2006-1368: COMMUNITY BUILDING AND IDENTITY DEVELOPMENT THROUGH GRADUATE COURSEWORK IN ENGINEERING EDUCATION

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Community Building and Identity Development Through Graduate Coursework in Engineering Education

Abstract

The new engineering education graduate degree program at Purdue University is a pipeline for educating future engineering faculty and professionals interested in pursuing careers that support research-based engineering education reform. The first cohort of doctoral seeking students was admitted in Fall 2005. Two courses were developed to address community building and identity development in this new field of study. Emphasis was placed on these two ideas as the field is currently not well defined and the research community is relatively small and fragmented. Such emphasis is also intended to circumvent common doctoral program issues including isolationism.

This paper presents an overview of the development of these courses and student evaluation of the course learning objectives. Students' favorable evaluation of the impact of these courses on dimensions of community building and professional identity development are highlighted.

Introduction

In Fall 2005, Purdue University admitted its first cohort of graduate students into the engineering education graduate degree programs. This was the highlight of a three-year process to realign the mission of the former Department of Freshman Engineering to support the scholarship of engineering education[1]. In Spring 2004, Purdue became the first research extensive university to launch a Department of Engineering Education (ENE). In Spring 2005, the Indiana Commission of Higher Education approved the proposal to create graduate programs at Purdue University in engineering education.[2]

The faculty assigned to teaching the introductory ENE courses identified a number of critical needs of graduate students entering this new field of study. Students will need to understand what it means to be a professional in this new area and what it means to be active in this profession. Students will also need to take an interdisciplinary perspective – that is understand how this field relates to the communities and from which it emerged (e.g. engineering and education). Students will need experiences that promote growth of the field and success of those who enter that field (e.g., circumventing problems in doctoral programs such as isolationism[3,4]).

These needs were translated into course goals to build community and promote identity development. In other words, these introductory courses need to bring students into this new field and help them navigate this field (and those communities that contribute to this field). This requires helping students understand the profession and their role in it, as well as enabling them to be active in the development of a professional community. These goals align well with modern approaches to doctoral education[5]. These goals also align well with what it means to build capacity in educational researchers[6]. And finally, these goals address significant local needs in ENE to facilitate linkages across engineering and education communities.

In this paper, we describe two new courses: ENE 595A – Introduction to Engineering Education and ENE 695A – Seminar in Engineering Education. In the sections that follow, we will

describe each of these courses highlighting course activities that promote community building and professional identity development. Following each course description, we present student evaluations of their achievement of the course learning objectives. Finally, we present student evaluations of the extent to which these courses contributed to community building and professional identity development. The development and evaluation of these courses is part of a related study in which students were interviewed at points throughout the semester to characterize their initial and evolving engineering education identities[7].

Overview of INTRO course (ENE 595A)

ENE 595A – Introduction to Engineering Education – (hereafter called INTRO) is a three credit-hour course that introduces students to the field of engineering education. The course was designed and taught by three engineering education faculty members, with backgrounds in the fields of agricultural and biological engineering, mechanical engineering, chemical engineering, and education. The faculty solicited ideas from other members of the engineering education community, including Karl Smith (the Morse-Alumni Distinguished Teaching Professor and Professor of Civil Engineering at the University of Minnesota) and Jennifer Turns (Assistant Professor of Technical Communications at the University of Washington), who graciously provided their expertise and ideas.

Early on, the faculty agreed that the INTRO course should enable participants to create frameworks regarding the landscape of engineering practice, the landscape of engineering "drivers" (i.e. those who influence engineering education), and the landscape of engineering education research. "Best" practices in engineering education teaching and frameworks for designing engineering education research studies were also considered key topics. As a result, the following course learning objectives were developed:

COURSE LEARNING OBJECTIVES

As a result of taking this course, the participants will develop the knowledge and skills to:

1. Define engineering and the engineering method, and list attributes of engineering as a profession.
2. Describe the context of engineering education in the US and globally
3. Describe the history, the present, and the future scenarios of engineering and engineering education
4. Summarize "state of the art" or "best" practices for teaching and learning engineering
5. Describe drivers and opportunities that are enabling engineering education research
6. Map the landscape of engineering education research at Purdue
7. Describe the elements of an engineering education research study
8. Articulate a clear personal teaching philosophy statement.
9. Articulate a clear personal research philosophy statement.

