Advising from community college to university: What it takes for underrepresented transfer students in STEM to succeed

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Abstract

Community colleges are increasingly recognized as providing an accessible and affordable pathway to STEM occupations, particularly for underrepresented racial and ethnic, first-generation, and low-income students. There are several institutional and academic factors that influence transfer outcomes. But one of the most central factors that can either help students successfully navigate the two-to-four-year pathway or cause significant roadblocks and cost students considerable delays – is advising. In this study, we investigate how advising practices at three institutions – two community colleges and one university – contribute to the success of underrepresented students on the transfer pathway in STEM disciplines. We conducted interviews with 39 near-transfer or recently transferred students in STEM. Most students experienced at least some good advising (72%); however, 55% reported poor advising experiences, which in some cases created undue challenges and barriers. Positive advising experiences contributed to students' sense of trust with their advisors, departments, and the institution. Early positive relationships with advisors also contributed to students being more likely to seek future help from advisors (including at other institutions); conversely negative advising relationships contributed to students being more likely to seek help elsewhere, like from friends or family, and sometimes giving up and not receiving any help at all.

Keywords: Advising, STEM, transfer, underrepresented, community college students, transfer pathways

Introduction

This paper addresses the importance of focused advising with underrepresented transfer students in STEM. Through their transfer function, community colleges represent an important avenue for social mobility for underrepresented racial/ethnic groups, low-income, and first-generation college students. Additionally, STEM careers are high-paying, stable and in-demand professions, yet STEM disciplines still face deep disparities in the representation of certain racial and ethnic groups and low-income populations (National Science Board, 2021). Moreover, STEM careers nearly universally require postsecondary degrees and 73% of new jobs in STEM fields will require a bachelor's degree (Fayer, Lacey, & Watson, 2017). With their diverse student populations and transfer opportunities, community colleges are poised to play a significant role in diversifying the STEM workforce and providing access and opportunities for social and economic mobility for underrepresented populations.

Transfer pathways are challenging which may hinder their ability to deliver on their promise of a pathway for social and economic mobility. Transfer students from community colleges -- especially those in STEM – often experience "transfer shock" in their first year at four-year universities (Cejda, Kaylor, & Rewey, 1998; Elliott & Lakin, 2020; Wetzel & Debure, 2018). This is commonly because transfer students earn lower grades than their native peers during their first year, are unfamiliar with institutional requirements at first, have a shortened timeline to completion, and may not yet feel connected to their majors or departments (Elliott & Lakin, 2020; Ishitani, 2008; Wetzel & Debure, 2018). STEM transfer students are particularly impacted because they have more sequential courses to take, which makes successful completion of every course critical for their already shortened timelines (Elliott & Lakin, 2020). Several researchers have found that effective advising is one of the most crucial contributing factors that

can help transfer students persist, overcome transfer shock, and boost their sense of belonging (Packard, Gagnon, LaBelle, Jeffers, & Lynn, 2011; Packard, Gagnon, & Senas, 2012; Wetzel & Debure, 2018). Students of color and those from low-income backgrounds are disproportionately impacted by the challenges of transfer because many of these students who attend college begin their studies in community colleges (Hagedorn, Moon, Cypers, Maxwell, & Lester, 2006; Witham, Malcom-Piqueux, Dowd, & Benismon, 2015). Further, underrepresented students continue to earn disproportionately smaller percentages of STEM undergraduate degrees (National Science Board, 2021). Therefore, the purpose of this study is to better understand what types of advising experiences help ease transfer progress for students in STEM, and particularly for underrepresented students (first-generation, low-income, and underrepresented by gender and/or race/ethnicity) since they are overrepresented in community colleges on the transfer pathway to a STEM degree. The research question guiding this study is: What kinds of advising interactions and relationships support the success and persistence of STEM transfer students' academic progress, and what kinds negatively impact students?

This study addressed this question through a qualitative interview study with near-transfer or recently transferred students in STEM at three institutions in different states that have had demonstratable success supporting underrepresented students in STEM. We focused on students' perceptions of impactful advising – both positive and negative – as there is a need for a better understanding of what transfer students experience and how they feel their experiences impact their academic progress.

Role of community colleges in promoting diversity in STEM education

Community colleges are increasingly recognized as providing an accessible and affordable pathway to STEM occupations, particularly for underrepresented racial and ethnic, first-generation, and low-income students (National Academies of Sciences, 2016; National Academy of Engineering & National Research Council, 2012). Community colleges represent a vital pathway for diversifying STEM education and careers because, according to the National Science Board (2021), people of color continue to be seriously underrepresented in the STEM workforce, even though they are the most rapidly growing segment of the U.S. population. Hispanics, African Americans, and Native Americans are especially underrepresented (National Science Board, 2021). Together these three groups account for nearly one third of the U.S. population, but only 23 percent of the STEM workforce (National Science Board, 2021). Community colleges are a pivotal avenue to increase social mobility, especially in STEM fields, because they enroll nearly half of the nation's undergraduates (Xu et al., 2017), and nearly 60 percent of Black and Hispanic students and nearly 50 percent of low-income students -- who are enrolled in four-year universities -- have attended a community college (Witham et al., 2015). Further, nearly 70 percent of STEM community college students are first-generation (vs. 38 percent of STEM students at four-year universities), 11 percent are Black (vs. 9 percent at universities), 14 percent are Hispanic (vs. 9 percent at universities), and 28 percent are 22 years old or older (vs. 4 percent at universities) (National Academies of Sciences, 2016). Indeed, community colleges enroll proportionately more students from underrepresented demographic groups, including racial and ethnic minorities, low-income, first-generation, and non-traditional-aged college students (Dounebaine, 2020; Jackson, 2013; Xu et al., 2017). However, despite community colleges' important role for broadening participation in STEM, persistence and

success rates are low for marginalized students enrolled in community colleges (Dounebaine, 2020). More information is needed on why these rates are so low and on what it takes for underrepresented students to persist and succeed via the community college to four-year university pathway.

Problems with transfer and success

Eighty percent of students who enter a community college report that they intend to earn a bachelor's degree (Xu et al., 2017). Yet researchers have found that only about a quarter of community college students actually transfer into a four-year institution (Le, Pisacreta, Ward, & Margolis, 2019; Xu et al., 2017), and only about 14 percent of those who transfer earn a bachelor's degree within six years (Le et al., 2019; Wyner et al., 2016). At the community college, the National Academy of Sciences (2011) reported that only about 26 percent of Blacks and 16 percent of Latinos in the 25-29-year-old range had attained at least an associate's degree, while for Whites it was 39 percent.

