

Interactive Session

Model-Eliciting Activities: A Framework For Posing Open-Ended Engineering Problems

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Abstract - This interactive session is for engineering and technology faculty interested in curriculum reform, real-world engineering problem-solving, addressing ABET Criteria, and empowering under-represented populations of students. Participants will take part in a Model-Eliciting Activity (MEA) group problem-solving session and learn the fundamental principles for developing a MEA. Participants will gain an understanding of the process involved in making advanced engineering content accessible to undergraduate students through a well-formulated MEA. They will also map the components of a MEA to the ABET Criteria and learn how MEAs serve under-represented populations.

Index Terms – ABET criteria, engineering problem solving, mathematical modeling, open-ended problems

SESSION DESCRIPTION & AGENDA

We will present a new framework for developing real-world client-driven problems called Model-Eliciting Activities (MEA) based on the models and modeling perspective [1]. These are highly open-ended problems that require student teams make new sense of their existing knowledge and understandings to formulate a generalizable mathematical model that the client can use to solve the given problem and similar problems. A MEA creates an environment in which skills beyond mathematical abilities are valued, as the focus is not on the use of prescribed equations and algorithms but on the use of a broader spectrum of skills required for effective engineering problem solving. Our motivation for using this framework is to provide a learning environment tailored to a more diverse population than typical engineering course experiences because they allow students with different backgrounds and values to emerge as talented.

At first glance, the models and modeling perspective seems like business as usual for engineering faculty. However, through the development, use, and study of MEAs in undergraduate engineering courses at Purdue University, we have found that the MEA framework fosters significant change in the way engineering faculty think about their teaching and

their students. Further, we have found that the MEA framework encourages the creation of problems that serve a variety of educational goals [2]. At the freshman level, we have been able to introduce advanced engineering topics [3], incorporate more engineering contexts, and foster teaming skills development.

The session will be divided into five interactive parts:

- *Open-Ended Problem-Solving Reflection* - In teams of four, participants will list challenges associated with creating, implementing, and assessing open-ended engineering problems for student teams.
- *MEA Overview & Participation in a MEA* – Participants will solve an MEA called Nano Roughness.
- *MEA Six Principles* - Participants will be introduced to the six principles that guide the development of a MEA [4] and how they relate to ABET Criterion 3.
- *MEA Opportunities and Challenges* - Participants will identify and discuss opportunities (including empowering under-represented students) and challenges for creating, implementing, and assessing MEAs.
- *Implementing MEAs in an Established Curriculum* - Participants will be provided with additional field-tested MEAs and will work to identify engineering content and contexts for generating new MEAs.

Our goal is to establish partnerships with faculty who are interested in using existing or developing new MEAs for use with students at their institutions. We wish to create a support network as well as an online library of MEAs.

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