LOWER-DIVISION UNDERGRADUATE MATHEMATICS STUDENTS' PERSPECTIVES ON THE PURPOSE OF TUTORING

A Thesis

Presented

to the Faculty of

California State University, Chico

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

in

Mathematics Education

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by

Spring 2021

LOWER-DIVISION UNDERGRADUATE MATHEMATICS

STUDENTS' PERSPECTIVES ON THE

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A Thesis

By

Steven Huff

Spring 2021

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ACKNOWLEDGEMENTS

Throughout the entire process of writing of this thesis, I would like to acknowledge all those people who provided support and assistance for this not just a piece of work I completed individually. First and foremost, I would like to thank my thesis co-chairs Drs. Stephen Strand and Krista Strand. Especially, Dr. Stephen Stand provided invaluable guidance, encouragement, and direction on a weekly basis throughout the duration of the writing process and Dr. Krista Strand for her wonderful insights. Both helped to elevate this thesis far above its initial potential.

I want to thank my professors in my Mathematics Education master's and undergraduate program for their expertise in crafting a rich, meaningful, and safe learning environment inspiring me to persevere despite frustrations. In particular, Dr. Jorgen Berglund for modeling excellent teaching practices that I attempt to model my own teaching after. If not for Dr. Jorgen Berglund calling me when I was a senior in high school I may have never traveled down this path, so thank you.

I would also like to thank my friends, family, and colleagues for their continued support even when I was not the easiest person to be around. The constant check-ins helped me to keep going and to stay positive. I would like to Allison McConnell, Billie Archuleta, and Kathy Huff for their patience during the writing process, all of whom helped me to develop better writing practices. Finally, a special thanks to my partner, Chelsea Palmer, for her unfettering patience and continued understanding throughout the duration of this process.

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The purpose of the present qualitative study is to categorize the beliefs about the nature and function of tutoring by college students at a public university in Northern California by developing three math-specific tutoring categories. Study participants included fifty-eight undergraduate mathematics students who completed a questionnaire to report math confidence, self-perspective on the purpose and importance of tutoring, and self-perspective on the importance of mathematics in life. The questionnaire consisted of a combination of Likert scale items and free response items. Additionally, four participants were selected for a follow-up interview based on their responses to the questionnaire. This study found three math-specific tutoring perspectives that help describe what students believe is the purpose(s) and function(s) of math tutoring. The results of the study determined that not all students think about the functions of tutoring in the same way. This difference between expectation and experience may reduce the usefulness of tutoring to some students. Thus, by not knowing the students' specific reason(s) for attending tutoring they may be left with the impression that tutoring is not an effective support system for them.

Keywords: perspective, math tutoring, math tutor, perception, belief, learning, confidence, student perspective

CHAPTER I

INTRODUCTION

What Is Tutoring: Purpose and Function

Throughout the long history of academic assistance many different types of services have claimed the same term, “tutoring”, to describe their means of serving struggling students. Whether the service be a dyad, group, scheduled or spontaneous, tutoring services tout positive results for students who attend regularly. However, not all students who enroll in tutoring services are successful. Instructors often remind students to use tutoring in order to be more successful in class, thus, leading students to believe that tutoring is a key to their overall success. Leading one to wonder, what exactly do students who in enroll in instructor recommended and university provided support services think is the purpose(s) or function(s) these support services in their short-term academic goal, help with math.

In general, tutoring may be thought of as a service to assist with knowledge or skills development. Tutoring services offer students access to guided practice of content, promotes general knowledge acquisition, and positively impacts self-esteem (Gardner III et al., 2007). By implementing research backed tutoring innovations, tutoring services are able to serve an ever-changing student body, which mirrors the current trend in student enrollment (Gardner III et al., 2007; Heron et al., 2003; Patterson, 2010). As a result, tutoring has positioned itself as a critical component in students' education and lives (Patterson, 2010).

History and Innovation

Historically the role of the tutor and tutoring has varied dating back to Ancient Greece. Some of the first and most notable tutors, such as Socrates, Plato, and Aristotle used a master and pupil tutoring structure (Gordon et al., 2007; Patterson, 2010). Tutoring in that time was highly individualized and intended for a master to pass on the skills of thinking and learning to a pupil (Gordon et al., 2007). This style of tutoring maintained its hold for many centuries in the form of apprenticeships, occurring well into the 18th century (Patterson, 2010). In America during the late 19th century, American universities began to reinterpret tutoring for more formal academic purposes, called preceptorials (Patterson, 2010). A preceptorial resembles more traditional education today, where a tutoring session maintains a small student-to-faculty ratio and it is the responsibility of the teacher/tutor to focus on specific content areas. Beyond preceptorials, tutoring was again reimagined for American one-room schoolhouses (Gardner III et al., 2007).

Education philosophers, John Dewey and others, popularized the idea of a single classroom teacher to bear the responsibility of teaching a formulated curriculum, abandoning the thought that tutoring was a distinctive form of instruction (Gordon et al., 2007). Not until the mid-20th century did tutoring, as we know it today, emerge. Tutoring began to gain traction as a service supplemental to classroom instruction to aid in classroom achievement (Gardner III et al., 2007).

The earliest forms of 20th century American tutoring began as an informal and unstructured method of educational assistance. These 20th century forms of tutoring were impromptu or on an as-needed basis in varying and unfixed locations, much like versions of tutoring in more recent years (Gardner III et al., 2007). Reflected well into the second half of the twentieth century, highly informal styles of dyadic tutoring maintained its grip on the American education system (Gardner III et al., 2007), resulting in the study of tutoring being highly

subjective and oftentimes anecdotal (Gordon et al., 2007). Within the last fifty years, the study of tutoring has become more structured and specialized, informing many tutoring innovations and identifying the need for more formal tutor training (Fernandes & Flores, 2013, Gardner III et al., 2007; Gordon et al., 2007). As a result, tutoring innovations better support changing student populations and are able to implement more complex tutoring strategies to help emerging student demographics (Gardner III et al., 2007; Heron et al., 2003; Patterson, 2010).

Brief Review of Literature and Definitions

As different tutoring services settled into set roles influenced by a particular model, the study of student perspectives emerged. However, with different support goals, students began to develop different expectations for the purpose tutoring would have in their education. Students' support goal(s) are influenced by prior life experiences giving rise to sometimes inaccurate expectations (Yale, 2019). Research goes on to catalog distinct student perspective themes – *Form of Guidance, Form of Mentorship, Form of Content Differentiation, and Supportive Environment* – that vary even within the same tutoring group or session, suggesting that perspective is influenced by the student-tutor experiences while at tutoring warranting further investigation.

Currently a large portion of research about tutoring and perspectives focuses on students majoring in subjects that are not related to science, technology, engineering, and math (non-STEM). We are able to reasonably speculate how most students view tutoring services or what tutoring support non-STEM students hope to receive (Fernandes & Flores, 2013). The researcher has identified a lack of information about students' tutoring perspectives while majoring in science, technology, engineering, or math (STEM) In particular, math tutoring perspectives

appear to be a point of divergence from other commonly categorized perspective themes (McMullen, 2011). An idea such as *Math Confidence*, or a personal belief about the ability to learn math, play a substantial role in a student's likelihood to use tutoring services for math support and thus alter perspectives (Duranczyk et al., 2006; Hendy 2014; Hill 2016; Zietra, 2016). Other beliefs like *Math Value* and *Math Anxiety* which are the students perceived importance and their frustrations with math respectively, also influence a student's likelihood to use tutoring services for math support and thus alter perspectives (Hendy et al., 2014; Hill, 2016). Another point of separation comes with the distinction between help with *learning/understanding* and help with *completion* while at tutoring (McMullen, 2011). Math students seem to have different goals for tutoring when compared to non-STEM areas of study, hence tutoring perspectives develop differently.

This study identifies a lack of knowledge and understanding of perspectives from undergraduate mathematics students in tutoring services. The primary aim of any tutoring service, especially math tutoring, is to support students in development of academia-related skills. Without knowing which skills the students seek or the purpose of their visit the student may not receive the tutoring they envisioned or hoped for. The present qualitative study sets out to categorize undergraduate mathematics students' perspectives of university provided tutoring services. The remaining chapters in this study will outline current literature about tutoring perspectives, describe how tutoring perspectives for undergraduate mathematics students were researched, present the results of the investigation, and discuss future applications of these findings.

The current study will broadly define *tutoring* as a service that provides additional academic support on certain subject areas or skills. The term *perspective* will be defined as students' beliefs about the nature and function(s) of tutoring experiences.

CHAPTER II

LITERATURE REVIEW

Why Research Tutoring?

The K-12 education system in the United States has been shifting toward student-centered learning away from teacher-centered instruction (Glowa & Goodell, 2016). Many higher education instructors have begun implementing student-centered learning as well, believing that the shift has a positive effect on student performance (Wright, 2011). In particular, Cantone (2001) encouraged student-centered instruction within mathematics classrooms. With the increase of student-centered classes in higher education, student interest in tutoring services offered by their institution has also increased (Fernandes & Flores, 2013). Hence, tutoring research has mirrored this increase over the past fifty years (Gardener III et al., 2007; Fernandes & Flores, 2013).

While no clear and simple consensus has been reached on a definition of *tutoring* (Fernandes & Flores, 2013), some useful themes and patterns have emerged from research into academic supports for students. Hixenbaugh and Thomas (2006) found that tutoring embodies many forms, including one-size-fits-all, just-in-time, proactive or reactive, support integrated into academic courses, support activities, or tutoring based on interpersonal relationships. Institutions subjectively interpret and implement academic supports with the goal of best serving

their students (Crisp & Cruz, 2009). Fernandes & Flores (2013) sifted through a plethora of tutoring characteristics and features to find a set of common themes - tutoring should guide and support students; promote intellectual, emotional, personal, and social development; differentiate instruction at the individual student level; actively integrate students into the university by setting up interpersonal relationships; and connecting students to other university services. VanLehn (2011) defines tutoring as "an adult, subject-matter expert working synchronously with a single student." While VanLehn's definition is quite narrow, other types of tutoring to consider include peer tutoring, cross-age tutoring, and problem-based learning where a tutor works with a small group of students. That is to say, a broad definition of a tutor is any person who provides any additional academic assistance on certain subject areas or skills.

Students' Perspectives on Tutoring

Researchers have consistently shown, despite the various tutoring services, common student perspectives about tutoring have emerged (Fernandes & Flores, 2013). *Perspective* can be thought of as students' beliefs about the nature and function(s) of tutoring experiences. The students' beliefs may have been formed before their tutoring sessions or influenced by the sessions. However, researchers such as Yale (2019) suggests differences between what students expect *prior* to tutoring services in contrast to the perspective they form *following* the services. The discrepancy in expectation and experience potentially inhibits success of tutoring, specifically how students form perspectives about math tutoring.