For students who do transfer, studies show that many community college students experience a loss in credits that will transfer to the four-year university, especially into STEM degree programs (Fink, Jenkins, Kopko, & Ran, 2018; Le et al., 2019; Zeidenberg & Columbia University Community College Research Center, 2012). About 43 percent of all transfer credits are not counted by four-year institutions (Le et al., 2019). Further, the transfer policies of four-year colleges greatly differ in the number of credits that they will accept transferred in from community colleges (United States Government Accountability Office, August 2017). For example, in one state, universities varied from 60 transfer credits up to 90 credits, with requirements ranging from 30 credits to more than half of all higher education credits earned to

be taken from that receiving institution (Zeidenberg & Columbia University Community College Research Center, 2012). Research shows that the more credits that students are able to transfer in to their four-year university, the more positive academic adjustment they tend to experience (Jackson & Laanan, 2015). Statewide articulation agreements and transfer policies can smooth the transfer process to public universities within the state, yet states differ in the extent to which they have adopted statewide policies to create clear and consistent transfer pathways. For instance, only 30 states have a statewide guaranteed transfer associate's degree and fewer than 20 states have instituted common course numbering to ease the transfer process for students and institutions (Education Commission of the States, 2020). Moreover, there is little evidence about the impact of these statewide policies on increasing transfer rates or reducing time-to-degree, though a recent report from the National Academies of Sciences found that systematic statewide policies to ease the transfer process can improve transfer rates, although in some cases, these policies impeded transfer rates (National Academies of Sciences, 2016). Clearly, how policies are enacted in local settings will impact their efficacy and there will always be a need for clear and individualized transfer advising, especially in strict sequential degree programs, such as STEM majors.

Though many transfer reforms are designed to reduce excess credits and time-to-degree, they may not always work as intended. Excess credits are costly for students, whether they are for courses that the student initially thought would be accepted by their intended programs that do not end up transferring, or because of additional, often unforeseen penalties. For example, some states, such as Florida, have imposed a surcharge on excess credits, so that students end up paying higher tuition rates for courses that go beyond program credit limits (Wyner et al., 2016). Many students are unaware of what credits will and won't transfer; one study shows that some

community college students believe that their two-year college programs are literally "two years" and that after those two years, regardless of what and how many courses they take, they will be able to transfer all of them to a four-year university (Hagedorn et al., 2006). Fink and colleagues (2018) suggest that institutions could help students reduce transfer inefficiency by having advisors help students explore and choose specific bachelor's degrees early during their community college experience.

Transfer success is perhaps even more difficult for STEM students. One study found that engineering transfer students were twice as likely not to graduate within five years as their native peers who started at the university (McCord et al., 2019). Women who transfer in STEM disciplines are especially more likely to experience academic difficulties adjusting to the four-year university environment (Jackson & Laanan, 2015). Additionally, many transfer students experience a less-welcoming climate than their native peers, and Lopez and Jones (2017) found that how well receiving institutions welcome transfer students predicts how well students adjust academically (that is, being perceived negatively is a positive predictor of poor academic adjustment).

Advising can significantly impact transfer students' success

There are a number of institutional and academic factors that influence transfer outcomes. But one of the most central factors that can either help students successfully navigate the two-to-four-year pathway or cause significant roadblocks and cost students considerable delays – is advising (Anft, 2018; Hagedorn et al., 2006; Lawton, 2018; MacDonald, 2014; Packard et al., 2011; Packard et al., 2012; Packard & Jeffers, 2013; Wetzel & Debure, 2018; Zhang, Gossett, Simpson, & Davis, 2019). Tailored advising has been found to especially help enhance the

success of transfer students into STEM programs (Hagedorn et al., 2006; National Academy of Sciences et al., 2011; Packard et al., 2011; Wetzel & Debure, 2018; Wyner et al., 2016). Recently, guided pathways advising models show promise in articulating clear program maps for community college students, encouraging them to choose a path early in their education and providing support to help them stay on that path (Bailey, 2017). Guided Pathways approaches can help first-generation college students and other students from historically marginalized groups to successfully navigate the myriad choices of programming at community colleges (Jenkins & Cho, 2013). Guided Pathways models are increasingly important because previous research shows that poor advising often results in students taking unnecessary courses or not being able to get into courses in a timely manner, which can cause lost time, money, and credits (Packard et al., 2011; Packard et al., 2012; Packard & Jeffers, 2013). This is especially detrimental to STEM students, given the sequential nature of their major pathways.

What is poor advising? A few studies have found that some advisors provided students with misinformation, such as advising students to sign up for courses that ended up not transferring, or instructing students to retake courses that were actually already completed at a level that would be satisfactory for their intended university (Packard et al., 2012; Packard & Jeffers, 2013). Passive advising – when an advisor omits crucial information that can help students navigate their pathways – can also be very damaging (Packard et al., 2012). Conveying indifference is also harmful. One study found that advisors who failed to advocate for students or help students troubleshoot difficult situations were perceived negatively (Auguste, Packard, & Keep, 2018). First-generation and low-income students who often face academic deficiencies are especially negatively impacted by poor advising practices (Hu, 2020; Meyer & Marx, 2014).

Poor availability for advising also affects students negatively (Packard et al., 2011; Packard et al., 2012). When students don't feel like they can access their advisors when they need to, they often give up and don't get help. One study found that several STEM women who transferred from a community college into a four-year institution reported that their assigned advisors were often unavailable, which caused significant roadblocks and frustration (Packard et al., 2011).

Research shows that many community colleges and four-year institutions are moving away from the model of having faculty double as advisors for their students; rather, having professional advising staff (Anft, 2018). While this takes the burden off often overloaded faculty, unfortunately the student-to-advisor ratio at many institutions, particularly community colleges, is often very high (Hagedorn et al., 2006; Hu, 2020; Martinez & Elue, 2020). For example, Hagedorn and colleagues (2006) found that the advising ratio of urban community colleges was approximately 1000 to 1. Advisors are also often lacking the resources they need in order to provide more meaningful, targeted support to all students (Castor, 2005; Lawton, 2018). Many students therefore end up trying to answer their questions on their own, and studies show that underrepresented students suffer disproportionately (Lawton, 2018).

