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Author

Hernandez, Damaris Madeline

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Exploring a Mathematics Transfer Student Intervention Curriculum: Acknowledged Identities
and Incorporated Supports Intertwined

A Thesis submitted in partial satisfaction of the
requirements for the degree Master of Arts
in Education

by

Damaris M. Hernandez

Committee in charge:

Professor Sarah Roberts , Chair

Professor Julie Bianchini

Professor Rebeca Mireles-Rios

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The thesis of Damaris Hernandez is approved.

Julie Bianchini

Rebecca Mireles-Rios

Sarah Roberts, Committee Chair

September 2021

Abstract

Exploring a Mathematics Transfer Student Intervention Curriculum: Acknowledged Identities
and Incorporated Supports Intertwined

by

Damaris Hernandez

This qualitative study explored a mathematics transfer student intervention program, a bundle of three courses, whose goal was to facilitate the social and academic transition of participating mathematics transfer students at the study university. The aim of the study was to examine, utilizing semi-structured interviews, how six participants—three mathematics faculty, who taught and implemented courses, and three incoming mathematics transfer students—accounted for transfer students’ identity as the students were supported in developing a mathematics transfer professional vision. Using a conceptual framework grounded in Jain et al.’s transfer receptive culture and Goodwin’s (1994) professional vision, I used thematic analysis to examine whether the curriculum supported students’ development of a mathematics professional vision and whether students’ identities were accounted for by faculty and students in the process. The findings revealed that although all four aspects of mathematics transfer professional vision were supported through the curriculum; some of the aspects could have been more strongly supported via different approaches. There were noted differences between the faculty and student perspectives on how mathematics transfer students’ professional vision were supported and

developed. Research and practical recommendations emphasize the need for a purposeful and simultaneous intervention and research.

Exploring a Mathematics Transfer Student Intervention Curriculum: Acknowledged Identities and Incorporated Supports Intertwined

There is currently little research about how mathematics transfer students¹ are assisted in their academic career at a four-year university upon their transfer. As mathematics is a Science, Technology, Engineering and Mathematics (STEM) field, it is crucial that educators attend to the specifics on how mathematics transfer students of today can be supported, as approximately, 50% of students who obtain a STEM degree from four-year institutions are utilizing the community college pathway (Laanan, 2010). More than half of STEM students who use the community college pathway to transfer into a four-year university are from ethnic and underrepresented groups (Jackson & Laanan, 2015). With such a diverse group of students, and as technology and innovation continues to rapidly advance, there is a need for a more diverse and larger STEM workforce (Bernstein, 2008). To remain a competitive nation, the United States must draw from underrepresented students to meet the demands of rapidly advancing workforce (Bernstein, 2008).

Millions of new jobs will be opening in STEM, and U.S. institutions are tasked to increase the persistence and retention rates of these students, to bolster the nation's workforce (Maltese & Tai, 2010). As a response to this demand, there is an expectation that the number of underrepresented minorities is expected to increase in the workforce, and, with this increase, there will be new qualifications, such as multilingual capacities and advanced degrees in STEM fields (Duran, 2020). With this ever-increasing charge for a highly educated STEM workforce, it is important to understand the reasons and attend to the challenge our four-year institutions face

¹ *Mathematics transfer student* refers to a student's identity, as a transfer student majoring in mathematics who has transferred from a community college. This student can also be referred to as *mathematics community college transfer student*. All definitions are also found in Appendix B.

in retaining our diverse underrepresented students, many of whom are often transfer students (Zhang, 2019). Focusing on how to best support our mathematics transfer students may help fill STEM job vacancies, help retain our diverse students of today, and improve the availability of STEM students for the future.

Much of the prior research on transfer students has focused on transfer shock, the temporary decrease of grade point average during their first or second semester of transition to a four-year institution and other dimensions of transfer adjustment (i.e., sense of belonging, social integration, culture shock, institutional adjustment; Cejda, 1997; Cejda, et al. 1998; Hill, 1965; Laanan, 2007; Melguizo, 2011; Townsend, 1995). Prior work has explored the experiences of students in higher education who come from low-income, underrepresented, non-traditional² and first-generation backgrounds, categories in which transfer students often fit (Laanan et al., 2010; Solórzano & Yosso, 2002). Though there has been general empirical research on transfer students, there is more research needed to understand the STEM community college transfer students and the ways in which we can best assist this population (Melguizo et al. 2011; Roberts et al., 2019).

What is known is that STEM transfer students are more likely to enter their institutions underprepared and that they are often less retained than their non-transfer³ peers (Lopez & Jones, 2017; National Governors Association, 2011; Zhang, 2019). For instance, incoming STEM transfer students may not be able to transfer all their STEM units from community college, and

² Non-Traditional Students is a term used for undergraduate students who are 24 years of age or older.

³Non-Transfer students are students who start as a first-year freshmen at four-year institutions. Non-transfer students typically attend their four-year institution for the entire four years.

they typically come in with less mathematics coursework, which is crucial to their major (Chen & Soldner 2013; Zhang, 2019). This missing coursework, in turn, may lead to an increased course load and decreased persistence in the major (Zhang, 2019). In the STEM field of mathematics, the current research available on mathematics transfer students finds that once community college mathematics students transfer to a four-year institution, they may face further factors that affect their success and timely completion of their major (Monaghan & Attewell, 2015; Zhang, 2019). For instance, undergraduate mathematics courses shift away from the computational mathematics that is taught in the K-12 and community college into abstract mathematics, proof-writing, and problem solving (Brown, 2017). Not having a sufficient mathematical foundation and course background may lead mathematics transfer students to leave the major. In attending to transfer student needs, the limited research available has shown that curriculum and programming that provides customized orientations and intentional advising has successfully improved the academic performance of transfer students (Scott, et al., 2017). Higher education intervention curriculum can, thus, be a factor in retaining STEM transfer students at four-year universities.

Statement of Problem

The mathematics department at this Study University has observed low retention rates of transfer students in the major, with approximately only half of the transfer students persisting. As a response to the low retention rates of transfer students, the mathematics department designed a bundle of three courses to support incoming transfer students' social and academic transitions in the major. Through this intervention curriculum, faculty attempted to support students in: (1) *writing proofs and engaging in problem solving* to prepare for upper-division courses; (2) *being a four-year university student* by learning how to study and engage with professors and peers; (3)

being a member of the mathematics community by collaborating and engaging with others; and (4) *finding a future as a mathematician* (Roberts et al., 2019). There is a scarcity of research on transfer intervention curriculum in which faculty readily acknowledge and support mathematics transfer students. Furthermore, there is general lack of scholarship that addresses relevant supports for transfer students at four-year universities and the ways to help incoming mathematics transfer students develop professional vision. Given this dearth of research, I qualitatively researched the following questions to investigate if the mathematics department faculty supported incoming transfer students to develop a mathematics transfer professional vision, and if, in the process, students and faculty accounted for their identities as transfer students:

1. How did faculty account for transfer students' identity as they supported transfer students in developing a mathematics transfer professional vision?
2. How did the transfer students account for their own identity as they developed a mathematics transfer professional vision?

Conceptual Framework

Jain et al.'s (2011) transfer receptive culture framework and Goodwin's (1994) professional vision provided the foundation for the conceptual framework in this study: *Professional Vision for Mathematics Transfer Students*. This developed conceptual framework considered incoming transfer mathematics students' development of professional vision of participating incoming transfer students in the mathematics major related in four areas that were first explored in Roberts et al. (2019): *proof and problem solving*, *being a four-year student*, *community*, and *a future as a mathematician*. My research questions considered: (1) if faculty accounted the identities of their incoming transfer students and supported their professional

vision in these four aspects at their receiving university during the implementation of the curriculum, and (2) how students accounted for their identities in relation to their development of professional vision within these four aspects.

Transfer Receptive Culture

I used Jain et al.'s (2011) transfer receptive culture as a foundation to examine if incoming transfer students who participated in the intervention curriculum were able to develop professional vision through their participation and engagement in the curriculum. Jain et al.'s transfer receptive culture extends the definition of college-going culture, which refers to the practices, environment and community that promote students' success in higher education, to one of a transfer student culture at a receiving, four-year institution. Transfer receptive culture is theoretically grounded in critical race theory in educational contexts (Jain et al., 2011; McDonough, 1997; Solórzano, 1998). Solórzano's (1998) critical race theory in educational context explains how dominant ideologies founded in the principles of "meritocracy, colorblindness, objectivity and race neutrality" are to be challenged in education settings in order to unveil both current and historical privilege (Solórzano, 1998 as cited by Jain et al., 2011; p. 258). Jain et al. aim to establish this connection by connecting critical race theory in educational settings to the transfer students, as many transfer students are from minoritized populations. Currently, there are only a few studies that have explored the transition processes of transfer students using a public four-year institution as a frame of reference (Dowd et al., 2008; Jain et al., 2011); my framework seeks to address the scarcity of transfer student experience at their four-year institution in present scholarship.

Fundamental to transfer receptive culture is the concept that students will succeed at a selective four-year institution because of their identities as transfer students (Jain et al., 2011).

The overarching principle of transfer receptive culture is that four-year institutions must be committed to providing the necessary supports for transfer students to transition successfully at their institution (Jain et al., 2011). Jain et al. state that an institutional commitment to support transfer students is not just reserved for community colleges; four-year institutions are also accountable for developing a culture that is receptive of transfer students. A four-year institution's commitment is crucial in transfer students' transition to higher education (Jain et al., 2011; Tierney, 1992).