Student Expectations of Tutoring and Experiences

Shifting to a more student-centered educational approach has not necessarily transferred to students' beliefs about the purpose of tutoring (Fernandes & Flores, 2013; Sloan, 2013). Sloan (2013) posits that writing tutoring-centers embody the very nature of student-centered support, claiming the primary function of writing centers is to address individual student needs. Despite this inherent student-centeredness, students tend to push the responsibility of learning off to the tutor, making the sessions more tutor-directed (Sloan, 2013). To combat this phenomenon, researchers have identified critical areas for improvement. Fernandes & Flores (2013) expressed the need for pedagogical training for tutors, whereas Johnston & Tinning (2001) noted the importance of clearly defining the tutor's role. A study of first year undergraduate students majoring in psychology found that students' expectations came primarily from prior experience with higher education, such as preparatory classes, outreach programs, and friends and family with experience in higher education (Yale, 2019). Yale (2019) also found that students' prior exposure to higher education led to tutoring expectations closer to the reality they experienced, and students seemed more confident asking for support. Other research suggests that students expect to be simply given information about a subject and did not view tutoring as an interactive process of questions and answers (Castensson et al., 1998; Fulford, 2016). Fernandes & Flores (2013) determined that students who chose to participate in tutoring services expect a tutor to demonstrate their subject-matter authority to correct or clarify any students' misunderstandings. Fulford (2016) echoed the previous findings by also stating that students expect the tutor to provide lectures and provide feedback explaining content that is unclear.

In contrast, Murphy et al. (2012) conducted a study at the University of Wisconsin-Madison identifying dissenting perspectives between tutors and students through their Russian Flagship Program. The first finding described a tension for the primary focus of sessions

between the students and the tutors. Students' desired help preparing for exams and in the class as a whole, whereas the tutors' focus was directed toward improving general concept knowledge and proficiency. These different perspectives are explained by interpreting the role of tutor because both groups tended to focus on the actions of the tutor. This view led both groups to see the tutor more like a teacher in a classroom, but the envisioned design of this particular program makes reference to fostering a productive learning environment and to encourage greater *student* initiative. Lastly, tutors expected students to take more responsibility for their own education by taking more initiative during tutoring sessions by being prepared with investigative questions and inquiries.

The students' experiences vary just as much as their expectations. This variance results from several factors such as specific tutoring programs, tutoring style, or simply the tutor (Kaiden, 1994; Yale, 2019). Yale (2019) found many students expressed they knew the tutor was there to help, but they were not entirely certain what the tutor was there to help with and had trouble identifying the purpose of the session. Yet, students believed tutoring was a mandatory component to success in higher education (Yale, 2019). This lack of clarity and purpose at tutoring sessions left students feeling that the tutors were indifferent and damaged the relationship between student and tutor, thus discouraging future contact. In opposition to this experience, some students found the same tutor to be genuinely caring, friendly, and interested in helping (Yale, 2019). Kaiden's (1994) research suggests if students experienced a caring tutoring environment, they were far more likely to continue using the tutoring service, hence, highlighting the need for research surrounding students' perspectives with respect to enrollment and repeat attendance in tutoring services.

Researched Student Perspectives on Tutoring

Research shows that some students believe tutoring is meant to be a *form of content differentiation*. Content differentiation – the varying of instructional strategies based on students' needs – can help students become familiar with university-level education through the supervision of a content-level expert at an individual level (The Glossary of Education Reform, 2013). Differentiation caters to each student's needs by helping them build up a knowledge base and academic learning skills that will better serve them in their future academic endeavors (Fernandes & Flores, 2013). Students expressed that tutors delivered personalized content effectively at the tutee's level, and the students perceived this as being the most helpful aspect of tutoring (Murphy et al., 2012). However, the perspectives for differentiation were not all positive. A study of pre-clinical medical students in an integrated two-year clinical skills peer tutoring program found that some students felt that tutors were discussing contradicting information which leads to confusion (Khalid et al., 2018). In addition to the contradicting information, Murphey et al. (2012) also found students perceived the level of content being discussed was too advanced for them. Suggesting that both tutors and students find it challenging to effectively express needs to their respective counterparts (Khalid et al., 2018; Vogel et al., 2007).

The next perspective discusses tutoring as a *form of guidance* for students. Fernandes and Flores (2013) describe that this guidance is intended to support students in multiple aspects of their academic career including intellectual, emotional, personal, and social dimensions. Braine & Parnell (2011) also suggests how using multiple aspects of guidance is crucial for the student's ability to maintain success and complete the course. By studying perspectives of baccalaureate students majoring in different disciplines research demonstrates how a multi-faceted *form of guidance* helped to foster engagement in learning, allowing students to access a broader range of

topics in greater detail when compared to in-class instruction (Li et al., 2018; Murphy et al., 2012).

Li et al. (2018) also found that beyond a *form of guidance* that some students felt tutors provided a *form of mentorship*. Like tutoring, the term mentorship is met with ambiguity – the literature suggests multiple definitions. With this consideration, however, some studies were able to pin down a more specific perspective of what students mean by mentorship. Crisp & Cruz (2009) and Miller (2002) separately considered tutoring as a facet of a larger system. Examined through the lens of mentorship, tutoring is an academic support aimed at advancing knowledge for a chosen course. Li et al. (2018) asserts that students who yearn for mentorship from their tutor want advice and suggestions in learning *how* to learn from someone with more subject-matter experience. Students in this group see the tutor as more than someone who supports assignment completion. Rather, the tutor is a mentor, suggesting tutors represent older students who were successful in learning. This leads younger students to believe attending tutoring is their chance to practice a model for the learning processes and implement strategies (Li et al., 2018).

Some students gained a more emotional perspective, which was described as a *supportive environment* (Braine & Parnell, 2011; Murphy et al., 2012; Li et al., 2018). A supportive environment describes the students' affective response, as students expressed higher levels of confidence whilst having lower levels of fear asking questions (Murphy et al., 2012). The results found by Li et al., (2018) are corroborated by Murphey et al. (2012), finding students strongly agreed tutoring was a positive, non-intimidating learning environment where students felt free to ask questions. Li et al. (2018) also confirmed the results by Fernandes & Flores (2013) saying that tutoring helped to support students' development of networks, encouraged integration into

their higher education community, and fostered a greater sense of belonging. Students expressed that only other students understand the struggle they are experiencing. By developing peer to peer networking students are able to collectively process information, furthering the support they perceive, and affording students the opportunity to build positive relationships, even friendships with their peers and tutor. Yale (2019) found that students frequently mentioned building an authentic bond was a salient aspect of tutoring and that this bond influenced their choice when deciding to return for repeated sessions.

Inhibitors of Student Success

The extent to which tutoring plays a positive role in success in higher education differs from student to student. A study of 200 medical students in medical school identified six potential inhibitors of success (de Grave et al., 2002). Those inhibitors include: Lack of Elaboration, Lack of Interaction, Lack of Participation, Difficult Persons, Lack of Cohesion, and Lack of Motivation (de Grave et al., 2002). Lack of Elaboration is defined as students having not studied adequately prior to tutoring resulting in some learning issues to be ignored. Lack of Interaction presents itself when students do not attempt to report learning issues or questions in their own words, and they instead dictate verbatim from notes or the text. Lack of Participation can be seen when a student appears to be well prepared for a tutoring session, but they do not engage in the discussion. Difficult Persons is a dominant personality that quickly takes over the discussions and does not let others speak. Lack of Cohesion can describe a student who is not afraid to ask questions, however, the questions interrupt the discussion. Other students describe disruptive questions as having already been answered or as knowledge the student asking should

already have. Lastly, Lack of Motivation can be identified when a student appears to not be prepared for tutoring, nor do they engage in what is being discussed.

The impact success inhibitor perceptions have on student integration in tutoring vary greatly and occur in different frequencies. However, the frequency of the success inhibitor did not seem to be a factor in the perspective the students formed about the inhibitors influence. For example, students identified Lack of Participation, specifically unequal participation, and Lack of Interaction as occurring most often but not having a great impact on one's ability to learn. Students identified Lack of Motivation and Lack of Elaboration at a lower frequency but perceived them as inhibiting the learning process most. Students also noticed that the tutor has a prominent impact on Lack of Elaboration, Lack of Interaction, and Lack of Motivation. In particular, students believe a tutor is expected to have motivational strategies to stimulate the student or group.

An older study done by Hendrick et al. (2000) aimed at examining the inhibitors of success as perceived by preservice teaching students tutoring at-risk elementary and secondary school students. Hendrick et al. (2000) identified that difficulty with basic and computational math skills, attitude and self-confidence, and time spent doing math are leading contributors toward lack of success. The preservice teaching students expressed that missing prerequisite knowledge hinders an elementary student’s ability to build more complex understandings in math and that attitudes and self-confidence contributed to their lack of involvement in the tutoring session. Preservice teaching students explained that the elementary students being tutored appeared to be more knowledgeable in the content than they think, suggesting math beliefs related to math behaviors might be a contributor. A potential reason why students fail may, in part, be due to time management (Hendrick et al, 2000) meaning the students either do

not spend enough time on a particular task before giving up or they unnecessarily rush through a task to complete it.

Hendy et al. (2014) conducted a different study from south-central Pennsylvania looking at undergraduate college math students in algebra classes and measured three common math beliefs (math value, math confidence, and math barriers) in students as they relate to mathematical success. The three math beliefs were scored using newly developed math belief scales which are math value scale, math confidence scale, and math barriers scale (Hendy et al., 2014). *Math Value* can be thought of as the student's perceived importance mathematics has in their short-term and long-term goals (Hendy et al., 2014; Hill et al., 2016). *Math Confidence* as described by Hendy et al. (2014) and Hill (2016) is the belief in one's ability to learn math and that by attending class, doing homework, and/or asking for help will help them advance their immediate or long-term goals. While *Math Anxiety*, which is a facet of the math barriers scale is described by Hendy et al. (2014) and Hill (2016) is the feeling of tension, confusion, and frustration when attempting to do math problems.

It was found that the three beliefs significantly explain poor math behaviors and lowered performance. Students exhibiting less Math Confidence or more Math Anxiety tended to show less class attendance, homework completion, and asking for help, which was associated with a decreased investment in recommended math behaviors, such as asking for help in class and tutoring, and lower final grade earned in the course (Hendy et al., 2014).

Another study focusing on students enrolled in college algebra at a Southern Texas Community College set out to describe the math beliefs, behaviors, and performance of women in math (Hill, 2016). Hill (2016) also showed anxiety in math to be linked with overall performance in the class determining that students with higher levels of math anxiety attended

class less, used tutoring less, and had lower final grades. Both Hendy et al. (2014) and Hill (2016) found that Math Value beliefs were more often associated with poor math behaviors and, that Math Value was significantly correlated with both Math Confidence and Math Anxiety.

