

# “Wait ... There is a Ph.D. in Engineering Education?” The First Year Experience of Three Students in an Engineering Education Department

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**Abstract** – As the field of engineering education continues to expand, so does the number of students receiving doctorates in the field. While engineering education programs are being actively developed, little is known about how students are experiencing these programs. This paper explores the first year experience of three students currently enrolled in an engineering education doctoral program. Each student attends the same program but varies in terms of their pre-entry attributes and goals. For this study an autoethnographic approach was taken, in which we first collaboratively developed an essay prompt related to our first year experience and how we entered the field of engineering education. We then each answered the prompt independently. Finally, we analyzed our responses for themes and trends. This paper is a first step towards better understanding the student experience in the field so that more work can be done related to students’ institutional experiences in engineering education.

*Keywords:* graduate student, autoethnography, engineering education programs, student experience

## INTRODUCTION

The number of programs that offer doctorates in engineering education (or similar degrees such as STEM education or technology education) is increasing as the field of engineering education moves to a more rigorous research discipline. Students in these programs take classes to situate themselves to become active members of the engineering education community, serving as both trained and experienced teachers and exceptional researchers. While current research has commented on the activities of students in these programs, little to no work has been done examining the students’ perspective on their experiences within these programs. Understanding the student perspective is extremely important so that programs can be designed to meet the needs of the students and provide meaningful and rich experiences to situate them to become experts. This work fills a gap in current literature by presenting an autoethnographic perspective on the first year experience of three students in an engineering education doctoral level program, examining our initial reasons for entering the field and our experiences through the first year.

## LITERATURE REVIEW

Although there has been little work specifically in our area of study, there are exemplar studies in the field of engineering education that adopt a similar research approach to understand faculty and student perspectives. We also draw on the studies that document the activities and classes taken by doctoral students in engineering education programs. Again, this paper is unique in that it presents information from the students’ perspective on their first year within engineering education.

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## **Similar Studies Informing our Approach**

A valuable body of literature exists which describe personal experiences and give advice to those engaged in engineering and engineering education related fields. Most of this work has been from the faculty viewpoint. For example, Lori and J. W. Bruce have written several papers related to their experiences as faculty members. One of their papers focuses on being married faculty in an engineering department [1], another focuses on balancing teaching, research, and service [2], and another provides their perspective on being an effective faculty member in the classroom [3]. Lozano-Nieto also wrote a perspective and advice piece based on scholarship in the engineering technology field [4]. Such papers help inform prospective and new faculty about the challenges and triumphs they may face as they move forward in their careers. Such pieces are essential in passing along information to the next generation of participants in a field. To capitalize on a similar knowledge base, our paper is addressed to future engineering education students to promote understanding of the field. However, we also see a potential audience as engineering education program administrators. Administrators in engineering education can gain valuable insight into the lived experiences of students in their programs through this work.

Students have also presented work related to their experiences in graduate school which serve as a source of inspiration for those entering the field. For example, Melvin wrote a paper that described his path through education pointing out some common pitfalls and strategies for overcoming them to assist future graduate students [5]. Also, Kotys-Schwartz and Zarske documented their experiences as teachers in outreach experiences during their graduate experience [6]. Each of these papers provides a firsthand perspective on a situation and provides advice for others in similar positions from the student view point. These types of papers are often viewed as position or editorial papers, but we believe if a systematic process is taken to explore the thoughts and opinions of the authors, the paper can be classified as autoethnographic research.

While existing studies do not often specifically call themselves autoethnographies, they could be classified as such if a systematic research focused approach was used to gather, analyze, and present the findings. Rossman and Rallis define autoethnography as a subset of ethnography that focuses on personal narratives [7]. In an autoethnography, “the focus is on the self, the personal experience that warrants narration” ([7], p. 94). An autoethnography allows the researcher to focus on his or her personal experiences as a means to gain insight into the culture of interest [7-8]. The work presented in this paper is considered an autoethnography because it is based on the firsthand accounts of the authors on an experience captured through narratives that were theoretically and methodologically grounded and analyzed.

