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Student support and engineering identity in an undergraduate civil engineering program: Progress from year 2 of NSF RIEF

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Introduction

For college and university engineering departments with a common first-year engineering program, there is a notable change in student support services as students move from the common first-year engineering program to their specific engineering major. We hypothesize that overall student support decreases during students' transition from a general first-year engineering program into their chosen engineering major, and that this transition may influence engineering identity. Research questions are as follows:

1. To what extent do student services support factors influence engineering identity over a four-year engineering program?
2. How does students' engineering identity shift due to changes in support in their engineering programs?
3. How do themes mentioned by instructors, advisors, and mentors help explain any differences?

This paper summarizes research progress in the second year of the NSF REIF supported project (Award 2406798), including preliminary results related to student interviews, faculty and staff interviews, and a content analysis of communications to students across the year.

Preliminary Results

To what extent do student services support factors influence engineering identity over a four-year engineering program?

Student surveys

A survey instrument was developed to examine the connections between engineering identity and student support services in civil and environmental engineering students by adapting existing, validated surveys (i.e., [1], [2]). The variables and survey items of STEM student perspectives of support instrument (STEM-SPSI, [2]) 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 questionnaire was piloted in fall 2024 and redistributed in spring 2025. Civil and environmental engineering students (1-, 2-, 3-, and 4-year students) and fundamentals of engineering students (1-year students) were invited to participate. The surveys were online-based and administered through Qualtrics.

Data for each survey item were tested for normality using the Shapiro-Wilk test ($\alpha = 0.05$). Because the data did not follow a normal distribution, nonparametric testing was primarily used

for analysis. Nonparametric correlation analysis was used to determine the Spearman ρ between engineering identity and the survey student services items. The Kruskal-Wallis test was used to determine differences in engineering identity and academic classification ($\alpha = 0.05$). When significant differences were found, post-oc tests were conducted tested using the Wilcoxon rank-sum test. Similarly, the Kruskal-Wallis test was also used to determine differences in the student support services items.

More than 80 participants started the survey, and approximately 60 participants completed all questions (16% freshmen, 20% sophomores, 20% juniors, and 44% seniors). Preliminary results suggest that:

- Engineering peer connections, engineering faculty connections, and faculty support are important in developing engineering identity (Table 2).
- Freshmen were more likely to receive instructor feedback than upper-level students (Figure 1a).
- Sophomores and juniors were less likely to have a faculty member in mind for a recommendation letter than seniors (Figure 1b).
- Sophomores were more aware of community service opportunities than seniors (Figure 1c).
- Sophomores reported having fewer faculty role models than freshmen and seniors (Figure 1d).

Document Analysis

A content analysis of common communications (e.g., weekly newsletters, bulletin boards) is in progress and will provide additional information about the timing, frequency of communications, and content of the communications regarding student support services. Weekly newsletters distributed to freshmen engineers during fall 2024, bulletin boards in the main engineering academic building during fall 2025, and academic advising newsletters during fall 2024 and beginning of fall 2025 are under evaluation.

Preliminary results of the newsletter evaluation indicated out-of-class engagement and engineering career development services were most frequent services communicated to freshmen throughout the semester. This analysis will be compared with survey and interview results (research question 2) to help identify impactful communication strategies.

How does students' engineering identity shift due to changes in support in their engineering programs?

Student interviews are being conducted to better understand how students' engineering identity shifts due to changes in support in their engineering programs over time. Initial student interviews were piloted in summer 2025 and were completed in fall 2025. Participants included two freshmen, two sophomores, three juniors, two seniors, and one first-year graduate student. Survey questions were related to engineering identity, student support services, and connections between engineering identity and student support services. Preliminary results support survey results. In general, sophomore students reported less interactions with student support services. Out-of-class experiences were highlighted by most students (Figure 2). Students will be interviewed again in spring 2026 to examine changes.

Table 1. Summary statistics of responses to survey items.