Students' Perspective on Math Tutoring

Generally, there is an overlap in tutoring perspectives and inhibitors of success expressed by students in tutoring. However, when specifically studying mathematics students in tutoring, tutoring perspectives and inhibitors of success is a subset of the larger group. Prior research suggests that within the larger perspective themes – *Form of Content Differentiation, Form of guidance, Form of Mentorship, and Supportive Environment* – math students can be segregated into distinct groups that play instrumentally different roles in their engagement in tutoring services.

McMullen (2011) identified four major perspectives in students' responses at the University of Connecticut's Quantitative Learning Center, which sampled 45 math students in Fall 2011. Students expressed the perspective "question asking/explanation of the material" most frequently. Two notable elements were identified to help explain the main theme. Students who formed this perspective talked about the value of having a tutor who was also a student and formed a connection because the students felt the tutor was "on their level of understanding". Students also found it helpful that the tutors would spend copious amounts of time on a single question or topic and this dedication was a major reason for these students to return to the tutoring center. The next most frequently stated perspective was "tutoring by a peer". This perspective is similar to the first with one distinction. The students who formed this perspective appreciated first and foremost that the tutor was not only a student, but also their peer. The

positive by-product reported was that the peer-tutor was able to explain from a familiar perspective. The third most frequently occurring perspective was “one on one help”. Students described tutoring to be extremely helpful because the tutor could explicitly help a student understand the math. The least frequently occurring perspective students expressed was “homework/study help”, which is interesting since the description of the Quantitative Learning Center is to help students understand their homework and/or prepare for tests.

The aforementioned math student perspectives might suggest there is a shift toward considering students perceived needs and expectations when supporting classroom and course learning. Another perspective by Hendrick et al. (2000) not yet mentioned, states that allusions to emotional ties mentioned by the tutors demonstrated a sense of responsibility to the students' success and failures. Another math specific perspective is developing a greater sense of Math Confidence. When studying Math Learning Centers, Duranczyk et al. (2006) also found that confidence gains can be a perspective students develop as a result of math tutoring. Demonstrating that tutoring might be a crucial aspect of a how Math Confidence develops in students.

Math Confidence might also affect how a student’s overall performance in a course. The increased sense of confidence influences not only student behaviors, including attendance to tutoring, but one study suggested the final course grade also (Duranczyk et al., 2006). Hendy et al. (2014) found that a students’ perception of Math Confidence could promote desirable math behaviors. Students’ behaviors suggested include higher class attendance, higher likelihood to complete homework and read their text, and a higher likelihood of using tutoring services. With an increase of each of these behaviors, Hendy et al. (2014) found that earning a higher grade is positively correlated. Hill (2016) also found that those who had lower measured levels of

confidence in math used tutoring more often, and the use of tutoring should have a positive correlation to increased confidence and overall academic performance. Zietra (2016) echoed a similar finding that first year math students' confidence can be unsteady when they first transfer into higher education. Perception of confidence in mathematical ability greatly influences a student's overall grade, as well as valuation of math's perceived importance (Duranczyk et al., 2006; Hendy et al., 2014; Hill et al., 2016; Zietra, 2016). In addition to developing confidence in math, they found that the students who earned a "C" showed the greatest gains in confidence; whereas those who earned an "A" saw minimal gains in confidence by using the tutor center. Muise (2016) posited,

> *"Knowing what tutees identified as salient to their participation provides peer tutoring directors and staff with ideas on how to create informal and welcoming environments and how to train tutors to individualize the sessions and market the benefits campus wide."*

Leaving us with the impression that tutors informed with a tutee's reasoning for attendance is just as important as the potential content discussed.

Knowing now what students commonly expect to receive in terms of support from the university system, the supportive environments they actually experience, and their perspectives about the tutoring services begs the following question:

> What perspectives do lower-division undergraduate mathematics students have about the purpose of university provided tutoring?

CHAPTER III

RESEARCH METHODS

Population and Sample

The participants for this study were students enrolled in either Precalculus or Foundational Mathematics in Fall 2019 at a public university in Northern California. The students enrolled in Precalculus were first-time freshman, transfer-students, or students who had successfully completed the necessary prerequisites[1] to be in the course. If the students were in Foundational Mathematics, they were first-time freshmen. If the students were first-time freshmen, they could be placed in one of these mathematics courses using California State University (CSU) multiple-measures placement that considers high school grades, coursework, and standardized tests. Such standardized tests that may be used for placement include Advanced Placement (AP), International Baccalaureate (IB), California Assessment of Student Performance and Progress (CAASPP), Scholastic Assessment Test (SAT), and/or American College Test (ACT). Students in this study did not meet the criteria for placement in "Category I - Fulfilled Requirement". Students placed in Precalculus, typically Science, Technology, Engineering, or Math (STEM) majors, fulfilled the requirements for placement in "Category II - Enroll in GE Math Course". Students enrolled in Foundational Mathematics were designated "Category III - Enroll in a Supported GE Math Course". Foundational Mathematics is a support corequisite course for students enrolled in Finite Math for Business Majors, Statistics, or College Algebra. The students used in this study were enrolled in Finite Math for Business Majors with Support or Statistics with Support. Students enrolled in Precalculus are typically first-time freshmen in their first two semesters but may be in later years or transfer students. Both Precalculus and Foundational Mathematics were instructed by the researcher, and both courses

[1] Prerequisites: GE Mathematics/Quantitative Reasoning Ready, and either 1/2 year of high school trigonometry or MATH 118 (may be taken concurrently) (California State University, Chico)

were taught in-person in the Fall 2019 semester. The extent to which the students have been subjected to tutoring or alike services in the past is unknown.

This study examined two class sections of Precalculus and two sections of Foundational Mathematics for a total of fifty-eight completed questionnaires. About 41% or 24 out of 58 respondents used a tutoring service and about 59% or 34 out of 58 respondents did not use a tutoring service. In this study the three tutoring support services used by students were the Math Learning Lab (MLL), Student Learning Center (SLC), and Supplemental Instruction (SI). Each service promotes themselves with a distinctly different description of the role their service provides in support of the student. The MLL's suggested purpose is for students to work together while completing homework. While the SLC states it is working toward inclusive, student-centered tutoring support. On the California State University, Chico website, SI is described as an academic assistance program. The description of SI is the vaguest about how or what its purpose is to students, but it is the only service that mentions that the SI leaders (tutors) are trained to facilitate group discussion (California State University, Chico, 2021). Out of the fifty-eight completed questionnaires only the students that attended tutoring were considered for the follow-up interview. Of those students that used tutoring only fifteen were deemed eligible for a follow-up interview. Again, when selecting students for the semi-structured interview the researcher looked for inconsistencies between the Likert responses and the free responses. To encourage participation in the interview the researcher sent out follow-up and reminder emails. Ultimately the researcher was able to interview four of the fifteen students considered to be eligible.

These two groups of students from Precalculus and Foundational Mathematics courses were chosen to participate in the study to help the researcher form well-rounded perspective

categories. It can be suggested that students with “Category II - Enroll in GE Math Course” placement have demonstrated more mathematical proficiency in past coursework when compared to their peers with “Category III - Enroll in Supported GE Math Course” placement. Students in Precalculus placed in “Category II - Enroll in GE Math Course” are placed using the Multiple Measures for Math STEM criteria which uses higher overall measures of success for high school GPA, math specific high school GPA and standardized tests. Whereas students in Foundational Math placed in “Category III - Enroll in Supported GE Math Course” are done so using the Multiple Measures for Math Non-STEM using a lower overall high school GPA, math specific GPA, and standardized tests results (Bracco et al., 2019). To avoid drawing false or misleading conclusions about the perspectives students have about tutoring and to accurately represent a certain perspective the researcher sought a mix of different mathematical proficiencies. To this end, the perspective categories described are representative of students that both use and do not use tutoring, as well as those from different mathematical backgrounds. It should also be noted that the data underwent the analysis process described below prior to greater understanding of the broader literature (Charmaz, 2006). Charmaz (2006) encourages novice grounded theorists to analyze the data independent of the broader literature to avoid viewing data through an earlier lens. However, after gathering a more complete picture about tutoring perspectives comparisons and delineations were able to be made (Creswell & Creswell, 2018).

The questionnaire was delivered to students by the researcher during the first 15 minutes of a class session in the last week of October 2019, week eight of a fifteen-week semester. Week eight was selected not only to give students a chance to decide whether to enroll in tutoring, but also to help minimize bias in favor for or against use of tutoring services. The collection of all

responses and proper vetting of students to be considered for the follow-up interview took place the remaining weeks of the Fall 2019 semester in preparation of Spring 2020 semester interviews. The follow-up interviews began in week four until week eight of Spring 2020. Unfortunately, due to the COVID-19 global pandemic, the researcher was unable to conduct more than the four interviews collected during the live semester session.

Data Collection Instruments

This study consisted of two instruments, a questionnaire and semi-structured student interviews[2], created by the researcher and his committee chair. The questionnaire was designed to highlight and capture what the participants believed was the purpose of tutoring and what they felt their role was as a student in a tutoring environment. The questionnaire was made up of three sections consisting of 11 items. The first section had two items asking about demographic information to sort students by course enrollment and use of tutoring (items 1-2). The next two sections focused on understanding and interpreting students' responses about their perspective(s). The second section had six items using a Likert scale for measurement as follows: strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree (items 3-8). The last section had three free response items (items 9-11). Details about what each item measured will be listed below.

Math Confidence was measured by three items, "I can be successful in math when I apply myself.", "I believe I will be successful in anything I try.", and "Think of a time in your life when you got stuck while solving a math problem. How did you feel while you were

[2] Examples located in the Appendix.

struggling? What did you do to move past the problem? (Please mention any tutoring, supplemental instruction or other additional resources if they apply.)" (items 4, 6, and 10).

Self-perspective on the purpose and importance of tutoring was measured by two items, "People will think less of me if I go to the Math Learning Lab, Student Learning Center, Private or Group Tutoring or Supplemental Instruction Sessions." and "What do you think the purpose of tutoring is? Other related resources?" (items 3 and 9).

Self-perspective on the importance of mathematics in life was measured by two items, "Math is needed to be successful later in life." and "Describe a good math student." (items 5 and 11).

The student interview was informed by the questionnaire and written with the goal of helping explain how students came to their understanding of the importance and purpose of tutoring and to explain their personal role in their tutoring session(s). In addition, the Likert responses (items 3 - 8) were used in tandem with the free response answers to determine potential interview participants. However, only the free response answers (items 9 - 11) were used when determining tutoring perspective categories. Asking students what they believe the purpose of tutoring is, as well as, what their beliefs concerning the ability to learn math helped establish their primary perspective about university provided tutoring services.

