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DESCRIPTIONS OF PEER MENTORS AS TOLD BY UNDERGRADUATE ENGINEERING STUDENT MENTEES (RESEARCH PAPER)

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ABSTRACT

Peer mentorship is a relationship between two people who are at a similar level. In this study, the setting is academic, namely peer mentorship amongst undergraduate engineering students. Within peer mentorship, participants aim to help one another through various activities, such as sharing information, helping motivate, providing advice, lending support, etc. The outcomes of peer mentorship are generally positive and mutually beneficial for mentors and mentees, but the focus of peer mentoring research in undergraduate engineering has primarily been focused on implementing and evaluating formalized peer mentoring efforts, not necessarily on the needs of students who may be in these relationships. To better understand students' perceptions, students at a western institution in the United States were surveyed during Fall 2020, early in the COVID-19 pandemic.

Of the 223 completed student survey responses, 79 indicated that they currently had a peer mentor when provided a definition and examples of peer mentorship. These 79 students were asked to describe their peer mentor both in terms of attributes (e.g., race, gender identity, year in school, first generational status, and major) and characteristics (e.g., enjoyment of engineering, value placed on engineering, career interests, extracurricular interests, hobbies, and effort exerted in engineering). Analysis of these student descriptions can provide recommendations of what may be important to students when finding their own peer mentors or peer mentoring advisors when attempting to formally match mentors to mentees.

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1 INTRODUCTION

1.1 Form and Function of Mentorship

In the past 20 years, the definition of mentoring has turned from the perception of mentoring being largely transactional and unidirectional with the mentor being thought of to steer the relationship and bestow information, an apprenticeship of sorts, toward more of a mentorship where the relationship between the mentor and mentee are more of a focus, meaning the mentor and mentee are helping each other in a reciprocal and mutually beneficial way (National Academies of Sciences Engineering and Medicine 2019). The types of mentorships acknowledged and observed now can include many different structures and developments; for example, a single mentor working with a single mentee formed from a formal assignment at work, a group of mentors with a single mentee formed by friendship and networking, online peer communities formed through an organization, etc. (National Academies of Sciences Engineering and Medicine 2019). Regardless of the mentorship dynamics and formation, the perspective is now that both the mentor and mentee play a role in the psychosocial and career support of one another.

With this shift in the scope of what is considered mentorship, the benefits of peer mentorship have been increasingly recognized. Peer mentorship includes a relationship between two people who are at the same or nearly the same level of experience where they are helping one another in their development (Colvin and Ashman 2010). This development, similarly to traditional mentorship, is aimed at psychosocial and career development (Collier 2017; National Academies of Sciences Engineering and Medicine 2019). In the context of this paper, this will be undergraduate engineering students at a western institution of the United States that are involved in peer mentorship to support one another psychosocially and in their academic career. Peer mentors may serve as a: (1) connecting link between their mentee and their university; (2) peer leader in motivating to do well academically and to be involved; (3) learning coach in improving personally and academically; (4) student advocate in listening and being a helper; and (5) trusted friend in connecting and caring (Colvin and Ashman 2010). Peer mentorship can provide powerful outcomes for both mentors and mentees in spaces such as identity development, increased productivity, belonging, degree attainment, achievement, satisfaction, and retention, which can be especially important for minoritized populations (National Academies of Sciences Engineering and Medicine 2019).