Ideas about the students who would enroll in the course and the challenges these students would potentially face helped faculty define the overarching goals of the course and design appropriate learning activities. The three goals faculty identified as critical (developing identity, articulating what is engineering and engineering education, and promoting community) are described below.

Developing identity - What is engineering education and what is my role? It was envisioned that students enrolled in the course would be from diverse backgrounds and would have different motivations for studying engineering education and different ideas of what engineering and engineering education encompass. The faculty believed it to be critical to help students develop their own definitions of engineering and engineering education and to begin to identify what their role in engineering education could be. In other words, faculty wanted to help students develop a personal identity within engineering and engineering practice, teaching engineering, and the scholarship of engineering education.

Ability to articulate 'what is engineering education?'. Because the field of engineering education is not well defined and the research community is small, faculty identified a need for students to be able to discuss what IS engineering education and their role in it early and often. Engineers traditionally have had difficulty defining engineering to non-engineers. Therefore, to promote public understanding of and interest in engineering and engineering education, engineering education students must have the ability to communicate this information to the general public. In addition, students must also be able to describe engineering education to others, particularly engineers, who may have preconceived notions about the field. The central belief is that for our students to have an impact on engineering education they need to be develop skills in talking, thinking, and working across the disciplines that make up engineering education.

Developing community. Isolationism[3,4], a common problem in doctoral programs, could be accentuated for students enrolled in a novel program and entering a field that is small and fragmented. ENE 595A faculty desired to establish a network of support for its students, where students would know and support one another, develop strong relationships with engineering education faculty, and be introduced to the national and international engineering education community.

INTRO Course Implementation

The course was offered in a three-hour block (with a break after 90 minutes) once per week. Typically two to three content areas or activities were planned for each class, with the faculty (all of whom attended each class) taking turns leading the discussion or learning activities. As depicted in Figure 1 and presented in Appendix A, these activities centered around the themes of what is engineering and what is engineering education (in the context of the history of engineering education, engineering education research, and teaching).