When selecting students for the semi-structured interview the researcher looked for contrasts between the Likert responses and the free responses believing that by investigating these contrasts would lead to more robust interview responses. Since the goal of the interviews was to further understand how student's perspectives about tutoring may have formed. Students that responded with *Agree/Strongly Agree* to the Likert items about both *Math Confidence* or *Self-perspective on the importance of mathematics later in life*, but then wrote about lacking

mathematical proficiency were selected as potential interviewees. Additionally, if students responded with *Disagree/Strongly Disagree* to the Likert items about *Self-perspective on the purpose and importance of tutoring,* but whose free response answers either were vague or lacked information, were also selected as potential interviewees.

The following examples demonstrate how students were selected for follow-up interviews:

Student 29:

Student 29 *Strong Agreed* that they could be successful in anything they try, specifically math (items 4 & 6), yet all three of their free responses lacked clarity or depth stating the following "Communicate and learn from another perspective." (item 9), "Watching YouTube videos. I reached this brick wall that was difficult to go through." (item 10), and "A dedicated disciplined individual." (item 11).

The vague responses leave one wondering how exactly Student 29 came to their strong, positive mathematical disposition making them a prime candidate for a follow-up interview.

Student 5:

Student 5 *Agreed* that they could be successful in anything they try, including math (items 4 & 6) and they believe learning math is important for success later in life (item 5). However, two of their free responses were inconsistent with their Likert responses by saying "I worked on something else while frustrated on the problem and wait until someone can help me with the problem. Like a friend or family member." (item 10) and "I think a good math student is someone who applies themselves and works hard to gain a better understanding of the problem." (item 11).

These free responses indicate the student does not believe *they* are able to demonstrate success in anything *they* try. By writing about meeting resistance when completing a math problem they would "wait until someone can help", but by also writing that "a good math student is someone who applies themselves and works hard" suggests that they cannot be successful at being a good math student. The portrayed inconsistency in beliefs made it necessary to dig deeper with a follow-up interview.

In these cases, and all other cases, the interview helped illuminate their free response answers and their overall tutoring experience.

The Researcher's Role

Particularly in qualitative research, my role as researcher needs to be addressed. I bring with me personal values, assumptions, and biases at the outset of this study. My prior experience as a tutor has shaped my perceptions of tutoring services. My current experience as a K-12 and college educator furthered my prior beliefs about tutoring being a reliable support service. As an educator, I underestimated my role and training in deciphering what students needed when students would ask for assistance. I believe this understanding of the context enhances my awareness and knowledge of what students are attempting to articulate. Particular attention will be paid to the contextual language clues students use in their speech.

Furthermore, the intent of each instrument was to capture and ascertain an individual's meaning of the purpose of tutoring. The researcher opted for a mindset when collecting tutoring perspectives to let themes emerge from the students' responses aligning itself with a constructivist philosophical worldview. Some hallmark features of a constructivist worldview include theory generation and multiple participants' meanings (Creswell & Creswell, 2018).

Constructivist learning theories posit individuals interpret the world in which they live, developing subjective meanings of their experiences relying heavily on the participants' views of the situation being studied (Creswell & Creswell, 2018). Constructivist researchers often attempt to address the process of interaction and acknowledge that their backgrounds shape their beliefs, thus influencing interpretations. The researcher's intent is on making sense of the meaning others hold about a central phenomenon, understanding that others' background also sculpts personal beliefs. Since the study set out to generate perspectives categories, a constructivist philosophical approach informed the study.

Data Analysis & Interpretation

This study used constructivist grounded theory for data analysis. Grounded Theory is a commonly used qualitative research methodology in which the researcher generates a general explanation for a central phenomenon as guided by the research participants. A central phenomenon can be thought of as a common, shared experience, such as a process, action, or interaction, for all participants in a study (Creswell & Creswell, 2018). Grounded theory is an inductive process that generates a theory about a central phenomenon, quite literally, grounded by the data. There are currently three major designs of grounded theory: systematic grounded theory, emerging grounded theory, and constructivist grounded theory. To use systematic grounded theory a researcher engages in multiple coding phases. These phases are open coding, axial coding, and selective coding. The hallmark of systematic grounded theory is its rigidity in approach (Birks & Mills, 2015; Creswell & Creswell, 2018). In contrast to systematic grounded theory, emergent grounded theory is analyzed through a post-positivist lens. Similar to

systematic grounded theory however, emergent grounded theory also believes in an objective reality, but it differs by acknowledging the participants' view on reality. The aim for emergent grounded theory is to collect unbiased data to help uncover the objective truth with the exception of knowing it can never be perfectly perceived (Ghezeljeh & Emami, 2009). However, the constructivist grounded theory approach pays more attention to a researcher's perception, personal philosophy, and beliefs. Another reason a researcher may adopt a constructivist approach for analysis is due to direct experience in the field of study or having worked with the participants making it easier to reflect on a single participant's reality (Charamz, 2006). Ghezelieh & Emami (2009) believe that constructivist grounded theorists do not simply report or describe participants' responses, but rather they also interpret how each participant interacts with the central phenomenon to generate categories of meaning. My experiences in the classroom often left me wondering, "How do students think tutoring will support their learning?" or more specifically "What do students believe is the purpose of tutoring support services in education?". Systematic grounded theory did not fully address my concern specifically because it referred to a shared common experience, not giving way to the possibility that certain students did not share in this common experience. While emergent grounded theory does not align with my philosophical worldview. As a result, constructivist grounded theory was adopted for use in the analysis of the data.

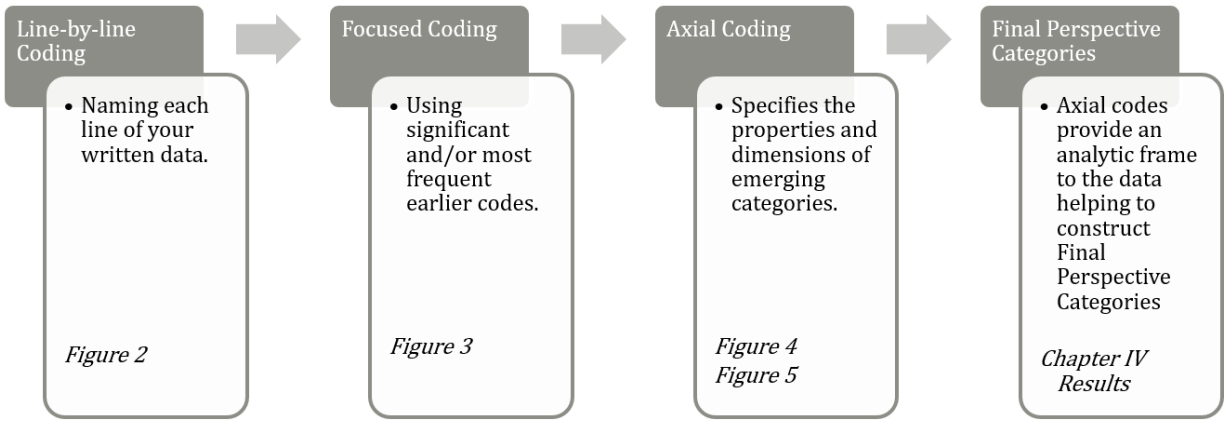
Questionnaire Coding Phases

The overarching question this study aimed to answer is "What are lower-division undergraduate mathematics students' perspectives on the purpose of university provided tutoring services?" Below is an explanation of how grounded theory was used for analysis in the current

study (see fig. 1). It should be noted that the use of color in the following *Figures 2, 3, 4, and 5* were for the researcher and did not have any lasting significance.

Figure 1

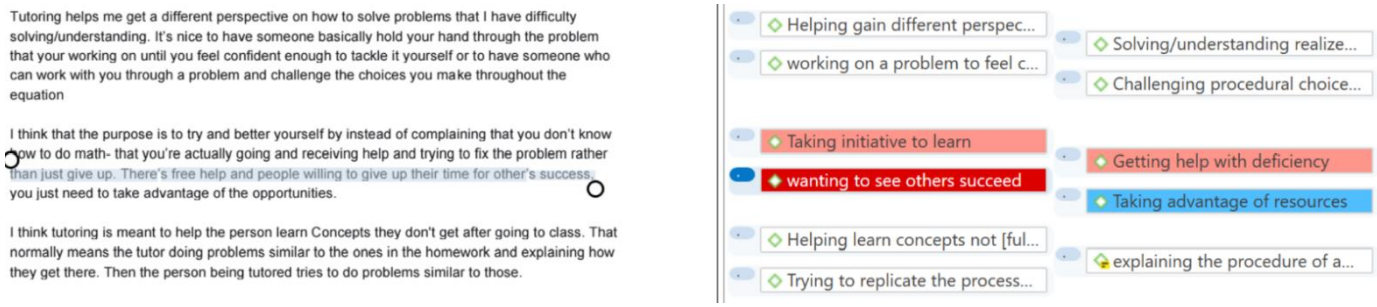
Brief Overview of Coding Process in Grounded Theory Analysis



After collection of the questionnaires, all free response data and interview responses were moved to a qualitative analysis program called ATLAS.ti 8. The data was then coded line by line to establish initial codes (see fig. 2). Line-by-line coding can be thought of as naming each line of written data to help minimize any preconceived notions the researcher might have about the data they collected.

Figure 2

Example of Line-by-Line Coding



After broad initial codes were determined, focused coding (e.g., Deepening knowledge for lasting understanding) was used to help solidify code groups and to begin development of

emerging themes by focusing on the most significant and/or most frequent initial codes (see fig. 3). At this stage, a colleague and thesis chair were involved to check for accuracy of current codes, future codes, and emergent categories. To limit researcher bias, the same colleague and thesis chair were consulted after each phase of coding hereafter.

