Longitudinal Memos Investigating First Year Engineering Pathways

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Introduction

As of 2013, the majority of incoming engineering students (either by freshman or transfer status) progress through First-Year Engineering (FYE) courses [1]. These FYE courses are intended to provide engineering students with the basic skills needed to succeed in higher level courses and an early introduction to the engineering discipline [2], [3]. Institutions with FYE courses or programs (i.e., multiple FYE courses in a sequence) create these courses in the way they best see fit to help their students succeed. However, this means that programs vary significantly in both content [4] and in matriculation patterns [1]. These FYE courses are some of the earliest exposures that students have to their engineering disciplines; however, their impact on students' engineering identity and community development is not well understood.

This project seeks to answer the question, *"How do students who are pursuing engineering degrees through pathways that vary with respect to first-year engineering structure, content, and timing describe their experience participating in engineering communities of practice and their emerging engineering identities?"* Data is being collected through a baseline survey of first-year engineering students, three-phase interviews with students following their FYE courses, and focus groups with FYE instructional staff. This executive summary and poster focus on the longitudinal memos which have assisted in our ongoing analysis of participant interviews. Additional details regarding work completed to date and future plans are also discussed.

Theoretical Lens

For this work, identity and community are conceptualized using Wenger's Community of Practice [5]. We conceptualize engineering communities as any groups that student engage in during their undergraduate career, whether formal or informal. Though students define these groups, during our analysis we are particularly interested in those engineering communities that are communities of practice (e.g., they have mutual engagement, shared repertoire, and joint enterprise [6]). Engineering communities are important for engineering identity development (e.g., [7], [8], [9]). Therefore, we are examining how different student pathways may impact community development in engineering students.

To begin to understand the impact of community on engineering identity, we used an instrument developed by Jones, Paretti, Hein and Knott [10] to understand students' major choice, career choice, engineering identity, engineering expectancy or ability, and belonging in engineering throughout students' first year in engineering. Additionally, we used Gee's [11] identity framework during the initial analysis of our interviews to develop a basic understanding of participants' nature, institution, discourse, and affinity identities. Our definition of identity has continued to be refined as analysis has continued using these frameworks.

Relevant Qualitative Data Collection & Findings

Phase 1 and 2 Student Interviews

Data collection from engineering students for this research includes yearly interviews over three years to monitor students' development in their engineering communities and identities while pursuing their degrees. This longitudinal study provides important information with respect to

the students' participation in communities and their sense of belonging, both generally and within these communities, over the course of their undergraduate education. A group of students were purposefully sampled to be interviewed in phase 1, as to include traditional and non-traditional students, main- and regional-campus students, and transfer and direct-admit from high school first-year engineering students. Not all students who participated in phase 1 interviews returned for the phase 2 interviews, so recruiting was opened to additional students for phase 2. The demographics of interview participants are shown in Table 1 below for both phase 1 interviews and phase 2 interviews.

Table 1: *Demographics of Phase 1 and Phase 2 interview participants.*

	Phase 1	Phase 2
Institution		
Institution 1	12	8
Institution 2	14	12
Institution 3	3	2
Matriculation Type		
First Year Engineering	14	13
Direct Matriculation	7	3
Post General Education	8	6
Pathways*		
General	17	12
Transfer	11	10
Regional Campus	3	2
Gender		
Male	18	12
Female	11	10

Both interviews were open-ended semi-structured, with protocol questions developed to guide the interviews. For more details regarding the interview protocol, please see our previous paper [12]. Gee's theory was found to particularly apply during phase 1, as answers to interview questions revealed students' connections with multiple identities including nature, institutional, and discourse. There were additional themes found in phase 1 that did not directly correlate with Gee's theory but still appeared to be salient amongst multiple participants, so these themes were included as codes for future analysis (e.g. experience as a woman in engineering, first year expectations, and engineering perceptions).

Interview analysis through Longitudinal Memos

In order to map the trajectories of participants, we developed longitudinal memos to connect the first and second phases of interviews. For the participants who had only completed a single interview with us, summaries of the interview and the participant's language around community and identity at the time of the interview were written into a single memo. The longitudinal memos for those that completed two interviews are based on the work of Lee et al. [13]. The

memos included summaries of the participant's two interviews, as well as what the participants said about community and identity. These memos also included notes on how the participants had differed between the phase 1 interview and phase 2 interview. When appropriate, direct quotations from the participants' interviews were also included. These memos were used to begin to make meaning regarding how the participants have changed across the two interviews.

Analysis is on-going, but initial findings are beginning to become clear. For example, many students describe the current year as significantly better than the previous year. This is for a variety of reasons, including internships and research experience; more meaningful courses as they progress in their degree; and major changes. Additionally, participants seem to be more intentional with the groups they participate in. Rather than participating in many groups, participants are generally taking steps to join groups or find mentors with a focus on advancing their career goals. Finally, participants are developing a clearer understanding of the engineering field, primarily derived from internship experiences. As analysis continues following the third interview, we expect themes to emerge to aid in developing an understanding of how the FYE experience impacts identity and community development. The data will be analyzed for trajectories that are common to pathways or student populations. We expect that some of these trajectories may be common amongst students, though others may be unique to a student population or pathway. By understanding students' FYE experiences and how they impacted their community and identity development, engineering colleges can tailor their FYE courses to support various student populations.

Instructor Focus Groups and Phase 3 Student Interviews

Preparations are currently being made to conduct the third phase of student participant interviews, as well as focus groups with faculty and teaching assistants involved in first-year courses at both institution 1 and institution 2. Participants for phase 3 interviews will be recruited from the list of students who have already completed previous interviews. The memos that were written (single interview memos as well as longitudinal memos) will help inform follow-up questions. Although we continue to explore our theoretical framework of identity and community development in engineering students, we also plan to further explore themes, including those related to community and identity, that were identified from transcripts throughout the memo writing process. Focus groups will also be organized and conduced early in the Spring 2020 semester with instructors of first-year engineering courses. These focus groups will explore instructors' views on course goals and how those goals develop students' engineering communities and identities. Results of phase 1 and 2 interviews will also be shared with the focus group participants as a way to facilitate a discussion of the alignment between instructors' desired outcomes and perceptions of the course with the students' perceptions of the first-year course experience. Both of these future steps will be completed by the dates of the ASEE 2020 conference and preliminary data analysis will be included in our poster.

Conclusion and Future Work

This project seeks to understand how various first-year engineering courses impact community and identity development throughout the college experience. Currently we are preparing for the third phase of interviews and focus groups and will soon begin examining the data across the timeframe of the study. By the time of the ASEE 2020 conference, all data collection including interviews and focus groups will be complete. The baseline surveys, three phases of interviews,

and focus groups provide insight into how different student pathways, such as transfer students, traditional students, and students who come from regional campuses, are impacted by their first-year engineering courses.

Our work will provide insight into the long-term impacts of first-year engineering courses. Though it is likely that there will be common trajectories of community and identity development from our interview population, unique trajectories are also emerging as we analyze the data. Understanding these trajectories will allow administrators to make informed decisions regarding the timing, content, and structure of their FYEP in order to meet their program's needs and goals.

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