## **Building on Prior Research**

Our work draws on existing work describing the practices of graduate students becoming engineering educators and general recruitment literature. For example, McNair and Borrego presented work on ePortfolio development in a graduate engineering education classroom [9]. Oware, Capobianco, and Diefes-Dux reported findings from interviews with students in engineering education related to the definition of engineering education, future challenges for engineering educators and the overall role of future engineering educators [10]. Finally, other studies have looked at developing a community of practice with students involved in engineering education research (e.g., [11], [12]). Rather than exploring curricular practices, we seek to understand the full experience of students in engineering education programs to offer recommendations to program administrators and future students. Similar studies have also explored students’ experiences directly but most of this work in traditional engineering programs focuses on mentoring programs for undergraduate students [13]. Some studies at the graduate level have been done, and they center on recruiting minority groups to graduate programs such as women (e.g., [14]). Our work is slightly different in that it focuses on general recruitment and experiences in a developing field solely at the graduate level.

## **Theoretical Framework**

Although several theories address educational experiences in the context of retention, and in doing so they highlight important factors that affect the experience (e.g., [15], [16]), we situate our study in Tinto’s Longitudinal Model of Institutional Departure [17]. In this theoretical framework, there are six interconnected categories that are linked over time. The motion through time is pre-entry attributes, goals and commitments, institutional experience, personal/normative integration, goal and commitments to outcome. While this is not a retention paper, per se, we selected this framework to guide this work due to the focus on institutional experiences as well as individual characteristics. Particularly, we have focused on the first three main categories (pre-entry attributes, goals and commitments, and institutional experience) to understand how engineering education students experience being a

graduate student in doctoral engineering education programs. Tinto's model provides great detail on each of the categories and even subcategories, but for this work we have taken a simplified approach. Figure 1 below depicts the part of the model that we used in our study.

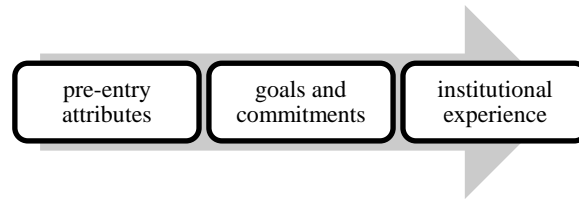


Figure 1: Modified Theoretical Framework

The way we employed the theory in our work allowed for a structured analysis of essay reflections on questions directly linked to Tinto's model. In other applications this model has been used to evaluate retention programs, cultural differences related to persistence, general motivation, etc. (e.g., [18], [19]).

## METHODS

We adopted an autoethnographic approach using qualitative research methods. Each researcher reflected in writing on their entry into the field and their experience as a first year doctoral student in engineering education. While the results of this work are from the perspective of the authors, a systematic process was used to collect and analyze the data. First, an essay prompt was collaboratively developed by the researchers that focused on the first year experience in a doctorate program and personal reasons for entering the field. Our aim for the prompt questions was to closely examine our goals, commitments, and overall institutional experience, which directly aligned with Tinto's model [17]. Once the prompt was developed, it was reviewed by an engineering education faculty member as a measure of validity. As a result of the review, one question was added. The final questions were as follows:

- 1) Why did you decide to pursue a degree in engineering education?
- 2) What were your pre-entry attributes (family background, skills and abilities, prior schooling, etc.)?
- 3) What were your initial goals and commitments?
- 4) What was your first year institutional experience?
- 5) How have your goals and commitments changed since you first started the program?

The next step in our process required the creation of narratives. In doing so, each researcher was given two weeks to answer the prompt questions and allotted a maximum of two single-spaced pages using 12-point font. Once the prompt questions were answered, we met to analyze the narratives.

The narratives were analyzed using an open coding structure where general trends among the prompt responses were recorded. Once the similarities were found between the responses, major differences were also examined. This process allowed categories or themes to be developed [7]. Following the initial coding sessions, we met as a group to review the findings as discuss any points of interest or to expand on initial observations. This systematic approach to analysis allowed for themes to be generated directly based on the three narratives.

## RESULTS

Analysis of the narratives yielded several themes. These key findings are offered in reference to each of the prompt questions for ease of organization.

### **Why did you decide to pursue a degree in engineering education?**

We each saw value in pursuing a Ph.D. in engineering education and personally viewed the degree as more useful than a traditional engineering degree. One author said:

“Even with pushes from others (e.g., major professor, dad), I did not see value in a Ph.D. in [a traditional engineering field]...my interests were more in the human-side of things.”

Similarly, another stated:

“I knew that researching student learning and development was a much better fit for me compared to traditional ... engineering work out in the field.”

Rather than pursue a traditional engineering Ph.D., we each thought that engineering education’s direct focus on people (opposed to physical objects) better suited our interests.

