The Future of Engineering Education
2024 Annual Conference & Exposition
Oregon Convention Center
Portland, OR . June 23 - 26, 2024
ASEE
Paper ID #43247

Impacts of Near-Peer Mentoring Between Graduate Students and Undergraduate Transfer Students in Engineering and Computing

Shannon Conner, Clemson University
Skylar Hubbarth, Clemson University
Dr. D. Matthew Boyer, Clemson University

Dr. Boyer is a Research Associate Professor in the Department of Engineering & Science Education in the College of Engineering, Computing, and Applied Sciences at Clemson University. His work focuses on how technology supports knowledge building and transfer in a range of learning environments.

Impacts of near-peer mentoring between graduate students and undergraduate transfer students in engineering and computing

Introduction

Mentoring is a practice in which a student, or mentee, and a more experienced individual, a mentor, engage in a relationship that includes advising or instructing by the mentor to the mentee. This type of relationship can be seen throughout academia and is commonly found between staff members and students. The concept of near-peer mentoring reflects the ideas and goals of traditional mentorship but is formed between individuals who are at similar experience levels, personally or professionally, where the mentor and mentee relate to one another due to similar age proximity, shared goals, common experiences, or personal connections they may not share with a more senior mentor. Near-peer mentors are often perceived as more in tune with the struggles of their mentees [1] and more approachable than an individual who identifies as an "expert" scientist [2]. Examples of near-peer mentoring relationships in academia include an upper-level student and a first-year student, an undergraduate student and a graduate student, or a graduate student and a new faculty member.

Near-peer mentoring can positively affect both the mentor and the mentee. Student mentees have stated that they feel more comfortable asking a near-peer mentor for academic help than they do a professor [3] and believe access to near-peer mentors promotes success in their coursework [4]. Students also believe that near-peer mentors understand problems that students encounter with peers in the classroom, such as in navigating group settings, and can help the students improve their communication skills [5]. Participation in near-peer mentoring programs help students learn to be self-sufficient and comfortable performing their classwork by utilizing skills learned from their mentors [6]. Mentees often appreciate the individualized attention they receive from a mentor that an instructor may not have the time or capacity to provide [4]. Beyond the classroom setting, students who underwent near-peer mentoring felt more connected to their college campus [4] and more comfortable in extending a personal connection to their mentors than to their professors, such as opening up about the use of drugs and alcohol [7].

Near-peer mentoring also provides benefits to mentors. Training programs for mentors can help increase technical knowledge, teach interpersonal and cultural skills, improve problem-solving, and develop research and teaching skills [3]. Working with mentees can provide opportunities to build communication skills, allow mentors the chance to practice explaining in depth research topics to others at an approachable level, and can encourage researchers to reflect on why they utilize certain research processes and their ultimate goals of research [2, 3]. Mentoring is also a valuable skill to have when entering the job market, and applicants with the ability to be an effective mentor are often sought by employers [1,8].

While there are benefits that both mentees and mentors experience in a near-peer mentoring relationship, there are also problems or concerns that should be considered when forming a mentoring program. Higher levels of comfort in asking their mentors questions could lead to student mentees solely seeking their mentors for help, rather than their classroom instructor, and they may rely too much on their mentor to solve all their classroom problems, limiting the learning they can do independently [4]. Other issues may occur if a mentor has not

been fully trained or equipped to help a mentee which can lead the students to find answers and feedback unuseful [5].

Program Background

The Student Pathways in Engineering and Computing (SPECTRA) program is an NSF Scholarship in STEM (S-STEM)(Award # 1834081) based out of Clemson University in South Carolina. The SPECTRA program focuses on aiding transfer students interested in an Engineering or Computing degree by offering scholarships, opportunity to form cohorts, and access to professional skill-building programs.

