Work in Progress: Exploring the Use of Faculty and Peer Mentoring as a Tool to Support Engineering Transfer Students' Transition

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WIP: Supporting Low-Income Transfer Students with Faculty and Peer Mentors

Introduction

This Work in Progress paper investigates the mentoring experiences of transfer engineering students during their first year at the University of California Irvine (UCI). One issue that has been commonly discussed is the transfer shock that transfer students experience right after their transition from their community college to a four-year university and its impact on their academic persistence and success [1,2]. Amongst a number of other factors, one factor identified as a potential cause contributing to this transfer shock is the lack of personal relationships with faculty and a lack of social integration into their peer group [3,4]. In-depth qualitative work at a small private university showed that faculty can perceive transfer students as complicated, that faculty and student expectations are often not aligned and that students often do not seek help in the way expected by faculty [5]. Transfer students' perceptions of the general lack of personal relationship has also been linked to less help seeking behavior shown by transfer students in other qualitative work [1].

One of the tools identified as a potential remedy is the provision of quality interactions with faculty and peers through mentoring. Despite a lot of variations in the way that mentoring is conducted, common characteristics of mentoring are that mentoring relationships are personal and reciprocal, that the focus of the mentoring is the growth and accomplishment of an individual and that support is provided in multiple ways, such as with professional and career development, role modeling and psychological support [6]. Mentoring has been found to be effective for promoting transfer students' success, in terms of their persistence and degree attainment [2,7].

In terms of faculty mentoring within STEM, studies have pointed to the fact that mentoring has additional positive effects apart from students' persistence. Several quantitative studies showed that faculty mentoring, particularly in the context of research involvement, positively influenced students' success by fostering the development of students' scientific identity and their beliefs in their own abilities [8,9]. In addition, adequate socioemotional and culturally relevant mentoring seems to play an important role for the positive development of underrepresented students in this context (e.g., first-generation college-going students) [10]. Unfortunately, these studies did not investigate the impact of faculty mentoring for transfer students in particular, leaving a gap in knowledge as to whether transfer students would benefit from these additional beneficial outcomes as well.

Apart from faculty mentoring, research also indicates that peer interaction and peer mentoring seems to impact (transfer) students' success positively. In a program within the Humanities aimed to create learning communities for incoming transfer students by providing co-curricular group building activities and common coursetaking experiences for transfer students, participating students had better overall grades and graduation rates than students who did not participate [11]. In addition, in a systematic review of the literature, peer interactions emerged as one crucial component of transfer success for underrepresented Latinx students in STEM [12]. Within engineering, [13] developed a gender-matched peer mentoring program to support the

retention of female students. They found that their peer mentoring increased female students' feeling of belonging and belief in their abilities, which was related to higher long-term retention and career aspirations. More evidence is needed to see whether such structured peer mentoring for transfer students in engineering would have the same benefits.

To further explore the benefits of faculty and peer mentoring for transfer students in engineering specifically, the current study focuses on low-income engineering transfer students from diverse backgrounds that received faculty and peer mentoring as part of a scholarship program to help them with their transition and to secure their retention and success in engineering. In this program, transfer students received two types of mentoring. Based on their chosen engineering major, they were matched with an individual faculty mentor to provide them with guidance. In addition, they were matched with a more advanced transfer student in their major to promote social integration. Faculty and peer mentors meet regularly with their assigned students to provide guidance and support. The aim of the current study is to explore students' perceptions of the mentoring program in terms of its benefits and opportunities for improvement.

Project approach

The current study aims to investigate the benefits of a mentoring program that was established as part of a larger scholarship program for transfer students at a large four-year university in the U.S., specifically the University of California Irvine (UCI). The scholarship program aims to help low-income students from diverse backgrounds to successfully transfer to and persist in the engineering program at UCI. The designed program targets the population of students who have the ambition to pursue engineering degrees, but often lack the resources or exposure to engineering opportunities. The program was developed to help combat low persistence rates and long times to completion within the transfer student population. The goal of the project is to increase the number of community college students who successfully transfer to an engineering major at a 4-year institution and to improve the transfer student experience in engineering by providing co-curriculum cohort activities to prepare for STEM careers or graduate studies. Co-curricular activities include a mentoring program as well as academic advising, tutoring, summer bridge programs, academic and career workshops, and industry and research internships. Transfer students join the scholarship program after their transition and stay enrolled throughout their tenure at the university. A total of 50 students are currently enrolled in the scholarship program and, thus, participate in the mentorship program.