The transfer receptive culture framework is comprised of five elements and stipulates that transfer students are legitimate members of their receiving four-year university community (Herrera & Jain, 2013; Jain et al. 2011). The elements of the transfer receptive culture framework are separated by the pre-transfer or post-transfer efforts of four-year universities. Pre-transfer efforts refer to how four-year institutions support transfer students before they begin their academic trajectories, such as, establishing transfer students “as a high institutional priority;” and “outreach and resources that focus specifically on the needs of transfer students must be provided” (Jain et al., 2011, p. 259). The post-transfer elements address how four-year institutions remain committed once students have transferred into their receiving university. The post-transfer elements are that four-year institutions must: provide academic and/or financial support; acknowledge the identities of transfer students; and engage in a reflective and analytical process by creating a transfer-specific framework for assessment and evaluation (Herrera & Jain, 2013; Jain et al., 2011).

Professional Vision

An institutional culture that is receptive of incoming transfer students can foster the professional vision of these students into a receiving four-year university. Goodwin (1994)

defines professional vision as the methods and ways that groups, such as professions, view and understand their professional working environment and regularly occurring experiences related to their line of work (Goodwin, 1994). Through the development of professional vision, those in a given occupation learn to see the world around them according to their profession. For instance, undergraduate transfer mathematics students transitioning to a four-year university learn to understand what academic life in their major institution entails. Moreover, professional vision posits that social interactions and work provide the setting for the development of professional vision (Goodwin, 1994). Goodwin noted that through professional vision, every profession shapes their discourse and organization relevant to their line of work. In this study, mathematics transfer students transitioned into their receiving university, staff and faculty introduced these students to discursive practices relevant to their major and their university. As practitioners of their field, incoming mathematics transfer students learned to perform skills and activities relevant to their discipline. Furthermore, Goodwin defined professional vision as being comprised of three key facets: (1) it is positioned within social situations and, as such, it is viewed from a perspective; (2) it involves engagement within a particular setting; (3) it is learned within specific communities and settings. Mathematics transfer students transferring into four-year universities learned to view their unique experiences of transitioning into a four-year university from a situated perspective. These students learned to view the context of their academic major and in their interactions with staff, faculty, and peers, such as within classrooms.

Goodwin's (1994) concept of professional vision further posits that those in a given profession have "socially organized ways of viewing and understanding events" that they can answer to and engage in (Goodwin, 1994; p. 606). This concept builds on the work of Lave and Wenger (1991), who articulate that practitioners generally develop their professional vision as

community members (Benedict-Chambers, 2014; Goodwin, 1994). Lave and Wenger (1991) further posited that the knowledge acquired to use tools relevant to a member is associated with a “socially articulated discourse” (Benedict-Chambers, 2014; Goodwin, 1994, p. 606). As new knowledge and tools are produced by the professional community, novices within that community must learn them. In the case of mathematics transfer students, they learn to understand higher mathematics by engaging in mathematics discourse taught by mathematics faculty. While engaged in this process, faculty teach these students in classroom settings, foundational mathematical knowledge and skills needed to succeed in mathematics at the four-year university. Situated and engaging interactions for a novice, such as an incoming transfer student with their faculty and overall new institution, are crucial for transfer students’ development of professional vision as such interaction can contribute to students’ academic adjustment (Lopez & Jones, 2017).

Drawing from past scholarship on Goodwin’s professional vision, this study examined how faculty supported the professional vision of incoming mathematics transfer students into their transition to the mathematics major at the Study University and if, in the process, the faculty and participating students and faculty acknowledged the transfer student identity. Specifically, I used Roberts et al.’s (2019) concept of development of professional vision along novice to expert within four aspects. These four aspects are: (1) *proof and problem solving*; (2) *being a four-year student*; (3) *establishing membership in a mathematics community*; and (4) *finding a future as a mathematician*.

Professional Vision for Mathematics Transfer Students

As this model is introduced, I outline the four aspects that are necessary for universities and their sub-units (i.e., academic departments) to establish to help incoming mathematics

students develop a professional vision in mathematics. The concept of professional vision for mathematics transfer students builds on the work of Roberts et al. (2019), who found that these four aspects provided a means to develop mathematics transfer professional vision development, while transfer mathematics students were enrolled in transfer specific courses at the Study University. As newcomers to their receiving institution⁴ and to higher mathematics, the trio of courses supported students to develop a mathematical foundation, such as with *proof and problem solving*, in tandem with helping them mature as *future mathematicians*, build the skills needed to *be four-year student*, and *establish a mathematics community* within the university, while acknowledging their identities and helping them successfully transition into their receiving institution.

An integral component for incoming mathematics transfer students to develop professional vision is that four-year institutions and their academic departments must teach them the foundational mathematics content needed to succeed in the major. Moreover, the institution is also responsible for giving them supports to help them navigate their new environment—the receiving four-year institution. Teaching students’ foundational mathematical content, such as proof and problem solving, will promote success in the mathematics major, but that content alone is not sufficient. For mathematics transfer students to also develop the professional vision needed as a four-year mathematics student, the institution must also provide a culture that is receptive through resources and support that are specific to their identities as incoming mathematics transfer students. This can be achieved by introducing them to the practices, skills and behaviors that are crucial for these students to develop at a four-year university and giving

⁴ Receiving Institution refers to the receiving four-year institution that community college transfer students enrolled in after completing community college. In the context of this study, the receiving institution is the Study University.

incoming mathematics transfer students a community in their limited time at their receiving institution. In addition, incoming transfer students must be able to see themselves as mathematicians as they progress in the mathematics major and post-graduation. In developing the participating mathematics transfer students' professional vision as both transfer and mathematics students, I will argue that the following four aspects are important for incoming mathematics transfer students' professional vision and will provide a review of the scholarship for each aspect. The four aspects of mathematics transfer professional vision are delineated below.

Proof and Problem Solving

The first aspect in helping transfer mathematics students develop professional vision is developing facility with proof and problem solving, which is needed to move into advanced mathematics courses. In mathematics education research, the transition to proof is a topic that has been widely researched (e.g., Edwards & Ward, 2008; Mejia-Ramos et al. 2012; Moore, 1994; Schoenfeld, 1985). The understanding of proofs is deemed crucial for "advanced undergraduate mathematics courses" (Mejia-Ramos et al., 2012; p. 3). Brown (2007) explained that undergraduate mathematics shifts away from the computational mathematics solving that are taught in the K-12 and community college into abstract mathematics and proof-writing and problem solving. Of importance is that incoming students vary in their backgrounds, beliefs, expectations, and mindsets regarding proofs, which can pose challenges to students (Weber & Mejia-Ramos, 2014).

Furthermore, mathematics education researchers have found a relationship between proof and problem solving (Weber, 2010). For instance, the concepts and logical mathematical reasoning used in the proof formulation and construction is also utilized in mathematical

problem solving (Weber, 2010). Along with this connection, they have also found links to specific strategies utilized in proof-related reasoning and how it impacts associated learning of mathematical reasoning (Weber, 2005). The research further posits proof and problem solving as being fundamental to doing higher mathematics. Undergraduate students often experience a sharp transition into these proof writing and problem solving once they transition into a four-year university (Brown, 2017). In order to view their environment around them as conducive to their professions as transfer mathematics students and to develop professional vision in their roles, their understanding of proof and problem solving is integral.

Being a Mathematics Transfer Student at a Four-Year University

The second element of helping transfer mathematics students develop professional vision is that transfer mathematics students should be supported in their acclimation at a four-year university and in the mathematics major. As previously discussed in the literature review, studies have found that transfer mathematics students often arrive with a false sense of security and low levels of self-efficacy (Scott et al. 2017; Taylor & Brookhill, 2018) in regard to their higher mathematical foundation and knowledge. Supporting incoming mathematics transfer students to develop the skills and knowledge related to navigating their four-year institution and major is needed to successfully become a student at a four-year university. This support can also assist transfer students in feeling situated and learning to see the university as both a mathematics student and, more generally, as a student at a four-year university. Jain et al. (2011) noted that programs for transfer students should be specific to the needs and unique challenges of transfer students. Transfer-specific mathematics programming would be especially beneficial to incoming transfer mathematics students to help them understand their roles as mathematics

student at a four-year university and to assist them in developing as transfer mathematics students.

Being a Member in a Mathematics and/or Transfer STEM Community

The third element transfer mathematics students must develop as part of their professional vision is to develop a community within their major and at their university. Developing a community within mathematics and as a transfer student at a four-year institution can be invaluable. In contrast, not feeling a sense of community can negatively impact the student (Townley, 2013). Much of the literature has found that the field of mathematics can often be perceived as exclusionary; students can be treated as outsiders and incapable (Boaler, 2002; Burton, 1999a; Fennema & Romberg, 1999; Solomon 2007). To counteract students feeling a lack of belonging, scholarship indicates that mathematics faculty should engage their students in participatory pedagogy, one that encourages active learning, practicing of knowledge learned and developing an identity of participation within mathematics (Solomon, 2007). Additionally, Herzig (2004) wrote, “the extent and nature of participation, viewed on the individual, interpersonal and community planes of focus, determine and limit their opportunities to learn to become mathematicians (Herzig, 2004; p. 201). The participatory methods and assignments that faculty use to teach mathematics in the classroom may foster communities of practice and learning opportunities within their students. Having faculty engage incoming mathematics transfer students in participatory pedagogy and creating opportunities for active learning, can help these students develop communities of practice within their mathematics field and at their receiving institution.