Effective advising, however, can significantly contribute to students' persistence (Bahr, 2008; Packard et al., 2011; Wetzel & Debure, 2018). There are several advising methods that have proven successful: Connecting with students early and developing strong relationships with them (Auguste et al., 2018; Dounebaine, 2020; Lawton, 2018; Lopez & Jones, 2017); meeting with students often, not just once per year (Filson & Whittington, 2013; Mu & Fosnacht, 2019); meeting with assigned students so that every student only has one consistent advisor (Auguste et al., 2018; Packard & Jeffers, 2013); and addressing not only help with students' course selection,

but also a wide range of students' needs such as building time management and study skills (Bettinger & Baker, 2014) and providing help with financial concerns, mental health issues, and extracurricular opportunities (Anft, 2018). There have also been several recommendations for specialized advising particularly for transfer students, as every transfer student has a unique story, which requires individualized consideration (Lawton, 2018; Wyner et al., 2016; Zhang et al., 2019). According to a recent report on community college leaders' view of what would help improve institutions' retention completion, and transfer rates, 65 percent of the leaders noted that personalized advising could have a substantially positive impact; and yet 58 percent of the leaders acknowledged that their institutions were failing at this (Inside Higher Ed, 2019). STEM transfer students are likely especially impacted by the quality of the advising they receive because sequential completion of courses is extremely important, and they need to make more purposeful course selections.

Although many of the challenges for advisors are similar at both two-year and four-year institutions, there are some that are particularly problematic for each type. As mentioned previously, community colleges usually have especially high student-to-advisor ratios, which makes it hard for them to meet the varied demands of students (Hu, 2020; Robbins, 2013). Advising sessions are often shortened due to the lack of institutional support, which results in little time for sufficient engagement (Bailey, Jaggers, & Jenkins, 2015; Hu, 2020).

Many four-year institutions have faculty advise students rather than employing staff to provide advising (White, 2015; Zhang et al., 2019). However, there is often a lack of incentives for faculty to provide high-quality advising; and when it's not a priority, students suffer from insufficient advising (Zhang et al., 2019). For universities that do hire advising staff, sometimes the staff lack in-depth knowledge of the specific disciplines and associated career options,

especially in STEM fields, and students may therefore only receive surface-level advising and lack the more comprehensive, tailored-type of engagement that they seek (White, 2015).

Despite clear links to student persistence, descriptive details about the kinds of advising interactions that help ease transfer progress are not clearly understood. Although there are numerous studies on student advising, most of them tend to lean substantially on quantitative methodologies (Zhang et al., 2019) and are not STEM-specific. In this qualitative interview study, we investigate specifically what kinds of advising practices contribute to the success of underrepresented students on the transfer pathway in STEM disciplines, as well as those that impede transfer progress.

Theoretical framing

Given our interest in students' experiences with STEM advising within transfer contexts, we frame our study using practice theory (Bourdieu, 1977; Giddens, 1984; Ortner, 1984; Rouse, 2007). Practice theory takes a sociocultural approach to the interaction between the individual and larger social and cultural structures. Practice theory is rooted in sociology and the groundbreaking work of Bourdieu (1977) and has been further developed by theorists in sociology, anthropology and education (e.g., Giddens, 1984, Ortner, 1984, Rouse, 2007, etc.). More recently, practice theory has been applied in the fields of STEM education and higher education to understand how students' science identities develop through higher education (Carlone & Johnson, 2007) and to explore gendered norms in scientific fields (Eisenhart & Finkel, 1998).

Practice theory is valuable for investigating students' transfer pathways because it reconciles the dichotomy between individual agency and social and cultural structure, positing that, through their actions and interactions, people both produce and reproduce social structures,

such as higher education systems (Bourdieu, 1990). Practice theory focuses on the performative and relational aspects of social systems and identity, rather than focusing strictly on individual's inner mental states (Rouse, 2007). By examining social relations and interactions, practice theorists can hypothesize about how patterns of inequities become stable and pervasive or how they may be interrupted or transformed in sites through the agency of local actors (Rouse, 2007).

We are using practice theory as a theoretical lens in this study because we are interested in understanding individual student's progress and pathways within larger educational systems. Our work is rooted in the groundbreaking work of Bourdieu (1977) yet informed by the cultural approach taken by educational theorists (Carlone & Johnson, 2007; Eisenhart & Finkel, 1998). In particular, we were interested in how policies are enacted in everyday practices at higher educational sites and how individuals experience transfer processes while navigating the pathway between community college and university. Advising interactions and practices are one of these local sites in which larger social and cultural structures and policies are enacted. By applying practice theory within given higher education contexts, or fields as defined by Bourdieu, we can identify patterns of social practice and advising interactions which influence the process of STEM transfer for underrepresented students. Another strength of practice theory is its focus on the importance of unwritten and tacit rules and understandings, in addition to formal frameworks and policies. This is especially important in STEM transfer advising which is ostensibly governed by a formal curricular pathway and inter-institutional transfer agreements, but in practice, has proven to be a difficult process because of informal policies and interactions that may not always benefit students. Using this lens, we analyzed students' experiences in relation to larger higher education and transfer systems to identify the advising practices and interactions that supported or impeded students' progress on the STEM transfer pathway.

Methods

This work is part of a larger, five-year mixed-methods descriptive case study of STEM students' experiences at community colleges and partnering four-year universities in three different U.S. states. The larger study involves interviews and surveys with graduating seniors as a retrospective investigation of what helped transfer students to persist to bachelor's degree completion. The study includes a longitudinal component that tracks the academic progress of transfer-ready and recently transferred students as they navigate transfer and departmental structures at two community colleges and one university. This paper is based on findings from interviews that have been conducted as a part of the longitudinal component of the study. Therefore, as part of this larger study, we have longitudinally tracked community college students' pathways to transfer through their degree program in a partnering four-year institution – in real time – via interviews each semester. This method allows us to understand how and why students' plans, decisions, and steps taken in their STEM pursuits contribute to their persistence and success. We selected a case study research design because they are ideal for understanding complex systems, such as investigating what promotes successful STEM transfer within complicated institutional contexts, in an in-depth manner (Yin, 2003). The interview data included in this report was drawn from the first set of student interviews conducted at the three institutions – that is, our baseline set of interviews with each student.

We selected the institutions in our sample based on pairs of community colleges and universities that had demonstrated success – in comparison to their peers – in supporting, transferring, and graduating underrepresented students in STEM. And we identified our longitudinal interview sample from institutional records of students who had more than 30 credits completed in STEM courses at the community college, and who indicated that they

intended to transfer in a STEM field to university. To triangulate data sources and gain a different perspective on the transfer process, we also selected a group of recently transferred students from a public, regional university. We selected a stratified sample of students from each of these institutions to invite to participate in the longitudinal study. We sought disciplinary diversity, so we selected students from a representative range of STEM disciplines, including the physical sciences, life sciences, engineering fields, mathematics, and computer science/information technology. We also sought to enroll students from groups underrepresented in STEM fields. To achieve this end, we stratified the sample based on race/ethnicity, Pell eligibility (as a proxy for low-income students) and first-generation college status. Overall, we designed the stratified sample to reflect the demographic and disciplinary enrollments of participating community colleges, while oversampling for students from underrepresented groups. Given the populations of students served by study sites, almost all longitudinal study participants have at least one aspect of their identity, and often intersecting identities, that reflect populations that have been historically marginalized in STEM fields (e.g., first-generation college students, low-income students, race/ethnicity or gender underrepresentation). For instance, the white men in our study sample are first-generation college students or low-income students.