Interestingly, the decision to pursue a Ph.D. in engineering education was powerful and swift. We were each very positive about our choice and enrolled within one year of learning about Ph.D. programs in engineering education. The powerful and swift decision is detailed by one author:

“I had no idea there was a degree in engineering education, but it was exactly what I was trying to do by combining my [traditional engineering] interests with a degree in education. I did a little research, found the Purdue program, and within a month was visiting the schools, within four months had applied, and within eight months accepted and quit my job.”

Once we heard about the field (not the department, the university, etc.), there was a strong desire to enter an engineering education doctoral program and each of us took deliberate steps to ensure that happened quickly.

### **What were your pre-entry attributes?**

The major theme when discussing pre-entry attributes was that each of us was very different. Our attributes are summarized in Table 1.

<b>Highest degree</b>	Bachelors	Masters	Masters
<b>Region</b>	South Carolina	Mississippi	Ohio
<b>Engineering field</b>	Industrial engineering	Computer engineering	Civil engineering
<b>Minor field</b>	Sociology	None	None
<b>Prior teaching experience</b>	None	Less than one year	More than one year; course coordinating
<b>Prior research experience</b>	Undergraduate research experience	8+ years (undergraduate, graduate, and full-time work)	Only research experiences related to thesis

Table 1: Summary of Pre-Entry Attributes

In addition to the information presented in Table 1, we differed in our positions before we began the Ph.D. program. One author entered the doctoral program directly from an industrial engineering bachelors program. Another author directly entered the program from a master’s program. Finally, the third author entered the program after working full-time for six and a half years in a research lab. Also, one of us entered the program as a graduate research assistant while the other two entered as graduate teaching assistants. Each brought a unique background to this study, which helped to provide meaningful and unique results.

### **What were your initial goals and commitments?**

We each had initial goals that focused on coursework, research, and teaching. However, coursework-related goals initially dominated the first year. As two authors stated:

“I knew I wanted a good balance of research, teaching and practical (recruitment and retention) experience, but in the beginning, I just wanted to keep my research advisor happy and make good grades.”

“To be completely honest, when I first arrived I knew I *wanted* to teach, and I knew I *had* to do research. ... My overall goal was just to complete my classes and get involved in the engineering education community.”

With each of us enrolled in required coursework, coursework completion was a common theme, but we did also comment on other aspects of our goals and commitments briefly.

### **What was your first year institutional experience?**

Overall, our first year experience was positive. We each described a period of social adjustment where “who I could work with and who I could not work with” emerged. We also describe positive experiences with faculty:

“I actually felt like my advisor was there to advise me” and “[Faculty] really helped me feel like part of the engineering education community and supported me in my exploration of the field”.

We also each highlight the high level of individual responsibility:

“I was able to co-direct the bridge program for incoming freshmen and teach one of the engineering classes.”

Finally, we each describe ownership for our program:

“This degree is definitely ‘my’ decision and with that, I wanted to keep an open mind and make sure that I was pursuing ‘my’ interests and not someone else’s. ... it was very important to me that I was making my own choices based on my interests.”

While we each had very different first year experiences, we each had many positive examples of social adjustment, social interaction, and available opportunities.

### **How have your goals and commitments changed since you first started the program?**

All of our goals changed to some extent, with the majority of goals becoming more focused. For example:

“I see myself really focusing on research and more specifically publications”

“I have also become more committed to the undergraduate engineering students”

As one author put it, “I think ‘exposure’ to new ideas and ways of thinking was one of the most important experiences of my first year” which allowed her to modified her goals from an informed perspective.

## **DISCUSSION**

As we initially discussed our responses, we were each surprised that none of us knew about engineering education until the year prior to entering the program. An important message to the audiences of this work is that simply because a student is at a school that has faculty participating in engineering education research does not mean that that student will be informed about the field. For each of us, there was a single person who acted as the gatekeeper to the field. That gatekeeper provided access to the field by recognizing our potential interest and then by providing information about the field. Our gatekeepers were sometimes professional colleagues and sometimes classroom professors. Even though there were faculty conducting engineering education research at each of our home universities before we began in our doctoral program, we did not know of the field until our gatekeeper provided access.