Given the limited research about mathematics transfer students, current scholarship indicates that for STEM transfer students and transfer students, in general, having a sense of

community (SOC) can also be of tremendous benefit. Scott et al (2017) studied a transfer learning community and found that establishing a community for STEM transfer students yielded successful retention and performance outcomes. Similarly, Townley et al. (2013) examined transfer students' sense of community in a transfer-specific STEM program that promoted retention through engagement. Townley et al. found that after controlling for participation, students who recorded high participation and a high SOC also reported a higher post-transfer GPA relative to students who reported high participation and a lower SOC. The transfer student experience can be affected by their incongruity between their ideal SOC and actual SOC. Unmet expectations of connections with others and identifications in their receiving institution can affect transfer students' social and academic success, including, but not limited to, performance on exams (Townley, 2013). In addition, STEM transfer students may have significant challenges regarding the transfer experience. Therefore, it is of importance that transfer students are provided with a community, so they can engage in situated and social work. This, in turn, will promote the development of professional vision in their receiving institution and major. In understanding what the connections are between learning, participation and how faculty can foster communities of practice in mathematics, faculty can develop pedagogy and curriculum that support the professional vision of mathematics transfer students at four-year universities.

Future as a Mathematician

The fourth aspect transfer mathematics students must develop as part of their professional vision is that incoming mathematics transfer students must view themselves as future mathematicians. It is important that students view themselves as mathematicians and find a future as a mathematician to develop their professional vision, by being exposed to and having the ability to succeed in advanced mathematical content, such as proof writing and problem

solving and post-graduate opportunities. In general, there is a dearth of research on what a mathematics post-graduate career entails, regardless of an undergraduate's transfer or non-transfer status. Current research finds that around a third of undergraduate students pursue an undergraduate mathematics degree to teach K-12 or at the post-secondary level, and two-thirds plan to pursue a doctorate in mathematics (Pirotrowski & Hemasinha, 2012). Furthermore, Dorff (2014) examined a "Careers in Math" speaker series at a university that emphasized communication skills, programming knowledge, a diversified STEM background, and having experience working on challenging problems, "whose solution was unknown as beneficial to a post-graduate career" (p. 307). Dorff further found that speakers stated summer internships as valuable experiences to help undergraduate students obtain future jobs. Dorff emphasized that different career options in mathematics led to an increase of mathematics majors. Being exposed to potential careers, opportunities and representatives in the field is important to help students develop professional vision to carve out their future as a mathematician.

Summary

In developing this conceptual framework, *Professional Vision for Mathematics Students*, I draw from Jain et al.'s (2011) Transfer Receptive Culture and Goodwin's (1994) Professional Vision to understand how mathematics transfer students can be supported in developing professional vision in the aforementioned four aspects Roberts et al. (2019) found in their study. As community college mathematics transfer students enter their new, four-year institution, it is important institutional agents, such as staff and faculty, provide a receptive environment for mathematics transfer students, by creating community, introducing students to the campus resources opportunities that are available to them as students at a four-year university, and teaching students foundational mathematical content to develop the discursive and social

practices needed to adjust and succeed as mathematics student at a four-year university. Furthermore, transfer receptive culture notes that institutions should create a transfer specific college success model that considers transfer students' unique and limited experiences at their receiving four-year university (Jain et al., 2011). In the case of mathematics students, aiding these students in figuring their future as mathematician post-graduation will, in turn, support their development of professional vision. I argue that, in providing a culture that is receptive of mathematics transfer students, faculty can support the development of mathematics transfer students' professional vision.

Literature Review

Mathematics transfer students face myriad challenges as they transition into the major at their receiving four-year university. Their position as transfer students pursuing a bachelor's degree in mathematics is connected to issues, such as transitioning into their new receiving four-year institution, grappling with their mathematical development, and having a limited time to complete their academic requirements. As this population of transfer students transition into their receiving four-year university and their major, it is important to remain cognizant of the challenges they face. In doing so, we must acknowledge mathematics transfer students' intersecting identities⁵ as transfer students, as students within a content area, and as students of underserved populations. Also of importance, it is vital to explore how intervention curriculum and programming can support these transfer mathematics students to develop a professional vision and support students' overall academic success. This section reviews the literature relating

⁵ Intersecting identities is a term referring to the multiple identities that students in higher education and specifically transfer students (in the context of this study) come in with. These identities can be related to socio-economic status, racial/ethnicity classification, those considered non-traditional and from other underrepresented backgrounds.

to STEM and mathematics transfer student population, their experiences, their identities as transfer students, the supports for this population with transfer-specific STEM curriculum, and the studies related to Jain et al.'s (2011) Transfer Receptive Culture and Goodwin's (1994) Professional Vision framework.

STEM Transfer Students & Mathematics Students

It is crucial that institutions ascertain what affects incoming transfer students in successfully completing and obtaining a STEM degree at their four-year institution (Lopez & Jones, 2017; National Governors Association, 2011). Community college transfers seeking to complete STEM degrees are more likely to enter their receiving institutions underprepared; they are also less often retained in their majors than their non-transfer peers (Lopez & Jones, 2017; National Governors Association, 2011; Zhang, 2019). National data shows that only 10 percent of community college students who transfer to a four-year university are able to obtain a bachelor's degree within six years from beginning their higher education journey (Hoachlander et al., 2003). Upon transitioning, STEM transfer students also often have to follow a curriculum that is highly structured and very restricting (Zhang, 2019).

There is a dearth of research on the specific challenges that mathematics transfer students face upon transferring to a four university. Of the limited research there is, Scott et al. (2017) found that STEM students, including mathematics students, unfortunately arrive to their receiving institution with a false sense of security of their academic and mathematical competencies. Upon arriving to the receiving institution, STEM transfer students often experience academic difficulties that arise from their lack of knowledge that is fundamental to their field of discipline not previously learned at their community college; these students are to quickly adapt to new skills, knowledge and ways of understanding their discipline. Taylor and

Brookhill (2018) similarly reported that community college mathematics transfer student arrived to their four-year institution with only a basic understanding of mathematical procedures and with low levels of self-efficacy. The ability to employ mathematical skills is essential for transfer student success in STEM fields (Wandel, 2015). Educators teaching the mathematics transfer student population need to be cognizant of the academic challenges they face in order to best support their students. Supporting these students in developing the needed knowledge, skills and methods of understanding mathematics at their receiving institution can promote academic success in the mathematics major and foster and mathematics transfer professional vision.

The Transfer Student Identity

The importance of recognizing transfer student intersecting identities is an inquiry that has been well-researched. Prior research has explored the experiences of students in higher education with intersecting identities, such as low-income, underrepresented, non-traditional and first-generation backgrounds. Transfer students often fit in these student categories (Solórzano & Yosso, 2002). A critical aspect to note, and one that is unique to the transfer student experience, is that transfer students have a limited time to complete their academic requirements in comparison to their non-transfer peers. Briggs et al. (2012) stated that the learning identities of students in higher education are not to be seen as uniform; diverse students can experience frustration and isolation if their receiving institution's learning expectations are incongruent to their own. Students from underrepresented and non-traditional backgrounds often arrive to college in need of guidance and of a sense of direction (Linares & Munoz, 2011). As student diversity in four-year institutions continues on a steady rise, institutions need to acknowledge all student identities to appropriately support them (Linares & Munoz, 2011). The diverse transfer

students of today need to be seen, heard, and deemed capable in succeeding in college; they will not succeed if they feel invalidated in their college classroom (Rendon, 2002).

In response to recognizing student identities, Rendon (2002) developed a validation theory for underrepresented students that emphasized validation as an enabling and supportive process, in which both “in and out classroom agents” work in tandem to support these students’ “academic and interpersonal development” (Rendon, 2002, p. 642). Used in transfer student studies, this theory states that college agents, such as faculty and staff, must build relationships in which they support their diverse student population and encourage students to build a support system with their peers (Linares & Munoz, 2011; Rendon, 2002). Furthermore, Castro and Cortez (2017) utilized Jain et al.’s (2011) transfer receptive culture framework and found that transfer students from underrepresented groups brought multifaceted lived experiences, such as those relating to ethno-racial identities, age, etc., which positioned students in different ways than their non-transfer peers in the higher education setting. As Castro and Cortez noted, transfer students come from diverse backgrounds, and faculty who work with them, should remain cognizant of these intersectional identities. Being aware of transfer students’ intersecting identities (i.e., low income, underrepresented minoritized students, etc.) allows institutional agents to provide a transfer receptive culture that helps transfer students succeed at the university (Castro & Cortez, 2017; Jain et al., 2011).

Transfer Receptive Culture

The scholarship using transfer-receptive culture as a framework has mostly studied partnership programs between community college and universities. For example, Herrera and Jain (2013) examined the efforts of a chancellor at an elite public university to recruit transfer students. Throughout a span of five years, the chancellor in this study attended surrounding city

colleges with high diverse populations and informed transfer students that their university was receptive of them and looked forward at the prospect of having them transfer to campus. As of 2013, nearly 40% of their incoming students are now transfer students. Similarly, Jain et al. (2016) examined a program offered by a Californian community college that partnered with a nearby university to implement a cross-campus program, STEP. Through STEP, the participating transfer students enrolled in an university upper-division course over the summer and attended workshops that touched on transfer-specific sources. Designed originally to ease the transition into a four-year university; throughout the years, the program shifted its focus by using a “critical race pedagogical approach,” motivating students to persist to attend graduate school (Jain et al. 2016, p. 1015). Jain et al. found that the program was successful in demonstrating four out of the five tenets of the Transfer Receptive Culture framework. For instance, students reported that they had a higher level of confidence in being able to transfer, that the university provided relevant transfer-specific resources that “complemented community college’s mission of transfer, that the university offered academic and financial support, and that faculty acknowledged the identities of transfer students (Jain et al. 2016, p. 1017). As Jain et al (2011) noted, the responsibility towards a successful transfer has often fallen solely on the community college system; four-year institutions are also responsible for creative a welcoming environment that is specific to transfer students and conducive to their transfer .

