

Work-in-Progress: Examining how faculty formal and multidisciplinary networks shape ethical worldviews

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Literature has shown that faculty peers within an educator's network have the potential to influence their perceptions towards pedagogies, multidisciplinary, and faculty development. While research has examined the influence of individual faculty on one another, less work has been focused on more holistically examining faculty networks' influences on shaping their worldviews. We designed a study to explore how the various connections faculty make within the university may potentially 1) influence their perceptions of ethical worldviews, 2) lead to new multidisciplinary experiences for students in STEM courses. As a part of a major revision to the undergraduate education curriculum at a southeastern R1 university, a plethora of multidisciplinary minors were created. The design and implementation of these courses over the past 5 years have created numerous examples of multidisciplinary courses, for students of varying discipline and level of experience to participate. While efforts have been made to assess the individual courses that are a part of the general education reform, little effort has been made in examining how the courses and the faculty leading them have impacted the larger university network. We utilize Social Network Analysis (SNA) framework to investigate teaching-, research-, and departmental-networks of faculty who are involved with the general education curriculum. Thirty faculty from the general education program will sit down for semi-structured interviews to examine their ethical worldviews. This study uses an imbedded mixed methods approach where data will be analyzed with thematic coding and integrated into the social network data) to have a comprehensive view of faculty ethical worldviews. This is a work-in-progress, we will report the findings in the full paper.

Introduction

One of the primary goals of engineering education is to prepare students for the workplace and provide them with the competencies necessary to succeed. Despite accreditation agencies such as ABET and engineering societies such as ASME providing standards for undergraduate programs, there are still calls to improve engineering education in terms of diversity, ethical reasoning, and an ability to function in a global market [1]–[3]. Researchers and faculty from across the country have attempted to promote diverse and ethical environments for students, to limited success.

There are many barriers to creating, initiating, and sustaining change initiatives in higher education, often due to the complex and decentralized structures of higher education institutions. In an examination of a change initiative to incorporate evidence-based instructional practices (EBIPs) in STEM, Fisher and colleagues (2019) found that the siloed nature of departments was a major barrier to change. They noted that even within departments, faculty would not discuss their teaching practices with others [4]. The lack of discussion about EBIPs might have been due to a lack of time or buy-in from the faculty [5], [6]. Faculty may not have the adequate resources to develop the necessary course material or may not have been supported by their department in the change initiative [7].

Current conventional methods for examining pedagogical change initiatives in higher education include semi-structured interviews with change agents, analyzing pedagogical artifacts, and surveys of involved faculty [8], [9]. Semi-structured interviews provide change agents and researchers with a more in-depth understanding of how they implemented a given change in their course or some of the barriers that they faced in the process of implementing new pedagogies [10]. On the other hand, surveys are useful in learning about the population of faculty at large and can more easily highlight adoption rates of pedagogies over time [11].

Social networks provide an avenue to analyze higher education that current methodologies do not take advantage of. Social networks are a series of nodes representing actors within a system and ties which represent connection between the actors [12]. In the context of higher education, social networks have been used to examine both student and faculty communities, both in identifying them and examining how they change over time. Social networks have been used to examine student living-learning communities and examine how STEM faculty communities of practice develop over time [13], [14]. In the example provided above, Fisher and colleagues discovered that departments were largely siloed and there was a general lack of communication about EBIPs. Similarly, Rienties and Heliot (2018) utilized social network analysis to analyze student learning ties in a multidisciplinary classroom, finding that students within a kept to those within their discipline [15]. If surveys look at the overall population of a network of faculty, and interviews examine the traits of the nodes within it, social network analysis combines the two and attempts to explain trends within the network by leveraging the ties of faculty.

Research Aims

The aims of this study are to examine the experiences of faculty in a large-scale curriculum revision. We utilize social network analysis and semi-structured interviews to examine the various connections that faculty have within academia and how their connections played a role in developing a course amidst a university-wide curriculum reform.