The goals of SPECTRA are as follows:

(1) to provide scholarship opportunities to low-income students who wish to pursue engineering or computing at Clemson
(2) to build cohorts of transfer students to support their transition into Clemson while also allowing for the Advisors for Cohorted Engineers (ACE) Fellows program to aid in the training and practice of Ph.D. candidates who wish to pursue careers in academia
(3) to assess its progress both internally and externally to assist the transfer students best and improve the program

The ACE Fellows program provides Ph.D. students looking to have a career in academia, and who would like to build their teaching skills, the opportunity to become the instructor of record for a course at Clemson University and to teach, or co-teach, an engineering course at a partnered technical college. Applications were accepted from any upper level PhD student studying either engineering or computing. Students who apply for the ACE Fellows program undergo an interview process during which they must provide a proposed course plan, including the topic of the research they would like to perform with the SPECTRA scholars or examples of potential research projects. Four ACE Fellows were working in the program at the time of our study; all four Fellows had had the opportunity to lead a research project, but at the time of interviews only two had had the chance to teach at a partnered technical college. During the research course, the students and ACE Fellows work closely together to produce and implement student-led research projects facilitated by the ACE Fellow. The relationship between the ACE fellow and the SPECTRA scholars resembles a near-peer mentoring relationship.

This paper aims to observe the relationship between the students and the ACE Fellows through the lens of Crisp and Cruz's [9] mentoring framework, with an additional goal of identifying aspects of the program that the students and the ACE Fellows find valuable to their time in the program. By understanding how the students and ACE Fellows view their relationship and the benefits they receive from each other, the SPECTRA program can make informed decisions about how to structure the collaborative aspect of this program based on where it is currently strong and where it could use reform, thus facilitating a positive and beneficial experience for both the students and the ACE Fellows during their time in the program.

Broader implications of this work include deeper understanding of how transfer students are impacted by near-peer mentoring and undergraduate research opportunities. In addition, the

ACE Fellows program is designed to provide graduate students who are interested in teaching, but who may not have the opportunity to do so in their own departments, the ability to be an instructor of record in a course of their own design. In analyzing the outcomes and responses of the ACE Fellows experience, we can observe how their identity and motivations towards teaching evolve and what they found most valuable after undergoing a teaching experience. Their perceived successes and failures of their teaching experience can provide insight into the value graduate students gain from teaching a course.

Methods

The SPECTRA program aims to implement design-based research in which the research findings influence the study's design and the implementation of program goals. The research conducted in this paper uses qualitative methodologies to analyze the experience of SPECTRA scholars and the ACE Fellows in a near-peer mentoring relationship. The SPECTRA scholars and the ACE fellows participated in semesterly interviews that probed their experiences in the SPECTRA program, their departments, and at the University. All four of the ACE Fellows were interviewed; participation was requested by their supervisor as part of their responsibilities during their time in the program. SPECTRA scholar interview participation was highly encouraged but not required by the program. Students were sent interview requests through their student emails and they could choose to accept or decline the request. Data from a total of 44 students were analyzed for this study. The interviews analyzed in this study were held over a one-year period, from Spring 2022 and Fall 2023, during which the same ACE Fellows were interviewed twice and 19 of the student participants took part in two interviews, the other student participants were only interviewed once.

Interviews lasted 30 minutes and were semi-structured. The interview process began in 2019, in which COVID-19 restricted in-person interactions. To accommodate the students, interviews were conducted via Zoom and then were continued to be held on Zoom as the online nature allowed students flexibility to work around time and travel restrictions. Zoom also allows for efficient recording and transcribing. One to two educational researchers helped to conduct the interviews, with one acting as an observer who could expand on topics at the end of the interview. Transcriptions were exported from Zoom, cleaned by researchers, and uploaded to Taguette, where they were then coded using a pre-established code book. The codebook had been developed at the beginning of the program and represented large themes derived from the initial data. The codebook has since expanded as more findings emerged. Following the initial coding process, the large thematic codes were further divided into subcodes, which were analyzed by the researchers to find commonalities among the participants' responses.

For this study, we focused on reviewing and analyzing codes that related to the students' and ACE Fellows' interactions. The ACE Fellows interviews were coded using the Crisp and Cruz [9] mentoring framework. The framework was also used to further subcode the student responses.

Near-Peer Mentoring Framework

Crisp and Cruz [9] found that much of the mentoring literature from 1990 to 2007 needed a stronger framework upon which to build research [9]. As such, they proposed a new framework around mentorship, which can be adapted for use in a near-peer mentoring context [5].