Developing a Professional Vision in Mathematics

Scholarship around the development of mathematical professional vision has primarily occurred with students in secondary education and within teacher education with preservice teachers. With regards to the development of professional vision with students in secondary mathematics, Gutiérrez et al. (2010) noted that the process of developing a professional vision in

mathematics necessitates a cohesive way of viewing, comprehending, analyzing, and engaging in mathematics that is specific to the distinct practices of mathematics communities. Sfard (2002) stated that engaging in mathematical discourse is crucial to students' learning as they develop mathematical professional vision during their work as mathematical novices; children learn mathematics by participating in mathematical discourse (Gutiérrez et al. 2010; Sfard, 2002, 2007). Mathematics is to be thought of as a social activity (Cobb et al., 1993). In viewing mathematics as a social activity, small group activities and class instruction can be conducive to a student's understanding of the subject that allow students to see the practices in the field as discursive accomplishments that are mediated in a social mathematics context (Gutiérrez et al. 2010; Mehan, 1978). In approaching the teaching of mathematics as a social activity, one that includes a participatory pedagogy and allows for constant discussion and collaboration, teachers can support students in understanding how to analyze, discuss, view and do mathematics and in turn, help them develop a professional vision.

The field of mathematics education has taken up the idea of noticing as related to professional vision, particularly with preservice teachers (Goodwin, 1994; Mason, 1998; Sherin & Han, 2004). Noticing is defined as the methods and ways used by teachers to observe the nuances of students' responses during instruction (Mason, 1998). In the act of noticing, the process of reciprocity unifies both teacher and student learning as they grasp mathematical concepts (Dominguez, 2019; Mason, 1998). As literature primarily studies students in the K-12 system, it is evident that there is a need to study how professional vision is developed in transfer students at a four-year university.

Intervention Curriculum and Programming

Intervention curriculum and programming, such as the one explored in this study, can be supportive of the multifaceted STEM and mathematics transfer student experience and ameliorate and promote these students' success at a higher four-year institution. Scott et al. (2017) found that 89% of incoming STEM transfer students participating in a transfer student learning community were retained in their majors. The transfer student learning community in the university study consisted of required bootcamp sessions that aided transfer students in developing academic and socialization skills, such as time management, organization, and peer groups. Another valuable added support in the transfer learning community study was an incorporated academic mentorship program, which aimed to help incoming transfer students with their courses and with their on-campus transition (Scott et al., 2017). Scott et al. cited the mentorship program within the transfer learning community as a valuable component of the program and important towards the transition of incoming transfer students.

Given the dearth of research on transfer student curriculum intervention, other higher education intervention curriculum, intended to increase the retention of underrepresented, non-traditional, and first-generation is reviewed. A study that explored a program at a four-year university, whose aim was to increase the retention rate of its male African American students and found that it produced favorable outcomes by providing students with an academic acculturation to the campus, access to resources, and the development of strong mentoring relationships (Brooks et al., 2012). In addition to acculturation program, students also need support systems and relevant curriculum. For example, Garcia and Okhidoi (2015) recommended supporting diverse, low-income, and first-generation students through such work. To bolster the retention and overall success rate of underrepresented and non-traditional students, it is essential that four-year institutions assess how the curriculum is taught and how it affects its diverse

students (Chesler, et al., 2005; Garcia & Okhidoi, 2015). Higher education institutions must pay close attention to the changing demographics of their student population to best support their diverse students. Faculty are responsible for creating curricula and programs that are specific to diverse, non-traditional, and/or transfer students to address their needs (Garcia & Okhidoi, 2015).

Method

Context

The study took place at a Minority Serving Institution (MSI) research university located in California. The university had a total of 26,000 students in the 2018-2019 academic year, with approximately 23,000 undergraduates. In this academic year, the ethnic/racial breakdown of the university was the following: 1% American Indian/Alaskan, 5% Black/African American, 29% Chicana/Latina, 28% Asian/ Pacific Islander, and 36% White. Additionally, 42% of entering students (freshman and transfer) were first-generation college student. In 2015, the Study University was classified as Hispanic Serving Institution (HSI) and an Asian American Native American Pacific Islander Serving Institution (AANAPISI), as reflected in the enrollment of Chicana/Latina, Asian American, and Native American students.

The mathematics department at the Study University required students to complete at least two mathematics courses at the study institution or at an accredited community college to qualify into the pre-major. For students to declare the full Mathematics major, students needed to pass all pre-major requirements with a 2.5 GPA and complete all pre-major requirements. If transfer students changed from the pre-mathematics major to the full major, transfers could submit their petitions in the quarter they were completing their coursework.

The study context was an intervention curriculum—a trio of courses designed for incoming mathematics transfer students, offered once a year every Fall Quarter since 2017. The three-course curriculum included courses referred to as Course A, Course B, and Course C. Two

of the courses, Course B and Course C, were offered exclusively to the incoming transfer students enrolled in the intervention curriculum. In the course catalogue, Course A, “Transition to Higher Mathematics,” was described as an introduction to the elements of proposition logic, techniques of mathematical proof and fundamental mathematical structures. Regarded by the mathematics department as a gatekeeping course, there were many Course A sections taught by different faculty throughout the academic year. The Course A section studied here was specifically for the enrolled intervention curriculum students in the 2018-2019 year—other sections were also offered Fall 2018, for both transfer students not in the intervention and for non-transfer students. Course B was an academic and advising course and it informed the participating transfer students of study management techniques, resources, available career opportunities, and overall, about life as a four-year mathematics student. Course C, a special topics in mathematics course, was a prerequisite course specifically for the intervention curriculum participants that served as an additional support for proof-writing and problem-solving development. This course also detailed the expectation for the upper-division mathematics courses. The mathematics department recruited participating transfer students for this trio of courses based on the following criteria: (1) community college grade point average; (2) number of mathematics courses completed at their community college of attendance; and (3) if they had taken the pre-requisite course to Course A at their community college.

Data Collection

For the data collection, student participants consisted of three male mathematics transfer student participants. There were also three faculty participants, who taught the intervention curriculum: the Course A instructor, a mathematics department lecturer, Dr. Connor Olson; the Course B instructor, an academic advisor, Ms. Delilah Nemet; and the Course C instructor, Dr.

Magdalena Blanco, a mathematics department lecturer and the creator of the three-course curriculum.

The three male students who chose to participate and the three faculty members who taught the curriculum courses in Fall 2018 each participated in a single, hour-long, semi-structured interview. Other demographic information was not available as this was pilot study data. Participants are identified using pseudonyms. Qualitative interviewing was utilized to understand how the instructors devised and executed their three-course intervention curriculum to develop professional vision in their incoming students. The interviews attended to the design and the development of the intervention curriculum courses, expectations of the course, the purpose and the intended effects of the bundled courses, student faculty interactions within the bundled course curriculum, and the faculty's views on the transfer students' experiences. Due to the social-distancing measures that were a result of the Covid-19 pandemic, the faculty interviews were audio-recorded with the consent of participants via Zoom. Students were interviewed during the Fall 2018; these interviews were conducted in-person by another graduate student. Student interviews attended to the students' proof and problem-solving, study skills and resources acquired through their participation in the bundle courses, the cohort-style format of the courses, and the challenges and successes the students associated with their participation in the bundle. In addition, students answered questions about their overall participation in the transfer-specific courses, the mathematics major, the Study University, students' general approach to mathematics, and students' post-graduating preparation and goals.

Data Analysis

A qualitative approach was used to gain a thorough and rich understanding of both the student and faculty interviews. More specifically, the analysis attempted to understand how

instructors organized and executed their intervention course curriculum to support the development of mathematics transfer students' professional vision in their participating transfer students. To answer the research questions, I coded using an a priori approach (Saldana, 2016) and aligned the codes with the conceptual framework. The first four codes encompassed the four aspects of the conceptual framework, *Professional Vision for Mathematics Transfer Students*; the fifth code was linked specifically to Jain et al.'s transfer receptive framework, to attend more specifically to student identity. These a priori codes were: (1) *proof and problem solving*; (2) *community*; (3) *future as a mathematician*; (4) *being a four-year university student*; and (5) *transfer identity acknowledgement and support*. I also coded for an absence of these codes; an absence of codes was defined as a code being not present and/or not acquired through a student's participation in the intervention curriculum; faculty described an absence of a code through incorporating a support because students had not received a given supports at their community college. Table 1 found in the Appendix A shows an overview of the coding scheme. A researcher and I developed fluency with these codes and then coded 20% of the faculty data independently. After this 20% of coding, the researcher and I reconciled our codes, and I updated the codebook. A Cohen's Kappa of 81.2% verified that agreement exceeded chance levels. Once the codebook was updated, we then proceeded to code the student data. The researcher and I coded the first 20% of the student data, where a Cohens Kappa of 63% was reached. In this step of the coding process, codes were reconciled and clarified, and common issues that were encountered during coding were discussed. On the next 20%, a Cohen's Kappa of 81.7% was reached, and once again, this allowed us to verify that our agreement exceeded chance levels. Analytical memos were written throughout the whole process (Yin, 2016). I then proceeded to code the rest of the data independently.