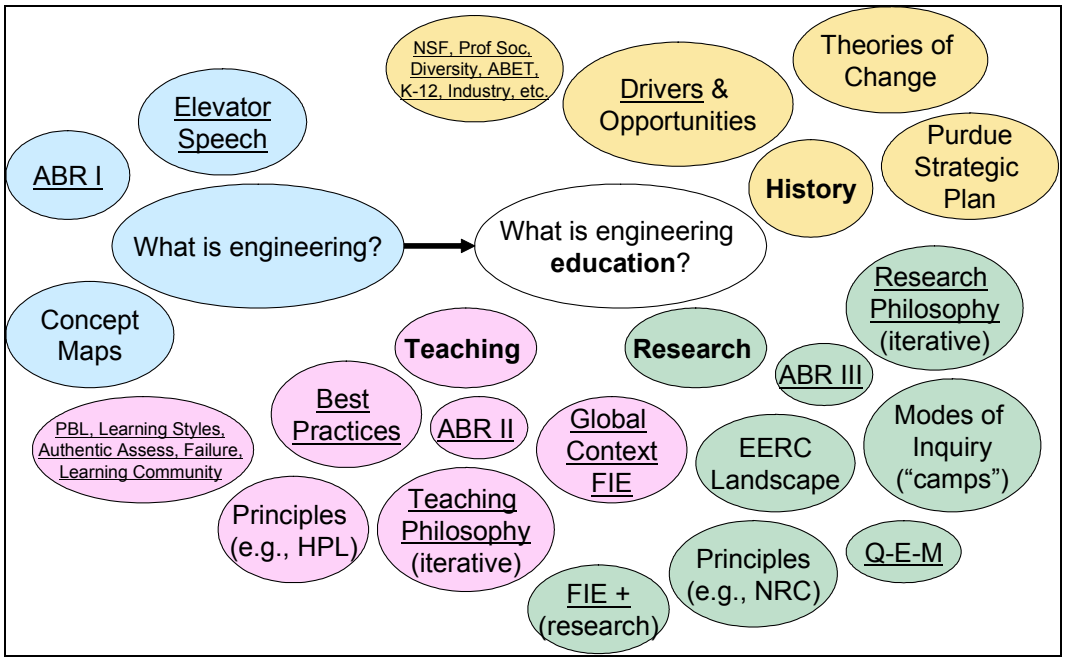

Figure 1. INTRO Course Organization

To accomplish the goals of building community and developing identity within engineering education, faculty centered course content on the development of a first set of engineering education philosophy statements, including an engineering "elevator speech" (a response to the questions "what is engineering?" and "what is your role?" as if the questions were posed by a stranger on an elevator ride), a teaching philosophy, and a research philosophy. Each statement was developed through a series of revision cycles, starting with auto-biographical reflections (ABRs). ABRs provided an (1) entry point for discussing ideas about engineering education and locating identities within an engineering education landscape and (2) an initial framework for organizing current views and exploring future ideas. An example of an ABR is presented below:

ABRII: Teaching Engineering

Write a reflection on your ideas about teaching engineering. Your reflection should clearly address these questions:

- *What are features of effective engineering education instruction (e.g. in or out of the classroom, at a distance)?*
- *What does effective mean to you?*
- *Describe two critical incidences or experiences from your personal history that have shaped your ideas about effective instruction.*

Follow-up activities were designed to build on topics addressed in the ABRs and facilitate students' development and articulation of their own philosophies. In keeping with the teaching engineering example, follow-up activities to ABRII were designed to give students (1) a landscape view of best practices of engineering teaching and learning; (2) an understanding of the purpose and elements of a teaching philosophy and how one's philosophy relates to his/her practice; and (3) techniques for probing deeper into one's own values and beliefs regarding teaching and learning. (See the course schedule in the Appendix for a list of course topics and assigned readings.)

Active learning techniques including think-pair-share, jigsaw, and concept maps were employed to promote collaborative learning, knowledge building communities, and feedback on student ideas/work. For example, after discussing cooperative learning as a "best" practice, students participated in a jigsaw where teams each discussed the extent to which one of five learning activities (that had previously been employed in the course) exemplified the principles of formal cooperative learning. Each team discussed a different learning activity. Then new teams, in which each team member had expertise regarding a different learning activity, were formed and charged to rank the five activities from least- to best-aligned with formal cooperative learning principles. In a separate learning activity, student teams postulated the values and philosophy of an engineering instructor who incorporates cooperative learning in his/her classes.

Student teaching and research philosophies and their elevator speeches went through at least one iteration cycle, with students receiving feedback from classmates, the course instructors, and, in the case of the teaching philosophies, peers from the Laboratory for User-Centered Engineering Education (LUCEE[8]) at the University of Washington (LUCEE is devoted to applying the methods of user-centered design to the challenges of engineering education.) Final versions were evaluated against criteria developed by the class. The use of peer feedback and consensus building to develop criteria for evaluating students' final products also promoted community building among the students enrolled in the course.

One additional project was required in the course: in teams of three, students were charged with preparing and delivering to the class a 50-minute presentation about a state-of-the-art teaching practice of their choice. Student teams identified an article the class would read about the teaching practice. Presentation content includes a description of the practice, evidence or theory supporting it as a good practice, and a demonstration or description of how the practice could be used in engineering education. Students were evaluated by their peers and the instructors on the quality and content of their presentations. Again, this is a very community building oriented pedagogy.

INTRO Course Evaluation

Students enrolled in the INTRO course were very diverse. A total of fifteen students enrolled including the entire first cohort (N = 11) in the Department of Engineering Education. The four graduate students from outside of the department represented science education, technology, and other engineering sub-disciplines. Seven women, four international, and four underrepresented students were enrolled. Thirteen students hold at least one engineering or engineering technology degree, with at least five different engineering disciplines being represented (i.e., civil, electrical, electrical and computer, industrial, and chemical engineering).

The focus of the course evaluation was to gain insight into the effectiveness of the course design and the extent to which the course objectives were met. While both quantitative and qualitative course evaluations were conducted, only the quantitative results will be presented here. Quantitative course evaluations were conducted at the start of the final class meeting. The evaluation consisted of 37 five-point Likert Scale items where the responses were strongly agree, agree, neutral, disagree, and strongly disagree. The items evaluated the following areas: achievement of course learning objectives, relevance of course to professional development,

teaching methods employed, community building, and identity development. With the exception of the course learning objectives, all items were drawn from the Purdue Instructor Course Evaluation Service (PICES) System[9] PICES is a catalog of over 600 items divided into 23 categories which instructors can use to create a course evaluation[10].