1.2 Matching Mentors and Mentees

One of the six practices for effective mentoring as recommended by The National Mentoring Partnership is matching and initiating (Garringer et al. 2015). Matching and initiating is creating mentoring relationships through pairings or groupings, and then supporting in the beginning of the relationship (Garringer et al. 2015). This requires decisions about how to best pair mentors and mentees as well as arranging the initial meeting(s) of the mentor and mentee (Garringer et al. 2015). When considering the dynamics between mentors and mentees, similarities and

differences in their deep and surface level identities are the two primary considerations. Surface-level identities would be considered attributes that may easily be determinable such as age, gender, race, etc. (National Academies of Sciences Engineering and Medicine 2019). Deep-level identities would be considered personalities, goals, attitudes, interests, etc. (National Academies of Sciences Engineering and Medicine 2019). Blake-Beard et al. (Blake-Beard et al. 2011) found that even though STEM students perceived that having a mentor of the same gender or race would be somewhat important and they reported receiving more help from those of their own gender or race, academic outcomes, efficacy, and confidence were not any different between mentorships of those of the same race or gender and those who were a different race or gender. This is also in line with the research review of The National Mentoring Partnership (Garringer et al. 2015). However, there may be a level of interpersonal comfort and confidence that could come through role modelling by having someone of the same gender and/or race as a mentor, so considering these surface-level similarities in matching are still suggested (National Academies of Sciences Engineering and Medicine 2019; Garringer et al. 2015). Within this study, mentees share their description of their peer mentor(s) through both surface- and deep-level similarities and differences, which will be expanded upon more below.

2 METHODOLOGY

2.1 Instrument & Rationale

The research instrument used in this study is described in terms of its validity, content, and administration are found in Christensen (Christensen 2021). The exploratory mixed-methods instrument that was created and employed to determine students' needs regarding peer mentorship (Christensen 2021).

After providing consent to participate in the study, students were given a definition and example of undergraduate engineering peer mentorship. They were then asked to provide whether they currently had a peer mentor or not, also indicating if this peer mentor was within the same institution and/or engineering or not (Christensen 2021, 258–59). The students were presented an additional block of questions depending on whether they had a peer mentor or not. The analysis in this paper was focused on one of the questions posted to those who did indicate they had a peer mentor, which was as follows (Christensen 2021, 246–47):

You indicated that you currently have a peer mentor. **Please describe who your peer mentor is.**

This can include both **attributes** (i.e., race, gender identity, year in school, first generational status, and major) as well as **characteristics** (i.e., enjoyment of engineering, value placed on engineering, career interests, extracurricular interests, hobbies, and effort exerted in engineering).

It is noted that these definitions of attributes and characteristics may be interpreted differently depending on the context, but for the sake of this study, the definition that

was constructed and provided to the intercoder agreement team is that an attribute is something used as a symbol of particular person, office, or status. A characteristic was defined as something representing values or qualities of a particular person. This is also the reason examples were given to students of attributes and characteristics that would fall under each.

2.2 Research Question

By having students describe their peer mentor in terms of both attributes and characteristics, student preferences for a mentor may be explored when matching mentors and mentees. To determine the prioritization of the separate attributes and characteristics that came up in student responses, the research question for this study was, “What are the self-described characteristics and attributes of peer mentors as told by mentees?”

2.3 Recruitment

All IRB approval, recruitment, and survey participation procedures are described in Christensen (2021). When asked “Do you currently have a peer mentor?”, 79 participants responded “yes”. Only 1 (1.2%) of those 79 respondents left their response blank for the question of interest. The demographic information for the 79 participants was considered representative of averages in the United States and more specifically the university the study was conducted at (Christensen 2021; Christensen and Villanueva Alarcón 2022a; 2022b). Specific demographic information for the 79 participants who did have a peer mentor as well as the entire 223 participants who submitted complete responses can be found in (Christensen 2021; Christensen and Villanueva Alarcón 2022a; 2022b).

2.4 Research Team Positionality

The positionality of the research team as well as efforts to keep the interpretation bias-free are described in all previous publications surrounding this same instrument (Christensen and Villanueva Alarcón 2022a; 2022b; Christensen, Villanueva Alarcón, and Corrigan 2023; Christensen 2021) and were employed also in this study. The first author’s position has shifted from that as a role of insider earlier publications to that of an outsider (Herr and Anderson 2015) since she is no longer a student at the institution of interest and is now an assistant professor in a different undergraduate engineering program. The second author continues to provide expertise in the realms of mentorship, teaching, and research to support analysis related to peer mentorship.