Upon completing the coding of data, I explored the data was furthered in NVivo and created matrices to look for emergent patterns (Yin, 2016). As Miles et al. (2014) noted, matrices are a creative and systematic way of understanding the meaning of the researcher's data. For this study, matrices were specifically used to explore patterns, comparisons, contrasts between faculty and students, as well as for total counts of each code (Miles et al. 2014). For example, when faculty spoke about incorporating supports that related to aspects of the mathematics transfer professional vision or transfer students' experiences Study University and major, they acknowledged students' identities (i.e., transfer student, non-traditional, underrepresented, etc.) as intertwined. Moreover, using matrices also served as a visual tool to examine how codes and variables interacted against each other. For instance, after examining the matrices, I decided to use thematic analysis for my data, "a method for identifying, analyzing, organizing, describing and reporting themes found within the data set" (Braun & Clarke, 2006 as cited in Nowell et al., 2017; p. 2). As Miles et al (2014) stated, a theme is a phrase or a statement that captures the meaning of a particular unit of data. I used thematic analysis to identify the themes that arose and fit the story found within the data set (Nowell et. al., 2017). Three overarching themes were found across faculty and student findings; two subthemes were found in student findings.

Findings

I found that faculty emphasized all four aspects of my conceptual framework, *Professional Vision for Mathematics Transfer Students*, and they implemented the mathematics department's curriculum and its incorporated supports, with their students' identities in mind. In supporting their students' development of a mathematics transfer student professional vision, the instructors acknowledged different aspects of their participating students' identity. The themes

found within these codes and data were: (1) holistic identity⁶; (2) identity as a mathematics community college transfer student; and (3) community college student identity, seen as an absence of knowledge, support, and time. Table 2 provides an overview of codes that were coded as an aspect of mathematics professional vision and transfer identity acknowledgement and support. The findings section will detail each of these themes more fully.

Table 2

Frequencies of Cited Mathematics Transfer Profession Vision Aspects found in relation to Transfer Identity Acknowledgement and Support

Faculty and Student	Mathematics Transfer Professional Vision by Transfer Identity			
	Proof and Problem Solving	Community	Future as a Mathematician	Being a Four-Year Student
Faculty	10	14	15	18
Student	5	3	5	3

Note. The table represents participants’ responses that were coded as both one of the four aspects of the mathematics transfer professional vision codes and as the *transfer student identity acknowledgement and support* code. Shading indicates the highest cited frequency counts by participant group.

Holistic Identity

Faculty

In the context of how the mathematics faculty supported their incoming transfer students in developing a mathematics transfer professional vision through the trio of courses, two of the three faculty spoke about the identities of their students in a holistic manner, a manner that accounted for transfer students’ intersecting identities, such as students’ identities as low-income, first-generation, underrepresented, independent and head of their household, non-

⁶ Holistic identity refers to transfer student and/or faculty referring to these students not just as community college students but also including their other intersecting identities.

traditional, etc. Discussing identities in a holistic manner meant that faculty acknowledged the transfer student experience as one that encompassed their intersecting identities such as ethnicity, socio-economic status, and as non-traditional students. For example, Delilah, the Course B instructor acknowledged both transfer student identities and their other intersecting identities. As a result of acknowledging these multiple identities, Delilah used her class efforts to introduce the transfer students to resources that would be most beneficial in helping them succeed at a four-year university and to develop a mathematics transfer professional vision. She stated:

When advising them and when doing this class, I really have to remember, it is almost like they are freshmen...they are in a brand-new environment...but they already had college underneath them...I make sure that they are aware of their resources, especially like EOP [Educational Opportunity Program – provided services to low-income and first-generation students] and things like that to help them out. They definitely can struggle more than a traditional transfer student, because if they are a first-generation, they are coming in blindly. (946-1053)

In her academic advising course, Delilah, who was also the department's undergraduate advisor, ensured that the resources she introduced the transfer students to were specifically tailored to the incoming transfer students and their intersecting identities. Furthermore, as transfer students at a four-year institution, she sought to support their professional vision by helping them understand what resources their new environment entailed and provided for them. Furthermore, Delilah shared,

A lot of them are commuter [students], so they'll come, get the classes that they need and leave, and they won't build on that social aspect. So, Course B is trying to break that barrier and actually having them build that social network. (986-987).

In this case, Delilah tried to respond to transfer students' identities, as related to commuting. She acknowledged that most transfer students typically commute, as they have many responsibilities.

As a former transfer student herself, Delilah recalled her own experience as a busy commuter student. Once she had transferred to her four-year university, she personally faced as a result on her own transfer student identity. Thus, in being able to situate her own identity in the context of her students, she provided supports that she believed would be helpful. Delilah explained,

I personally know that I was one of those zombies, where I had to work, I had to go to school, I commuted...I wish I had a class that was like this...you know [it] was easier to have a social network of everybody that's the same around me. (991-992).

She structured her class to give the participating mathematics transfer students a community, an aspect she felt was absent from her four-year college experience as a former transfer student.

When discussing the transfer students who had previously participated in the curriculum, Magdalena, the Course C instructor remained aware of transfer students' intersecting identities. She acknowledged the challenges she had seen stemming from identities, such as independent and non-traditional student status from transfer students she has previously taught. She shared:

One of the biggest challenges is that many of them have to work...they actually need to work to survive. So, they are actually more limited in their studies. I have seen all kinds of situations...last year, a single father who was, had to work to sustain his boy, and he was taking care of his boy and studying at the same time, and things like that. So, you can definitely feel the difference between, you know, these more younger kids and the transfer students. They all feel like adults to me, like people who are responsible of their lives and, and definitely that makes it harder for them. (1201-1238)

The creator of the bundle courses disclosed the responsibilities that these transfer students carried as older and non-traditional students who often were the main source of income for their households. In consideration of the observed outside commitments that affected the students' time they could devote to their studies, she wanted to make sure that courses had incorporated supports to gain a community during class time. She stated:

One of the reasons why I made this program...so interactive was to force them to communicate with other students, right? If they were just sitting in class in which the only thing that they are doing in the class, that would be more difficult to develop. (248-253)

As she accounted for their outside lives and commitments, Magdalena saw community as an integral support to incorporate in class, one that helped them develop a mathematics transfer professional vision.

Students

In contrast to faculty responses, the students did not mention or acknowledge that the intervention curriculum supported their intersecting identities. One participating transfer student shared his intersecting identity but not in the context of incorporated intervention curriculum supports. Albert stated:

So, I am a first-generation student, and I come from this small town...in the high desert. There is this weird mentality there that you kind of won't do anything...So, I had two friends and both of them kind of made the first step, and one is at Cal Poly Pomona now, doing engineering...and the other just graduated and... got into UC Irvine...and kind of infiltrated the system and kind of gave me more motivation honestly to do it because

nobody in my family had gone...I felt lost like, "How do people do this?" Having a friend my age there actually...it helped out so much, more than anything else. (78-87)

Seeing his friends take a first step in pursuing a higher education motivated Albert to attend community college and transfer to Study University, as he did not know of anyone else who had attended college beforehand. This transfer student talked about his identity in a holistic manner. However, Albert did not talk about his identity in relation to the curriculum and its perceived support.

Identity as a Mathematics Community College Transfer Student

Faculty

When discussing why the intervention curriculum was created and their decision to include certain supports, the faculty saw the intervention curriculum as aligned with the students' identities as community college transfers. In aligning the intervention curriculum to their identities, the faculty supported students' development of a mathematics transfer professional vision.

Magdalena, the creator of the bundle courses, shared the supports she initially thought of when incorporating supports to the transfer mathematics student intervention curriculum. She shared:

So, we decided to create this bundle of courses to help with the transition from community college to the university with certain goals in mind. One of them was to help them create a community, since those courses are just for them, so that helps them...find other students with the same background and also, everyone is new to the community.

(60-66)

Having worked with transfer students prior to the implementation of the curriculum, Magdalena was aware that community college transfer students typically took large courses with non-transfer students who had already established a community at the Study University. She understood the challenges that arose from their status as a transfer student and wanted to give the participating transfers opportunities within their courses to build community, an aspect of mathematics transfer student professional vision. On other goals for the transfer-specific intervention, she continued,

And then, the other one was to make more explicit to them what was expected from them when doing upper-division courses, since the mathematics they do in community college are different than what they do in upper-division are all proof-based. (66-70)

She understood that as community college mathematics transfer students, they may not have learned theoretical and abstract mathematics, such as proof and problem solving. Rather than have them jump into upper-division without this mathematical foundation, she hoped that the curriculum supported them in developing proof and problem solving which in turn, helped them develop their professional vision as mathematics transfer students as the faculty taught the students foundational mathematical content needed for higher mathematics taught in the mathematics undergraduate major at the Study University.

The Course B instructor shared how she accounted for transfer students' identities when designing her course. Delilah stated:

I make it a big deal, especially for transfer students that, they come in in their third year, by the next year, if they want to go to grad school, they're applying for grad school already, within a year of just being at Study University. So, they need to learn to make

relationships with their professor, so they can get letters of recommendation from them for grad school, and things like that. So, I make sure to establish that early on. (393-399)

Transfer students typically came in as juniors and, due to their limited time, they only had two years to earn their degree, create networks and, in the case of those in the mathematics major, figure out their future as a mathematician. Having been a transfer student, Delilah was aware of their limited time and all that it affected. Through her advising course, she helped mathematics transfer students develop the skills they needed to be a four-year student by making office hours part of the course and grade, so they can build relationships with faculty and get clarification in course material they found challenging. Furthermore, she sought to change their perceptions of office hours by enforcing it as an assignment as she stated that in community college: “office hours are kind of rare... and you only go if you are struggling or if something is wrong” (237-241). Typically, transfer students enter as juniors and thus, they only have two years to complete their course requirements and develop faculty relationships. By making office hours a course assignment, she supported interactions with staff, and thus, supported them in developing qualities related to *being the four-year student*, as four-year students are expected to seek faculty offices, and *community* aspects of mathematics transfer professional vision. The course requirements encouraged helpful and positive interactions with staff.