Table 1 presents the results of the quantitative evaluation items that pertain to the achievement of the course learning objectives. These course objectives map to the three overarching course goals: developing an engineering education identity, articulating the nature of engineering and engineering education scholarship, and promoting community. This last goal can be extended to understanding the broader engineering education community such as developing a sense of the engineering education landscape – its history, major influences, and opportunities to contribute.

Table 1. Evaluation of INTRO Course Learning Objectives (N = 15, unless otherwise noted)

595A Course Objective	As a result of the successful completion of this course, I am able to:	No. Strongly Agree	No. Agree	% Strongly Agree	% Strongly Agree or Agree
1	Define engineering and the engineering method, and list attributes of engineering as a profession.	8	6	53%	93%
2	Describe the context of engineering education in the US and globally (N = 14)	2	10	14%	86%
3	Describe the history, the present, and the future scenarios of engineering and engineering education	3	8	20%	73%
4	Summarize "state of the art" or "best" practices for teaching and learning engineering	8	6	53%	93%
5	Describe drivers and opportunities that are enabling engineering education research.	8	7	53%	100%
6	Map the landscape of engineering education research at Purdue	2	9	13%	73%
7	Describe the elements of an engineering education research study	7	6	47%	87%
8	Articulate a clear personal teaching philosophy statement	11	4	73%	100%
9	Articulate a clear personal research philosophy statement	5	8	33%	87%
	Objectives of course are appropriate	8	6	53%	93%

As stated previously, the INTRO course strongly emphasized students iterative development of teaching and research philosophy statements that reflected their beliefs, values, goals, and interests. By the end of the course, all the students agreed (and more than half strongly agreed) that they could articulate their own teaching philosophy (Objective 8). As shown in Table 2, course evaluations regarding articulating a research philosophy were also positive, yet to a lesser extent (Objective 9). Observations drawn from the philosophy drafts suggest that students were more familiar with ideas about effective pedagogy than about the nature of engineering education research. Similarly, for many of the students this was the first time they had ever reflected on their ideas about research. As such, the differential gain in developing a research philosophy might be expected.

Objectives 1, 4, and 7 emphasize the kinds of knowledge and skills associated with engaging in engineering education scholarship. As shown in Table 1, most students perceived that the course had a positive impact on their understanding of engineering as a profession (Objective 1) and effective pedagogies for engineering education (Objective 4). To a slightly lesser extent, students felt that their ability to describe the elements of an engineering education research study had increased (Objective 7). Students also perceived that the course positively impacted their understanding of the engineering education community. All students perceived gains in their ability to describe drivers and opportunities in transforming engineering education (Objective 4). Most of the students agreed that the course developed their understanding of the context of engineering education (86%, Objective 2) and the history and future scenarios of engineering education (73%, Objective 3). Similarly, 73% of the students agreed that the course impacted their ability to map the engineering education research landscape (Objective 6).

Overall, the course evaluations suggest that course objectives were met. Similarly, more than 90% of the students agreed or strongly agreed that the course broadened their views and helped organize their ideas. It should be noted that some of the students in the course were in the later phases of their doctoral degree, whereas for most, the course was truly an introduction to engineering education. This may help explain some of the variations observed in the evaluation results.

Additional course evaluation items illustrated aspects of the learning environment that contributed to learning. Most of the students strongly agreed or agreed that:

- "the teaching methods used in this course enable me to learn" (80%),
- "adequate feedback is provided to guide my progress in this course" (67%),
- "meaningful feedback on coursework is provided" (87%),
- "class discussions are helpful to my learning"(80%),
- "team teaching is effectively used in this course (87%),
- "team teaching provides insights a single instructor cannot" (80%),
- "the course appears to be well organized" (87%), and
- "progression of this course is logical from beginning to end" (87%).

Overview of SEMINAR course (ENE 695A)

ENE 695A - Seminar in Engineering Education - (hereafter called SEMINAR) is a one-credit hour course with a focus on community building. The aim of the seminar is to give graduate students an opportunity to interact with one another and with members of the engineering education community at local and national levels. During fall 2005, these interactions were facilitated via three interviews—a peer interview in which students interviewed one another, an internal professional interview in which students interviewed engineering education faculty or researchers on campus, and an external interview in which students interviewed off-campus leaders in engineering education.