Based on our stratified sample of students at the three study sites, we emailed invitations to their college email accounts with information about the study and a sign-up form. The sign-up form collected information about their transfer intentions (or major for university students), major fields, and demographic information to verify that we had the correct background information for students.

During the student recruitment process, we anticipated that we would recruit 10-15 students from each study site. The total population of transfer-ready STEM students at the first community college was 251 students. Based on stratified sampling procedures, we sent interview invitations to 120 students and 29 students signed up for interviews. ~~Based on our stratified sampling procedures,~~ W~~w~~e selected 16 of these students for participation in the study. The total population of eligible students at the second community college was 372 students. ~~Based on our stratified sampling procedures,~~ W~~w~~e sent interview invitations to half of these students and received 33 responses. From these 33 responses we used our stratified selection criteria to select 11 study participants. The total population of recently transferred STEM students at the university was 676. ~~Based on stratified sampling procedures, w~~We sent interview invitations to 223 students and we received 24 responses. Based on our selection criteria, we enrolled 12 of these students in the study.

From the sign-up survey, students selected a date/time for the initial 90-minute baseline interview. ~~Baseline interviews were conducted~~Our team of four researchers conducted baseline interviews during week-long site visits to participating campuses ~~by a team of four researchers~~. ~~Interviews were conducted~~We conducted interviews in-person on campus in private STEM study rooms or campus library study rooms. ~~Baseline interviews were conducted~~We administered baseline interviews in the academic year 2018-19. Since then, ~~longitudinal interviews have been conducted~~our team has interviewed ~~with~~ students each semester via phone or web conferencing technology. Follow-up interviews ~~have~~ typically ranged from 30 to 60 minutes. Students ~~have~~ received a small gift card for each interview completed. ~~All interviews were transcribed verbatim by an~~An external transcription service -- that complies with institutional review board

confidentiality protocols~~.~~ – transcribed all interviews verbatim. ~~All study procedures were approved by the~~Our university institutional review board approved all study procedures.

~~Interview protocols were developed by a~~Our team of four researchers developed interview protocols, which ~~and~~ were based on constructs of interest from our research questions and theoretical framework. Interview protocols were semi-structured to provide systematic data collection across key themes (e.g., advising, transfer processes, departmental climates, etc.) while allowing the flexibility to ask follow-up questions and explore unexpected or emerging themes (Fontana & Frey, 2005). The baseline interview protocol addressed students' experiences at their community college and their transfer planning experience. Topics included students' initial choice to attend community college and major in a STEM field, students' classroom experiences and involvement in campus activities; their experiences with faculty, peers, and advisors; their experiences during the transfer planning process; and their decision-making around transfer and university choice. Topics addressed during follow-up interviews included students' transfer progress or adjustment to the university if they had already transferred, their academic progress; classroom experiences in STEM courses; involvement with campus or departmental activities; and continued experiences with peers, faculty and advisors. This paper addresses students' experiences with advising and transfer and post-transfer academic planning and adjustment. The analysis in this paper is drawn from baseline interviews with students. Relevant questions on the interview protocol include: "Tell me about your experiences with transfer advising." "How were advisors helpful during the transfer process?" "How were advisors not helpful during the transfer process?"

We analyzed the interview data using Domain Analysis Methods (Spradley, 1980). We chose Domain Analysis because it allows for careful, systematic, and precise analysis of key

themes of interest, such as “good advising” and “poor advising.” We also chose this method because it allows for both inductive and deductive coding. We had constructs that we were interested in, yet we also wanted to be able to capture unanticipated responses or emergent themes that were salient to students’ experiences.. Using Domain Analysis in NVivo qualitative software, we generated codes inductively and deductively. We used deductive coding to identify categories of interest from our theoretical framework and interview protocols, such as advising, transfer planning, student-faculty interactions, and college choice. We used inductive coding to identify themes that were important in students’ accounts, but not explicitly addressed in interview protocols, such as sense of belonging, self-efficacy, and self-advising. Through this coding process, we tagged distinct issues in the transcript data with code names. Groups of codes were then clustered into larger domains of meaning (e.g., poor advising, good advising, self-advising, belonging, identity, etc.).

The codes used in this manuscript include “poor advising,” “good advising,” “self-advising,” “students’ recommendations to institution” and “transfer planning.” Using our categories of codes, we then constructed taxonomies to link and explore relationships between the larger domains and the specific coded examples within the domains. For example, we explored the “poor advising” code to identify examples of poor advising, including sub-codes that relate to the practices, interactions, or policies that resulted in poor advising outcomes for students, according to their accounts in interviews. As another example, we explored the “good advising” category to identify specific examples of good advising from students’ perspectives, creating sub-codes such as “personal advising” and “caring, compassionate advising.” This allowed us to compare important themes and to generate claims from the data. From these codes, we generated frequencies to determine the prevalence of certain experiences, such as types of

poor advising. We were also able to compare outcomes and experiences across different groups of students, such as disciplinary field or first-generation college students, yet the small sample size of interviewees did not provide enough nuance to warrant specific claims in these areas.

Four researchers coded the data and met regularly to review transcripts and iteratively develop and refine coded categories to enhance the inter-rater reliability of coded interviews. We ran inter-rater reliability analyses on our codebook in NVivo software and affirmed that we had attained very high inter-rater reliability on the codes used in this analysis. For instance, the inter-rater reliability for "good advising" was 96.5% and for "poor advising" was 95.3%, indicating that there was nearly 100% consensus among coders in selecting passages that reflected students' depictions of poor advising or good advising.

We enhanced the trustworthiness and credibility of the research in multiple ways throughout the research design and implantation process. For instance, we sought a wide range of participants for our study who would be reflective of the student populations of study sites. We achieved this through careful sampling and selection of students based on institutional records. In this way, we countered possible bias that may result from speaking only to a particular type of participant. We randomly selected students from within the stratified categories that we had created to counter selection bias among participants. We also enhanced the credibility of our research during the analysis and coding process by clearly operationalizing and defining codes amongst a team of researchers (LeCompte & Goetz, 1982). By setting clear boundaries between coding categories we achieved high inter-rater reliability in our coding of interview transcripts. We also followed standard recommendations in qualitative research such as checking findings and hypotheses with participants (member-checking) to solicit feedback on their accuracy and to encourage further reflections about emergent findings (Lincoln & Guba, 1985). We also

triangulated our research design in several ways, including mixed methods in the larger design, and the use of multiple analysts, the selection of participants from multiple sites, at different points along the transfer pathway, and with different demographic and disciplinary backgrounds. We also triangulated data by collecting data over multiple points in time (Denzin, 1978). We engaged in reflexive research design, data collection, and analysis by employing multiple researchers with different disciplinary and demographic backgrounds; maintaining notes, journals, and analytic memos throughout the research process to reflect on our own beliefs in relation to the research; and to look for disconfirming evidence throughout the analytic process (Lincoln & Guba, 1985; Malterud, 2001). Therefore, we enhanced the rigor of the study through careful selection and triangulation in the research design and data collection process, and by employing reflexive, collaborative, and systematic processes during data collection and analysis.