The framework divides the impacts of mentoring into four constructs: (1) psychological and emotional support, (2) support for setting goals and choosing a career path, (3) academic subject knowledge support, and (4) specification of a role model.

The first piece of this framework is psychological and emotional support. Psychological and emotional support concerns how the participants feel supported. Examples of support may be feeling that someone is listening to them, experiencing moral support and encouragement, and helping to find problem resolution. The second piece of the framework is support for setting goals and choosing a career path. There are many ways in which a mentee can find career or goal-related support from a mentor. Support may look different depending on the setting, but mentors may help students or mentees find what they are successful at or enjoy and provide them with a better understanding of some of the groundwork it could take to get there. In an academic setting, this could look like a mentor using their own experiences to provide suggestions of careers or goals for which the mentee could further explore.

The third aspect of the framework looks at academic subject knowledge support. A mentor should provide the student with assistance in their coursework. Knowledge support is often reflected as a teaching-based relationship where the mentor teaches or shows the mentee something to help with their school curriculum. However, this can also occur outside of the classroom, such as by promoting a student's achievements or shielding them from negative repercussions. The fourth portion of the framework is the specification of a role model. The mentee should be able to learn from their mentor's past experiences, such as their successes and failures. The mentor shares things about themselves with the mentee throughout their relationship, or, through observation of the mentor, the mentee can pick up on how to manage and react to situations.

Data and Analysis

Psychological and emotional support

While the SPECTRA scholars did not necessarily believe that the ACE Fellows were crucial members of their psychological and emotional support network, they did indicate that the ACE Fellows created a more comfortable and relaxed environment for them when compared to their usual courses and professors. The students discussed feeling connected with, or more comfortable around, the ACE Fellows primarily due to their closeness in age. The scholars indicated that, while they did view the ACE Fellows as instructors, they also saw them to be students like themselves. Several felt that the ACE Fellows were more in tune with their personal experiences and struggles which made them more relatable and act with greater understanding. One student appreciated that their Fellow saw their struggles, validated the difficulties they were going through, and encouraged them to keep trying.

Additionally, the classroom environments created by the ACE Fellows were seen as less structured or strict. One student indicated that “classes feel more like a conversation” with their ACE Fellow as opposed to the standard lecture format many were used to. The students felt comfortable talking with the Fellows after class about personal interests that did not relate to their course material, such as personal hobbies, further indicating that the students viewed the

ACE Fellows as someone they felt comfortable speaking with and opening up to. See Table 1 for sample quotes from student interviews that relate to psychological and emotional support.

Example student quotes highlighting *Psychological and emotional support*
"I think the big difference is that: with the professor there's – I think, for some people it's – there's like a barrier of, okay, this professor, you know, talk to him like, formal and stuff like that. With my CI instructor, it's a lot easier to talk to him, because it's not as much of a gap in terms of like, knowledge and age."
"I don't know if I could have gotten this far without her, because I was able to talk to her, and she was like. Hey, you know what you're doing fine - keep going. It's hard- engineering's hard. You can do this, and she gave me the confidence to keep going. I- I don't know if I would have been able to do it without her"
"They kind of understood our struggles a lot more I think that a professor could, and a lot of the instances, because she was currently going through a lot of like the struggles that we were going through as- as students."

Table 1: Student interview quotes highlighting situations of the ACE Fellows providing students with psychological and emotional support.

In interviews with the ACE Fellows, while they did not believe they provided direct emotional support, they did think that they tried to create a comfortable and casual environment for the students. They wanted the students to feel open to asking them questions and discussing day-to-day activities with them. Like the scholars, the ACE Fellows felt that the casual environment was related to their closeness in age and the similarity in their situations of both being students. See Table 2 for sample quotes from ACE Fellow interviews that relate to psychological and emotional support.