Prior to the first class, the course instructor asked several ENE graduate students about topics that they would like to learn more about within the seminar. Creating a curriculum vitae and interacting with upper-level administrators at the university were recommended activities. Also,

engineering education faculty new to campus presented their programs of research, and speakers from various campus resources spoke on topics of interest to graduate students (Table 2).

The SEMINAR course learning objectives are:

COURSE LEARNING OBJECTIVES

As a result of taking this course, the participants will develop the knowledge and skills to:
1. Define my role in the engineering education community
2. Identify and interact with members of the engineering education community at the local and national level
3. Identify and utilize resources that will help me successfully complete my doctoral program
4. Identify and utilize resources that will help me successfully transition into the professional engineering education community

SEMINAR Course Implementation

A goal of the course was to develop a sense of community among ENE's first cohort of graduate students, between students and ENE faculty, between students and the university community, and between students and the national engineering education community of scholars. To encourage a community among the cohort, students interviewed one another using student-generated questions and wrote two-page synopses of their interviews. Similarly, students wrote synopses of interviews with faculty within Purdue's Department of Engineering Education and with off-campus researchers with interests in engineering education research. Students delivered four-minute in-class presentations on their external interviews during week 14 of the course. Additional connections to the on-campus community were established via interactive sessions with staff from Purdue's Center for Career Opportunities and the Office of the Vice President for Research.

To help students develop their identities within engineering education, students learned about on-campus engineering education research projects and wrote a final reflection paper. Over the course of the semester, four ENE faculty, an ENE doctoral candidate, and an international engineering education researcher presented their research and answered students' questions about the research process (Table 2). At the conclusion of the seminar, students reflected upon how the presentations, interactive sessions, and course content helped them identify additional resources that they might need to tap into during their tenure at Purdue. Additional suggestions for the reflection paper included a description of an engineering education timeline (e.g., list of activities that students might become involved in within the department or the engineering education community, research projects that students would like to start, etc.) and a summary of professional goals that students wanted to achieve as engineering educators.

SEMINAR Course Evaluation

Nine of the eleven students within the course completed an evaluation of the seminar on the last day of class. The survey had quantitative items that focused on achievement of course learning

objectives, teaching methods employed (including the invited speakers), community building, and identity development. As with the quantitative evaluation of the INTRO course, all items with the exception of the course learning objectives were drawn from the PICES list. The rating scale was a five-point Likert Scale where the responses were strongly agree, agree, neutral, disagree, and strongly disagree. Results from the evaluation of the course learning objectives are presented in Table 3.

Table 2. SEMINAR Schedule of Topics & Assignments

Week	Topic	Assignment
1	Departmental Introductions & Announcements	
2	Curriculum Vita Workshop Presentation Sponsored by Purdue's Center for Career Opportunities	
3 & 4	Research Presentations by Engineering Education Faculty Members	Peer Interview Synopsis
5	Interaction with Engineering Education Graduate Program Chairperson	
6	Engineering Education Student Recruitment Discussion with ENE Director of Communications	
7	Research Presentation by Engineering Education Faculty Member	
8	October Break	
9	Student Attendance at Frontiers in Education Conference (No Class)	
10	Engineering Education Resources Discussion	Professional (Internal) Interview Synopsis
11	ENE Doctoral Student Presentation	
12	Research Funding Presentation by Purdue's Director of Research Development Services	
13	Presentation by Purdue University Provost Research Presentation by Visiting Engineering Education Researcher	Professional (External) Interview Synopsis
14	Student Presentations of External Professional Interviews	
15	Student Discussions of Interviews and Discussion of Spring 2006 Courses	
16	Research Presentation by Engineering Education Faculty Member	Reflection Paper

Table 3. Evaluation of SEMINAR Course Learning Objectives (N = 9)