In her advising course, Delilah also had assignments to help students develop as future mathematicians, another aspect of mathematics professional vision. She shared,

most of the other assignments are related to specific topics, so, like the career one, I’ve had them do career exploration... One of my favorite ones is having them do an information interview with um, a person in their desired field of interest. (399-404)

In her advising course and with the understanding that their time at the Study University was limited, she wanted to ensure that they explored career in mathematics, which aligned with the *future as a mathematician* aspect of mathematics transfer professional vision. In fully understanding their identity, through such activities as the career exploration survey, as community college mathematics transfer students and as individuals, Delilah incorporated supports and exposure to future careers that would assist students in developing a mathematics transfer professional vision and deciding on a future career that used their mathematics degree.

Despite the intent of the intervention curriculum, Dr. Connor Olson admitted that he did not necessarily tailor his course to address the identities of the transfer student. He stated:

I mean to be honest; I didn't really design my class with like transfer students per se in mind. Like, I would probably teach the class very similarly if I had, you know, if I did not have transfer students. But at the same time, the way the bundle students of class were structured, like, I said it was meant to give them more of a sense of community, more of a sense of, "Hey we're all in this together." (243-250)

Connor attributed his course as supportive and acknowledged transfer students, because they were within a course within the intervention curriculum, a trio of courses that were designed to establish a community. His course, however, was not specifically designed with the mathematics transfer student in mind. In participating in this curriculum, the transfer students took classes as a cohort and, as a result, the mathematics transfer students built a community amongst themselves and were supported in developing a transfer mathematics professional vision. On the aspect of community and how the bundle of courses was designed to build it, Connor, the Course A instructor continued:

Really, the motivation behind doing that was to have a group of students who would follow each other around and meet regularly outside class to do problems together and we felt like... if they took all three classes together, then, sort of naturally, they would tend to do that... My impression is that it did happen with these students. I mean, I saw them walking around campus in a little herd of, you know, transfer students. (173-193)

He recalled seeing his past students who had participated in the intervention around campus together, and he attributed the community building, an aspect of mathematics transfer professional vision, to the cohort-learning design.

Student

In alignment with faculty responses, participating mathematics students saw all aspects of mathematics transfer professional vision as they acknowledged mathematics transfer student relevant supports and their own identities as community college mathematics transfer students. The aspects observed were: (1) *proof and problem solving*; (2) *being a four-year student*; (3) *community* and; (4) *future as a mathematician*. Yassin, an incoming transfer student, shared his experience with Dr. Magdalena Blanco, the instructor for the Special Topics Mathematics course, Course C. He stated:

I liked it [Course C]. Magdalena Blanco was amazing. She really cares for her students and stuff. She's a great mathematician. Um, and it kind of, like, served a few purposes, cause it, like, helped, it did help a lot of the transfers student, myself included—like, get that level of rigor and thinking about, how to get better at writing arguments out and stuff, like, that. But, it also helped build a little transfer math community. (183-188)

Yassin shared, as a transfer student, he felt supported in developing proof and problem solving and in establishing a sense of community with fellow transfer students in Course C. He praised

the creator of the courses for her instruction and her attention to students. Albert, a first-generation community college transfer student, summarized his experience in the intervention curriculum.

I think overall, you know, I had a blast, and it was a great way to meet a lot of people...I mean in some ways, it changed my life. That was the first classes I took here at UCSB. I took two math courses my first quarter here, and those were my first real classes here that was different, so it kind of really helped me get into the expectations of the university and kind of, where I should be at. And you quickly realize transferring that, you know, being a top student at a small community college doesn't mean anything here, because everybody's at that level. Especially ones that are beyond Math 8...You have to work your way back up. (634-643)

Albert explained that the trio of courses were integral for his transition, as both a mathematics student and a student at a four-year university. He acknowledged that as a transfer student, the mathematical content and his overall understanding of mathematics was different than of what he was taught at his community college. The transfer intervention courses helped him obtain the mathematical content such as proof-writing and problem-solving and four-year student qualities needed to succeed.

Community College Student Identity seen as an Absence of Knowledge, Support, and Time

A third theme that arose was *community college students' identity seen as an absence of knowledge, support, and time*. This theme was not discrete, as it overlapped with the theme *Identity as a Mathematics Community College Transfer Student*. However, in discussing

absences⁷, these themes were distinct enough to create an additional theme. While faculty viewed the community college student identity holistically, as an absence of knowledge, support and time, students categorized the perceived absences that arose from being community college students in two subthemes. These subthemes were: (1) *habits or skills developed prior to coming to the study university*; and (2) *an absence of knowledge that stemmed from community college*. Table 3 describes what faculty and students interpret as absences of mathematics transfer professional vision either in response to incorporated curriculum supports or students' transfer student experience.

Table 3

Frequencies of Cited Absences of Mathematics Professional Vision Aspects

Faculty and Student	Absence of Mathematics Transfer Professional Vision by Transfer Identity			
	Proof and Problem Solving	Community	Future as a Mathematician	Being a Four-Year Student
Faculty	1	4	3	4
Student	1	1	1	4

Note. The table represents the absence of the mathematics transfer professional vision aspects as discussed among participants. The highest instances cited by groups of participants notes how each group identified absences of mathematics transfer professional vision as related to the curriculum or the transfer student experience. Low frequencies indicate low number of absences cited.

Faculty

The faculty saw the students' identities as community college mathematics transfers as being tied to absence of certain types of knowledge. As the faculty discuss the curriculum and its

⁷ Absences refers to either a faculty member or transfer student's perception of a missing component a mathematics transfer student's prior education during community college, their limited time at the Study University, or a limited support the student has received. As the concept of absences is discussed in the study, these perceived absences are related to aspects within the *Professional Vision for Mathematics Transfer Students* framework.

incorporated supports, they discussed what knowledge or skill set incoming transfer students did not come in and must be trained on in order to succeed in the major and at the four-year university and, thus, to develop a mathematics transfer professional vision.

Delilah discussed the importance of remaining cognizant of these transfer students' identities to give them the supports they need. Delilah shared:

They're coming into an environment as juniors, where these students that are juniors at the same level of them, that came in as freshmen, have already established something... They've already established their friends, they've already established, you know, their resources on campus. So, you know, I feel like working with transfer students...I have to remind myself, "Yes, they're juniors, just like their counterparts."...They're at that level, but they're really not, because they didn't have the, the other two years to get acclimated to campus, to see how this, the university works. (932-942)

Delilah was aware that though transfer students enter with a junior status, these students did not possess the knowledge, support, and time that non-transfer junior students have typically established by their third year at the Study University. Transfer students were new students to the university and ,as such, these students needed to build their community, to acclimate themselves to university resources and overall, be advised on what being a four-year student entailed in a span of two years. Moreover, they needed to learn different ways of understanding mathematics as community colleges typically focus on computational mathematics, rather than abstract and theoretical mathematics (Taylor & Brickhill, 2018). Delilah continued:

I feel that they do develop study habits, it's, they struggle at first, they really do, because there's a very big difference between community college, mathematics, or just lower-division mathematics in general versus upper-division. So, I have, you know, overheard

them talking, or they talk to me about, like, "I've had to learn to change my study habits."
(903-909)

While Delilah acknowledged that students had the absence of knowledge related to skills related to *being a four-student*, such as time management and academic planning, she filled this absence by introducing them to resources such as time management, academic planning, how to properly study for exams in her advising course. In incorporating these supports, she supported them in developing a transfer mathematics professional vision.

Dr. Magdalena Blanco, wanted to address faculty members' concern that transfer students had low academic prior to the intervention curriculum:

There were a lot of comments from the faculty about concerns about [transfer students'] performance in upper-division courses, when they were transferring to our program. So, what happened is that [faculty] were mostly concerned about [transfer students] not having student, other students to work with, because they were not part of the community, and they were scared of going to office hours and participating in conversations in class. And, and also, their performance were, was notoriously lower than our own students. (49-56)

Before the implementation of the intervention curriculum, many mathematics faculty had discussed the challenges they had observed in their incoming mathematics transfer students. With this feedback, Magdalena decided to address these concerns by creating a program with a cohort-style design to address the absence of community for transfer students in the mathematics department. The advising course, Course B, would assist transfer students with developing skills in being a four-year student; the mathematics courses A and C would focus on proof and

problem solving; and together, the courses would focus on community and helping transfer students develop as future mathematicians.

Magdalena further explained how the department incorporated supports through these courses as a result of perceived absences, as described above, of the transfer students, related to community, as well as proof and problem-solving content preparation, as students transferred from community colleges. She discussed the reasoning behind the intervention curriculum collaborators creating a gate of courses, that would include Course A, Transition to the Higher Mathematics course, the traditional gate-keeping course. However, due to budgetary limitations, these courses were only available to a subset of incoming transfer students that year. She stated:

So, we decided to create this, like, gate, so, these three courses become a gate, everyone [the subset of participating transfer students] has to go through them and be equally prepared. And none of them is an upper-division course, per se, and so those courses [are] preparing them for the real upper-division courses. So, the way that I created the class was focus on problem-solving, focus on collaboration between the students; it was more about developing the skills that they didn't have, they don't have so much of a chance to develop in community college. (125-133)

As juniors, transfer students typically have upper-division courses accessible to them upon transferring to the Study University. However, she and other faculty, including the intervention curriculum collaborators realized that they may not be adequately prepared to succeed in the mathematics major at the Study University if they only took upper division courses upon transferring. This trio of courses would allow the participating transfer students to be equally and appropriately prepared and subsequently, support them in their development of mathematics transfer student professional vision.