RQ1: What are College of Engineering faculty experiences in developing courses for a university-wide curriculum revision?

RQ2: What are the personal networks of faculty who have developed courses during a university-wide curriculum revision?

Methods

Settings and Participants

This study analyzed faculty networks from a Research 1 University in the Southeastern region of the United States. The selection was made based on faculty involvement in the curriculum revision and their being in the College of Engineering. Data was gathered via three methods based on the type of information. Faculty coteaching data and institutional affiliation data were scraped from the school's internal course sign up system via Python. Research collaborations data of faculty were collected via Python by collaborating findings from databases such as the Engineering Village and ScienceDirect. Lastly, faculty were selected from within the

College of Engineering to participate in 45-60 minute, semi-structured faculty interviews to create informal networks. Informal networks for the purpose of this study to include collaborators on various institutional and departmental committees, faculty who provided or received advise for teaching, mentorships, and collaborators on the creation and implementation of a course/minor the faculty member helped design as part of the curricular revision. The faculty interviews also helped to corroborate the research and coteaching networks. As this paper is a work-in-progress, the study is currently in data analysis phase, and the results below are from two pilot interviews conducted with faculty in STEM departments outside of the College of Engineering who took part in the university-wide course redesign.

General Education Curriculum Reform

This Southeast R1 University has recently revised the general education curriculum to improve integration across courses. In the new model, each course has one of two common learning outcomes -- ethical reasoning or intercultural and global awareness. By incorporating these learning objectives across all of the general education courses over the students academic career, students might be able to better integrate their learning across courses, including across disciplines.

Pilot Interview Contexts

Pilot Interview 1 – Designed and taught a 3000 level (junior) course pertaining to the chemistry of green materials. The course was part of a integrative minor but was scrapped after 2 years due to a low student enrollment rate.

Pilot Interview 2 – Help to design a multidisciplinary minor between four colleges at the university, which includes three core courses with a capstone experience in the senior year. Designed and taught the 3000 level (junior) core course for this minor.

Findings and Discussion

From the pilot interviews, researchers have highlighted four aspects of the curriculum redesign process including 1) barriers to course design and teaching, 2) faculty learning of ethics, 3) the incorporation of ethical reasoning into the curriculum, and 4) the resources from the department and the university utilized by the faculty member. These four themes taken from faculty interviews help to describe the experiences of faculty more holistically during the university-wide curriculum reform.

Barriers to Teaching

Throughout the university-wide course reform, faculty faced many barriers in the design and teaching of their newly created or revised course. The pilot studies highlight many structural issues within the university's system which inhibit the creation and successful implementation of the new courses. The faculty member from Pilot Interview 1 had their course scrapped after two years of teaching. While the course numbers were

“There just weren't enough people taking it. So there is money once you hit I think 30 Students enrolled. Okay. And so it was a pandemic. I don't think that

helped me. I had 11 in the first year, I had seven the second year during the pandemic. And, and the grant funding, for me, had funding for two years. And they ran out, they discontinued the minor and the class, like a few months ago.”

While the enrollment numbers were low, even for an upper-level technical elective, if students had started to take the required courses within the new general education system for the minor, they would not have had the ability to even enroll in the course due to not having taken the required courses. This faculty member highlighted another reason for the course and the minor being discontinued after two years from a higher-level standpoint.

“I think it probably makes sense that it was I never figured out how we were going to get students in this minor. I mean, the University created, like 25, minors, and students aren't signing up for minors. So I didn't really expect that to last, I did think I would get enrollment up high enough for the class to last.”

With the creation of many new minors, and even more preexisting minors that were not integrated into the new system, it was inevitable that some of the new minors would fail along with the courses. While courses with a certain number of students would receive funding to ensure their continuation, for labs and capstone courses, this was often not enough. The faculty member who helped design the minor found that “the capstone is a faculty effort intensive endeavor.” It often requires a dedicated faculty member to teach, and with the funding model, not many new faculty were hired to teach the general education courses, which shifted the burden to current faculty who would have had to been paid for their increased workload.