Example ACE Fellow quotes highlighting *Psychological and emotional support*
"I've become [a] familiar face, so they are more-I mean-we can have discussions now. They are not afraid to be more open about how they feel, like, what they think about situations regarding the- the projects that we're doing right so, and they are more open to ask questions in a typical way they would ask questions"
"the one year I'm at [Technical College], students are really willing to share their story with me, and I'm able to learn what their life is like"
"because I'm about the same age, and like I'm not you know, scary old professor, or something like that. I think it helps them feel a little bit more comfortable in the class, and like they can both talk to me and kind of try new things and get outside of the comfort zone a little bit more"

Table 2: ACE Fellow interview quotes highlighting situations of providing students with psychological and emotional support.

In analyzing the data, the psychological and emotional support aspect of mentorship is fulfilled in this relationship due to the ease of atmosphere the students feel in the classroom. While the students do not provide indications that the ACE Fellows would be the first person they would reach out to in the event of needing more official support, they do feel comfortable and consider the class a break from other more strict courses, and they enjoy what they are working on in the SPECTRA class.

Support for setting goals and choosing a career path

In setting goals and choosing career paths, the ACE Fellows main focus is for the students to succeed and complete the research projects they perform in their course. Learning to plan and manage a project is beneficial for future careers, but the students also believed that the ACE Fellows assisted them with some career insights or potential pathways to explore after graduation. For some students, their ACE Fellow introduced them to people currently working in their field of research, and they shared careers that could be possible for students with interests relating to the ACE Fellows field of study. Students also appreciated that the Fellows would discuss problems or important topics being debated within the current workforce, as it provided insight into the field. Additionally, a few students expressed an interest in graduate school. They believed that the ACE Fellows could be used as a resource to discuss continuing their education as a potential plan for their future. See Table 3 for sample quotes from student interviews that relate to support for setting goals and choosing a career path.

Example student quotes highlighting *Support for setting goals and choosing a career path*
"We also got the ability to visit different doctors' labs as well, and see what kind of research that they were doing. And how – how what they were doing could be applied to our major as well. And so we're just seeing all this different stuff and opening our eyes to different avenues and whatnot."
"they gave me a um perspective on how you know, graduate level engineering works, and how you know you could go get a Phd after um after college. So that really gave a better perspective on that. Maybe help make some decisions of what I'm going to do after I get out of college."

Table 3: Student interview quotes highlighting situations of the ACE Fellows providing students with support for setting goals and choosing a career path.

The ACE Fellows hoped that they were able to show students how their research could tie together with multiple programs and majors. A common theme among the Fellows was that, while the ACE Fellows may not have been in the same program as the students, they wanted the students to be able to connect engineering and computer science topics back to their own interests and passions. They wanted to show the interdisciplinary nature of engineering and the importance of working with others. See Table 4 for sample quotes from ACE Fellow interviews that relate to setting goals and choosing a career path.

Example ACE Fellow quotes highlighting *Support for setting goals and choosing a career path*
“I'm like a channel, or like a window to like, reflect this stuff, or convey the stuff that you needed to learn in order to earn your degree, right? But there is, like, a whole world that you can explain. You can go explore on your own.”
“I obviously – I'm not going to represent all of the engineering majors, but I always encourage them to explore what they could do with their major.”

Table 4: ACE Fellow interview quotes highlighting situations of helping students with setting goals and choosing a career path.

The ACE Fellows, while not working in industry at the time of teaching, have high skill levels, experience, close ties to instructors, and potential connections with people in industry. These are traits that can be considered very valuable to the SPECTRA scholars. The students seem to benefit from getting to work with a graduate student on a research project and being able to learn skills and network with others who could help them achieve the careers they desire.

Academic subject knowledge support

Much of the subject knowledge that the students develop comes from the ACE Fellows helping them with their specific research projects. Most of the students found that the topics taught in the courses were interesting and enjoyable. A few of the ACE Fellows made it a standard practice to have the students connect what they were working on in the course back to the student's own interests, majors, and potential careers. While this was a positive aspect of the program for some, other students found relating the material from their research back to their major to be difficult.

The SPECTRA research courses were also viewed as beneficial to students' learning, as the students expressed the course provided a hands-on experience that their traditional classes lacked. In addition, students felt that the ACE Fellows could more effectively answer some of their questions than a traditional instructor. They believed this to be the case because the ACE Fellows were closer to their experience level and likely had learned the same material more recently than a professor who had been teaching for many years. See Table 5 for sample quotes from student interviews that relate to support for setting goals and choosing a career path.