Connor identified absence of mathematics transfer professional vision related to proof and problem solving and future as a mathematician as a knowledge absence of university level mathematics in incoming mathematics students.

It's like a whole new way of thinking about what mathematics, study of mathematics is really supposed to look like. So, that is, that is both [*chuckles*] the joy for me and the challenge is trying to, you know, turn them, turn them onto it...our concerns especially for transfer students, is that ,you know, they come in and they, they don't really have a lot of time to figure out and sometimes it's too late once they've taken a couple of math classes. They can't turn around and major in something else. (341-357)

Throughout his years teaching the introduction to proofs course, the instructor has seen that community college mathematics transfer students come with different expectations of what mathematics is. He saw this as an absence of proof and problem solving and future *as a mathematician* that was brought by their identity as an incoming mathematics community college transfer student. He also shared, “it can be a real hit-and-miss as far as just their actual mathematical preparation or, kind of their maturity based on their experience from their community college” (915-918). Through his course and the intervention curriculum, Connor sought to strengthen transfer mathematics students’ mathematics knowledge that they may have not received in their community college courses, and to help them figure out their future at the university, whether it was in mathematics, or they switched into another major at the Study University. He ideally would want to help foster a future as a mathematician in his students but ultimately, he just hopes to help them persist at the university. The faculty understood the mathematics transfer student experience as one where fundamental mathematical content, skills related to being a four-year-year student, community and supporting them in figuring out their

future as a mathematician at the Study University and post-graduation needed to be learned by these incoming transfer students upon transferring. Faculty noted these aspects as foundational skills and knowledge not always learned in their community college mathematics students at their prior institution.

Students

Regarding the aspects of mathematics transfer professional vision, students viewed an absence of mathematics transfer professional vision aspects in three ways, the latter two of which contrasted with faculty. These two subthemes were: (1) *habits or skills developed prior to coming to the study university*; and (2) *an absence of knowledge that stemmed from community college*.

Habits or skills developed prior to coming to the study university. When asked how the intervention curriculum assisted them in developing the four aspects of professional vision, the students, in part, interpreted absence of *being a four-year student, community, or future as a mathematician* and other aspects of mathematics transfer professional vision, such as having already developed habits or skill sets in community college, having their resourcefulness, or wanting to see different within the curriculum. This contrasted with how faculty perceived the concept of absence of mathematics transfer professional vision as either related to a lack knowledge, support, or time that derived from transfer students' experiences at their community colleges. While students saw an absence of mathematics transfer professional vision as skills they had already learned, their proactiveness or content they wished to see from the curriculum, faculty saw an absence of supports that they needed to incorporate into the curriculum. As an example, when Albert, a participating transfer student was asked if he felt supported in developing four-year student university habits, such as going to office hours, he stated:

I've personally never had a problem with that. I've had a lot of approachable teachers in my life. So, I don't really think [the intervention curriculum] helped me approach faculty...Course B, [which was] also for transfer students, one of the assignments was to approach faculty. (362-366)

Even though Course B, the academic advising course incorporated supports that encouraged the students to go to office hours, Albert did not credit the intervention curriculum faculty for helping him develop the four-year student habits of attending office hours. As he shared, he has felt comfortable seeking help from faculty in previous institutions. Similarly, Noah also felt comfortable approaching faculty prior to transferring to Study University. Noah shared:

So, I was always really good at that, so I do not think it improved it at all, because when I was at my CC, I, you know, I became very familiar with the math faculty, and so, I'm not like, I know a lot of people who are, like, scared of professors, so I don't think it improved it as much, because I already, kind of, had that skill under my belt. (260-263)

With regards to building community in the form of establishing study groups, Albert discussed that the incorporated curriculum supports, and assignments were not helpful. He is comfortable of facilitating groups himself, though this is yet another aspect incorporated into the curriculum and of mathematics transfer professional vision. He responded:

I don't think it helped too much, because I felt I was already prepared for that by the nature of the courses prior to transferring, and I just think I'm kind of an approachable person, so I've never really had a problem just forming a study group. (423-426)

Faculty's incorporated supports, such as community building and being a four-year student, were not perceived as new skills that the participating mathematics transfer students felt that they need

to learn. They had learned these skills prior to attending the Study University and enrolling in the intervention curriculum.

An absence of knowledge that stemmed from community college. A student discussed proof and problem solving as being absent from his community college coursework. Albert shared:

Yeah, well, I mean, I guess this varies from institution to institution, but my community college in particular didn't emphasize proofs or even, you know, we never went over that. There were obviously theorems and proofs in the book, but we were never expected to prove ideas. It was always just kind of understand it and then be able to do problems. (329-332).

Abstract and theoretical mathematics was not taught in community college curriculum. Proof writing and problem solving was something he had to quickly learn as an incoming transfer mathematics student entering the Study University. Faculty also interpreted proof and problem solving as an absence of knowledge stemming from community college and therefore, incorporated proof and problem solving supports into their curriculum. This alignment of absences was important, as it provided the core of curriculum in Courses A and C.

Discussion

I found that the faculty accounted for their transfer students' mathematics community college transfer student identity as they supported them in developing a professional vision through the department's transfer intervention curriculum. The faculty designed the mathematics transfer student intervention curriculum to support the development of professional vision in a subset of their incoming transfer population. Furthermore, the cohort-learning model and activities incorporated into the intervention curriculum allowed these students to learn

mathematics skills in a smaller and more inclusive environment and helped them build a community amongst themselves (Bailey et al., 2005; Jackson, 2010; Jackson & Lanaan, 2015). In regard to supporting their mathematics transfer professional vision by developing their proof and problem solving, Course A and Course C faculty taught the students fundamental skills to prepare the participating transfer students for the upper-division courses in the major. Proof and problem solving was seen as an integral support for incoming mathematics transfer students, as they might not have learned fundamental higher mathematics concepts in their community college coursework.

Through the curriculum, the faculty addressed absences of knowledge, time, and support that arose from their community college transfer students' prior experiences and education at their former institution. For instance, the faculty included intentional advising for the participating transfer students (Scott, 2017), activities to get them thinking about postgraduate-life and their futures as mathematicians, as transfer students are only typically at the Study University for two years. Course B also included supports to academically socialize them as a four-year university student, by teaching the transfer students study methods such as study management (Crawford, 1999) and having them attend office hours to build relationships with faculty (Hoffman, 2014). Overall, the curriculum sought to provide supports that would give the mathematics transfer students the knowledge, resources, and social adjustment through community that the faculty deemed necessary to succeed.

Two out of the three study faculty also acknowledged the holistic identity of their mathematics transfer students as independent, underrepresented, and non-traditional students, among other intersecting identities. With these identities in mind, the faculty implemented a curriculum, in which students had opportunities to develop aspects of mathematics transfer

professional vision, such as, proof and problem solving, community, future as mathematicians, and being a four-year student.

Students accounted for their own identity as they reflected on their experiences in the intervention curriculum and on their perceived development of mathematics transfer professional vision. However, there is contrast on how students spoke on their identities. A clear difference was that the students only acknowledged their mathematics transfer student identity in relation to the curriculum and not any other identity, such as first-generation, low-income, and underrepresented students. Students shared that collectively, the trio of courses assisted them in building a community amongst their transfer peers, allowed them to build community with faculty and in the proof writing and problem-solving aspects of transfer mathematics student professional vision. The community aspect is of importance to note, because, as transfer students typically enter the Study University as junior status, they are often placed in course with their non-transfer peers. The cohort-style design and the supports embedded in the curriculum allowed the participating incoming mathematics transfer students to develop a community within themselves. While the students mentioned that the trio of courses encompassed all aspects of mathematics transfer professional vision, they cited some aspects as less helpful than others. For example, two of the three students acknowledged that the advising course spoke on career opportunities that aligned with future as a mathematician and gave them the opportunities to make connections with faculty by making office hours part of their grade. However, the students had already acquired the skill of interacting and connecting with faculty in community college. Therefore, these students did not deem that assignment helpful.

There were some notable comparisons that faculty and students noted within the curriculum that supported mathematics transfer professional vision. Students and faculty both

felt that the curriculum assisted the students in developing proof and problem solving and community amongst peers. In addition, faculty also acknowledged that the curriculum gave them the opportunity to explore students' futures as a mathematician through career exploration assignments. In terms of assisting them in seeking skills, such as going to faculty during office hours and forming study groups, which are aspects of being a four-year student, there was a contrast in what faculty and students viewed as valuable four-year students' skills and what skills students come in from their community college experience.

Limitations and Suggestions for Future Research and Practice

I have identified the following two limitations for this qualitative study: a small student sample size and only having interview data from one single period of their undergraduate career. The limited sample size was due to the low response rate of mathematics transfer students who participated in the intervention curriculum. It would have been beneficial to conduct more student interviews to expand student perspectives of the intervention; however, even with this sample size, important information was drawn from the incoming students who participated in the transfer curriculum. In addition, it would also be beneficial to obtain student perspectives' later in their undergraduate career to gain some insights on how the intervention curriculum has assisted as they progressed into the major.