Faculty Learning

With the design of courses that required an ethical reasoning component to them, faculty were not always adequately equipped with the knowledge to teach ethics in their course, and thus had to leverage resources to prepare themselves for it. Faculty read academic literature, sometimes having to shave entire textbooks down to one or two lectures. One faculty member discussed the importance of the connections they had around campus.

“I have friends all over campus, and we get into discussions about teaching.”

Another faculty member highlighted the various courses that the university requires of faculty to receive their free computer, which range from discussions of pedagogy to preparing faculty to teach the ethical reasoning component of the general education reform through a voluntary summer institute for faculty.

Incorporating Ethical Reasoning

Both two faculty members tackled the task of incorporating ethical reasoning into their curriculum differently. The first had a smaller class, 10-15 students depending on the semester, and was able to tailor some of the discussions, readings, and videos that students had as assignments in the class around the students' experiences.

“The first year I had an Indian student [the student] was able to talk about, she knew of this group of Indian workers that were living on the trash it was, well, they cleaned the

streets because they were looking for something of value, but they were also open burning it, they're breathing in all the toxins. So, you know, we're bringing in the chemistry to structure why it's toxic, what part is useful, what part is not.”

“And then in the next year, I had a student from South Korea, and were when she would go back to visit family. Once a week, everybody meets down in the basement and sorts the recycling together. It's a whole social activity based on recycling.”

By leveraging the experiences of their students, the faculty member was able to introduce the ethical ramifications of littering through real-world examples that applied to their students. Other pedagogical methods for incorporating ethical reasoning in the classroom were through historic case studies, quizzes on applied ethics terminology and sustainability, and lectures on gray literature and the Responsible Conduct of Research.

Resources

With any large curriculum reform, it is important that those most directly involved in the curriculum change, the faculty, receive the support and resources they need. As part of the initiative, faculty who were designing or retooling a course could as for small grants that provided them with \$2,000-\$10,000 to pay for traveling to conferences and universities to design the course, or to pay a TA to help in the teaching and assessment of the course. In the case of the faculty member involved with the minor, their team received \$90,000 in funding as part of the grant, which primarily went to paying the faculty member in charge of the Capstone experience. Outside of the monetary resources that the faculty utilized, the university has a center for improving teaching and learning, which one faculty member highlighted as an important resource for them and colleagues.

“I don't know if they still do this, but they would offer these formative assessments, I don't know if they still do that. But it's essentially, they, they'll come into your class, and they'll, and they'll review it. And then they'll meet with the students in like these little focus groups, and get feedback, and then they'll meet with you. And they'll give you all this discussion, ideas and books to read or whatever.”

Whether directly or indirectly, the university provided many options for the faculty involved in the curriculum initiative to engage in both formal and informal learning experiences to prepare them for their upcoming courses. One issue that wasn't highlighted here but needs to be explored further is how accessible this information was, and if faculty knew of the opportunities that they had available to them. Lastly, all faculty had social capital of their colleagues and friends, with whom they could discuss course design and pedagogy in the design of their course.

Faculty Networks

Throughout the pilot interviews, faculty were asked to describe other faculty that they interacted with during the time of the university-wide curriculum reform. Based on the results the relationships that the participant (ego) had with the other faculty (alters) were used to create egocentric networks with multiple types of ties, which are depicted below in Figure 1. While the

sample size of this pilot study is small, and close to a dozen interviews have been or are scheduled to be conducted soon, there are a few conclusions that can be drawn from these pilot interviews.

Across the two pilot interviews and in the interviews that are currently being conducted, there has been a large variance in the number of colleagues that have been identified in interviews, ranging from 8-15. While the issue is likely multi-faceted, two reasons for this are differences in faculty in the ability to recall names from multiple years ago. Because of this, the research team had begun to prompt faculty before the interview about having to remember names for the purpose of creating networks. Additionally, multiple faculty members have taken the time to go through old emails to find former collaborators, which has increased the number of alters identified by the interview participants.

