Work-in-progress: Evaluating student support in a civil and environmental engineering program

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Abstract

Student support services like faculty interaction, extracurricular activities, peer-interaction, professional development, and additional support likely change over the course of study for an engineering student at a large, regional university. Generally, broad support is given in the first year of an engineering program, then more specific supports are provided during the next three consecutive years within an engineering program. These more specific supports often come with challenges that need to be explored to further understand the intricacies and impacts that these supports have on individual engineering student development. This work in progress paper will examine connections between engineering identity and the role of student support services over the course of a four-year civil and environmental engineering program for four cohorts. A survey of undergraduate engineering students will investigate students' perceptions about student support services and engineering identity at various stages in an undergraduate civil engineering experience in four separate cohorts: 1) first year in a general engineering program, 2) second year after moving into the civil engineering major, 3) third year civil engineering student, and 4) fourth year civil engineering student. Results from this research will help identify student support variables that influence perceived engineering identity during different stages of an undergraduate engineering program. This new knowledge may aid colleges and universities in developing or refining the support structures necessary to improve retention at their institutions.

Introduction

Student retention to the second year is important as it is an important benchmark for persistence in an engineering program. Interventions to improve academic deficiencies have been associated with an increase in student persistence beyond the first year [1]. As such, student support services providing curricular and co-curricular support are often focused on first-year retention goals (e.g., bridge programs: [2], [3]; required study labs: [4]; out of class engagement events; curriculum support for math readiness: [4]). Additional services that may extend beyond the first year include items like living and learning communities [5], mentoring programs [6], and advising [7]. Typically, these student support interventions are evaluated on an individual basis [8], but we are adopting a holistic approach as suggested by Lee et al. [8] to better understand the impact of student support services across a 4-year program.

Godwin and Lee [9] suggest that there is a decrease in students' overall engineering identity (i.e., seeing oneself as or feeling like an engineer [10]) in the second year of an engineering program; increases in engineering identity are reported beyond the second year with the greatest overall engineering identity reported in the fourth year [9]. This dip in overall engineering identity in the second year aligns with a change in curricular and co-curricular support (i.e., student support services) as students move from a general engineering program to the requirements of their specific major. We hypothesize that changes in engineering identity may be related to this change in student support.

This work in progress paper will examine connections between engineering identity and the role

of changes in student support services over the course of a four-year civil and environmental engineering (CEE) program. Specifically, to what extent do changes in student services support factors influence engineering identity over a four-year engineering program? Preliminary results are reported. Data collection and analysis are in progress.

Background

Engineering students at the R1, land grant institution which is the location for this research enter the Fundamentals of Engineering Program (FEP) in their first year. Students move into their selected engineering major after GPA and course criteria are met. The focus of this research is students entering the majors in Civil Engineering and Environmental Engineering (Civil Engineering and Environmental Engineering majors). During this transition, students move from the FEP program, where they receive all levels of student services identified by Lee and Matusovich [11] to CEE where there is a notable change in student support services available through the required civil engineering curriculum. For example, availability of student study spaces, tutoring services, and faculty that they interact with change, and their peer groups divide among majors. These few examples are only a subset of the challenges during the transition. With a holistic understanding of the student support services utilized by students throughout the entire program, efforts can be developed to increase retention rates beyond the first year.

Methods

A survey was developed using two existing validated surveys: Godwin and Kirn's [12] instrument for evaluating engineering role identity and the STEM Student Perspectives of Support Instrument (STEM-SPSI, Lee et al. [8]). Demographic data was also collected at the end of the new survey [13]; questions were informed by Fernandez et al. [13] and McEldowney et al. [14]. The variables and survey items of STEM-SPSI were updated from a STEM to an engineering perspective when needed. Variables included engineering identity, academic advising support, academic peer support, faculty support, engineering faculty connections, engineering peer connections, out-of-class engagement, engineering career development, and general career development (Table 1). Responses were recorded on a six-point scale (1 = Does not apply to me; 2 = Completely disagree, 3 = Disagree; 4 = Neither agree nor disagree; 5 = Agree, 6 = Completely agree).

The final survey was given online and administered through Qualtrics. West Virginia University Institutional Review Board (WVU IRB) approval is on file. To encourage participation and completion by undergraduate civil engineering students, the target length of the final CEE survey was reduced to 10 minutes, including only engineering-related items.

The CEE survey was distributed to CEE students in November 2024 via flyers for participation and emails. This initial recruitment resulted in a small number of participants (n = 6), partly due to the timing of the end of the fall semester. The survey will be distributed again in the spring 2025 semester to both CEE and FEP students.