Survey item	*n*	*x*	*s*	*M*	IQR
Engineering Identity					
I see myself as an engineer.	61	5.15	0.73	5	5-6
Academic advising support					
I received helpful guidance when planning the path of courses required to earn my degree.	61	4.95	1.02	5	5-6
I received helpful guidance on registering for classes.	60	4.98	1.10	5	5-6
An academic advisor was available when I needed assistance.	61	5.36	0.84	6	5-6
Academic peer support					
I had access to students whom I could ask for academic assistance.	61	5.03	0.84	5	5-6
I received advice from peers on how to be academically successful in engineering courses.	61	4.85	0.96	5	4-6
I had an easy time finding someone to work with on my academic work.	61	4.64	1.10	5	4-5
Faculty support					
My instructors were available to meet with me if needed.	61	5.21	0.61	5	5-6
I receive responses from instructors in a timely manner.	61	5.07	0.89	5	5-6
My instructors fostered an atmosphere of mutual respect.	61	5.20	0.73	5	5-6
My instructors provided enough resources to support my learning.	61	4.98	0.90	5	5-6
My instructors connected class topics to potential careers.	61	4.87	0.97	5	4-6
Engineering faculty connections					
I had an engineering faculty member who I consider a role model.	59	4.34	1.17	4	3-5
I was mentored by an engineering faculty member.	53	3.92	1.07	4	3-5
I had the opportunity to network with engineering faculty members.	58	4.45	0.99	5	4-5
I knew faculty members in my major who I would feel comfortable asking to write a recommendation letter.	60	4.63	1.25	5	3.25-6
I had engineering faculty members with whom I could relate.	61	4.51	1.09	5	4-5
Engineering peer connections					
I regularly socialized with engineering students outside of class.	61	4.82	1.15	5	4.5-6
I regularly socialized with students in my major outside of class.	60	4.52	1.14	5	4-5
I met engineering students who are now my friends.	61	5.11	0.97	5	5-6
I spent time with engineering students who shared my career goals.	61	4.85	1.01	5	4-6
Out-of-class engagement					
I was aware of opportunities to volunteer or participate in community service.	61	4.57	1.06	4	4-5
I was aware of opportunities to be involved in engineering organizations.	61	5.20	0.63	5	5-6
I had opportunities to participate in out-of-class activities with other STEM students.	61	5.02	0.74	5	5-5
I received information about joining clubs and teams related to my interests.	61	5.13	0.87	5	5-6
I was aware of opportunities to gain leadership experience.	60	4.98	0.68	5	5-5
Engineering career development					
I received assistance with preparing for career fairs.	58	4.43	1.08	5	3.75-5
I met professionals in my field (i.e., those working) with whom I could relate.	59	4.54	1.01	5	4-5
I was encouraged to apply for internships, co-ops, or research opportunities.	59	5.25	0.76	5	5-6
I had access to a professional I consider a role model.	59	4.47	0.99	5	4-5
I had access to a professional from whom I received mentoring.	54	4.25	1.01	4	4-5
General career development					
I discussed opportunities for pursuing a graduate degree outside of my major.	55	3.95	1.15	4	3-5
I discussed opportunities for pursuing a professional degree (e.g., law school, medical, vet, MBA).	55	3.76	1.14	3	3-5
I received advice on preparing for professional examination (e.g., LSAT, MCAT, GMAT).	57	4.21	1.15	5	3-5
I was encouraged to explore careers outside of engineering.	59	3.59	1.02	3	3-4

Note: Likert scale: 2 = completely disagree; 3 = disagree; 4 = neither agree nor disagree; 5 = agree; 6 = completely agree; 1 = does not apply to me (removed from analysis); *n* is total count, *x* is mean, *s* is standard deviation, *M* is median, and IQR is interquartile range

Table 2. Nonparametric correlation results with "I see myself as an engineer." for significant relationships reported ($\alpha = 0.05$).

Variable	Survey item	ρ	*p*
Academic advising support	I received helpful guidance when planning the path of courses required to earn my degree.	0.39	0.002
	I received helpful guidance on registering for classes.	0.37	0.004
Academic peer support	I had access to students whom I could ask for academic assistance.	0.39	0.002
	I had an easy time finding someone to work with on my academic work.	0.33	0.009
Faculty support	I receive responses from instructors in a timely manner.	0.29	0.023
	My instructors fostered an atmosphere of mutual respect.	0.37	0.003
	My instructors connected class topics to potential careers.	0.35	0.005
Engineering faculty connections	I was mentored by an engineering faculty member.	0.48	<0.001
	I knew faculty members in my major who I would feel comfortable asking to write a recommendation letter.	0.43	<0.001
	I had engineering faculty members with whom I could relate.	0.41	0.001
Engineering peer connections	I regularly socialized with engineering students outside of class.	0.30	0.018
	I met engineering students who are now my friends.	0.30	0.018
	I spent time with engineering students who shared my career goals.	0.32	0.012
Out-of-class engagement	I was aware of opportunities to gain leadership experience.	0.26	0.048
Engineering career development	I met professionals in my field (i.e., those working) with whom I could relate.	0.37	0.004
	I was encouraged to apply for internships, co-ops, or research opportunities.	0.28	0.031

