

Master Class: Cultivating Curiosity

Improving Metacognition and Motivation and Revealing Misconceptions in Engineering Students

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WHY CULTIVATE CURIOSITY IN ENGINEERING STUDENTS?

Too often it is only the instructor who poses questions, leaving students little practice in cultivating their curiosity. In an attempt to cover content, faculty often make “the fatal pedagogical error (which) is to throw answers like stones at the heads of those who have not yet asked the questions” (P. Tillich).

Curiosity enhances student motivation to understand the content being discussed in class. It provides students with practice in asking questions, increases metacognition, and serves as a rich springboard from which to introduce additional content and/or address misconceptions. A curious mind is often valued in industry; Eric Schmidt, as CEO of Google, said, “We run this company on questions, not answers.” While much of engineering education is based on teaching a procedure, there is little guidance in helping students learn to be curious.

GOALS AND APPROACH

This session is designed to help faculty understand one method of cultivating curiosity in their engineering students and to be eager to implement it in their classes. The techniques for cultivating curiosity have been shown to have a statistically significant impact and can be adapted to diverse teaching situations independent of content, level, or enrollment/size of the engineering course.

This master class will be hands-on and interactive throughout. We demonstrate a technique to invert the questioning roles of instructor and student by requiring students to generate questions, not answers. This method relies on categories of questioning based on how we model the world around us and is therefore particularly useful in model-intensive fields such as engineering. Cultivation of student curiosity during engineering education can have immediate and long-term positive effects and thus contribute to a globally competitive supply of engineers.

LEARNING OUTCOMES

By the conclusion of this master class, participants:

- Will be more aware of the role of curiosity in effectively preparing a globally competitive supply of engineers.
- Will be familiar with, through discussion and examples, categories of questions that demonstrate curiosity.
- Will have hands-on practice in using categories of questioning to generate questions with increasing fluency.
- Will be aware of best practices for using this technique, through modelling and discussion.
- Will have created at least one example that uses this technique and can be implemented in a course which the participant teaches.
- Will have considered possible obstacles to effective implementation of this technique in their own teaching situation and strategized with others about possible counter-measures.

PRESENTERS

Long-time STEM educators Frank and Susan Kowalski are interested in how engineering students can be better prepared to meet the challenges they will face in their future careers. Successful efforts to nurture creativity in engineering physics students stimulated their recent interest in the relationship between creativity and curiosity. Frank and Susan are both honoured to be HP Catalyst Fellows.