Figure 3

Example of Focused Coding

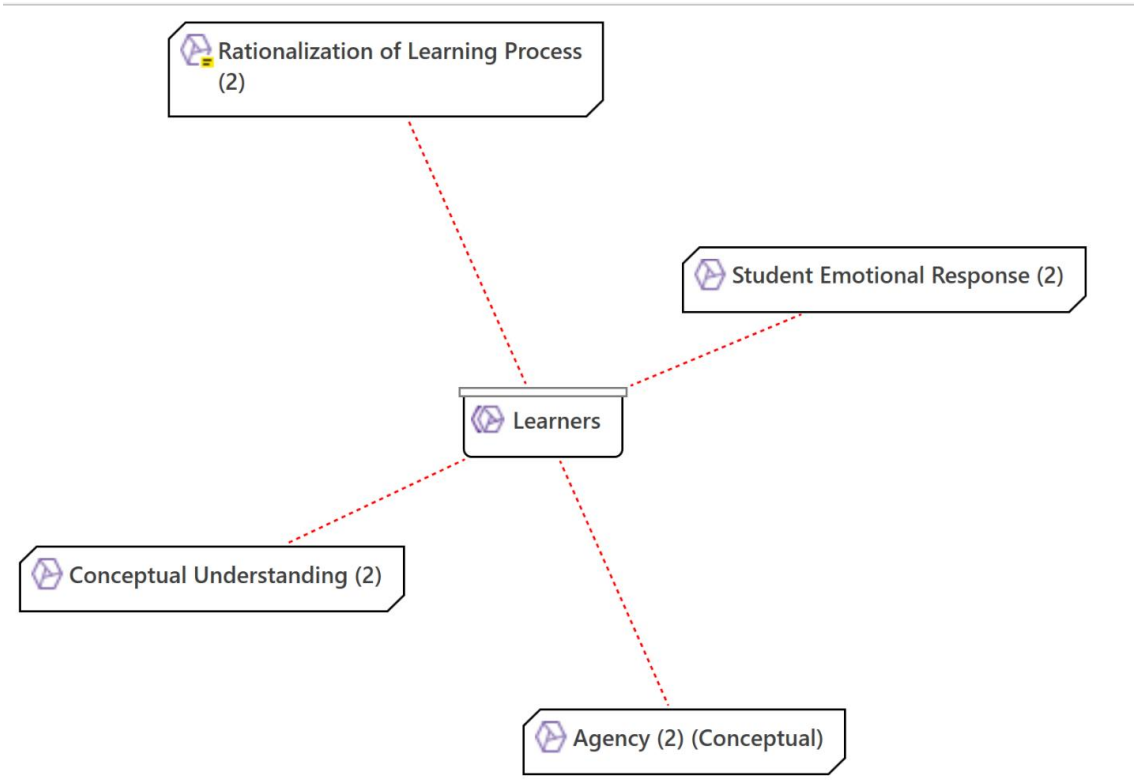
After focused coding (e.g., Deepening knowledge for lasting understanding & Social Construction of knowledge and understanding) was complete, the researcher engaged in axial coding by grouping the codes from the focused coding continuing to shape emerging themes (see fig. 4) (e.g., Conceptual Understanding). Emergent categories (e.g., Learners) were decided by grouping emerging themes that share common attributes or were aspects of a given process (see fig 5).

Figure 4

Example of Emerging Themes

Figure 5

Example of Emerging Category



Interview Coding Phases

Once the emergent categories from the questionnaire were decided, the interview was then coded using the axial codes developed during the questionnaire coding phases. The questionnaire axial codes provided an already established framework for analyzing student interview responses. The emerging interview categories were used to saturate the emergent categories determined by the questionnaire. The questionnaire emerging categories and interview emerging categories were also cross-referenced to check for accuracy. By comparing both questionnaire emerging categories and interview emerging categories, the tutoring perspective categories were determined and used throughout this study.

Language Interpretations with Context

Beyond merely identifying keywords and phrases, the researcher used contextual clues suggesting stronger, alternate interpretations for similar statements. Students may have more than one perspective about tutoring, thus for our purposes the most evident perspective was captured and used when determining perspective categories. Most students will favor a particular aspect of their tutoring experience suggesting a student could believe tutoring has more than one purpose or function (Braine & Parnell, 2011; Hendy et al., 2014; Khalid et al., 2018; Li et al., 2018; McMullen, 2011). Students may also use similar words or phrases but are describing different experiences surrounding tutoring. Therefore, certain students may be grouped with students that appear to have differing perspectives about tutoring, but their responses share a similar context as you will see in the following questionnaire quotes.

Example 1:

Example one will help explain how multiple responses may have been used when informing a tutoring perspective category. Quote 1 and 2 below highlights how keywords alone cannot always be used to gain a full understanding of a student's perspective about tutoring.

Student 52 (Quote 1): "[Tutoring] is used to get a secondary opinion or view on something I do not *understand*. The second explanation will help me understand more."

This explanation is vague because it is not clear what the student is claiming they do not understand. Yet, this response suggests they wish to collaborate with the tutor to gain a shared understanding. However, their supporting response helps to elaborate their overall perspective.

Student 52 (Quote 2): "I asked an upper-division student who directed me in the right direction, and that helped me *solve the problem.*"

This response makes it clearer that their perspective about tutoring is to receive guidance when attempting to solve a problem.

Both responses being analyzed in tandem helped the researcher more accurately ascertain this student's perspective of tutoring more accurately. More specifically, the student's use of 'understanding' and 'solve the problem' suggests that they want to better understand how to complete a problem, highlighting their primary goal is to complete a mathematical exercise.

Example 2:

The next example illustrates how keywords in a student's response might suggest a certain perspective about tutoring but the situation they describe about tutoring suggests a different perspective altogether.

> **Student 54 (Quote 3):** "I think tutoring is meant to help the person learn concepts they don't get after going to class. That normally means the tutor doing problems similar to the ones in the homework and explaining how they get there. Then the person being tutored tries to do problems similar to those."

In Quote 3, Student 54 expressed a desire to "learn concepts they don't get after going to class" which would suggest a perspective of wanting to gain a greater conceptual understanding. However, by describing they want to "learn concepts" at tutoring by "doing similar ones … and explaining how they get there. Then the person being tutored tries to do problems similar to those" suggests that they believe tutoring should guide them in the completion of some problem or task.

Example 3:

Example 3 is meant to elaborate for the reader how some students might describe the same situation but may use different terminology.

Student 10 (Quote 4): "Drilling the concepts by teaching others is one of the best ways to see if you really know how to solve a problem."

Student 56 (Quote 5): "discuss as a group on how we can solve the problem and get the solution"

Quotes 4 and 5 described similar functions for tutoring. When Student 10 says they would like to "Drill the concepts" to see if they "really know how to solve the problem" is synonymous with Student 56's quote. Both students are describing situations where they want to work collaboratively with their peers or tutor to complete a task.

Example 4:

Example 4 will demonstrate how some students describe their tutoring perspective with more than one purpose and how those purposes may be interwoven.

Student 10 (Quote 6): "I think tutoring is an opportunity to learn with others. Not everyone learns the same way so taking extra time out of class can be extremely beneficial when it is re-teached a different way.… Overall, I think tutoring is a way to provide extra confidence when trying to execute a problem."

Student 10 suggests they believe tutoring serves two functions. The first being a place where students can get support when completing tasks with others, but they seem to simultaneously believe that tutoring is also meant support Math Confidence.

Generalizability

While this project is somewhat limited in scope, it offers several important jumping-off points for research into student experiences of tutoring, and the math education community more broadly. This will give the research community a study that is easily replicated and, consequently, various alterations to this study can be done in an attempt to drill down to the core of what influences overall student success. Specifically, for the mathematics education community this research will be critical. There are multiple factors that impact students' behaviors in math, a primary factor being beliefs about math learning. It is the researcher's belief that if educators better understand why students use support systems or what purpose they believe tutoring has in their education, then institutions can begin to offer services and training that will better meet our students where they are in their educational journey.

CHAPTER IV

RESULTS

Student responses were collected in the middle of a semester, not making it clear *when* the students' perspective is rooted. With this consideration, three distinct math tutoring perspectives emerged from the students' belief about the nature and functions of math tutoring: *Understanding Oriented, Problem/Task Completion Oriented,* and *Affective Oriented*. student perspectives derived from student free response questions on the questionnaire (see fig. 6).

It should be noted that the term "*Understanding"* was the primary descriptor some students used when describing their perspective of tutoring. The researcher recognizes that to define "*understanding"* would be difficult and could potentially have different meanings for

different students. So, for the purposes of this results section when students in this study used the term *understanding* we can assume after further examination of the Questionnaire and Interview responses the students meant to reason, explain or to elaborate on mathematical ideas by collaborating with a peer or tutor.

Figure 6

Descriptions of Student Tutoring Perspectives.

Understanding Oriented	Problem/Task Completion Oriented	Affective Oriented
Students described wanting to understand a mathematical concept in more depth. These students also described wanting to share knowledge and to work collaboratively with their peers and tutor, by communicating and challenging choices to better learn with greater depth. These students wanted guidance in how to learn.	Students described wanting to complete a task by having a tutor explicitly showing them "how to solve" mathematical problems. Students also described wanting to be shown "how to solve" mathematical problems in different ways. These students wanted guidance in completing a mathematical exercise.	Students described tutoring as a place where tutors are happy to help and encouraging. These students also described how tutoring might support the development of math confidence.

Below I will provide an overview of all three perspective categories with their definitions and where each category aligns when compared to the perspective themes identified in the broader literature. I will then elaborate on each perspective category and give detailed questionnaire quotes and interviewed excerpts that helped in deciding those categories. Each category will be explained individually but it is not my intention to imply that each perspective category is mutually exclusive. Finally, it should be noted once more that the following perspective categories were determined without extensive prior knowledge of the broader

literature to avoid making interpretations influenced by previous research. Furthermore, the data was collected mid-semester not making it clear *when* the students' perspectives are rooted.

Discussion of Categories

Understanding Oriented

One student perspective that emerged was *Understanding Oriented* (see fig. 7) and was determined by focusing on keywords or phrases such as "concept", "learn/understand", "different", "share", or "from a peer". Twenty-three of the 58 student quotes indicated a desire to share knowledge and to communicate with each other encouraging understanding from alternative viewpoints. These quotes help make it clear that some students primarily believe the purpose of tutoring is for further investigation of ideas discussed in class suggesting they wanted to work collaboratively with their peers by attempting to re-learn from their peer's viewpoint or to re-teach in a way not standard for the group.

Figure 7

Understanding Oriented Explained

Understanding Oriented	Problem/Task Completion Oriented	Affective Oriented
Students described wanting to understand a mathematical concept in more depth. These students also described wanting to share knowledge and to work collaboratively with their peers and tutor, by communicating and challenging choices to better learn with greater depth. These students wanted guidance in how to learn.	Students described wanting to complete a task by having a tutor explicitly showing them "how to solve" mathematical problems. Students also described wanting to be shown "how to solve" mathematical problems in different ways. These students wanted guidance in completing a mathematical exercise.	Students described tutoring as a place where tutors are happy to help and encouraging. These students also described how tutoring might support the development of math confidence.

The questionnaire quotes below (see fig. 8) help make it clear that these students primarily believe the purpose of tutoring is for further explanation of ideas discussed in class. Furthermore, that these explanations are meant to support understanding or learning concepts.