Mentorship program

In terms of the mentoring program, scholarship students receive individualized support through faculty and peer mentoring.

The faculty mentoring program aims to provide a direct link between students and faculty members to increase student-faculty interaction. As part of the mentoring program, professors from key engineering disciplines are recruited to act as mentors. Scholarship students are then assigned to faculty mentors based on the fit of the students' major and the mentors' engineering discipline. Mentors and mentees are expected to check-in via email regularly and meet 1-2 times per term. Faculty mentors receive some initial information on what is expected of them as part of

the mentoring program and are advised to share their own stories and provide a safe haven for students as part of their mentoring activity.

The peer mentoring program aims to assist the transfer students in thriving in the engineering program by providing social and academic guidance and support. To achieve this, scholarship students are matched with more advanced scholarship students in the program. Students are matched based on their respective majors and gender (if possible) at the beginning of the program. First, participating peer mentors and mentees take part in an orientation session, in which mentors' and mentees' roles, responsibilities and benefits are discussed. At the end of this orientation, matched mentors and mentees sign mentoring and confidentiality agreements. Students then meet several times throughout each term (in accordance with their availability and terms stipulated in their mentoring agreement) and submit quarterly reports on their progress allowing the program staff to intervene or assist should problems arise.

Methods

To assess students' perceptions of the mentoring program, two sources will be used. Targeting all students within the program (targeted n=50), students will receive a survey that assesses their experiences with their faculty and peer mentor. Table 1 below shows all measures used in the survey in detail. The focus of the survey will be to better understand how students engage with both their faculty and peer mentors. To this end, students will be asked to report on the frequency and mode of interaction (see Section 1 in Table 1) as well as their perceptions of the quality of their engagement with the mentors (see Section 2 in Table 1). The quality of engagement will be assessed in terms of open-ended questions to allow for the emergence of new knowledge as can be seen in Section 2 in Table 1 as well as through the use of relevant established mentoring scales, which are shown in detail in Appendix A. Given the diverse socio-demographic background of the students in the mentoring program, their perceptions of how cultural background influences their relationship with their faculty and peer mentors will be addressed as well (see Section 3 in Table 1). Lastly, students will be asked to provide an overall assessment of their mentoring experiences with both their peer and faculty mentors (see Section 4 in Table 1). As indicated in Table 1 (see Column 1: Item Focus), the majority of measures will be used to assess both faculty and peer mentoring experiences with the exception of a few measures that aim to assess aspects specific to the faculty or peer mentor relationship.

Table 1. S-STEM mentoring survey measures

Item Focus	**Item**	**Response Options**
Section 1: Engagement with mentor		
F/P	Have you been assigned a mentor?	Yes/No
F/P	How often do you meet with your mentor?	Have not met yet/ less than once a quarter/ once a quarter/ twice a quarter/ Three times a quarter/ More than 3 times a quarter
F/P	How do you communicate with your mentor? Check all that apply	In person/ via email/ via phone/ via zoom/ via online chat (e.g., discord, slack)/ other

F/P	Which form of communication do you use most often?	In person/ via email/ via phone/ via zoom/ via online chat (e.g., discord, slack)/ other
F/P	Are you satisfied with how often you meet your mentor?	Yes/ No, would like to meet more often/ No, would like to meet less often
Section 2: Quality of Engagement		
F/P	In what ways does your mentor support you?	Open-ended
F/P	How could your mentor support you better?	Open-ended
F	Established Mentoring Scales [13,14,15,16]	see Appendix A
Section 3: Diversity Experiences		
F/P	Does your mentor have the same gender/ethnicity as you?	Same gender/ Same ethnicity
F/P	How does your own and your mentor's cultural background influence your relationship with your faculty mentor?	Open-ended
F/P	Culturally relevant mentoring scale [10]	see Appendix A
F	How familiar are you with the personal background of your faculty mentor?	1= Not familiar at all to 4= Very familiar
F	Which one of these factors influenced your interaction with your faculty mentor the most?	Socioeconomic status/ Race/ ethnicity/ Other, please explain: / None of the above
F	How do your past personal or professional experiences influence your interaction with your faculty mentor?	open-ended
Section 4: Overall Assessment		
F/P	How would you rate the overall quality of the mentoring you currently receive from your mentor?	1= Very low to 7= very high
F/P	To what extent do you feel that your mentor is meeting your expectations?	1= Not at all to 7= completely
F	In which of these areas did you have the most growth and improvement after receiving mentorship from your faculty mentor?	Self improvement / Academic performance/ Research experience / Professional development
F/P	Do you feel that having a mentor helps you in navigating your undergraduate studies at UCI?	1= Helps a lot to 4= Does not help at all
F/P	To what extent do you feel that your mentor is meeting your expectations?	1= Not at all to 7= Completely
F/P	How would you rate the overall quality of the mentoring you currently receive?	1= Very low to 7= Very high