2.5 Qualitative Analysis Procedures

The goal of the qualitative analysis of student descriptions of the characteristics and attributes of their peer mentor was to find what may be most identified by students. As such, a phenomenological-approach was employed, similar to the other studies conducted by Christensen (Christensen, Villanueva Alarcón, and Corrigan 2023; Christensen and Villanueva Alarcón 2022b; 2022a; Christensen 2021) with some differences in coding procedures.

For the first round of coding, the first author randomly chose 40 of the 79 participant responses to perform initial coding using the coding system of two codes: characteristics and attributes. The definitions and examples were provided to another researcher as a code book for intercoder agreement. Provisional (i.e., coding starting with set codes with flexibility to add, subtract, or expand) and simultaneous coding (i.e., applying two or more codes to same participant response) (Saldaña 2013). Based on the two researchers' coding experiences, it was decided that sub-codes were needed to deepen the analysis.

Sub-coding (i.e., detailing data into categories) was employed in the second round of coding (Saldaña 2013). The provisional subcodes were the examples given to students for attributes and characteristics, but additional subcodes allowed emergence of other codes throughout the analysis. The first author performed this additional round of coding then approved it through the student researcher who supported intercoder agreement. Consensus was gained on the coding applied to student responses. As such, the first author was then able to apply the newly established and agreed upon coding scheme to all 79 participant responses. The sub-codes were only applied once for each participant's response even though they may have mentioned something within that code multiple times for a peer mentor or they mentioned something for more than one mentor.

3 RESULTS & DISCUSSION

The finalized coding categories with sub-codes, which include but are not limited to the examples given to students in the definition, are presented in Table 1 with frequency counts for each. Of the 404 total codes, 48% of the codes were within the realm of attributes and 52% were within characteristics. It should be noted that these codes relate to any mention of these attributes or characteristics with no regard do whether it was a positive or negative mention of that given attribute or characteristic.

Based on these results, it is shown that the five examples of attributes given in the definition to students were within the top six most frequent attributes coded with first generational status being the least frequent (i.e., 7.6% of participant responses). This is somewhat expected since major, year in school, gender identity, and race may be more easily distinguished through common conversation and appearances than first generation status. The unexpected answer within the top six attributes was courses. Courses were mentioned in 36.7% of participant descriptions, which included both being students in the same course or having a teaching assistant who became a peer mentor within a course.

The six examples given in the definition to students were within the top eight most frequent attributes coded. The ability of the student to provide quality advice and/or support to students, which was an emergent code separate from the examples provided to students, appeared with the same frequency (i.e., 36.7% of participant responses) as effort exerted in engineering. Career interests appeared in 30.4% of participant responses. "Friend" was another emergent code in the top characteristics that appeared in 10.9% of student responses. Hobbies, extracurricular interests,

value placed on engineering, and enjoyment of engineering all appeared in less than 25% of student responses.

Table 1. Coding scheme for qualitative analysis with main codes (i.e., attributes and characteristics) and sub-codes as listed with frequencies.

Attributes (main code)		Characteristics (main code)			
Sub-code	Freq.	Sub-code	Freq.	Sub-code	Freq.
major*	49	advice/support	29	intelligence	4
year in school*	44	effort*	29	motivation	3
gender identity*	34	career interests*	24	formally assigned	2
courses	29	friend	23	informally assigned	2
race*	24	hobbies*	19	interests	2
first generation*	6	extracurricular interests*	14	time demands	2
marital status	2	values*	14	respect	1
religion	2	enjoyment of engineering*	13		
socioeconomic status	2	personality	10		
stage of life	1	relation/living situation	10		
transfer status	1	study group	9		
Total Attributes	194	Total Characteristics		210	

Note: *indicates examples given to students in question prompt definition

To better visualize the overall magnitude of these sub-codes, a word cloud was generated (“Free Word Cloud Generator” 2021). It should be noted that some sub-codes were shortened or hyphenated to allow phrases to be included without being overly burdensome.