Moreover, there were other notable limitations that prohibited this study to examine retention. In its four-year run, the recruitment process and implementation process has changed several times. For example, the faculty changed the admission requirements of the program. In 2017-2018 and 2018-2019 academic years, the faculty selected the students based on grade point average and number of mathematics content courses they took in community college. In the 2019-2020 and 2020-2021 years, the faculty allowed the incoming students to opt into the

intervention curriculum if they took the community college pre-requisite course to Course A. Within each two-year period, the requirements have changed slightly. The yearly implementation has changed, as well. Additionally, in the 2017-2018 academic year, Courses B and C were offered at the same time and in the 2018-2019 year, and there were two sections of Course A offered specifically for the incoming transfer students. In the 2020-2021 year, the courses were offered remotely, and the participating transfers did not have an assigned Course A section. Transfer students in the bundle enrolled in 8 different Course A sections. The consistent changes in recruitment and implementation are deterrents to studying retention and improvement to curriculum outcomes.

For future research and practice, a more purposeful intervention implementation must be considered. The implementation of the intervention curriculum and how that will affect research and data collection must be explored simultaneously. Recruitment and implementation must stay consistent to examine retention of these students and to appropriately evaluate this curriculum longitudinally. At this moment in time, there has not been any two years with an established control group though there are larger subset of transfer students not enrolled in the intervention curriculum every year; also, there has not been a consistent recruitment and implementation practice. Therefore, an evaluation to analyze success of the program is not possible. Furthermore, it would be useful to survey incoming mathematics transfer students at the community college level. If the mathematics department and the university had insight regarding the exact knowledge and skills with which their incoming mathematics transfer students are coming, the department could tailor the faculty intervention curriculum to serve them most appropriately.

Conclusion

High transfer student attrition rate is not specific to the Study University. Studies show that approximately only about 27% of community college transfer students who utilized the public school system graduated with a bachelor's degree within six years of community college enrollment (Hoachlander et al., 2003; NCES, 2020). This mathematics intervention curriculum at this Study University was implemented to foster academic and social adjustment, which, in turn, supported the development of mathematics transfer professional vision. By examining this curriculum through a professional vision lens and one that accounts for the identities of mathematics transfer students, there were noted incorporated supports created specifically for this population. Though the mathematics and Study University have taken strides to improve the education trajectories of these students, there is more to be done. In order to ensure success, there must be a more careful consideration in implementation and recruitment practices.

There is a dearth of research on the mathematics transfer student population and how we can best support their retention, timely graduation, and overall success upon transferring to their four-year receiving institution. It is crucial to focus on this population, as approximately 84% of community college students from underrepresented minoritized populations and about 50% of our nation's students are entering community college as a pathway into a degree in STEM (Starobin & Laanan, 2005; Zhang 2019). Therefore, it is important that we implement and research intervention curriculum programming for STEM transfer students. We have an ever-increasing need for STEM graduates in our workforce (Jackson & Laanan, 2015), and it is vital that we focus on this population to meet this need.

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Appendix A

Table A1

Codes, Descriptions and Examples for Bundle Course Data

Code	Description	Example Quotation Demonstrating the Code
Proof and Problem Solving	<p>Related to the understanding, learning, and/or acquisition of skills relating to proof and problem solving in preparation for upper-division courses and what faculty expect on exams and courses specifically related to proof and problem solving.</p>	<p><i>Faculty Example:</i></p> <p>So, we talked many times [Course A & C instructors] about wanting to have the same philosophy as far as trying to teach students how to do proofs, but we also wanted to have it be that we didn't, um, overlap on content... The point was that we were both going to emphasize proof writing as opposed to the content. We'd have different content but the same philosophy as far as proof writing goes.</p>
	<p>Student examples are related to students discussing math-related content, as well as proof and problem solving in relation to their courses.</p>	<p><i>Student Example:</i></p> <p>Math 8 was great because it really helped you deal with this mental wall that's there. It's like this infinitely high mental wall that you have to jump over to get into proof writing math and I guess you don't have to jump over it but that's your initial thought, like, "This is how I have to get to the other side".</p>
Being a Four-Year Student	<p>Related to the teaching or learning of general academic habits, behaviors, and characteristics of being a student at a four-year research university.</p>	<p><i>Faculty Example:</i></p> <p>'Cause I make it a big deal [in Course B], eh, especially for transfer students that, they come in in their third year, by the next year, if they want to go to grad school, they're applying for grad school already, within a year of just being at Study University. So, they need to learn to make relationships with their professor, so they can get letters of recommendation from them for grad school, and things like that. So, I make</p>

		<p>sure to establish that early on. Um, most of the other assignments are related to specific topics, so, like, the career one, I've had them do career exploration tests, and had them do a little bit a writeup about that.</p>
	<p>Students are introduced to university resources (i.e., EOP, etc.) and practices (i.e., office hours, participating, studying-related methods or assignments) that will help them succeed as a four-year student.</p>	<p><i>Student Example:</i></p> <p>If section didn't answer any of my questions, I went to the professor, um... because then you can kind of get your technical questions answered. You know, "If I write it like this, does it still say the same thing as if I write it like this?" Yes or no, blah, blah, blah- so then- then you can- I feel like a huge part of it is having a conversation about why your proof doesn't make sense</p>
Community	<p>Related to the importance of and integration into a community on campus.</p>	<p><i>Faculty Example:</i></p> <p>I know that all the other transfer student instructors and I have noticed that they do become very close as a cohort. And so, we'll see them walking in groups walking down the halls and things like that. So, we know that we've been successful in that, you know, establishing them, to have a group where they can bounce ideas off each other and support each other.</p>
	<p>Related to students referring to having studying groups and helpful collaborations and/or interactions with faculty, teaching assistants, and fellow students.</p>	<p><i>Student Example:</i></p> <p>The environment she set up in the class was like real open and friendly. There were like some points where we had like a...would divide us into groups and give us group work or like uh. It also—she encouraged like getting with some of the other students and like working on stuff together.</p>
Future as a Mathematician	<p>Related to the planning and preparation for post-graduation (i.e., internships, jobs, graduate school, etc.).</p>	<p><i>Faculty Example:</i></p> <p>One of our goals with the class was to actually make the students aware of</p>

Also related to the future math identity these students are to develop as they progress into the major and how their overall understanding of what mathematics is has changed.

what it means to think as a mathematician, and what kind of work they should expect from mathematic classes and upper division [courses]. And so, our goal [is double] is not only to tell them how it's like to be a mathematician, but to tell them, "Is this something that you would enjoy doing?" [because] not all of them have been exposed to that kind of thinking, and so they come thinking that mathematics is the kind of math that they have done in community college.

Students develop the skills qualities, and skills and behaviors to succeed in upper-division course and the mathematics major, in general. This is not explicitly related to proof and problem solving.

Student Example:

I think that it...teaches you a new way to think?...Because before, I was like, "I just want to do computational stuff, like, I don't really care about all these other things." Um, but it teaches you a- it teaches you a different kind of, like, logic, I think... Proofs as a whole, as well, uh, they teach you to think differently, and that's what is valued, I think. And if you're a mathematician going into, like, these jobs that... you know, they're, like, engineers, you know, all of them, they're- they're used to doing stuff like that, but I think you offer a different perspective as somebody who's studied math.

Transfer Identity Acknowledgement and/or Support

This code attends to how the experiences and identities of transfer students, first generation students, non-traditional students, underrepresented and minoritized students are acknowledged by faculty.

Faculty Example:

I really have to remember – it's almost like they're freshmen, in a way. Um, because they are in a brand-new environment, um, so, it's, it's hard 'cause they – they're like freshmen, but they've already had college underneath them. So, they're a very interesting population to work with... they definitely can struggle more so than a,

This code also relates to transfer students or faculty

referring to classes as being for you know, traditional transfer student, transfer students or having um, because if they're a first- support that is transfer specific generation, they have nothing – they or that helps them in the don't really have any support at home. transferring process.

*Absence of Transfer Identity
Acknowledgement and/or
Support*

The lack of transfer identity acknowledgment or support; students explicitly refer to a mention of courses or faculty not helping to acknowledge transfer students or supporting them as transfer students as per the code definition.

Student Example:

Math 94, It was like a tutored... seminar- or, it was like a transfer seminar, I think? Um, but if I was not a transfer student, and I just went here as, you know, a student, I think that would be really beneficial because a lot of people that I know in these math classes are planning on either, you know, uh, going for their master's or Ph.D. and trying to teach somewhere or being a researcher...

Appendix B

This section will provide a list of key terminology used in the context of this study

- **Non-Traditional Students** is a term used for undergraduate students who are 24 years of age or older.
- **Non-Transfer students** are students who started as a first-year freshmen at a four-year institution. Non-transfer students typically often attend their four-year institution for their entire four years.
- **Intersecting Identities** is a term referring to the multiple identities that students in higher education, and specifically transfer students (in the context of this study) with which students come to their institutions of higher education. These identities can be related to socio-economic status, racial/ethnicity classification, those considered non-traditional, and from other underrepresented backgrounds.
- **Holistic Identity** refers to transfer student and/or faculty referring to these students as not only community college students but also their other intersecting identities.
- **Mathematics Transfer Student** refers to a student's identity as a transfer student majoring in mathematics who transferred from a community college. Also referred to as Mathematics Community College Transfer Student
- **Community College Student Transfer Student Identity** refers to students who have transferred from the community college system. Faculty and students mention this identity in context of abilities, qualities, and skills.

- **Absences** refers to either a faculty member or transfer student's perception of a missing component a mathematics transfer student's prior education during community college, their limited time at the Study University, or a limited support the student has received.
- **Receiving Institution** refers to the receiving four-year institution that community college transfer students enrolled into after completing community college. In the context of this study, the receiving institution was the Study University.