The second surprise came when we realized how different our responses were even though we were from the same engineering education program. Though this result is consistent with Tinto’s model suggesting pre-entry attributes and goals and commitments shape institutional experience, we were surprised since we were enrolled in similar courses and had many similar first year experiences. Our various means of social integration may have been a contributing factor to this difference. We chose various living arrangements (on-campus graduate dorm versus off-campus apartment), we had different office experiences (large, loud, shared office versus smaller, quieter office), our offices were located in different locations (in the main building near faculty offices versus in another building), and we participated in different social circles (engineering education graduate students only versus university-wide groups). Social integration was a major part of the first year for each of us since we all relocated when beginning our doctoral program. Our various ways of integrating may have had a stronger influence on our first year than we originally assumed.

Upon further reflection, we discovered that we all met resistance while beginning to pursue our engineering education degrees. While this was not specifically part of the prompt, it came out during discussion of our results and during coding sessions. The resistance varied from remarks that engineering education was not a true engineering field to others explicitly stating that a degree in engineering education was worthless and the student

would be better off pursuing a Ph.D. in a traditional engineering discipline. This resistance was directly at odds with the encouragement provided by the gatekeeper.

## CONCLUSIONS

This study and reflection of our first year experiences in an engineering education program provided many benefits. Personally, we each were able to evaluate our previous year and identify short-term goals that may need further modification for each of us to reach our long-term goals. Also, the experience of writing a paper and coordinating efforts is a valuable skill for graduate students to have. However, true to our reasons for entering the field of engineering education, it is not the small personal gains that are most important. It is our hope that the themes, patterns, and ideas presented in this paper will impact future engineering education community members. Particularly...

For administrators interested in recruiting potential engineering education students...

- It is important to advertise the field more. Each of us came from different programs and different universities that had engineering education researchers, but each of us did not know about the field until a particular individual lead us to the field. Faculty, administrators, and current graduate students could potentially be a gatekeeper to engineering education, so it is important that we included a wide range of people in advertising campaigns, both at schools actively involved in engineering education and those schools that are not.
- It is important to consider a student's social integration when they are beginning your program. Each of us had very positive experiences in our first year and each of us decided to remain in our programs. The social activities available to us included professional activities (e.g., meetings with faculty), semi-professional activities (e.g., formal graduate student functions), and non-professional activities (e.g., basketball games). It may be prudent to consider what social activities are available to potential students and ensure they are aware of the activities. While academics are important, having a socially integrated student can have a great impact on their experiences.

For students interested in enrolling in an engineering education program...

- Consider what is important to you in an engineering education program. While every student has a similar experience in terms of coursework, other details of one's doctoral program, including student and faculty relationships, can have a major impact on their institutional experience. That fact is illustrated by our unique first year experiences, even though we were all enrolled in the same program. Different programs will provide an even greater variety of experiences, which are all valuable and impact future success. Keep all that in mind, and select the program you expect to be most compatible with you.
- It is important to participate in social activities with other engineering education students. Those students are your future colleagues and collaborators, and you should get to know them at least on a professional level to begin to build your professional network.
- If you have a passion for engineering education, take control of your future. Do not let others discourage you with negative comments about the field. Do not let others choose your research interests. The field of engineering education is very broad and can accommodate a lot of interests. There is something out there for everyone interested in engineering education.

As we continue our engineering education doctoral programs, we hope that lessons learned by participating in our study will help others as well as ourselves.

### Limitations

There are several limitations of this work. First, only three student experiences are represented and these might not represent the common experience in this program or other programs at different universities. Second, participants were asked to reflect back on their experience from a year ago and may have altered or omitted noteworthy events. Lastly, since each participant was allotted only two pages to reflect, a researcher may not have had enough space to represent his or her first year experience, goals, and commitments in entirety. Each limitation does not discredit our work, but simply puts bounds around the extent to which it can be generalized.

## Future Work

The research presented provides initial insight into what it is like to transition from a technical engineering discipline to an engineering education doctorate program. As a follow up to this study, there are several lines of research that should be pursued. First, the experiences of more students needs to be investigated to determine how students are ending up in engineering education programs nationwide and if their experiences and reasons are similar to those represented in this study. Second, students completing engineering education course work while being enrolled in other institutions outside the setting in this work have unique experiences that also need to be understood. It is our intention to investigate how students are developing interest in and entering the field of engineering education to ensure that the discipline continues to grow. This will allow engineering education departments to better recruit students, whether that be into a certificate or doctorate program, and maximize students experiences, increasing their commitment to the field.

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