide it to my students.

Expected Student Outcomes

I want my students to accomplish several goals throughout their education and specifically in my class. First, they should acquire a solid accurate understanding of fundamental chemical engineering topics, such as conservation laws, that thread through several courses in the discipline. More than the mathematical forms of these laws, I believe in promoting understanding of the underlying physical phenomena. In the example of energy conservation, students should recognize that the complete energy balance consists of energy changes that occur within any system and across its boundaries and that it is simplified depending on assumptions taken regarding the nature of the system. Expecting them to memorize the simplified balance for every unit of a typical plant is unrealistic and, in fact, unnecessary if they thoroughly understood the basics of each unit. Second, I want students to develop a sense for how the topics covered in different courses connect together and be able to integrate them cohesively. When solving problems, students should be able to identify and examine the underlying physical theories rather than focus on superficial details in the problem statement. Lastly, I would like to cultivate each student's metacognitive abilities by encouraging them to consider the limitations of their own knowledge. Socrates once said: *"The only true wisdom is in knowing you know nothing".* This concept of self-awareness and its correlation with learning is one I believe in strongly for my students and myself.

Teaching Role

My role as an instructor is to help students achieve these outcomes and prepare them for their professional careers by providing them with a positive learning atmosphere to practice their analytical, problem-solving and non-technical skills. I consider an ideal learning environment to be one in which each student is comfortable verbalizing his or her thinking process by asking and answering questions freely. Therefore, my classroom provides students with ample opportunities to interact with one another and myself in discussions. I aspire to coach students by fostering an apprenticeship relationship with them rather than one in which I seem unapproachable or intimidating.

Instruction and Assessment

In developing my teaching strategies, I found that depending on one form of instruction alone is ineffective at capturing the students' interest and engaging them in the learning process. A proven approach to alleviating this issue is active learning; a set of educational techniques which extend beyond traditional lecturing to enhance the learner's experience (Freeman et al., 2014; Prince, 2004). Therefore, my instructional philosophy is deeply rooted in active learning and consists of implementing a variety of methods depending on the nature of the concept I am teaching. When covering basics or reviewing information that students have been taught previously, I find that interactive lecturing provides a useful channel to disseminate large amounts of information. In these sessions, students are asked to engage by answering quick 'clicker' questions periodically throughout the lecture. In addition to refocusing the students' attentions, this strategy provides me with immediate feedback on the class' understanding and informs me on how to proceed. However, in teaching concepts with observable effects, such as heat transfer through various geometries, I find that designing experimental set-ups and allowing the class to run lab experiments in groups allows students to physically see the ideas we discuss in class. For students who learn better by doing a task rather than being told about it, these supplements are remarkably helpful at correcting their misconceptions. The final and perhaps most useful active learning strategy I frequently use is in-class group problem-solving sessions and discussions. I am a proponent of peer-learning and have seen it play a major role in student education. In my experience, guided discussions through various concepts, and especially those that are emergent and difficult to physically see, are key to probing each student's understanding and revealing their deep-seated misconceptions and gaps in knowledge. In addition to active learning, I regularly include entertaining or interesting 'hooks', including engineering explanations of everyday phenomena and experimental demonstrations, in order to make my students' experiences enjoyable and memorable.

The final leg of my course design is assessment and, as with the instructional methods, I find that using a mixture of assessments provides me with a more comprehensive representation of my students' progress. My students have generally responded well to having frequent low stakes assessments where they get immediate feedback. These have normally been in the form of online exercises that either contributed very little to the overall grade or was graded on participation. Additionally, I use traditional tests throughout the semester to assess what my students are able to do without having access to external resources. Finally, I assign my students a group design project at the end of every course because it is my belief that these are the most authentic tasks for training future engineers. These assessments allow students to practice several non-technical skills such as teamwork, communication and presentation that are essential for a career in the engineering industry. I use a criterion-based grading scheme because I believe that is a fair form of evaluation that encourages positive peer interaction.

Student-Teacher Dynamics

My interactions with students are based on the goal of developing a more collaborative learning environment. I have found that the way students phrase their questions and comments is very telling of their underlying confusion. Therefore, in interacting with my students, I often begin by listening and asking them to rephrase their thoughts. If there are signs of a deeper misunderstanding, I answer their questions by asking some of my own. I coach them through their confusion by prompting them to consider the core concepts involved and guiding them to the correct idea, rather than providing the answer in a more direct manner.

Conclusion

Although my teaching experience thus far has been brief, I have had the opportunity to develop and revise my teaching philosophy. My empathy for undergraduate students has grown and allowed me to become more patient and receptive to their problems. In addition to learning through experience, I aim to pursue the certification in college teaching and attend teaching workshops hosted in Michigan State University. Through these sessions, I hope to continue to grow as an educator in order to improve and enhance learning in science and engineering. This is a goal that I am excited to pursue in my academic career.

References

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