

The Real World: A Factor that Engineering Faculty Consider in Making Decisions about Teaching

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Presentation Outline

- Studies of Engineering Educator Decisions (SEED)
 - Why teaching decisions?
 - What do we mean by teaching decisions?
 - Purpose of study
 - Research methods
- Real World – Preparing Students for Engineering Practice
 - Authentic experiences
 - Professional standards
 - Trade-offs in teaching
- Implications – pedagogical content knowledge
- Summary

Why teaching decisions?

- Entry point to understand teaching
- Synthesis point for all information (including factors and constraints)
- Links to general teaching expertise

What do we mean by teaching decisions?

- “A decision made during the execution of the professional responsibilities of the teacher” – Sutcliffe and Whitfield (1979).
- B. F. Skinner’s notion of a decision does not require to have choices. (as cited in Copeland, 1971).
- A decision is a commitment to act.

SEED - Purpose

- To understand:
 - The *types* of teaching decisions that engineering faculty make
 - The *processes* by which they make teaching decisions
 - The *factors* they consider in making teaching decisions
 - Their level of *satisfaction* with the *outcomes* of these decisions

SEED Methods

- Qualitative, semi-structured in-depth interviews
- Critical Decision Method
- A total of 33 participants
- 9 of 10 engineering departments
- Faculty at all tenure levels and non-tenure track faculty
- Oversampled for women (10 women and 23 men)

SEED Protocol

- Interview questions included:
 - Background/Demographics
 - Definition of teaching decisions
 - Reaction to decision making framework
 - Pre-active teaching decision
 - Interactive teaching decision
 - Processes and outcomes
- Thematic analysis across interviews

Findings to Date

- Time – not just a constraint
 - Time as surrogate for student maturity
 - Blurring the boundaries – combining teaching with research
 - [Huang, Yellin, and Turns 2007]
- Ways of taking students into account depended on participant, context, and/or situation
- Several actions represented a balance between students' needs and the educator's own needs and interests
- Teaching decisions affected by power issues
 - educator not having power, e.g. need for tenure results in teaching decisions that are less optimal for student learning
 - educator having power, e.g. freedom to make different teaching decisions because the professor is tenured

In what ways did engineering faculty consider the real world in making decisions about their teaching?

Real world – Preparing Students for Engineering Practice

- Previous studies – Journal of Engineering Education (JEE)
 - Strategies in solving workplace problems (Jonassen *et al.* 2006)
 - Experiences with entrepreneurship (Bilan *et al.* 2005, Dabbagh *et al.* 2006)
 - Ethics and professional responsibilities (Loui 2005, 2006)

Ways of considering the “Real World”

- Authentic experiences
 - senior capstones
 - group projects
- Professional standards
 - modeling professional practice
 - ABET as proxy
- Trade-offs – making choices about including material

Authentic Experiences

- "...our senior design project, these are always company based projects, so I solicit projects from companies in the area..." *[Ed, full professor]*
- "They (the students) appreciated the fact that people were actually interested in what they were going to come up with..." *[Nathan, associate professor]*

Professional Standards

- Using **professional practice** for guidance
 - "...if one were grappling with this type of situation as a professional, these are the documents you would go to..." *[Trent, assistant professor]*
 - "people in industry who do the work and study on the research...most of the questions has no analytical solution...numerical approach is only approach... most convenient approach, okay, to solve the real world problem." *[Eugene, full professor]*
- Using **ABET** for guidance:
 - "...we typically cover a variety of topics that are...ABET requirements..." *[Simon, full professor]*
 - "...in design we want to address a lot of the ABET professional development issues..." *[Ed, full professor]*

Trade-offs

- Time as curriculum design constraint
- "... any time I try to introduce something with a real world example there's a trade-off... explain the principle or taking the group of students down to see a piece of equipment that's attached to a wall... Is it so underpinning that they can't do without it, or is it something that, yeah, I could spend the time doing that, but it's not on the critical path." *[Bea, associate professor]*

Implications – Preparing Students for Real World of Engineering Practice

- Findings represent decisions made on a daily basis
- Findings represent examples of pedagogical content knowledge (PCK)
- Decisions based in PCK to prepare students for engineering practice

Pedagogical Content Knowledge

"...the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations - in a word, ***the ways of representing and formulating the subject that make it comprehensible to others***. Since there are no single most powerful forms of representation, ***the teacher must have at hand a veritable armamentarium of alternative forms of representation*** some of which ***derive from research*** whereas ***others originate in the wisdom of practice***."

[Lee Shulman, 1986]

Summary

- Studies of Engineering Educator Decisions (SEED)
 - Studying teaching decisions is powerful lens for understanding engineering teaching
 - Process, factors, outcomes
 - Balancing needs of students/learners with power issues (e.g. departmental politics) and personal needs (e.g. career, family)
- Real World – Preparing Students for Engineering Practice
 - Authentic instructional experiences
 - Model professional standards
 - Trade-offs in teaching
- Implications – pedagogical content knowledge

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