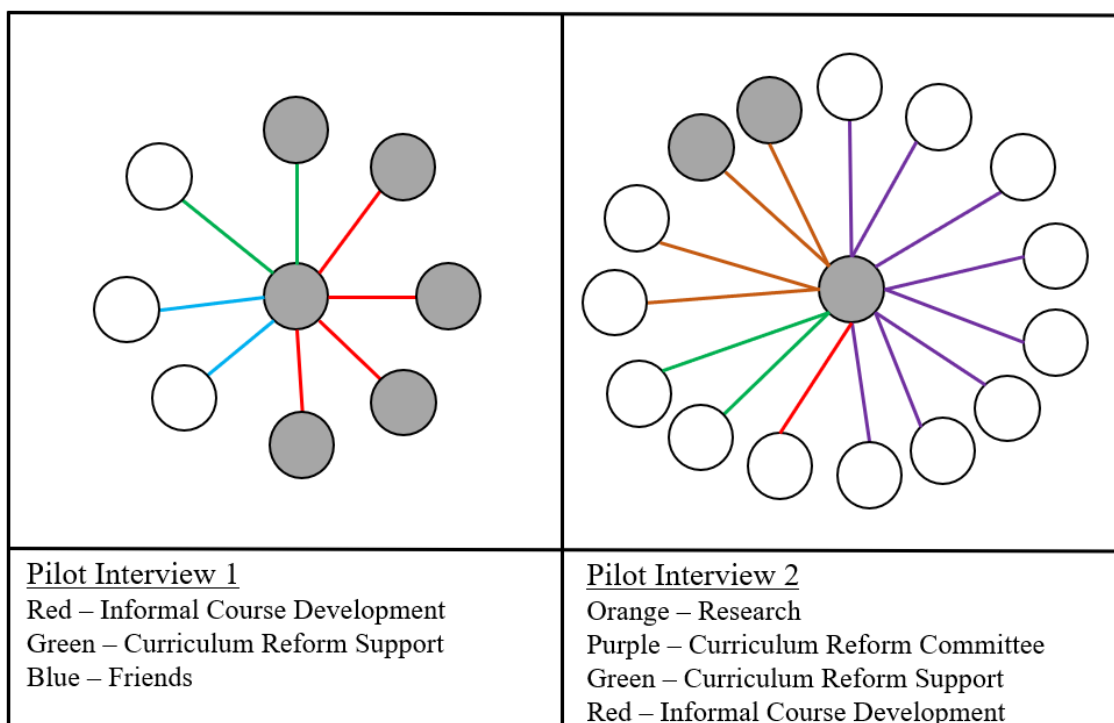


Figure 1. Egocentric Networks for Pilot Interviews depicting in-major (gray) and out-of-major faculty (white)

Conclusions and Future Work

From the two pilot interviews, various barriers to creating courses within a university-wide cultural shift were observed. While resources had been allocated for faculty to research and design new courses, there was not much money allocated to sustaining full minors that needed dedicated faculty, like in the case of the Capstone Course. Additionally, departmental support was not necessary for the successful design of a course or a minor. Having the general education course curriculum reform exist outside of any department or college provided faculty the agency to leverage other resources to pursue the creation of courses and minors that their department might not have otherwise supported. One issue with the structure of the process was that many

new minors and courses were created at one time, which even with an increasing student population, meant that the new courses were competing, which limited their success.

Moving forward, this work has begun to interview more faculty from the College of Engineering and plans to create between 10 and 15 egocentric networks. Additionally, after the interviews of the central faculty (egos) are completed, the adjacent faculty (alters) will be reached out to for similar interviews and be asked similar questions. This will create many more completed networks that will seek to examine correlations and cliques that arise from the interconnected faculty.

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