The ACE Fellows view themselves as teachers to the students. Through their classes, they want the students to not only experience research but also learn engineering (and computer science) material and practice things that will help them in their classes, at the university, in their future jobs, or in their lives. See Table 6 for sample quotes from ACE Fellow interviews that relate to setting goals and choosing a career path.

Example student quotes highlighting *Academic subject knowledge support*
“I did super enjoy that class. It was very, like, because it wasn't like him teaching us stuff. It was him just like saying, like necessarily teaching us how to think in a certain way, but teaching us how to think in our own way. It [is a] very, like, exploratory class.”
“every week you had to, basically, like, present, like, how the prior week's topic is relevant to your major. Like you would have to find some sort of correlation between what we talked about, and how it can be applied in your major, whether it was in the past or present, or even in the future.”
“the thing about professors is that normally, they've done it for so long it's like, it's hard for them to answer questions to someone who doesn't know like, all the steps, because to them it's just like breathing, in a sense, whereas the graduate student, they recently went through those classes. They kind of understand those questions a bit more from your perspective. And so you get a lot more feedback that’s – I don't say just more helpful, but you get a lot more feedback that's easier to interpret.”

Table 5: Student interview quotes highlighting situations of the ACE Fellows providing students with academic subject knowledge support.

Example ACE Fellow quotes highlighting *Academic subject knowledge support*
“I always provide not just the classroom applications, but also the practical.”
“academically they are beginning to understand the general expectation of what it is like to be in a 4 year institution like Clemson. The expectations that you should expect-oh like the demands you can expect from your-your professors and stuff like that, because I-that's basically how I would demand what I would demand of them.”

Table 6: ACE Fellow interview quotes highlighting situations of providing students with academic subject knowledge support.

In summary, the SPECTRA students indicate high academic value in the research course. The students are given the opportunity to gain hands-on experience, which can put their class-learned knowledge to practical use. Negative aspects relate to students who struggle to find how their major connects and, therefore, how the class can help them further their subject knowledge. Perhaps a solution to this is to have the students connect the material back during the course itself in a manner that some of the ACE Fellows have already self-implemented.

Specification of a role model

Most students did not directly refer to the ACE Fellows as role models; however, the definition of a role model is someone to look up to as an example of what to do or as someone to imitate. Considering this definition, the students' responses indicate that they viewed the ACE Fellows as people to model in some way.

The students often discussed their respect for the knowledge the ACE Fellows brought to the classroom and saw them as figures they could learn from. Beyond subject knowledge, the

students felt that the Fellows helped them develop confidence in their abilities and gave them better insight into approaching problems. The students believed that the Fellows were good resources and that they would be willing to help them if they needed it. In addition, some students interested in graduate school found the ACE Fellows to be a good resource for how applying to and attending graduate school worked. See Table 6 for sample quotes from student interviews that relate to ACE Fellow specification as a role model.

Example student quotes highlighting *Specification of a role model*
"I was looking into going to a graduate program, too. So talking to him about his process of going to a different school, and whether or, like, about, like, the thesis that he had to do for the masters program, and through the uh, like, what his research is to the doctors program. Um, like the Phd program, it's been like, really insightful of like different perspectives, I guess, of graduate school"
"it was good because it was also good to see how a graduate student would approach problems and how he will, you know. It's good to hear his feedback on certain things. How we approached it."
"It's like a mentor, like, you know you can, so that you know he- he has full- a lot of knowledge and a lot of done, not learn, he can be learned from."

Table 7: Student interview quotes highlighting situations of the ACE Fellows fitting the specification as a role model.

In the interviews with the ACE Fellows, they saw themselves more as an instructor than as a role model. However, they did believe they had some role model and mentor-like qualities, such as motivating them to succeed both in and out of class and showing them that if they themselves were able to succeed, then the students would be able to as well. See Table 8 for sample quotes from ACE Fellow interviews that relate to setting goals and choosing a career path.

The students in the SPECTRA program indicate that they view the ACE Fellows as someone whose actions could be modeled to succeed, and the Fellows themselves seem to agree that in observing and working with the students, they hope that the students are able to visualize themselves succeeding similarly in the future. This aspect of the relationship appears to be strong and of high value for the students in the SPECTRA program.