Figure 1. Cloud map emphasizing the magnitude of each coding category given according to the size of text (“Free Word Cloud Generator” 2021).

Three overarching themes that the coders garnered from this analysis is that students are going to lean toward some sense of convenience, which may come from someone they already spend time with (e.g., in the same courses and/or major,

friends, relation/living situation closeness [roommate/fiancé], study group). This also allows a mutual benefit to be acquired in the relationship, which is appreciated by students. An additional theme is that students may not recognize that mentorship is happening or its power. Finally, someone with strong motivation, effort, and goals (e.g., major, effort, career interests) seemed to resonate strongly with peer mentees. Representative quotes for each of these themes are shown in Table 2.

Table 2. Representative Quotes of Themes. All

Theme	Representative Quotes
Sense of Convenience and Desire for Mutual Benefit	<ul style="list-style-type: none"> • “We are both super busy and don't have as much time to commit to engineering stuff, but together with our limited time we are still able to accomplish a lot. We have different hobbies and different career interests, but she is literally the only reason I have survived one of my classes this semester.” (Participant 5) • “He is majoring in computer science and is as far along as I am. I am minoring in computer science so we have a lot of the same classes. I also help him with math a lot because I am farther ahead than he is in math. We have similar career interests and hobbies. We play video games together and have started our own business together. He tries very hard in his degree it's harder for him to understand certain subjects than it is for me, so I am able to help him with a lot of things.” (Participant 69) • “There is a girl in my engineering class that I have grown close with. We have become friends and awesome study partners. She excels at somethings that I am not good at and I excel at somethings that she is not good at. Overall we help each other understand what is going on in all of our classes.” (Participant 30).
Lack of Recognition of Mentorship	<ul style="list-style-type: none"> • “My peer mentor is a man I have had a large amount of classes with as our degree plans are almost identical. He is someone that I have spent large amounts of time with working on various assignments and problems within our classes that we share. Outside of our engineering interactions there is not much. We are friends, but with the amount of time we both spend on school it ends up becoming the focal point of everyone of our interactions. I personally see nothing wrong with this as it has been incredibly constructive for me and hopefully for him as well. We do joke around and have casual conversation, but we mostly motivate one another to excel within our respective field.” (Participant 8) • “I have never had an assigned peer mentor, but I feel like every semester I make a friend or two that I have a bunch of classes with and they really fill that role. Though I'm friends with a lot of the guys and have a few that I would consider peer mentors, the women I've met in engineering have helped me more than anything! They're usually at the same point as me, sometimes in my major sometimes not and even though we don't always have similar career goals or interests we always have a similar passion for engineering.” (Participant 53)
Strong (e.g., motivation, goals, effort) Students Resonate with Mentees	<ul style="list-style-type: none"> • “She works really hard and takes school seriously so I know that she knows her stuff and will give me quality advice, not just the first thing that comes to her mind.” (Participant 6) • “I have a few friends in my study group I consider to be mentors. They are all smarter than me, but still good friends. There is about half females in the study group, and I am better friends with them than the males. They all are devoted to their families, and most have spouses and a few have children.” (Participant 32)

3.1 Recommendations & Implications

Based on the aforementioned results, there are a few recommendations and implementations to be recognized regarding peer mentorship. For the first theme of students leaning toward some sense of convenience for who their mentor is, mentees valued the mutuality of benefit in the relationship, particularly around interest convergence. This is an important theme as we didn't recognize a strong need of race or gender being central to mentor/mentee matching conveyed by students even though they may have mentioned the race or gender of their mentor. Interest convergences amongst departments of engineering can be centralized around not just technical aspects (e.g., engineering clubs, professional societies, etc.), but they can also be centered around personal interests (e.g., sports, arts, video games, etc.) to be able to conveniently connect students. For this, it is recommended that engineering departments try to intentionally coordinate events with centralized campus entities to bring together engineering groups to that. While many of these personal connections can happen organically, there does appear to be value provided in formalizing some of these initiatives at the department and institutional levels.

