UNDERSTANDING FACULTY ATTITUDES ABOUT STEM-RELATED EDUCATIONAL REFORMS

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Focus of our research team

Transforming engineering for a more socially conscious higher education curriculum

Projects

• Humanistic studies into engineering education to enhance service learning: improvement of competencies of biological and agricultural engineering educators

• Identifying faculty-based specifications for improving instruction and enhancing student success in STEM disciplines

• Analyzing faculty attitudes and beliefs about a liberal arts-orientated student’s interest in the STEM disciplines
Why this research?

• University of Massachusetts-Lowell (survey)
  - 51% of engineering faculty were reluctant to integrate social issues into the traditional coursework

• Worchester Polytechnic Institute
  - faculty in the humanities and arts: engineering will “poison” their disciplines.

• Public perception

• Lance Schachterle, Associate Provost at Worchester Polytechnic Institute
  - Liberal education needs to integrate engineering and liberal arts curricula
  - 2008 Symposium on Engineering and Liberal Education. Union College, NY
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METHODS

- Qualitative
- Semi-structured interviews

- 13 faculty participants so far
  - 7 from STEM (Chemistry, physics, biology, math, engineering and technology)
  - 6 from Non-STEM
  - 8 more faculty have participated.
NON-STEM Reform Practices in Department

- Review of learning outcomes for undergraduate and graduate programs
- Department head personal emails to recognize teaching
- Teaching Awards within Department
- Faculty mentors for beginning teachers

Susan: “Um, I’m in the department with some really good teachers, and um, they’ve won awards...so I think teaching is an important value, but in terms of sort of like, micro-managing, what or how you ought to teach, I don’t think that occurs”.
Non-STEM Reform Practices in Department

- Revise curricula to keep it up to date
- Put courses online
- Move to semesters
- Trains graduate student teachers
- Portfolio essays versus 3 essay requirement
- Brown bag lunches
Non-STEM faculty attitudes toward reform

• What you want students to be able to do
  - Martin: “...but if there’s a challenge to that is if it seems like the curriculum is going to begin to move away from maybe, let’s say, my research interests or my area or will require me to do some retooling, um, I might give pause.”

• Some discussions occur but reforms may not happen
  - Mary: “I think...so it depends on what it is. It also depends on if there is research to support it. If they come in and say we should do service learning, I would say what’s your evidence that students learn more if we do service learning. I’m just using that as an example.”
NON-STEM FACULTY ATTITUDES TOWARD REFORM

Unconsciously competent

- Hank: “Usually people, faculty will say when they’re asking about your job, what is your teaching load as to what is your research expectation? Those two words, I think, are very telling. Um, load is a burden. And you want the lightest load possible”

- Felt the need for mandates

- More time allotted for teaching development
STEM REFORM PRACTICES IN DEPARTMENT

- Some collaboration between disciplines that had connections
  - Other sciences
- Proposed online classes
- Visit previous students for feedback
- Some ideas do not generate a lot of attention
- Highly engaged in curriculum reforms and program reforms
- Changes in textbooks
- No teaching reform or real evaluations
- Strategy 10
- PRISM
- STEM mini-grants
STEM Reform Practices in Department

- Align curriculum with defined goals for graduates
- Change in methods may or may not trickle down (balance is good)
- Traditional teaching is more common
- Studios
- Some faculty want direct training in teaching and more resources
Will: “Even those that do not want to change, you have to sell your point and show—nobody wants to change because we’re used to this system, because it’s easy...They listen to the employer. If the employer says, we would like somebody with these skills set, and you’re not providing it, and we’re trying to develop a curriculum out to provide that then, the battle as a chair is removed”
STEM faculty attitudes toward reform

- Luke: “Um... at the university level, we have the Center for Teaching and Learning that sponsors faculty learning communities every year... I’ve done four of them, and I’ve found them useful to varying degrees”.

- Very open to reform, providing resources to help faculty improve teaching

- Bob: “It’s almost like every faculty member should go through a full year course on just teaching, eight hours a day, every day, learning about teaching stuff before they ever let a professor in a classroom.”
Opinions

- Not qualified to teach STEM in non-STEM
- More supportive of non-STEM integration into STEM
- Other factors in STEM are more important: race, class, gender, etc.

Time to cover content

- Good for introductory courses but not high levels in STEM courses
- Knowledge is inherently interdisciplinary
- Students can see relevance to own lives
- Technology is used to do something else
- Doesn’t work
Opinions

- Appropriate for some classes and not others
- Knowing when it is appropriate and what topics are appropriate
- Content is too full
- The STEM students take more non-STEM courses than non-STEM take STEM courses (one-sided)
- STS courses fail due to superficiality
- Is helpful when teaching “boring” topics
- Cannot know the “big picture” if there is no integration
- Need interdisciplinary collaboration
- Departmental pressure to only focus on STEM
INTEGRATION

Process of integrating social perspectives and dimensions into the operational (teaching strategies, methods of content organization, time and place of course delivery, student conformation) and formal (program and course structure, content, and materials) aspects of the STEM curriculum.
Ellingboe (1997a) found that in two of the colleges, it was the deans and a few committed faculty who led the change efforts. These faculty members acted as campus champions, selecting a large group of faculty who were committed to the new direction. This group played a crucial role in shaping attitudes, knowledge, and behavior among the wider faculty population, thereby pre-determining desired outcomes which would be appropriate for their institutions. However, success in these efforts should envision change on their campuses, not just within their immediate circles.

The figure illustrates the interplay between different organizational units:

- **Senior administrators**: Institutional commitment, leadership, vision, and support.
- **Faculty**: Campus champion, Select group of faculty, Large numbers of faculty.
- **Students**: Demand, participation.
- **Other stakeholders**: Context, External factors.

The diagram shows interactions and feedback loops, indicating the need for continuous engagement and adjustment based on research-based data.
Senior administrators:

- Institutional commitment, leadership, vision, and support
- Culture of supporting the scholarship of teaching and learning
- Facilitate structure for collaborations
- Evaluation, recognition, and reward systems
- Resources, professional development, consultants, support personnel
- Mini-grants (funding, time release, graduate students)
Organizational units: Administrative structure and coordination

Faculty: Campus champion, Select group of faculty, Large numbers of faculty

Attitudes, knowledge, and behavior

- Leadership
- Knowledge (content, context, pedagogy)
- Research (SoTL)
- Innovativeness, creativity
- Initiative (lead by and with examples)
- Mentorship and Collaboration (individuals, FLCs, brown bags)
- Participate in professional development
- Curriculum revision (learning outcomes, structure) and curriculum development (transformation, materials, strategies)
What do Faculty need?

- 1) Support from the administration (vision, leadership, culture supporting the scholarship of teaching and learning);
- 2) Change in policies (evaluation, reward system, recognition, leave);
- 3) Group and individual training and professional development opportunities;
- 4) Collaboration (i.e., faculty learning communities) and mentorship;
- 5) Access to consultants, support personnel, and resources (examples, materials, ideas, strategies);
- 6) Mini-grant programs (funding, time release, graduate students, other resources)
- 7) Leadership from faculty