Example ACE Fellow quotes highlighting *Specification of a role model*
"I think my roles is an ACE Fellow, or, again, similar to as a teacher of trying to be a unofficial mentor to these students and trying to help point them in the right direction when they need it, for something outside of class trying to help them succeed within class, trying to help with a lot of community building and trying to make it where the class can be beneficial to them without being a burden to them."
"it can be more of a near-peer mentoring kind of situation where a lot of them are similar age to me. Some are older, some are younger, but I'm, you know, quite close to their age in most cases, and you know I look like a lot of them, which I think kind of helps with the "oh, hey, there's someone here that like I can kind of relate to, and I can see that. Well, there's- they succeeded here. They're doing well here. Well, that makes me feel like I can as well."
"I'm hoping that, you know, students will see me as, like, a catalyst as their – like what they wanted to do in the future, rather than see me as like, oh, I just take this class and get it over with."

Table 8: ACE Fellow interview quotes highlighting situations of identifying with the specification of a role model.

Benefits of near-peer mentoring on the ACE Fellows

While the interaction with ACE Fellows provides the SPECTRA students various benefits, the ACE Fellows noted many benefits for themselves as well. The most cited benefit was regarding the chance to have teaching experience. The ACE Fellows program was designed to give students the opportunity to teach and develop their own projects and curriculum. Teaching opportunities may be challenging to find within some departments, and for several of the ACE Fellows instructing the research course was their first chance to teach in academia. All of the ACE Fellows believed that the experience had taught them how to improve their teaching ability, and some believed the experience helped develop their teaching identity so that they could see themselves as instructors who genuinely want the students to succeed in their course as opposed to just teaching as part of their job description. See Table 9 for sample quotes from ACE Fellow interviews that relate to their feelings of improvement as an educator.

Beyond feeling that they improved, the ACE Fellows could specifically point out things they learned about teaching through participating in the program, including becoming better at teaching, but they also found that the experience allowed them the opportunity to become better at planning, organizing, and skills such as syllabus creation. See Table 10 for sample quotes from ACE Fellow interviews that relate to their feelings of skill improvement through experience.

Example ACE Fellow quotes highlighting *Feelings of Improvement as an educator*
“I do feel like I have become a stronger professor or a stronger instructor this semester.”
“I think it's changed in the sense that I think of myself less as a-as-as an ACE Fellow, and more of being a teacher now. I think, in the-the first semester of it, it was much more so you're an ACE Fellow, you're doing it as part of this program, you're here to do XYZ, and the second semester, it feels more of a… my primary goal is to be a really good teacher for my students, and to help them succeed.”
“I've learned a lot more about different resources, via OTEI (Office of Teaching Excellence and Innovation), which will blame [NAME] for and and other things like that, and how to- how to be a more effective teacher. And it's been really helpful for kind of growing that side of my skill set, and as someone who down the road wants to be a college professor, being able to have this experience and, like, get to play around with a lot of these skills early in my career has-has been really awesome.”

Table 9: ACE Fellow interview quotes highlighting feelings of improvement as an educator.

Example ACE Fellow quotes highlighting *Skill improvement through experience*
“It kind of gives that overview of the different aspects of teaching from TA-ing to- to creating your own class, to being- provide the material and developing the curriculum from the material.”
“[I] learned that teaching’s really hard but last semester was the first time I'd ever taught a course, or ever designed a course so definitely had a-a very big learning curve with all of that. I think the biggest thing I learned moving from that semester to this semester is that it's okay to dial back the breadth of the project or the amount of material that you're trying to cover in in a course like this, because at least in my mind that's not the primary goal of it.”
“I'm getting a good idea of what I'm getting myself into just in case I get into academia-you know, the developing syllabus, developing curriculum, engage our students, and also supervisor like basically acting on the capacity of a principal investigator for- for- for projects.”

Table 10: ACE Fellow interview quotes highlighting feelings of improvement as an educator.