Figure 8

Understanding Oriented: Questionnaire Quotes 1

Student 3: "ultimate purpose is to build a lasting understanding."	**Student 30:** "To be familiarized with the concept more in depth"
Student 4: "When a concept is not being understood"	**Student 42:** "understanding a concept clearly … another outlet for students to learn from different angles.".
Student 11: "help students learn and understand concepts"	**Student 54:** "help the person learn concepts"

In particular, some of students below (see fig. 9) indicated a desire to share knowledge, understand, and to communicate with each other encouraging learning from alternative viewpoints. These students also expanded on why they believe sharing knowledge and collectively working toward an understanding is beneficial for all students.

Figure 9

Understanding Oriented: Questionnaire Quotes 2

Student 5: "purpose in tutoring is to help others or oneself can a better understanding on a topic that is difficult or seems to be a struggle."	**Student 29:** "Communicate and learn from another perspective."
Student 10: "I think tutoring is an opportunity to learn with others. Not everyone learns the same way so taking extra time out of class can be extremely beneficial when it is re-teached a different way."	**Student 43:** "people with a broader and greater understanding trying to impart their knowledge".
Student 26: "To share knowledge. If one person is struggling and another can help I feel like they should."	**Student 55:** "to have multiple explanations of concepts"

To further explain how this category was determined, excerpts from the semi-structured interviews are provided. When describing their experiences leading up to tutoring or at tutoring three students described below an affinity for reasoning, explaining, and collaborating with a peer or tutor.

The interview excerpts below point to students' believing that the purpose of tutoring is meant to support their development of understanding the *why* of mathematics by guiding them to a richer understanding of mathematics through further explanation and discussion.

We can see Student R (see fig. 10) express three different times that they do not simply want to learn a procedure but rather an explanation of where they are going wrong to help develop mathematical concepts. Student R also expresses a fondness for a Socratic style of collaborative tutoring by having a choice or explanation challenged, furthering their understanding of the issue at hand.

Figure 10

Understanding Oriented: Student R Excerpts

Student R (excerpt 1): "There's a purpose behind it to learn a identity [or] theorem or whatever it was ... it doesn't matter, then it needs, there is a reason why they put it there. So, I needed to figure out why or at least to be able to attempt it or trying to figure it out."
Student R (excerpt 2): "let's say a tutor was there I'd be like well this right here in this area there's something that's missing and then I'd be like, "oh really what" and so I would have to them explain it, what I was doing, and they're like, "that's close but what about this" and so I also [believe] if I can explain it or what was happening then I know that I understand that concept okay and so it was a combination of things I would say part of it is you know actually writing it out the other one is talking through it and then see if I can visualize the components."
Student R (excerpt 3): "if I make a mistake then that if I go through and correct it, like I was just in a tutoring session before this and I said here's my quiz this is what I knew at that point I didn't want to just produce a right answer, I said, "this is what I know, give me some feedback", "oh it's wrong", "okay now, why?" and so then I went through and "oh right there, okay" and so now when I see it next time hopefully it'll be easier to recognize or whatever. So I'm seeing the failures or whatever"
Student R (excerpt 4): "let's say a tutor was there, I'd be like well this is right here in this area, there's something that's missing and then I'd be like, "oh really what" and so I would have to them explain it, what I was doing, and they're like, "that's close but what about this"

Again, we can see that Student A (see fig. 11) is indicating they want further explanation to help them understand. Highlighting the benefit of using tutoring for learning information they had previously missed from class.

Figure 11

Understanding Oriented: Student A Excerpts

Student A (excerpt 1): "At first it's nerve-racking but after I get comfortable and I understand they keep on explaining me what's going on so that I feel like I walk out of there [with] more understanding [despite when I went in I was] all nervous and like I didn't know what I was looking for or anything like that."
Student A (excerpt 2): "I didn't understand it completely so I would ask the question you know, "hey I didn't understand the way she was teaching can you explain it to me and I break it down more or is there something I'm missing or something I didn't catch when she was in class something like that. "Can you explain it to me?" and then that's where we go off"

Student G (see fig. 12) highlights that they believe the tutors are typically more knowledge on a specific subject. They also suggest tutoring is place where you can nurture your understanding of mathematical ideas with someone that has "more knowledge" and "can explain it better", rather than trying to understand by reading the assigned text or something similar. Additionally, Student G alludes to a preference for group interactions finding it easier to openly express a question and once the question is asked the group will collectively help the collective understanding.

Figure 12

Understanding Oriented: Student G Excerpts

Student G (excerpt 1): "just to be able to go in there and get a better understanding with the material with [a tutor]. People that have more knowledge in the field that can explain it better than just reading it from a book or something like that"
Student G (excerpt 2): "it's me and the [tutor] getting the actual points that I need to improve on instead of just going in to lecture and trying to catch up. Actually, need to focus on what I need help with as opposed to what the class doesn't understand."
Student G (excerpt 3): "I like it with a group of people. I feel like it's easier to say your problem to and not so one on one"
Student G (excerpt 4): "It's usually a group. Then we'll all sort of, if we have a problem here, we'll go off of it then, even if the tutor, even we help each other out once we get to that point. A lot of it, especially for construction [management courses] a lot of the things are group oriented so that was pretty useful, bunch of us with one tutor."

The student excerpts and quotes suggest that for these like-minded students the purpose of tutoring is a place where content support is tailored to the student(s) asking the question(s) and making the response(s). Implying these students believe tutoring to be a clearinghouse of knowledge distributed by re-teaching, re-learning, and asking questions.

Problem/Task Completion Oriented

Another student perspective that became apparent was *Problem/Task Completion Oriented* (see fig. 13). This category was determined by students' who expressed their primary interest in tutoring was "how to do", "extra practice/example problems", "other ways", "different perspective", "receive", and "how to solve" suggesting their goal was focused on the completion of a mathematical task., keywords and phrases like "topic", "practice", or "extra

problems/example problems" were expressed by the students. Thirty-six out of 58 students expressed they wanted to learn a topic or practice more problems suggesting they want guidance in completing a mathematical task in hopes of being more successful on homework completion or other related materials. It is important to discuss how additional terminology referencing "how to solve" suggest different interpretations of the student responses on the purpose of tutoring when compared to responses that suggest *Understanding Oriented*.

Figure 13

Problem/Task Completion Oriented Explained

Understanding Oriented	Problem/Task Completion Oriented	Affective Oriented
Students described wanting to understand a mathematical concept in more depth. These students also described wanting to share knowledge and to work collaboratively with their peers and tutor, by communicating and challenging choices to better learn with greater depth. These students wanted guidance in how to learn.	Students described wanting to complete a task by having a tutor explicitly showing them "how to solve" mathematical problems. Students also described wanting to be shown "how to solve" mathematical problems in different ways. These students wanted guidance in completing a mathematical exercise.	Students described tutoring as a place where tutors are happy to help and encouraging. These students also described how tutoring might support the development of math confidence.

The student quotes below (see fig. 14) highlight how the primary focus for students in this category was to be guided toward completion of a task or to have their solving techniques challenged while working, potentially collaboratively, toward the completion of mathematical task.

Figure 14

Problem/Task Completion Oriented: Questionnaire Quotes 1

Student 13: "guide students on any questions or confusion they have on a certain topic or problem."	**Student 51:** "learn how to do"
Student 28: "you get more example problems"	**Student 54:** "I think tutoring…normally means the tutor doing problems similar to the ones in the homework and explaining how they get there. Then the person being tutored tries to do problems similar to those."
Student 46: It's nice to have someone basically hold your hand through the problem that your working on"	**Student 57:** "just extra practice to get material down"

Specifically, some students (see fig. 15) indicated they preferred *completing tasks* as a part of collective effort. Suggesting, the discussion around a shared effort was to *complete a problem* in a quick and efficient manner.

Figure 15

Problem/Task Completion Oriented: Questionnaire Quotes 2

Student 10:"Drilling the concepts by teaching others is one of the best ways to see if you really know how to solve a problem."	**Student 55:** "To ask clarifying questions, get extra practice, to learn other ways to complete problems"
Student 46: "… get a different perspective on how to solve problems that I have difficulty solving/understanding."	**Student 56:** "discuss as a group on how we can solve the problem and get the solution"

The above student quotes indicate their primary interest in tutoring was "how to do" or "extra practice" suggesting the focus of their visit at tutoring was to complete a mathematical

task. The following interview excerpts help to explain why students believe the purpose of tutoring is for guidance on problem completion.

Present in Student R's (see fig. 16) response is speaking of how *Problem/Task Completion* might look and how it might help might achieve further success in the class as a result.

Figure 16

Problem/Task Completion Oriented: Student R Excerpt

Student R (excerpt 5): "if I see something similar or have a similar problem the practice will help me solve the problem or the test result."

Students like Student A (see fig. 17) believe that the purpose of tutoring is to discuss multiple approaches for "how to solve" mathematical exercises. By this assumption it was determined that students who describe tutoring in this way seek alternate ways for solving mathematical exercises, but ultimately the goal is to "figure out the solution to that problem".

Figure 17

Problem/Task Completion Oriented: Student A Excerpt

Student A (excerpt 3): "I got to know my group and stuff like that and we'd go do homework together or if we didn't understand something text each other, "hey, do you understand this problem?", "do you get it?", "how do you do it?" We'd help each other and bounce ideas off each other and try to figure out what was the solution to that problem stuff like that."

Whereas Student N's responses (see fig. 18) help the reader understand that some students yearn for a level of familiarity with certain types of mathematical exercises believing that by "going the extra mile" they will achieve the success they desire whether that be on the

test or on the homework indicating they believe tutoring will help them complete the mathematical task at hand.

Figure 18

Problem/Task Completion Oriented: Student N Excerpts

Student N (excerpt 1): "If I had just gone in solo and stuck to the plan of bringing in the problems and showing them exactly what I can't do I think that would have been much more beneficial."
Student N (excerpt 2): "It's just someone going the extra mile to understand something to get the grade that they want to get. I just think it's some extra class time, just more time spent on certain problems to understand how to do."
Student N (excerpt 3): "…go in sit down with the tutor, show them the problem that you're doing and they'll it to you again because odds are the teacher did explain it in class, you just missed it."
Student N (excerpt 4): "Then say I wanted to get help with my homework I would go through every problem and say, "Hey I didn't I didn't particularly get this one." So I would bring in that question and ask that certain question to the tutor and I'll have just a base few questions that I want to go over"

However, Student G (see fig. 19) sheds light how a question-and-answer interaction in their tutoring session might have unfolded. It seems apparent that by Student G's response that the question is not *Understanding Oriented* but rather the question they ask is something along the lines of "how do you do this problem?" and the answer is directly working toward the completion of a problem. Whereas Student A describes how a group interaction may have looked.

Figure 19

Problem/Task Completion Oriented: Student G Excerpt

Student G (excerpt 5): "When I would go there it would be pretty much just like question and answer and I'll show you how to do it.