Preliminary Results

Mean responses from the initial survey distribution indicates that these CEE students generally agreed with the statement "I see myself as an engineer." One student identified as a sophomore, two students as juniors, and one as a senior.

On average, students agreed with survey items related to faculty support engineering peer connections, and out-of-class engagement. Less agreement was reported for items related to general career development and engineering faculty connections. Engineering identity will continue to be explored when data from additional cohorts are collected, and sample size is larger, but preliminary results from these items may highlight opportunities for curricular and co-curricular activities.

Table 1. Mean and Standard Deviation of Scores for Each CEE Survey Item

Survey item	*n*	Mean score	Standard deviation
Engineering Identity			
I see myself as an engineer.	5	4.8	0.8
Academic advising support			
I received helpful guidance when planning the path of courses required to earn my degree.	5	4.6	1.1
I received helpful guidance on registering for classes.	5	4.6	1.7
An academic advisor was available when I needed assistance.	5	4.8	1.1
Academic peer support			
I had access to students whom I could ask for academic assistance.	5	4.8	0.8
I received advice from peers on how to be academically successful in engineering courses.	5	5.0	0.7
I had an easy time finding someone to work with on my academic work.	5	4.4	1.5
Faculty support			
My instructors were available to meet with me if needed.	5	5.0	1.0
I receive responses from instructors in a timely manner.	5	4.8	1.6
My instructors fostered an atmosphere of mutual respect.	5	5.2	0.8
My instructors provided enough resources to support my learning.	5	4.8	1.3
My instructors connected class topics to potential careers.	5	5.4	0.5
Engineering faculty connections			
I had an engineering faculty member who I consider a role model.	4	4.8	1.3
I was mentored by an engineering faculty member.	4	4.0	1.0
I had the opportunity to network with engineering faculty members.	4	4.5	1.3
I knew faculty members in my major who I would feel comfortable asking to write a recommendation letter.	4	4.5	1.3
I had engineering faculty members with whom I could relate.	4	4.8	1.3
Engineering peer connections			
I regularly socialized with engineering students outside of class.	4	5.3	0.5
I regularly socialized with students in my major outside of class.	4	5.0	0.0
I met engineering students who are now my friends.	4	5.5	0.6
I spent time with engineering students who shared my career goals.	4	5.3	0.5
Out-of-class engagement			
I was aware of opportunities to volunteer or participate in community service.	4	5.0	1.4
I was aware of opportunities to be involved in engineering organizations.	4	5.5	0.6
I had opportunities to participate in out-of-class activities with other STEM students.	4	5.0	0.8
I received information about joining clubs and teams related to my interests.	4	5.5	1.0
I was aware of opportunities to gain leadership experience.	4	5.0	0.8

Engineering career development			
I received assistance with preparing for career fairs.	4	5.0	1.4
I met professionals in my field (i.e., those working) with whom I could relate.	4	4.8	1.3
I was encouraged to apply for internships, co-ops, or research opportunities.	4	5.3	1.0
I had access to a professional I consider a role model.	4	4.5	1.3
I had access to a professional from whom I received mentoring.	4	4.0	1.0
General career development			
I discussed opportunities for pursuing a graduate degree outside of my major.	4	3.5	1.0
I discussed opportunities for pursuing a professional degree (e.g., law school, medical, vet, MBA).	4	3.5	1.0
I received advice on preparing for professional examination (e.g., LSAT, MCAT, GMAT).	4	4.7	1.5
I was encouraged to explore careers outside of engineering.	4	3.5	1.7

Note: Selections of "1 = Does not apply to me" were removed in the calculation of the mean response and standard deviation.

Future Work

Initial data collection began in November 2024 for CEE students. Participant recruitment will continue in the spring 2025 semester, for both first-year FEP students as well as CEE students. With an increase in sample size, we expect to examine for the following:

- Differences in engineering identity by program year
- Differences in perceptions of student support services by program year
- Relationships between perceptions of student support services and engineering identity
- Relationships between engineering identity and program year
- Relationships between perceptions of student support services and program year

Future work will also include adding in qualitative data collection and analysis to help tease out the intricacies of engineering identities across the four years of the program. Ultimately, results of this research will add to the body of knowledge related to the importance of student support services in developing engineering identity. Much of the research and support provided to students in engineering has been allocated to first-year engineering students. This academic and social support has translated into improvements in the retention of students during the first year. This research addresses retention past the first-year level, addressing how changes in academic and social support may explain the attrition observed.

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