Institutional review

This study was approved by the University of Colorado Boulder's Institutional Review Board (Approval #18-0170). Each study site's institutional review board reviewed the human subjects research protocol and accepted the approval of the author's university. To collect student records data, we worked with representatives from each participating institution's Office of Institutional Research to identify the study sample using FERPA compliant directory information. Students were invited to participate in the study via email, and upon the solicitation sign-up, they received an information email which further explained the nature of the project and included a copy of the informed consent for their review. Potential interview participants then had time to review the letter of consent away from the investigators to consider whether they wished to participate in the study before participating in the interview. Prior to the start of the interview, the interviewer further explained the study with each participant, and then secured signed consent before

proceeding with the interview. All study procedures, instruments, consent forms, and recruitment materials were reviewed and approved by the institutional review board.

Participants

We interviewed 39 students at three institutions: One urban southern university, one western Pacific community college, and one southeastern community college. We selected institutions that appeared to be doing well in supporting underrepresented students in STEM with high transfer rates and strong local transfer partnerships. To identify institutions, we searched the federal Integrated Postsecondary Education Data System (IPEDS) for institutions with higher-than-average rates of enrollment and graduation for historically underrepresented students. And notably, this search yielded institutions that are moderately selective and more commonly attended by underrepresented students in contrast to highly selective institutions that have tended to be the settings of STEM persistence research. Unfortunately, at one of our identified institution pairs (community college and neighboring university), we were unable to secure permission to interview students at the community college. So instead, we interviewed recently transferred STEM students at the university which had the added benefit of adding the perspective of post-transfer students to our analysis. And at the other two sites, we interviewed students at the community college to establish our baseline data of STEM transfer students.

Interviews were conducted with 19 women and 20 men and represented a variety of intended majors (31% Biological Sciences, 25% Engineering, 21% Computer Science, 10% Chemistry, 13% Mathematics). About 80 percent of students were racially underrepresented, reporting 55% Hispanic, 7% Black, 10% Asian American, 7% Pacific Islander, and 20% White. Over half of the students were Pell grant recipients (59%) and a little less than half of the students were first-generation college students (44%).

Limitations

This interview study provides an in-depth analysis of the experiences of a small sample of participants. The small sample size from only two community colleges and one university – from three different states – makes it difficult to find patterns and make claims, particularly about different racial, ethnic, low-income, and first-generation students. Because of the small sample size and multiple, intersecting identities of most students in this study, we were unable to disentangle findings for specific groups, such as first-generation, Latinas in engineering or low-income white men in computer science. Therefore, we report general themes that we identified across most study participants.

Although the findings provide rich details about the students' experiences from lengthy one-on-one interviews, we were only able to recruit and longitudinally track 39 participants. While our sample covered students from across five different STEM fields – biological sciences, engineering, computer science, chemistry, and mathematics – it does not have a large number in every category, which also makes it difficult to detect differences and patterns among the disciplines.

This study also includes only interviews with students about their experiences with advising and advisors, but does not include interviews with advisors, faculty, or staff. Therefore, we were unable to examine how students' perceptions correlated with advisors' perceptions and did not have data about advisors' methods or demographics. Additionally, we only asked students what their experiences had been like with the advising that they received, but we did not ask specific questions, such as how students felt their demographic identities might have impacted their advising interactions. This is because the advising inquiry is part of a larger

descriptive case study where we are also examining other variables that impact students' persistence and success in STEM, which limited the number of questions we could ask students about each topic.

Despite these limitations, the interviews provide elaborate details about STEM transfer students' experiences with advising at both two-year and four-year institutions. Furthermore, the findings revealed several commonalities among the students that contribute invaluable insights into the ways in which advising practices can affect success for students – especially from underrepresented groups – on the STEM transfer pathway. While we may not know how widespread or generalizable these particular advising practices are due to the number of institutions and students included in the study, the rich detail provided in interviews can lay the groundwork for further large-scale investigation of STEM transfer advising practices across a number of campuses.

Results

We found that every student we interviewed reported they had visited their academic advisor at least once. In the following, we share the most commonly described characteristics of negative and positive experiences with advising offered by the students in our interview study – that is, students' perceptions of what makes advising 'good' and 'poor.' We explain and illustrate how these interactions and relationships with their advisors impacted students' academic experiences.

The cost of poor advising

Over half of the students that we interviewed had negative experiences with advising (~~N~~ n = 21), and more than half (~~N~~ n = 23) also reported that they hardly or never sought advising and tried to

make decisions about their academic needs on their own, either due to poor advising (as defined by the students) or not trusting their advisors.

Conflicted advice from multiple advisors

One of the most common complaints among the intended-transfer students was receiving different advice from multiple advisors (~~N~~ n = 10~~, about 25%~~). Students found the conflicting advice confusing and frustrating:

> I don't know why each counselor says different things. You can go to three different counselors in one day and I think each one of them will tell you something different. – *Community college student intending to transfer, biological sciences*

> When you're talking to the counselors, I guess it really depends on who you get, because some counselors lay out a plan, but they kind of just give it to you and they're like just follow this … Whereas others try to kind of get to know you a little bit so they can tailor it. – *Community college student intending to transfer, computer science*

> I keep talking to different advisors, and everyone says something different. It took me awhile to find someone who finally knows what they're talking about. – *Community college student intending to transfer, computer engineering*

A few recently transferred students also complained about the conflicted advice they received from having met with multiple advisors, indicating that this is not just a problem at the community college but at four-year institutions for recently transferred students as well:

> I think it's because I was a transfer student, so I think some advisors probably got that … but it's hard talking to one person about all this stuff and then you have to go and explain everything to a different person, and you're like, I think the other person sort of understood what I was trying to do, but I don't know if this person fully understands, and it's just a struggle. –*Recently transferred university student, mathematics*

> My advisor was horrendous. She would continuously put a hold on my account causing me not to be able to register for classes when I needed to. When I asked her why there was a hold, she would say that I haven't completed tasks in order to lift the hold. She also told me I did not have to take certain courses, such as chemistry. Then when I got my next advisor, she told me that I had to take those courses, which then put me an entire semester behind. –*Recently transferred university student, civil engineering*

Students reported that some advisors gave them vague responses that left them confused, some advisors provided incorrect guidance, and a few students noted that the differing advice caused them to take unnecessary courses and resulted in delays in their academic progression. One community college student said she wasn't aware that she already had enough credits to apply for her degree until she talked to a second advisor, noting that the first one had not identified this for her. Overall, students wished for consistency, and they found varied guidance from different advisors disconcerting and disruptive to their academic progress.