A few of the ACE Fellows discussed a deeper understanding of the additional struggles and motivations that transfer students may have compared to other students. One Fellow brought up how working with the students gave them a better understanding of diversity, equity, and inclusion, and also discussed how in speaking with the students they learned more about their lives and interests and what motivates them to succeed. Another Fellow brought up aspects to the SPECTRA program that they viewed as needing improvement. They discussed feeling that the students in SPECTRA may need more prolonged support than what was provided and that the difficulties that transfer students face may not go away after their scholarship period is up. While the Fellow felt that transfer programs need to support their students better prior to the SPECTRA program, their participation did appear to make them consider the specific ways in which

SPECTRA could be improved, and their ideas are valuable insight as they work closely with the students and speak with them often. See Table 11 for sample quotes from ACE Fellow interviews that relate to their feelings of understanding transfer students.

Example ACE Fellow quotes highlighting *Understanding transfer students*
"I changed my perspective about DEI. I used to think DEI is only about – which I don't think it should be. you know, about race, ethnicity, stuff like that. Really, transfer students are another perspective to DEI, because they are not non-traditional college students, right? And these students have – their stories really changed my view as well, of why people wanted to get a bachelors. Some people wanted to help their families to provide. So, I think that helped me grow personally, not just from, like, oh, academic, or, like, career-wise"
"I think there also needs to be a lot of work on- Well, how do we make it feel like we aren't still abandoning them? Because I think that's kind of one of the big problems with transfer students and transfer programs right now. It's just kind of all on-how do we get the students here? And then, once they're here, how do we help them succeed?"

Table 11: ACE Fellow interview quotes highlighting feelings of understanding transfer students.

Discussion/Conclusion

Our findings mirror other near-peer studies in the benefits that they bring to both the mentors and mentees. Many of the mentees felt comfortable working with the ACE Fellows which stemmed from the sense that they were more at ease in speaking, interacting with, and asking the Fellows questions compared to their other instructors. These feelings allowed the students to feel more relaxed and confident in the research that they were performing as well as feeling that they were getting a break from a more traditional classroom experience. The atmosphere in the course may also connect back to previous findings in the SPECTRA program in which the students believed the research course provided a good environment to build strong connections with their peers, allowing for the creation of friendships and study groups, which is an aspect of the program that the students greatly valued [10].

Additional student benefits are that the SPECTRA scholars believed that the ACE Fellows were helpful to them when considering what they want for their futures, which came up in both the ACE Fellows and student interviews. The students felt that they could see potential options for themselves based on their interaction and experiences from the class. For some students, these possibilities included the idea of attending graduate school. From the ACE Fellow's point of view, they attempted to incorporate discussions of career paths into their lessons to give the students some additional considerations in the process of figuring out their futures. Further researching the specifics of how student research can overlap with career goals is an aspect of the program that could benefit from expanding. Students who indicated that they did not see career benefits to participation in the research course may be better served if they were to have more options for research, which more strongly relate to their specific fields, or a more deliberate attempt to tie multiple aspects of different engineering programs into the different research topics. Some program changes have recently been made that would allow students to participate in a research course outside of the SPECTRA program if the topic relates more

strongly to their interests. As this is a recent adjustment, the results of allowing students research options outside of the program have yet to be observed.

ACE Fellows benefits mostly centered around feelings of improvement in their skills as educators. They believed that the opportunity to be involved in the ACE Fellows program provided them with a flexible space in which they could practice their skills and attempt to make improvements to their classroom teaching style to find what would be most beneficial to the student's learning as well as their own comfort. They also found that they were able to develop skills beyond being able to convey material, but also learned how to develop a course from the ground up, which included the opportunity to construct a syllabus and lesson plan, run a classroom taking into account time constraints and student and abilities, and how to account for student expectations for the course. As many had not had the chance to teach prior to the SPECTRA experience, the lower-stakes environment of a research course may have provided them opportunity to develop their identities and skills as instructors. In addition, working with transfer students brought some of the Fellows a deeper appreciation of some of the additional struggles that transfer students may face through their degree program which may make them more understanding educators in the future.

