

Fundamental Research in Engineering Education: INTRODUCTORY REMARKS

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Session 206, “Fundamental Research in Engineering Education,” at the Nashville AIChE meeting in November 2009 was sponsored by group 4 of the National Program Committee to start a dialog on doing rigorous fundamental educational research. The session was chaired by Dr. LaRuth McAfee and co-chaired by Drs. David Silverstein and Phil Wankat who made introductory remarks. Papers were presented by Professors Milo Koretsky, Margot Vigeant, and Ron Miller.

Engineering education research is becoming more important as illustrated by: NAE attention and development of CASEE, increased ASEE attention, NSF grants and sponsorship of national colloquiums, tightening of *Journal of Engineering Education* (JEE) publication requirements, and new Ph.D. programs. Chemical engineering professors (*e.g.*, Felder, Miller, Prince, Shaeiwitz) are currently leaders, but most ChE professors are not trained to do rigorous engineering education research.

The paradigm for quality in engineering education research has slowly ratcheted up and become more rigorous. Before 1993, data, a literature review, and references were not required and the message was often, “I tried it, it worked and students loved it.” In 1993 *JEE* introduced what I will call the Old Quality Paradigm that papers had to be scholarly. Typically, papers covered course or curriculum innovation and included a short literature review, references, and data in the form of student surveys and/or evaluations. In 2003 and again in 2008 *JEE* introduced the New Rigorous Paradigm that aimed to place the quality of *JEE* papers at the level of the best educational journals. This paradigm requires: hypothesis in advance, a thorough literature review, grounding the research in learning theory or human development theory, an appropriate mix of quantitative and qualitative research methods, Institutional Review Board (IRB) approval in advance,

and testing of the hypothesis during the research. Very few engineering professors have been trained to do engineering education research at this level.

Many important educational items do not fit into this definition of educational research. We still need to have ChE professors working in course and curriculum, laboratory, and homework development. Although *JEE* will no longer accept papers in these areas, *CEE*, a peer-reviewed archival journal, and the ASEE and FIE Conference Proceedings happily accept a large number of papers in these areas. These papers will be informed by the rigorous research published in *JEE*, but will not employ the same research methodology.

The following steps are recommended for professors who want to learn to do rigorous educational research: First, collaborate with a social scientist. Acceptance rate is 10 times greater in *JEE* if an engineering professor collaborates with a social scientist. Second, although it takes significant effort, retool and learn how to do rigorous educational research. Methods to do this include attending the NSF-sponsored REE workshops, taking educational research courses on campus, and extensive self-study.

An alternative for professors who do engineering education research as a hobby or who are slowly learning how to do rigorous research is to initially publish in venues that are less arbitrary in the type of papers they will accept than *JEE*. There are research journals such as the *International Journal of Engineering Education* that accept a wider variety of papers than *JEE*. In addition, many more papers are published in the ASEE and FIE Conference Proceedings than in all of the engineering education research journals combined. Although this alternative is viable for individual professors, *to retain its leadership in Engineering Education, ChE must have more professors doing rigorous educational research.*