Poor advising on courses

Six students reported their advisors gave them either misleading or incorrect guidance on which courses to take that would transfer into their desired bachelor's STEM degree programs. Some students ended up taking extra courses that were not needed for transfer:

> I was a computer science major, but then I changed my major [to computer engineering]. My counselor wanted me to pursue [taking a course] still, despite me changing my major. … I started using this website called "Assist" – it's this website that literally tells you what courses the universities are looking for … It tells you Engineering 145, 167, and how that correlates to [the community college's] engineering 250. I didn't need that course. –*Community college student near transfer, computer engineering*

> My first semester … most of those classes I didn't have to take, but I took them because they advised me to take it. Now I have extra hours. Because I didn't know hours was "a thing." I didn't know that it was '60.' I thought you would just take your classes. So it took a long time. – *Community college student near transfer, mechanical engineering*

One student shared his frustration with not knowing he had to take a certain biology course in order to transfer into his desired STEM major. His advisor failed to help him understand this requirement for transfer, and as a result the student ended up changing his major from biotechnology to bioengineering:

> I didn't know I had to take that [particular] biology [course]. It wasn't until spring [too late] when I realized I had to take it. I ended up changing majors so I could just take the fastest option. –*Community college student intending to transfer, bioengineering*

Another student missed an opportunity to be possibly placed in a higher mathematics course because his advisor failed to share the appropriate test options for the student:

> When we enrolled here, we had to take an assessment test. I took the test for mathematics and I actually did pretty good and they put me in the highest math possible for entry students, based on that assessment test, which was algebra. But they didn't tell me that I qualified to take a higher-level assessment test, which could have put me in calculus. …Then [later] doing the higher-level assessment test, I skipped pre-calculus and placed in calculus, but I had already lost a whole semester. I could have just taken calculus in my first semester. –*Community college student near transfer, computer science*

A recently transferred student into a university mathematics program complained that her advisor was unable to help her navigate options on when to take certain requirements, as well as how to re-take failed courses:

> I failed calculus because … she [my advisor] didn't tell me that I probably shouldn't have taken Intro to Computer Science and calculus at the same time. Both of them are extremely hard … And I failed both of them. I tried to talk to my advisor about it … "Is there anything I can do to maybe either retake these classes or get around taking them or something?" And she had no idea at all. –*Recently transferred university student, mathematics*

These examples of students taking unnecessary additional courses, inappropriate courses for transfer into specific STEM programs, unsuitable simultaneous courses; not getting the chance to take appropriate assessments for advancement; and not understanding how to re-take failed courses are all opportunities where advisors could have helped – rather than impeded – students' progress. Instead, all of these students suffered delays, excess cost for needless courses, and/or changed their pathways as a result of poor or insufficient guidance.

Inaccurate or inadequate advising

Unfortunately, many students felt that their advisors either lacked knowledge to adequately advise them, or in some cases, actually provided incorrect information to the students.

Community college students shared examples of how their advisors were unaware of what the students needed to transfer into specific university programs:

> She gave me a list of the general required credits to get the [associate's] degree. But I wouldn't say she was very knowledgeable about the specific stuff you would need [for transfer into the biology program at X university], just the general requirements. – *Community college student near transfer, biological sciences*

> The advisors here just stirred up craziness … one thing the advisor told me was that I wasn't going to be graduating on time because I needed to take Calc two. I was so frustrated and stressed out. But … I ended up doing my own research, and realized that Calc two wasn't even relevant to my degree type at all, I didn't need it to get in. – *Community college student near transfer, biology*

Some students noted that their uninformed advisors would often send them to talk to someone else, which the students found very frustrating:

> I have an advisor who isn't very helpful and normally just tells me to go and talk to someone else about specific issues I'm having. *–Recently transferred university student, biology*

> I asked my advisor about what classes I should take because I wanted to double major in computer science and microbiology … He just told me to go contact each school. I feel like he had no idea what was going on, and he wasn't really listening to what I was saying. He just sent me somewhere else. *–Community college student intending to transfer, biology*

In summary, ~~20 percent of the~~seven students we interviewed ~~(N = 7)~~ perceived that their advisors lacked adequate knowledge to be able to provide sufficient and correct guidance for their academic progression, which included information about course options, specific requisites for transferring into degree programs at certain universities, and how to go about double majoring. Students felt especially frustrated when their questions were left unanswered, or they were directed to talk to someone else. We noticed that the students in our sample who were studying biological sciences tended to experience problems with this the most. Both students at the

community college and four-year university levels reported that incorrect guidance negatively affected their academic progress.

Advising unavailable when needed

A common complaint among two-year students was not being able to get an advising appointment when they really needed it (~~N~~ n = 7):

> If you're trying to find counseling in the fall, you usually don't get an appointment until a month later, because everyone is trying to transfer at the same time, and everyone needs to double check with their counselors. It's such a hassle to even get an appointment. – *Community college student near transfer, computer science*

> You either have to make an appointment way far in advance or you go in and wait like three or four hours, even if you get there at 8 a.m. And when you get there, it's like they don't give you any attention because they're rushing. –*Community college student near transfer, interdisciplinary medical sciences*

Some students attributed the lack of availability to an understanding of how overwhelmed their advisors likely were:

> I understand their work situation is horrible, and maybe they are just so overwhelmed. There are too many students for them to handle. They can't give them the care that they should. –*Community college student near transfer, computer engineering*

Poor availability was more of a problem for community college students than for recently transferred university students. Having to wait to see an advisor, feeling rushed through appointments, and sometimes never getting to see an advisor at all was frustrating and discouraging for students. As previous research demonstrates, students who struggle to get help when they need it often give up and don't get any help at all (Packard et al., 2011; Packard et al., 2012).

Lack of care, support and friendliness

One third (n~~N~~ = 13) of students reported that they felt a lack of support and encouragement from their advisors. This was the most frequently reported negative comment about advising from students at both the two-year and four-year institutions. Many of these students perceived their advisors as unfriendly, judgmental, and sometimes even discouraging. Students wanted to feel like their advisors cared about their academic success and well-being and were often sorely disappointed when they didn't receive such care.