Involvement in undergraduate research has been previously shown to improve transfer students' experience at their institutions [11, 12]. SPECTRA is unique in its approach as it includes near-peer mentorship entwined with undergraduate research. Combining the two has had positive impacts to both the students and the ACE Fellows. As such, for future iterations of the SPECTRA program and transfer programs with similar goals, the inclusion of a near-peer aspect should be highly considered to not only improve transfer students' experience but also provide a unique opportunity to graduate students who are interested in academia to not only be an instructor of record but also to develop and run their own course material in a low-stakes environment.

References

[1] Zaniewski, A.M., Reinholz, D. “Increasing STEM success: a near-peer mentoring program in the physical sciences,” *IJ STEM,* vol. Ed 3, no. 14. Aug. 2016.

[2] Edgcomb, M. R., Crowe, H. A., Rice, J. D., Morris, S. J., Wolffe, R. J., & McConnaughay, K. D. “Peer and near-peer mentoring: enhancing learning in summer research programs,” *Council on Undergraduate Research Quarterly,* vol. 31, no. 2, pp. 18-25. 2010.

[3] Abeywardana SU, Velasco S, Hall N, Dillon J, Chun CA. “Near-peer Mentoring in an Undergraduate Research Training Program at a Large Master's Comprehensive Institution: The Case of CSULB BUILD,” *UI J.,* vol. 11, no. 1. May 2020.

[4] Colvin, J. W., Ashman, M. “Roles, Risks, and Benefits of Peer Mentoring Relationships in Higher Education,” *Mentoring & Tutoring: Partnership in Learning,* vol. 18, no. 2, pp. 121-134. May 2010.

[5] Gunn F., Lee H.L., Steed M. “Student perceptions of benefits and challenges of peer mentoring programs: divergent perspectives from mentors and mentees,” *Marketing Education Review*, vol. 27, no. 1, pp. 15-26. 2017.

[6] Al-Thani, N. J., Santhosh, M. E., Bhadra, J., & Ahmad, Z. “The Prominent Roles of Undergraduate Mentors in an Online Near-Peer Mentoring Model,” *Sustainability*, vol. 15, no. 4. 2023.

[7] Qua K, Pinkard O, Kundracik EC, Ramirez-Bergeron D, Berger NA. “Near Peer Mentors to Address Socio-Emotional Issues Among Underrepresented Minority High School Students in Research Intensive STEM Programs: Perceptions of Students and Mentors,” *J STEM Outreach,* vol. 3, no. 1. 2020.

[8] Anderson, Margery K., R. Jerome Anderson, Laura S. Tenenbaum, Emily D. Kuehn, Holly K. M. Brown, Swati B. Ramadorai, and Debra L. Yourick. “The Benefits of a Near-Peer Mentoring Experience on STEM Persistence in Education and Careers: A 2004-2015 Study,” *Journal of STEM Outreach,* vol. 2, no. 1, pp. 1–11. 2019.

[9] Crisp, G., & Cruz, I. “Mentoring College Students: A Critical Review of the Literature between 1990 and 2007,” *Research in Higher Education,* vol. 50, pp. 525-545. 2009.

[10] Conner, S., DiSilvestre, O. A., Ridlehuber, M. L., Averitt, L.& Boyer, D. M. “Examining Student Experiences Related to Transfer from Two-Year Technical Colleges to Engineering and Computer Science Degree Programs at a Four-Year Institution.” American Society for Engineering Education (ASEE) Conference, Baltimore, MD, United States. 2023.

[11] Chamely-Wiik, D., Frazier, E., Meeroff, D., Merritt, J., Kwochka, W. R., Morrison-Shetlar, A. I., Aldarondo-Jeffries, M., Schneider, K. R., & Johnson, J. “Undergraduate Research Communities for Transfer Students: A Retention Model Based on Factors that Most Influence Student Success,” *The Journal of Scholarship of Teaching and Learning*, vol. 21, no. 1. 2021.

[12] Nerio, R., Webber, A., MacLachlan, E., Lopatto, D., & Caplan, A. J. “One-Year Research Experience for Associate’s Degree Students Impacts Graduation, STEM Retention, and Transfer Patterns,” *CBE Life Sciences Education,* vol. 18, no. 2, pp. ar25–ar25. 2019.