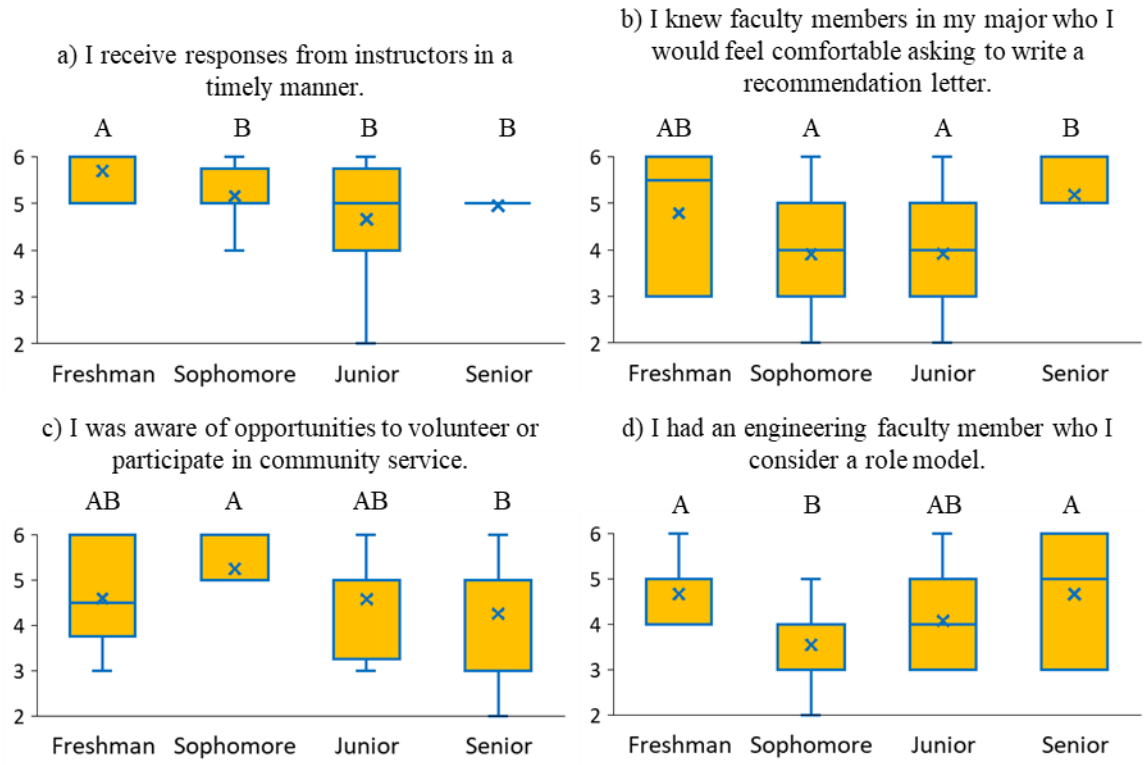

Figure 1. Differences in survey items by academic classification.

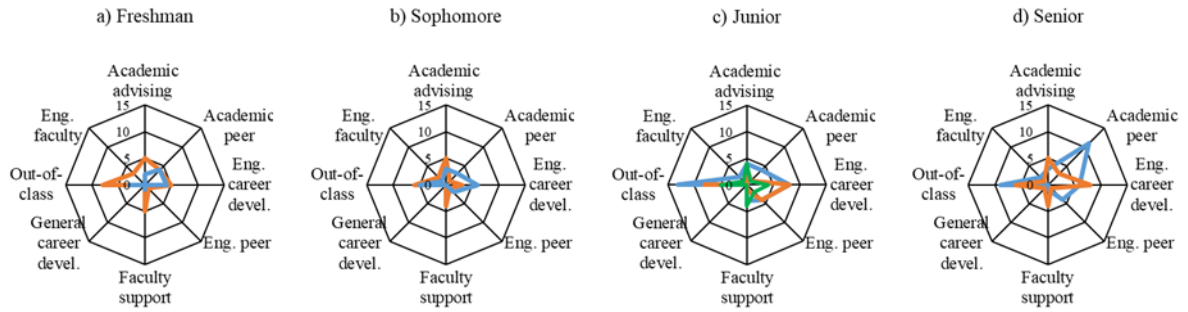

Figure 2. Frequency of primary codes in student interviews; *n* = 2, 2, 3, and 2 for freshman, sophomore, junior, and senior students, respectively.

How do themes mentioned by instructors, advisors, and mentors help explain any differences?

Faculty and staff interviews will help explain differences in students' experiences. Two faculty interviews have been conducted representing civil and environmental engineering faculty and academic advising; additional interviews will include staff involved in recruitment and faculty that primarily teach freshmen engineers. Interview questions are related to engineering identity (Do you see yourself as an engineer? Why or why not? How have you observed engineering identity among your students? How do the engineering identities of students change over time?), student support services (What type of support services are important to help engineering students be successful, and how do they contribute to their success? How do you provide curricular and/or co-curricular support to engineering students in your current position? What do you find the most important support you provide for students? What differences exist between the curricular and co-curricular support strategies of the common first-year program and civil and environmental engineering?), and connections (How has the transition period as students move from the first-year program to their major impacted the attitude and achievement of your students? Of the students you mentor and have strong connections with, what stage of their academic career did those connections form? Do you have any suggestions related to planning student support services for civil and environmental engineering students?).

Future Work

The knowledge gained from this research may help colleges and universities in developing or refining the support structures and systems necessary to improve retention at their institutions. Data collection for faculty/staff interviews and follow-up student interviews continues. Qualitative analysis related to document analysis and interviews is in progress.

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