The students were frustrated that their advisors were impersonal, unsupportive, and discouraging:

> You feel like they don't believe in you. I was in a low math [course], so when I said "I want to study engineering," I didn't feel any support from my advisor. –*Community college student near transfer, mechanical engineering*

> I really feel like I don't matter to them. It's a very impersonal interaction between the students and the counselors. –*Community college student near transfer, mathematics*

> I was mainly always told "You can't do that." But then I did it. The advisors told me I couldn't. – *Recently transferred university student, mathematics*

One community college transfer student who tried to meet with an advisor at her prospective four-year university believed she was treated differently simply because she was a community college student:

> The advisors are kind of judge-y because you're community college students. It's harder to get their attention. They expect you to fail. If you tell people in advising for any science-related field that you're a community college student, they think that you're just not as smart. –*Community college student near transfer, interdisciplinary medical sciences*

Students wished to feel supported both academically and personally by their advisors. Advisors who didn't communicate in a friendly way or show such support were often perceived by students as uncaring and discouraging. These negative interactions sometimes lead to mistrust in advisors' guidance, as the following community college student shared with us:

> I felt like they didn't believe in me and I didn't have much support from my advisor … I'm about to transfer, and I have specific questions for my applications, but I wouldn't go to the advisors for help – I don't trust them for that type of information. *–Community college student near transfer, mechanical engineering*

In summary, many students described that they felt their advisors "didn't care" about them, were sometimes "judgmental," and seemed to rush through advising sessions without taking time to listen to their individual needs. Unfortunately, some students reported they ended up not getting the advising help they needed at all, either because they felt unsupported or because they didn't trust their advisors' guidance after negative early visits, and therefore avoided additional advising.

Hardly used advising services

Another problem reported by seven students was rarely or never using the advising services offered:

> Out of the four years I've been here, I only just started visiting the counselors about a year ago. *–Community college student intending to transfer, applied math*

> I don't trust them and have hardly interacted with them. *–Recently transferred university student, computer science*

Students mainly reported that they did not use the advising services available to them because they believed that they could figure out course selection for themselves and that advisors were unable to offer guidance on anything else that might be helpful, didn't trust their advisors, or were unable to get an advising appointment when they needed one.

As has been demonstrated in previous research about the detrimental effects of poor advising, we also found that students' perceptions of poor advising negatively affected students. Poor advising caused unnecessary delays in academic progression, especially for community

college students who intended to transfer into a STEM major at a four-year university; excess courses and credits due to poor planning; lost time and money; and perhaps most significant to students – feeling generally unsupported and discouraged by the people students expected and hoped to receive encouragement from the most.

Most students experienced at least some good advising

Fortunately, ~~72%~~most (n~~N~~ = 28) of the students we interviewed reported that they experienced at least some good advising at their institutions. Many of these students reported mixed experiences as well – that is, some good advising, and some poor advising, which was often the case when students had experiences with multiple advisors.

The most common descriptions of 'good advising' from the students' perspectives related to the advisor "connecting" with the student in a personal way, showing care for the student's situation and progress, and providing individualized, tailored advising (~~N~~ n = 11~~, nearly 30%~~):

> My advisor has really been there for me. She knows some of my personal background. She knows me as a student, and she's been supporting me throughout this semester and last semester. –*Community college student near transfer, applied math*

> What's helped me the most to keep on pursuing my goal of transferring is my mentor – my advisor from the honor society. When I still didn't have any friends here and I didn't know anybody – she was the first one I got really close to … once a week my advisor and I would meet up. I was able to talk to her, share stuff with her … I was able to trust and ask for her help or guidance when I was starting out. – *Community college student near transfer, biology*

For community college students, these more personal and tailored advising sessions usually took place with specific program advisors. That is, special programs that supported economically and educationally disadvantaged students, including historically underrepresented students in STEM, to prepare for and excel in math, engineering, and science majors via special

tutoring and other opportunities. Students found their program advisors to be more friendly and supportive than traditional academic advisors:

> I asked [my program advisor] about my schedule for the math tutoring and she helped me find math tutors and has helped me with any question that I have about financial aid or anything else. She takes the time during the appointment to talk about how I'm feeling, as well as about all my classes and all of that, it's been really helpful. – *Community college student near transfer, chemistry*

> This program is pretty amazing. We're a big familia, so whenever I go in [to the advising office], I just feel like I'm talking to someone I know. It just feels great. Just like a mom or an aunt there to help you. –*Community college student near transfer, aerospace engineering*

Community college students who were not enrolled in special programs, and those who were but were still required to meet with traditional academic advisors, were mostly either unhappy or neutral about the advising they received. But program advisors were often described as having accurate and up-to-date knowledge of requirements at both the community college and the intended four-year institution for transfer. They were also able to provide information about high-impact opportunities, such as research and participation in professional societies, as well as career and financial matters. Additionally, program advisors were often described as being "like family" and provided the emotional support that students sought, whether for an academic struggle or a personal hardship.

The most frequently reported comment about 'good advising' from recently transferred university students was also related to friendly, caring, personal, and tailored advising. We noticed that these kinds of "friendly" and "personal" comments were department specific. That is, some departments tended to have advisors that students really appreciated, while other departments tended to have advisors that many students reported negative experiences with.

Overall, we learned that 'good advising' experiences were most often described by students from all institutions and backgrounds as "personable," "caring," "compassionate," "tailored," "friendly," "like family," "warm," and "encouraging." 'Good advisors' provided not only academic help, but emotional support as well. This kind of support meant a lot to students, and for many – especially the first-generation and marginalized students in our study – it translated to feeling a stronger sense of trust with their advisors as well as feeling a greater sense of belonging to the STEM community on campus.

Discussion

The good news is that we found most STEM students – at both the two- and four-year institutions – experienced at least some good advising; however, their experiences were often mixed with poor advising interactions as well. That is, ~~72%~~28 (of 39) ~~of the~~ students reported some 'good advising experiences,' but ~~55%~~21 students reported some 'poor advising experiences' and many of the students reported they had both. These mixed advising experiences pinpoint some of the interactional factors in advising relationships that contribute to equitable or inequitable STEM transfer outcomes for underserved students.

Our results confirm previous findings that poor advising experiences often contribute to lost time, money, and credits for students (Packard et al., 2011; Packard et al., 2012; Packard & Jeffers, 2013). But we also found that poor advising interactions can cause lost confidence and trust as well – in the advisors, the department, and sometimes the institution – leaving students feeling confused, unsupported, and frustrated. We were also able to define what 'poor advising' means to the students: Conflicted advice, usually from having multiple advisors; misleading or incorrect advice on courses or pathways in their STEM major, or intended STEM major; lack of internship and career advice, usually due to advisors' lack of knowledge in these areas; lack of

availability for advising appointments in crucial moments before registration; and the most frequently occurring negative description was for a lack of support, encouragement, and friendliness from advisors. In this way, students' everyday interactions with advisors served to perpetuate inequitable higher education structures that disproportionately impacted low-income, first-generation college and other underserved students. STEM transfer pathways are complex and rigid and advising support is often underfunded at the two-year and four-year levels, both of which may contribute to the pervasiveness of inequitable transfer structures. In some cases, student-advisor interactions and relationships created undue challenge and barriers for students, illustrating some of the reasons why STEM transfer pathways are difficult for students to navigate.

