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Visit to University of Arkansas
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Purpose:

Share and disseminate knowledge and experience using Model-Eliciting Activities (MEAs) in the classroom and discuss the benefits of their use.

Probable visit arrangement:

1.5 hour session with a small group of interested faculty to define MEAs, discuss research results, show examples of various MEAs and discuss/demonstrate their use in the classroom

Short follow-up meetings may be scheduled with faculty afterward for a personalized discussion on how MEAs could be used in a particular class.

Abstract:

One of the challenges for engineering educators has been how to assess the ABET professional skills.[1] As one part of a 7-University NSF funded collaborative research project titled "Improving Engineering Students' Learning Strategies Though Models and Modeling" (DUE 071780), we have discovered a classroom educational intervention that can be used to assist with this challenge. Model-Eliciting Activities (MEAs), which are a proven educational methodology for presenting complex, realistic, open-ended problems to students, can also serve as an assessment tool, both in the classroom, and, by extension for ABET. Although originally developed by mathematics education researchers, MEAs have recently seen increased use in engineering curricula. These posed, realistic scenarios require a student team to develop a generalizable model and then use it for the specific problem at hand.

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[1] Defined as those ABET Criteria 3 Student Outcomes that can be challenging to teach and assess, they include: **Process skills*** – communication (outcome g), functioning on multi-disciplinary teams (d), understanding professional and ethical responsibilities (f) and **Awareness skills*** – understanding engineering solutions in a global and societal context (h), knowledge of contemporary issues (j), need for lifelong learning (i)

Recent research has demonstrated that they **improve student problem solving and modeling skills** as well as **increase their understanding of course concepts**. Our research also has identified additional benefits of using well-constructed MEAs in the engineering classroom. In particular, they can be an effective tool to **improve students' knowledge and understanding of certain ABET professional skills including professional and ethical responsibility, understanding the impact of engineering solutions in a global and societal context, communication, as well as teamwork**. At the University of Pittsburgh, we have conducted a series of experiments in industrial engineering courses (engineering economy and probability and statistics) in which students in sections using MEAs were compared to parallel sections in which MEAs were not used. A series of assessments were performed including pre and post concept tests and student course evaluations. Analysis was also done using student reflections recorded after completing MEAs. Students in sections of the courses that used MEAs rated their knowledge and understanding of these professional skills significantly higher than students in sections that did not use the MEAs. In addition, our collaborators at the California Polytechnic State University in San Luis Obispo found similar results in a mechanical engineering course in dynamics.

As a result, we recommend that engineering faculty seriously consider using MEAs as a tool to improve both student learning and the attainment of a number of ABET outcomes in addition to providing a process for assessing that attainment. By combining pre- and post-concept inventories with the MEA implementation, faculty can better document learning gains, and thus have a comprehensive tool for ABET assessment. This should prove especially helpful in those areas where previous assessments may have shown weaknesses or inadequate attainment.