Students that responded with a desire to solve a problem suggest they believe the purpose of tutoring is for *Problem/Task Completion* or is meant to be support in their process of solving problems. Differing from the student responses that makeup *Understanding Oriented* who described, collectively, a belief that help and guidance was reserved for further investigation of mathematical ideas.

Affective Oriented

The final perspective identified in the student responses was *Affective Oriented* (see fig. 20). Seven student responses indicated they attended tutoring because the tutor made them feel welcome, confident, and encouraged. The keywords and phrases that became apparent in describing this category were "confidence/confident", "happy" and "encourage people". The student quotes below help to illustrate the affect tutoring had on their mathematical disposition.

Figure 20

Affective Oriented Explained

Understanding Oriented	Problem/Task Completion Oriented	Affective Oriented
Students described wanting to understand a mathematical concept in more depth. These students also described wanting to share knowledge and to work collaboratively with their peers and tutor, by communicating and challenging choices to better learn with greater depth. These students wanted guidance in how to learn.	Students described wanting to complete a task by having a tutor explicitly showing them "how to solve" mathematical problems. Students also described wanting to be shown "how to solve" mathematical problems in different ways. These students wanted guidance in completing a mathematical exercise.	Students described tutoring as a place where tutors are happy to help and encouraging. These students also described how tutoring might support the development of math confidence.

The quotes below (see fig. 21) are representative of those students who described tutoring as an encouraging place that supported confidence.

Figure 21

Affective Oriented: Questionnaire Quotes

Student 6: "A place where people are happy to help you with math or any other math question you need."	**Student 13:** "This enables people to be more confident in their math skills"
Student 9: "There's free help and people willing to give up their time for other's success"	**Student 31:** "To help and encourage people who aren't doing as well in math to continue and improve in the field of math."
Student 10: "I think tutoring is a way to provide extra confidence when trying to execute a problem."	**Student 46:** "working on until you feel confident enough to tackle it yourself"

Differing from all other student responses, students who used affective language when describing tutoring did so primarily without reference to completing or understanding mathematics. It should be noted that the broader research states Math Confidence is a huge driving force for student's enrollment and maintained enrollment in tutoring (Hendy, 2014; Hill, 2016). Next, the three excerpts below will help to further explain these student's affective disposition.

Student A's excerpts (see fig. 22) below explain how crucial the initial tutor-student interaction is by saying a tutor's attitude when greeting them is important for repeat attendance. Suggesting initial contact makes the student feel more welcome. In addition, Student A also self-identifies as a struggling mathematics student but expresses appreciation for a positive and encouraging message by the tutor.

Figure 22

Affective Oriented: Student A Excerpts

Student A (excerpt 4): "Not just not knowing them but like if their vibe's not energetic you know, some dull people you know just like very dry and stuff like that. Besides to a person that's like, "oh my goodness yes let me help you" like all that stuff so like that's a lot of, that's also what can drive I would say need to not like what to do anymore"
Student A (excerpt 5): "They were more calm. They're like, "hey it's okay." I would be like, "oh I'm sorry. I'm kind of dumb or something like I'm really slow and stuff" and they're like, "no it's okay like let me break it down to you." They may help you they're really positive about it"

Furthermore, Student N and G believe (see fig. 23 & fig. 24) that by going to tutoring and spending additional time on mathematics helps them achieve their mathematical goal hence influencing their confidence in math.

Figure 23

Affective Oriented: Student N Excerpt

Student N (excerpt 5): "I felt good, I felt good about it like I said I was a little bit nervous the first couple times just because I was scared I was [going to] ask a dumb question, but once you get over that fact I felt good about it … most of the times when I went in I was super happy leaving every time … once you start to understand everything you feel really good"

Figure 24

Affective Oriented: Student G Excerpt

Student G (excerpt 6): "Definitely more confident. I guess just doing any extra work outside of class will definitely help but I felt more confident"

By the previous quotes and excerpts students suggest that tutoring is more than just a place to help with *understanding* or to receive guidance *completing a task*. Some students reasoning for attending tutoring is support their *affective* perspective, fostering confidence in their mathematical abilities by creating a welcoming and encouraging environment.

CHAPTER V

CONCLUSION

This study examined perspectives undergraduate mathematics students have about the purpose of university provided tutoring services. Specifically, the study sought to answer the following question:

> What perspectives do lower-division undergraduate mathematics students have about the purpose of university provided tutoring services?

To answer this research question this study used qualitative methods, administered two instruments for data collection and constructivist grounded theory for data analysis. Constructivist grounded theory is a grounded theory approach that uses the researcher's experience to help inform and guide results. Constructivist grounded theory treats every participant's experience as different or individually constructed. In this study, the students' use of language when describing experiences or rationale about tutoring in conjunction with contextual clues provided informed the development of the tutoring perspective categories. It was paramount that the students' perceptions, beliefs, and ideas about tutoring were captured, thus constructivist grounded theory yielded more actionable results. Students participated in tutoring for a wide variety of reasons developing different purposes of tutoring in their education. Additionally, the aggregated data from the study positions itself in line with the broader researched tutoring perspective themes. Implying that the results about math-specific tutoring perspectives – *Understanding Oriented, Problem/Task Completion Oriented,* and *Affective Oriented* – and the tutoring perspective themes from the broader literature – *Form of Content Differentiation, Form of Guidance,* and *Supportive Environment* – are related in some way.

Moreover, three different university provided tutoring services were used by almost half of the students in this study, but the researcher was able to identify three distinct tutoring perspective categories. When looking at the students who *used tutoring* it is not all clear they know how each tutoring service is defined since all three tutoring perspectives were spread among all three tutoring services. Since the study was conducted mid-semester, not much can be said about whether the perspectives about tutoring were developed prior to enrollment or after. However, the data suggests that most students that both *used tutoring* and *did not use tutoring*

primarily viewed tutoring from a *Problem/Task Completion Oriented* perspective than any other perspective – *Understanding Oriented* and *Affective Oriented*.

Recommendations

Discussion of Results for Tutoring Service Directors and Tutors

Tutoring Service Directors

This study can inform current and future tutors, as well as tutoring service directors in some powerful ways. The current literature and results from the study have made it exceedingly clear that students may view tutoring from different perspectives when compared to their peers and may have drastically different goals in mind. However, research on perspectives has shown that many students, depending on their background, have trouble anticipating what tutoring is meant to support. This implication points to a weakness in the term *support* and its function for both students and tutors. Oftentimes, students are expected to define words like *support* by exposure. Due to varying perspectives, *support* may look different from one student to the next. Thus, the data collected suggests expanding on and clearly defining what *support* could mean for various students. Since the data collected also highlights how the term *tutoring* may have three completely different purpose(s) and functions(s) for students and their success. Therefore, expressly defining a particular tutoring service function may minimize future student confusion about how that service can support their academic goals.

Tutoring service directors have a role in the improvement of the experience had by both tutors and students. If tutors are to be flexible educators, the broader research and results of this study also promotes the need for continued pedagogical training. A tutoring service used by students in this study describes its function as being a place for student-centered aid, and yet

students still described their experience as being *Problem/Task Completion Oriented.* Student-centered practices are meant to shift the responsibility of learning to the student. However, the argument can be made that students attending tutoring with *Problem/Task Completion Oriented* perspective are pushing the responsibility of learning onto the tutor. Thus, data from this study suggests tutors be equipped with the tools necessary to determine and address any perspective allowing them to successfully redirect a tutoring session's learning responsibility back to the student. Additionally, data from the study suggest a set of clearly defined tutoring service functions might be displayed where the students have easy access to the information. Thus, creating a welcoming experience for the students by helping them find a tutor to address their concern in a supportive and efficient way.

Knowing how students view tutoring, especially if they do not enroll in the service regularly may be beneficial in broadcasting a wider message about tutoring's overall benefits. In addition, having a well-rounded understanding of who uses their services and the role students believe tutoring has in their education can support the success of these services.

Tutors

Beyond simply training, the tutor is meant to be a support system for the students, and it is critical the tutor apply their training. The literature and results of this study also suggests tutors ask students what they hope to experience by participating in tutoring. All tutoring perspectives determined by this study were spread between all tutoring services used by students. Suggesting that students are not sure which service will suit their needs. Students seem to be blindly choosing a tutoring service believing any form of tutoring will satisfy their needs. With the goal of the student in mind, by opening a dialogue for the student the tutor can then tailor their assistance, by individually addressing specific concern(s). The data highlighted that although

students in this study used three different tutoring services, they predominantly had the same perspectives. As an alternative, if it is not feasible for the student tutor to individualize the assistance, then the data suggests that tutors must define their role explicitly to the students in hopes of guiding the student to an appropriate tutor that will best address their individual needs.

Directions for Future Research

Future Direction a.

The first direction for future investigation may be "What differences in perspectives exist between students who used tutoring services as compared to those who didn't?" Knowing this information may help inform all of those involved in the tutoring process by expressly highlighting if there is a difference in perspective between these two groups of students. Additionally, it allows for data collection that might be able to suggest if a perspective can change while enrolled and regularly attending tutoring. For example, this type of question may allow a researcher to determine if a student's primary tutoring perspective can sway between one of the three – *Understanding Oriented, Problem/Task Completion Oriented,* and *Affective Oriented*.

Future Direction b.

Another future possibility for research may be "What differences in perspective exist between students who used tutoring services and passed their mathematics class when compared to those who did not pass?" This sub-question may address a previously mentioned concern about unintentionally ignoring the non-dominant student perspective, by highlighting the perspectives of students who could be viewed as unsuccessful at tutoring. Future research may be able to illuminate the primary perspective or reasoning students have about continued usage

of tutoring despite not being successful in the course they are trying to gain support in. This sub-question could potentially influence the changes tutoring service directors decide to implement when innovating tutoring protocols.

Future-Direction c.

A third direction for investigation might be "What differences in perspectives exist between students and the tutoring service they enrolled in?" This sub-question as a primary focus could inform tutoring service directors how closely student's tutoring perspectives compare to the tutoring services overall support goal they are seeking to employ. With this information, tutoring service directors may be able to make appropriate modifications to better support students guiding them toward the tutoring services' overall goal.

Final Remarks

From the Educator

As an educator first and foremost, the data collected and analyzed from this study helped to draw an awareness to why some students might find tutoring to be a futile endeavor. Some students decide to attend tutoring with goals of success but are sometimes met with frustrating experiences that deter them from continuing attendance. Throughout the duration of this study one potential reason might be due to some inconsistencies between classroom instruction, the students' perceived purpose of tutoring, and what the tutor expects from the student. If a student is from a classroom focused on being student-centered and they attend a tutoring session with an *Understanding Oriented* perspective but go to a session geared for *Problem/Task Completion Oriented* perspectives may cause a rift in the perceived value tutoring has for a student.