There is a level of mutual reciprocity that can come through these peer relationships. It does not necessarily matter that one student is stronger academically or more involved extracurricularly. It does not necessarily matter that students are the same major or at the same point in their academic career. It should be continually emphasized that together, mentors and mentees can accomplish more because no one person is able to know or do everything.

Second, students may not recognize all the mentorship that is happening since they may only have casual or very compartmentalized connections to these mentors with a lack of formalization, but they do recognize the significance of these relationships. A recommendation for this theme is to intentionally bring forth knowledge from upper-level students to students in lower-levels to share knowledge and insight regularly. For example, bringing in students as both peer mentors and undergraduate teaching assistance may allow students to more regularly identify mentors who can help them navigate their educational processes with more ease. Another example can be an assignment created by an instructor where students are tasked to interview upperclassmen with the intent to help them navigate their class or overall undergraduate research experience. While these activities may appear simplistic, these examples highlight that these types of organic connections do not require many resources to make large impacts on students' success.

Students may need help in recognizing and capitalizing on these relationships. As mentioned by participant 8, it can be "incredibly constructive" to have a mentor, even if you may not interact with them in all spaces. When considering matching mentors and mentees, it may be advantageous to allow for choice and matching to happen in various spaces, allowing students to find someone who can help them in one specific area as needed without the expectation that they need to just have a single mentor that can do everything. Advising can also play a role in this, whether formal

academic advisors or faculty advisors and mentors, to encourage and help in networking efforts.

Lastly, there is a sense that there is a benefit to having a strongly motivated and intelligent peer mentor. Students really focus on the support and advice that can be given by their peer mentor, which may be a result of who the mentor is as a person and what they value. These things should be considered if formally matching mentors and mentees.

As these considerations are made in our development of a culture of peer mentoring either through formal or informal needs, we can see that there is a need for certain characteristics and attributes to be considered depending on the needs of both the mentor and mentee. As we better consider this matching in a flexible way, students can continually find and benefit from a variety of mentors instead of getting focused on just one mentor who is the lone source of all support.

3.2 Limitations & Future Work

This survey was given under COVID-19 pandemic circumstances, so it is recognized that this may have influenced student responses. There were limitations to the short-answer, anonymous format of the question analyzed since it was very limited in the scope it was able to cover. With students being offered definitions of attributes and characteristics, obviously those were some of the top codes, but we did see that students emerged with other characteristics and attributes that were important to them in highlighting the description of their peer mentor. Because of the format, the research team could not further ask for elaboration or clarification in areas of interest. The responses also were not considered in conjunction with any participant demographic information or other responses to qualitative questions. Future work could allow these combinations of results to be further pursued. Future work will also explore additional insights about the needs and perceptions of those with a peer mentor versus those who did not have a peer mentor.

4 CONCLUSION

By exploring descriptions of peer mentors from those students who currently felt that they had a peer mentor allowed for the emergence of things that should be considered when matching, initiating, and encouraging mentorships. Students really resonate when there is a mutual reciprocity in their relationships, allowing themselves to receive support but also to give support. Students may also have difficulty in recognizing the importance of the mentoring relationships they do have, regardless of how casual they may seem. Students also appreciate when their mentors show strong motivation, drive, and value, which helps them to push themselves as well. These findings further confirm the benefits of peer mentorship and the wide variety of positive means that peer mentorship can come by. This speaks to the need for students to have many mentors for the various spaces they are involved in and have choice and flexibility in their mentors. Students do not need to be the “same”, but any positive connections created for students are meaningful.

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