Note: F=Faculty, P=Peer.

In a second step, a subsample of students (targeted *n*=15) will be invited to participate in an in-depth interview to learn about their attitudes towards mentoring and their mentoring experiences throughout the scholarship program in more detail. To this end, a detailed interview script has been developed (see Table 2). To be able to explore whether and how the mentoring program meets the students' needs, we will first ask students about their general attitudes towards their own identity as an aspiring engineer (see Section 1 in Table 2) and their conceptions of what constitutes good mentoring (see Section 2 in Table 2). Lastly, their perceptions of the benefits of having a faculty and peer mentor and the way their mentors support them are explored (see Section 3 in Table 2). The interview script will be further adapted as needed throughout the data collection to address any areas of importance to transfer students.

Table 2. S-STEM mentoring interview script

Section 1: Questions on identity development
What made you pursue engineering as a major?
When you first decided to pursue engineering, what did you expect being an engineer would be like?
What type of qualities did you think an engineer should have?
Has your impression about what it takes to be an engineer changed since you enrolled in engineering? If so, in what ways?
Do you identify yourself as an engineer? If yes, why? What makes you an engineer? If no, why not?
Section 2: Questions about mentoring in general
In general, what qualities would make someone a role model to you?
What would make someone a mentor in your eyes?
Have you had people in your life that acted as a role model or mentor for you when it comes to your pursuit of an engineering degree?
Who are they and in what ways were they a role model to you?
Section 3: Questions about S-STEM mentoring (asked about faculty and peer mentors separately)
What benefits do you think you obtained from being mentored?
How do you think your mentoring experience helps your personal growth?
How do you think your mentoring experience helps your professional growth?
Do you feel like your faculty mentor helps you in your research and career development? If so, how?
Do you feel that your mentor helped you persist in and achieve your academic goals? If so, how?
What type of approaches does your mentor use that were the most proactive?
How does your faculty mentor communicate with you? What type of communication approaches do you feel most comfortable with?
Does your faculty mentor help you feel like you belong at UCI? If so, how did your mentor help you?

In what ways is your faculty mentor sensitive to your specific background, in terms of your own specific racial and socioeconomic background as well as transfer student?
How does the cultural background of your mentor influence your mentorship relationship?
What mutual beneficial outcomes do you think this mentorship relationship had for both you and your mentor?
Would you be interested in maintaining your relationship with your faculty mentor?
What do you hope to gain from the mentorship in the future?

The S-STEM program is currently underway and the data collection for the present study (surveys and interviews) will be conducted within the next two upcoming terms (Spring and Fall 2023). The sample will include all students enrolled in the S-STEM program at the time of data collection. Due to the multi-year nature of the S-STEM program, students will be from several cohorts of the program (e.g., students within the first as well as second year of the S-STEM program).

Proposed data analysis and anticipated results

We expect to collect a rich and broad set of both quantitative and qualitative data from the surveys and interviews described above. Therefore, we will use a mixed-methods analysis approach to explore the students' responses. The goal of the analysis will be to produce results that inform the design and implementation of mentoring experiences to improve low-income engineering transfer students' persistence and satisfaction in engineering.

For the quantitative survey data with responses on a Likert scale from 1-7, we will compute descriptive statistics to better understand how students perceive the quality of their mentoring experiences. We will analyze correlations between responses to specific questions to determine how different aspects of the mentoring relationships are related, and we will perform pairwise statistical tests to explore, for example, how the frequency and modes of communication or engagement with mentors affects the quality of the mentoring experiences.