As a result of the successful completion of this course, I am able to:	No. Strongly Agree	No. Agree	% Strongly Agree	% Strongly Agree or Agree
Define my role in the engineering education community	3	4	33%	78%
Identify and interact with members of the engineering education community at the local level	7	2	78%	100%
Identify and interact with members of the engineering education community at the national level	4	4	44%	89%
Identify and utilize resources that will help me successfully complete my doctoral program	4	5	44%	100%
Identify and utilize resources that will help me successfully transition into the professional engineering education community	4	4	44%	89%
Objectives of course are appropriate	5	3	56%	89%

Overall, course evaluation ratings for the SEMINAR were positive. All students who completed evaluations for the course agreed or strongly agreed that the seminar gave them an opportunity to interact locally with members of the engineering education community and helped them to identify and utilize resources that would help them to complete their doctoral programs successfully. Only 78% of the students agreed or strongly agreed that the seminar helped them define their roles within the engineering education community. This number might be explained by some students' exposure to engineering education research and resources prior to the course.

Evaluation of Shared Goals: Building Community and Identity Development

A cohort of 11 students participated in both the INTRO and the SEMINAR courses. As described in earlier sections, both courses shared goals of building community and promoting identity development within engineering education. These two goals emphasize key attributes of the ENE program for promoting the long-term success of our students: developing ideas regarding their role in engineering education, a plan for having an impact within the department and the larger community, and a strong social network. For example, in both courses students explored and articulated their ideas about engineering education research and teaching. This included how they perceived their role in engineering education as well as their goals for what they want to achieve in this profession. Similarly, a variety of opportunities were incorporated in the courses to promote community. These include opportunities to discuss ideas with peers and faculty, investigating the engineering education community, and networking with the broader engineering education community.

To evaluate community and identity issues across both courses, we included the same items from the PICES list on the final quantitative course evaluations. Items were ranked on a five-point Likert scale from strongly agree (SA) to strongly disagree. These results are provided in Tables 4 and 5. Across both courses, students experienced the classroom as an environment that promoted inclusivity, mutual respect, and freedom of expression. These attributes of the learning environment were designed to promote community building among the cohort within and to some extent outside of the classroom. For example, all of the students felt that the INTRO and SEMINAR courses promoted freedom of expression and sharing of ideas in class. Similarly, 87% of the respondents from the INTRO and all of the respondents from the SEMINAR perceived mutual respect as a concept practiced in the classroom. A similar pattern was seen for the item characterizing opportunities to learn from other students. An interesting result was the extent to which students felt motivated to discuss new ideas outside of class (more than 75% of the respondents from both courses).

Items that were selected to evaluate the extent to which the courses promoted identity development emphasized personal and professional growth (Table 5). For example, part of developing an engineering identity is understanding one's professional goals and aspirations. For both courses, more than 75% of the respondents agreed or strongly agreed that the course made them more aware of their interests and talents, contributed significantly to their professional goals, and related to their educational path. Of particular interest is that more than 75% of the respondents strongly agreed that both courses play an important role in their education.

Table 4. Evaluation of Community Building

	ENE 595A (INTRO to Engineering Education) (N=15)			ENE 695A (SEMINAR in Engineering Education) (N=9)		
PICES Item	Percent SA	Percent SA & A	No. SA & A	Percent SA	Percent SA & A	No. SA & A
This course shows sensitivity of individual interests/abilities	27%	73%	11	33%	78%	7
This course provides an opportunity to learn from other students	67%	87%	13	67%	100%	9
I feel that I am an important member of this class	53%	87%	13	67%	100%	9
Mutual respect is a concept practiced in this course	73%	87%	13	78%	100%	9
I am free to express and explain my own views in class	53%	100%	15	89%	100%	9
I am motivated to discuss new ideas outside of class	47%	87%	13	44%	78%	7

Table 5. Evaluation of Professional Identity Development

	ENE 595A (INTRO to Engineering Education) (N=15)			ENE 695A (SEMINAR in Engineering Education) (N=9)		
PICES Item	Percent SA	Percent SA & A	No. SA & A	Percent SA	Percent SA & A	No. SA & A
This course made me more aware of my interests and talents	40%	87%	13	33%	78%	7
This course contributes significantly to my professional growth	53%	87%	13	44%	78%	7
The relationship of course to my education is apparent	80%	87%	13	78%	78%	7

Despite the variety of topics covered within the INTRO and SEMINAR courses, current levels of interaction with the local and national engineering education community, previous exposure to resources within engineering education, and prior development of their professional identities may have contributed to students' lower evaluations of professional identity development than their evaluations of community-building. For example, one student had begun writing her dissertation in an engineering education area, another student had taken several educational methods courses prior to the course, and another student had completed a master's thesis in an engineering education area. All three of these students had also either attended or presented at a national engineering education conference prior to the course.