Unsurprisingly, on the flip side students' most frequently occurring description for 'good advising' was based on the advisor's attitude and treatment toward them: Friendly, supportive, tailored, and encouraging advice was most valued by students. Students wished for personal and tailored advice; they wanted to feel like the advisor cared about their academic progress and needs. At the community college level, students who were enrolled in special STEM-support programs, especially those designed for economically and educationally disadvantaged students, tended to find their dedicated program advisors much more helpful than traditional academic advisors. Program advisors were often described as being "like family" and provided emotional support, in addition to academic support, which meant a lot to students and increased their level of trust with the advisor. At the four-year university level, 'good advising' experiences tended to be department-specific; that is, we noticed some departments seemed to have more positive advising experiences and some had more poor advising experiences. The departments with more "friendly," "compassionate," "personable," advisors who provided "tailored" and "clear"

guidance on courses and pathways, as well as advice about internships and careers, were labeled as more positive and helpful. Overall, for both two- and four-year institution study sites, we found that the more connected and comfortable students felt with their advisors, the more students visited their advisors and felt like they could trust the guidance provided.

Through the lens of practice theory, program advisors and certain other academic advisors in this study acted as empowered institutional agents to provide social, emotional and academic support to underserved students, thereby facilitating their transfer progress and promoting their success and retention in STEM majors. In these small and informal ways, individual advisors overcame the inequitable transfer structures that disproportionately impact vulnerable students. In practice, state-level and institutional-level formal transfer policies and agreements may not play out as smoothly as intended because of informal mechanisms, such as institutional actors who provide incorrect information or are inaccessible to students. On the other hand, some individual advisors supported students' progress and were pivotal in their success, but these tended to be program advisors with smaller caseloads in a mission-driven program to support underserved students. Our findings suggest the importance of high-quality, individualized advising in the STEM transfer process and the ways in which every day advising interactions and relationships can either reproduce inequitable transfer structures, or potentially, transform these structures to create more supportive and inclusive STEM transfer pathways.

Conclusions and implications

Based on our findings on how STEM students define 'good' and 'poor' advising; in addition to previous research on the tremendous cost of poor advising on students, not only financially, but also mentally and emotionally; and the significant contribution that effective advising can make on students' persistence and progress, the following recommendations may be helpful: Advisors

should build one-on-one relationships with their students, making meaningful connections; provide tailored support; and provide emotional support and affirmations. Currently, high advising loads that are typical in many colleges and universities are inimical to the development of the supportive, personalized advising that is needed to successfully navigate complex STEM transfer pathways, particularly for underserved student populations, such as low-income or first-generation college students.

Several researchers suggest that advisors should try to connect with their students as early as possible (Auguste et al., 2018; Dounebaine, 2020; Lawton, 2018; Lopez & Jones, 2017; MacDonald, 2014). Widespread adoption of Guided Pathways approaches or other mechanisms to support students to choose and navigate academic pathways early in their community college experience can help them to transfer successfully with less wastage of money, time, and credits. These approaches must be undertaken with ongoing, caring support from advisors. We found that the students in our study who felt they had developed positive relationships with their advisors early in their academic pathways were more likely to seek future help from their advisors; conversely, those who had negative experiences were more likely to seek help elsewhere, like from friends or family, and sometimes they gave up and didn't get help at all.

Almost all students in our study who reported positive experiences with their advisors talked about receiving tailored, personal advice. Other advising scholars recommend having dedicated advisors for specific groups of students so that each student can meet consistently with one advisor (Dounebaine, 2020; Lawton, 2018; Wyner et al., 2016). Wyner and colleagues (2016) suggests four-year institutions employ dedicated advisors specifically for transfer students as well.

Friendly, compassionate, and personal advising was highly valued by students. Other studies have also found that students especially appreciate emotional support from their advisors (Auguste et al., 2018; Packard & Jeffers, 2013). One study demonstrated that advisors who can communicate confirmations of student belonging are perceived as more helpful by students who report about positive advising experiences (Auguste et al., 2018).

STEM-specific advising – beginning at the community college – is also important. While previous research has also found that poor advising leads to wasted time and money, we found that the STEM students in our study – especially those who are also low-income – suffered perhaps even more so from poor advising about courses. Because of the rigid, sequential pathway of STEM majors, students who receive misleading or incorrect guidance about which courses to take that would transfer into their desired STEM degree programs face significant delays and excess costs, and unfortunately, in this study, we found that sometimes students end up switching or dropping out altogether as a result. While many students switch out of their intended STEM majors, unfortunately the percentage of students from underrepresented racial and ethnic demographics switching out remains significantly higher (Seymour & Hunter, 2019). Academic advising in STEM disciplines must begin at the community college, and because STEM is so rigid and complex, there seems to be a strong need for STEM-specific advisors. Advisors need to be better prepared to offer guidance on proper course selection for specific STEM programs and connecting four-year institutions, not just general requirements; and they need to continue to evolve to support the whole student, considering the student's background, financial concerns, and academic goals.

A final note about the importance of good advising beginning at the community college level for transfer students: Advisors can likely provide more higher education-based knowledge

than often offered through family or peers, and they possess key information about the initial steps in the transfer process. Therefore, we believe that advisors in community colleges can have long-lasting effects on students' progress, especially for first-generation college students. But effective advising at all levels can significantly contribute to students' persistence and success and ensure that transfer policies work as intended.

Recommendations for future research

~~Our interview findings on students' perceptions of 'good' and 'poor' advising are based on a small sample size, and therefore do not provide the opportunity to analyze patterns and differences among separate demographic groups (e.g., race/ethnicity, gender, low-income, first-generation), across the intersecting identities held by students, or among separate STEM disciplines. Nor is qualitative research intended to be broadly generalizable; this study was designed to better understand the advising processes, practices, and interactions that helped or hindered student transfer progress at a specific set of public higher education institutions in three state contexts.~~ We believe a follow-up study using a quantitative survey that further examines our findings of the most described characteristics of students' experiences with advising would be useful to gain a more generalizable understanding of what impacts students most, as well as help identify differences among disciplines and demographic groups. We also recommend future research that includes advisors' perceptions of methods that work best in advising sessions, and that examines how students' demographic and disciplinary identities interact with advisors' identities.

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