For the qualitative data, we will use an inductive-deductive thematic analysis approach (see, e.g., [17]) to explore students' perceptions of the quality of their engagement with the mentors. For this approach, we will first develop a preliminary code book based on themes that appear in the literature on effective mentoring programs and on challenges that transfer students face. Then, we will update the code book inductively based on the themes that appear in the students' open-ended survey and interview responses. This will allow us to better understand students' perceptions and experiences of their faculty and peer mentoring relationships. Based on the literature and the questions we are asking, we expect that students will describe their past experiences, motivation for pursuing engineering, ideas for effective mentoring, and how factors such as cultural, socioeconomic and/or racial background influence their faculty and peer mentor relationships.

Discussion

The results from analyzing these quantitative and qualitative data will have implications for the design and implementation of similar mentoring programs for engineering transfer students in general, and for low income engineering transfer students in particular. For example, we expect the results will inform how to design mentoring programs that improve students' sense of belonging in engineering programs, positively impact their engineering identity, and promote their success in engineering degree programs and professional engineering careers. The results will inform how to match mentors and mentees (e.g., based on factors related to cultural/socio-economic/ethnic/gender/engineering discipline) to promote students' academic and professional success. These results will also inform how frequently mentors and mentees should communicate, what format the interactions should take (e.g., over email, in person, online chat, etc.), what additional training may be helpful for the faculty and peer mentors to be effective mentors to this population of students, and generally what aspects of the mentoring experience is most impactful for the students. We plan to use these results to improve the existing scholarship program and to share effective strategies with the engineering community on how to motivate and support engineering transfer students.

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Appendix A

In the following, established scales used for the assessment of the quality of engagement with the faculty mentor (Tables A1-A3) and the peer mentor (Table A4) and a scale used to measure culturally sensitive mentoring by both the faculty and peer mentor (Table A5) are displayed.

Table A1. Mentoring Competency Assessment Scales (MCA) [14]

Please rate how skilled you feel your mentor is in each of the following areas (Response scale: 1= Not at all to 7=Extremely, not observed)**:**
Maintaining effective communication
1. Active listening
2. Providing you constructive feedback
3. Establishing a relationship based on trust with you
4. Identifying and accommodating different communication styles
5. Employing strategies to improve communication with you
6. Coordinating effectively with other mentors with whom you work
Aligning expectations
7. Working with you to set clear expectations of the mentoring relationship
8. Aligning his/her expectations with your own
9. Considering how personal and professional differences may impact expectations
10. Working with you to set research goals
11. Helping you develop strategies to meet research goals
Assessing understanding
12. Accurately estimating your level of scientific knowledge
13. Accurately estimating your ability to conduct research
14. Employing strategies to enhance your understanding of the research
Fostering independence
15. Motivating you
16. Building your confidence
17. Stimulating your creativity
18. Acknowledging your professional contributions
19. Negotiating a path to professional independence with you

Promoting professional development
22. Helping you network effectively
23. Helping you set career goals
24. Helping you balance work with your personal life
25. Understanding his/her impact as a role model for you
26. Helping you acquire resources (e.g. grants, etc.)

Table A2. Community Mentorship Experience [15]

My faculty mentor knows about clubs, organizations and programs across campus.
My faculty mentor understands the resources that the institution has to offer.
My faculty mentor informs me about different events or organizations that he/she thinks would match my interests.
My faculty mentor asks about my experiences in clubs, organizations or other activities in which I participate.
My faculty mentor encourages me to take part in recreational activities.

Table A3. Identification with faculty mentor scale [16]

I identify with the life and accomplishments of my faculty mentor.
I identify with the life of my faculty mentor.
I identify with the accomplishments of my faculty mentor.
I admire my faculty mentor.

Table A4. Quality of mentor-mentee relationship [13]

How much do you identify with your peer mentor?
How similar do you feel to your peer mentor?
Do you feel personally connected to your peer mentor?
Do you feel your mentor–mentee relationship has good chemistry?
How much do you admire your peer mentor?
How much support have you been getting from your peer mentor?
How much has your peer mentor been available to you?
Can you imagine yourself achieving a similar level of success in engineering as your peer mentor in the future?

Table A5. Culturally relevant mentoring scale [10]

To what extent did your faculty/peer mentor ...?
…understand how your background (e.g., ethnicity, gender, social class) contributes to your experience of being a student
…spend time getting to know you, your background, and your goals at the beginning of your UCI experience
…closely relate to your personal background (e.g., ethnicity, gender, social class)