Overall, the majority of the students agreed that both courses helped them to develop a professional identity and to establish community at local and national levels. The evaluation results highlight opportunities to improve the two courses. For example, to increase sensitivity to students' interests and abilities, future seminars might provide additional or different experiences for students in advanced stages of their doctoral programs. In addition, formative surveys distributed throughout semester may provide guidance in developing topics that will be presented during the latter part of the course. Similarly, the evaluation results for the INTRO course suggest that greater care be given to creating a learning environment that shows greater

sensitivity of individual interests and abilities. This will be particularly important for the ENE program given that pathways to the program will be interdisciplinary in nature and therefore student backgrounds will continue to be highly diverse.

Conclusion

Launching a new interdisciplinary graduate program is an exciting endeavor. New courses need to be developed, and there are considerable opportunities for designing innovative graduate level experiences. A new field also requires proactively thinking about how to bring people into that profession as well as how to promote community to sustain and grow the profession. At Purdue, two courses in engineering education were developed to meet this challenge. Although each course had specific learning objectives, both shared a focus on promoting community building and identity development. These shared goals were targeted to promote the success of our graduates by building an educational experience around who they are, who they want to be in an emerging profession, what it means to be in that professional community, and how to get there. As such, the INTRO and SEMINAR courses were design to initiate our new graduate students into engineering education scholarship by providing a learning environment that facilitated community and identity development as an engineering education scholar. Together, these courses provided opportunities for our students to engage in the engineering education community – both locally and nationally.

Both courses were designed to emphasize community building and identity development by providing opportunities to explore the engineering education landscape and their role within that landscape. At a local level, the learning environment emphasized multiple forms of interactions between peers, faculty, administrators, and other scholars (national and international). For example, for the INTRO course students developed personal philosophy statements about engineering education, teaching, and research; for the SEMINAR course students developed an action plan for their professional career which included a timeline and description of professional goals. Similarly, both courses required students to explore the recent Frontiers in Education Conference in Indianapolis – either interviewing engineering education leaders attending the conference or identifying papers on global engineering education to share with their peers. Overall, the evaluation results illustrate that course learning objectives were met, although there was also opportunity for improvement. The results also illustrated that students perceived the learning environment as promoting the course goals.

One student described it best in the written course evaluation:

"….Honestly, I don't think I have ever reflected so much on my values about education in my life…of course, this is tied to the course as well as the nature of this being my first semester in ENE and a member of the first cohort of graduate students…I often related to the experiences of other students…I realized I had similar experiences and opinions with some of the other students and professors in the course. It's sort of community building in a way because I believe I am working with people who I share similar values with in many cases. The course made me ask myself a lot of questions about our community, who are the members and where I fit in this community as far as my interests. It's great because each of us have unique interests and passions and for some of us, unique responsibilities and the course discussions and assignments

helped me begin to shape my ideas about what my responsibilities/role may be in the engineering education. More than anything from the course, I know that my identity will continue to change (similar to how teaching philosophies and research philosophies grow over time). This is a huge comfort."

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Appendix A

Table A.1. INTRO Schedule of Topics and Assignments

Week	Topics	Assignments Posted
1	Course Syllabus & Expectations Community Building **What is engineering practice?** • Landscape of Engineering Practice	ABR I – Engineering. & Engineering Practice Reading – Engineering Education Landscape: Drivers, Opportunities, and Challenges[A1-A5]
2	**What are ways to influence (change) engineering education?** • Drivers, Opportunities, & Challenges • Theories of Change	Elevator Speech Draft Landscape of Engineering Education "Drivers" Reading – More on Drivers[A6, A7]

Week	Topics	Assignments Posted
3	**What are opportunities for change?** • Homework Report Out – Driver Investigation Revisit: **What is engineering practice?** • Peer Review Elevator Speech • Develop review criteria • Instructor Feedback on ABR I	Best Practices in Engineering Teaching and Learning - List of 10+ Landscape of Engineering Education: The National Science Foundation as a Driver ABR II – Teaching Engineering Reading - Collaborative / Cooperative Learning [A8-A10]
4	**What are best practices in engineering teaching and learning?** • Insights from the learning sciences • Landscape view • Investigate "Collaborative / Cooperative Learning" as a best practice	Elevator Speech Final Reading - Teaching Philosophies[A11] • Locate two teaching philosophies on the Web. Reading - Reflections on Teaching or Thinking about Teaching[A12,A13] Best Practices in Engineering Teaching and Learning – Team Assignment
5	Cooperative Learning • Define what is cooperative learning (consensus) and discuss how to improve CL activities **What is a teaching philosophy?** • Identify purpose of teaching philosophy • Develop and test rubrics to evaluate teaching philosophy content and style • Broaden vision of what your teaching philosophy could comprise	Reading - Teaching Philosophy[A14] Reading - Teaching & Learning is Disciplinary[A15] Reading for Best Practice 1 – Problem-Based Learning[A16] Reading for Best Practice 2 – Teaching Pedagogies for Diverse Learners[A17]
6	**What are best practices in engineering teaching and learning?** • Best Practices Presentations: o Problem-Based Learning o Teaching Pedagogies for Diverse Learners	Best Practices in Engineering Teaching & Learning - Reflection Teaching Philosophy Rubric – Putting it to Test Reading for Best Practice 3 - Performance Based Assessment / Authentic Assessment[A18] Reading for Best Practice 4 – Learning from Failure[A19] Readings – Teaching Philosophies[A20]
7	**What are best practices in engineering teaching and learning?** • Best Practices Presentations: o Performance Based Assessment / Authentic Assessment o Learning from Failure **What is a "good" teaching philosophy?** • Generating a Rubric	Frontiers in Education 2005 • Global/International Paper • Education Research Paper Reading for Best Practice 5 – Learning Communities[A21]
8	**What are best practices in engineering teaching and learning?** • Best Practices Presentations: o Learning Communities **How do best practices relate to the teaching philosophy?** Navigating FIE	Teaching Philosophy Draft What is Engineering Education? - read and dissect 2 research papers • FIE paper • Best Practice related paper
9	FRONTIERS IN EDUCATION (FIE)	•

Week	Topics	Assignments Posted
10	**What is the engineering education landscape?** • Debrief global perspectives (FIE paper) • Debrief education research papers • Creating an engineering education research landscape based on the EERC	ABR III – Engineering Research Reading - Perspectives on Research[A22-A23] Expanding the Research Landscape – Generate 10 research question with an EERC theme
11	**What is engineering education research?** • Comparing research in the physical and social sciences • Identifying the necessary knowledge and skills • Questions, methods, and evidence • Generate a research question	Reading - Qualitative and Quantitative Research[A24-A26] Peer Feedback on Teaching Philosophy Drafts Mapping research questions, evidence, and methods – refining your research question
12	**What is engineering education research?** • Comparing modes of inquiry **What is a research philosophy?** • Finding your research identity	Reading - Development of a Research Study[A27] Reading - Debate on the Nature of Education Research[A28] Reading - Research Philosophies • Locate two research philosophies on the Web.
13	Teaching Philosophy • Redevelop rubrics to evaluate teaching philosophy Research Philosophy • Develop and test rubrics to evaluate research philosophy	Teaching Philosophy Final Research Philosophy Draft Reading - On Becoming an Engineering Education Researcher[A29] Reading - On Preparing Engineering Education Scholars[A30]
14	THANKSGIVING	
15	Engineering education research • Identify challenges / strategies about research philosophy statements • Summarize features of engineering education research Engineering education as a profession • Characterize attributes of a profession - Link to preparation for engineering education profession • Characterize forms of scholarship - Link to forms of scholarship in engineering education • Design an engineering education program	Peer Feedback on Research Philosophy Drafts Peer Evaluation on Teaching Philosophy Finals Research Philosophy Final Written Course Evaluation
16	Research Philosophies • Identify challenges / strategies about research philosophy statements • Provide peer feedback on strengths and what needs improvement Elevator Speeches Revisited • Reflect on "your role" – has it changed? Engineering education research – What does it look like? • Attend an MS Defense	

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