Furthermore, different types of mathematical tasks in the classroom may potentially influence how students interact with tutoring. Supplying completion-oriented tasks may impose a sense of urgency on completing those tasks, therefore it is not unreasonable to assume students will employ the services of tutoring for such completion of a task. Whereas, if the task supports the development of a student's reasoning skills, minimizing the need to "complete a task" they may engage in tutoring in a vastly different way. Many educators, including myself, fall into the trap of broadly recommending tutoring services without much thought or knowledge that different tutoring centers may have a tutoring structure distinct to their tutoring center. It is to no fault of the educators, nor should it be their responsibility to support students in understanding the varied purposes each tutoring center offers but to identify if their students need additional support and to recommend it. That is not to say the educator should knowingly withhold information from the students, but rather if an educator is unaware of the differences between tutoring centers, it is the responsibility of the centers to inform the students of its specific function. The data seems to suggest that how educators engage with students in the classroom may also have bearing over the development for their students' perspective(s) of tutoring services.

From the Researcher

Now more than ever, the college experience is reaching more and more students from diverse backgrounds. Students are flocking to tutoring support groups with expectations fueled by prior higher education experiences. The literature has uncovered and explained that the college expectations and the college experiences do not always coincide. Understanding what students expect from tutoring is important in developing tutoring services and guiding how students potentially view the university provided support service, thus giving both student and

administration better control over the educational experience. The data collected suggests helping students toward a clear and concise understanding of tutoring services, as well as, having clearly defined tutor roles and responsibilities which better tailors a student's support experience. To this end, tutoring service coordinators need to support the pedagogical training of its tutors as well. Without this information we fall victim to "Survivorship Bias". Succinctly put, Survivorship Bias is the logical error of focusing on those who were successful in some measurement metric and neglecting those who were not successful, either deliberately or by chance. This logical error will lead to erroneous conclusions, overly reporting results that may not be representatives of a whole group. In the framework of tutoring and tutoring research, many studies are set up to focus on effectiveness and study the successes to help inform the steps necessary to help others be successful as well. The issue is that by neglecting the perspectives of both successful and non-successful students, we may be reinforcing the dominant perspective that an effectiveness metric is being innovated toward. By neglecting to recognize non-dominant students' perspectives, research is failing to acknowledge how those perspectives might hone, change, or shape future tutoring innovations. Clearly, those who are successful in current model tutoring will continue to be successful, so we must turn our attention to understanding what our students think our support systems is meant to support. That is to say, research needs to continue investigation what students think the purpose(s) and function(s) of tutoring is in relation to their education.

Not all students are benefiting from the current "one-size-fits-all" tutoring recommendations. Students are often left wondering which tutoring service – MLL, SLC, or SI – will best fit their need without fully understanding that each service is meant to perform a particular function. Clearly differentiating tutoring services to foster enrollment in tutoring that

supports what students want to learn should be the focus of any support group. With this change we might begin to reduce tutor focused sessions in favor of student-centered sessions. Training tutors in pedagogical ideas with clearly defined roles may help tutoring services transition to being truly student-centered. Most importantly, these supports are meant for our students. Thus, by helping students determine what is most important to their support, learning, and education, we as educators can continue our commitment to empowering students' success.

REFERENCES

Baeten, M., Kyndt, E., Struyven, K., & Dochy, F. (2010). Using student-centered learning environments to stimulate deep approaches to learning: Factors encouraging or discouraging their effectiveness. *Educational Research Review*, *5*, 243–260.

Birks, M., & Mills, J. (2015). *Grounded Theory: A Practical Guide* (Second). Thousand Oaks, CA: Sage Publications.

Bracco, K. R., Schrager, C., Calisi, G., Gutierrez, P., Salciccioli, M., & Finkelstein, N. (2019). College-ready in the California State University system: Campus experiences implementing EO 1110. San Francisco, CA: WestEd.

Braine, M., & Parnell, J. (2011). Exploring Student's Perceptions and Experience of Personal Tutors. *Nurse Education Today*, *31*, 904–910.

"California State University, Chico." *California State University, Chico.* 2021. https://www.csuchico.edu/. Accessed 21 Mar. 2021.

Cantone, K. (2001). The Rx for Remedial College Math: Learning Communities. *Research and Teaching in Developmental Education*, *18*(1), 66–70.

Castensson, R., Dahlgren, M., & Dahlgren, L. (1998). PBL from the Teacher's Perspective: Conceptions of the Tutor's Role within Problem Based Learning. *Higher Education*, *36*(4), 437–447.

Charmaz, K. (2006). *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. Thousand Oaks, CA: Sage Publications.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches.* Thousand Oak, CA: Sage Publications.

Crisp, G., & Cruz, I. (2009). Mentoring College Students: A Critical Review of the Literature Between 1990 and 2007. *Research in Higher Education*, *50*(6), 525–545.

de Grave, W., Dolmans, D., & van der Vleuten, C. (2002). Student Perspectives on Critical Incidents in the Tutorial Group. *Advances in Health Sciences Education*, *7*, 201–209.

Duranczyk, I., Goff, E., & Opitz, D. (2006). Students' Experiences in Learning Centers: Socioeconomic Factors, Grades, and Perceptions of the Math Center. *Journal of College Reading and Learning*, *36*(2).

Fernandes, S., & Flores, M. (2013). Tutors' and Students' Views of Tutoring: A study in Higher Education. In *Back to the Future: Legacies, Continuities, and Changes in Educational Policy* (pp. 277–295). Sense Publisher.

Fulford, A. (2016). Education: Expectation and the Unexpected. *Studies in Philosophy and Education*, *35*, 415–425.

Gardner III, R., Nobel, M., Hessler, T., Yawn, C., & Heron, T. (2007). Tutoring System Innovation: Past Practice to Future Prototypes. *Journal of Intervention in School and Clinic*, *43*(2), 71–81.

Ghezeljeh, T.N. & Emami, A. (2009). Grounded theory: Methodology and philosophical perspective. Nurse Researcher, 17(1), 15–23

Glowa, L., & Goodell, J. (2016). Student-Centered Learning. In *Student-Centered Learning: Functional Requirements for Integrated Systems to Optimize Learning* (pp. 1–3). International Association for K-12 Online Learning.

Gordon, E., Morgan, R., O'Malley, C., & Ponticell, J. (2007). *The Tutoring Revolution*. Lanham, MD: Rowan and Littlefield Education.

Hallberg, L. (2006). The “Core Category” of Grounded Theory: Making Constant Comparisons. *International Journal of Qualitative Studies on Health and Well-Being*, *1*(3), 141–148.

Hendrick, W., McGee, P., & Mittag, K. (2000). Pre-service Teacher Learning Through One-on-one Tutoring: Reporting Perceptions Through E-mail. *Teaching and Teacher Education*, *16*, 47–63.

Hendy, H., Schorschinsky, N., & Wade, B. (2014). Measurement of Math Beliefs and Their Associations with Math Behaviors in College Students. *Psychological Assessment*, *26*(4), 1225–1234.

Heron, T., Villareal, D., & Yao, M. (2006). Peer Tutoring Systems: Applications in Classrooms and Specialized Environments. *Reading and Writing Quarterly*, *22*(1).

Hill, B. J. (2016). *An Exploratory Investigation of the Beliefs, Behaviors, and Performance of Women in College Algebra in a Rural Community College* [Dissertation]. Texas A&M University.

Hixenbaugh, P., & Thomas, L. (Eds.). (2016). *Personal Tutoring in Higher Education*. Trentham Books.

Johnston, A., & Tinning, R. (2001). Meeting the Challenge of Problem-based Learning: Developing the Facilitators. *Nurse Education Today*, *21*(3), 161–169.

Kaiden, E. (1994). Repeat Attendance at a College Tutoring Center: Students’ Perspectives. *Research and Teaching in Developmental Education*, *11*(1), 49–62.

Khalid, H., Shahid, S., Punjabi, N., & Sahdev, N. (2018). An Integrated 2-year clinical skills peer tutoring scheme in a UK-based medical school: Perceptions of tutees and peer tutors. *Advances in Medical Education and Practice*, *9*, 423–432.

Li, T., Petrini, M., & Stone, T. (2018). Baccalaureate Nursing Students' Perspectives of Peer Tutoring in Simulation Laboratory, a Q Methodology Study. *Nurse Education Today*, *61*, 235–241.

McMullen, B. (2011). *Perceptions of Peer Tutoring in a Post Secondary Setting* [Thesis]. University of Connecticut.

Miller, A. (2016). *Mentoring Students and Young People: A Handbook of Effective Practice*. Taylor and Francis Group.

Muise, A. (2016). *The Importance of College Level Peer Tutoring from the Student's Perspective* [Dissertation]. Lesley University.

Murphy, D., Evans-Romaine, K., & Zheltoukhova, S. (2012). Student and Tutor Perspectives of Tutoring in a Russian Flagship Program. *Russian Language Journal*, *62*, 107–127.

Patterson, E. (2010). *Best Practices in Mathematics Tutoring* [Thesis]. The University of Texas at San Antonio.

Sloan, P. (2013). Are We Really Student-Centered? Reconsidering the Nature of Student "Need." *Praxis: A Writing Journal*, *10*(2).

VanLehn, K. (2011). The Relative Effectiveness of Human Tutoring, Intelligent Tutoring Systems, and Other Tutoring Systems. *Educational Psychologist*, *46*(4), 197–221.

Vogel, G., Fresko, B., & Cheruta, W. (2007). Peer Tutoring for College Students with Learning Disabilities: Perceptions of Tutors and Tutees. *Journal of Learning Disabilities*, *40*(6).

Wright, G. (2011). Student-Centered Learning in Higher Education. *International Journal of Teaching and Learning in Higher Education*, *23*(3), 92–97.

Yale, A. (2019). The Personal Tutor-Student Relationship: Student Expectations and Experiences of Personal Tutoring in Higher Education. *Journal of Further and Higher Education*, *43*(4), 533–544.

Zietara, S. (2016). *Secondary to Post-Secondary Mathematics: Factors Perceived by Students as Inhibitors and Enablers to Their Success* [Thesis]. University of Toronto.

APPENDIX

Questionnaire

Number you were assigned: Email (@mail.csuchico.edu):

Demographic Information

1. In which course are you enrolled?

☐ Math 119 Precalculus Mathematics

☐ Math 107-051 Foundational Mathematics and Co-Requisite for Finite Mathematics

☐ Math 105-051 Foundational Mathematics and Co-Requisite for Statistics

2. Which additional resource(s) do you use. (Check all that apply)

☐ Math Learning Lab ☐ Student Learning Center Private or Group Tutoring

☐ Supplemental Instruction Sessions ☐ I don't use any of these resources

☐ Other(please specify):_____

Student Perspectives

Please indicate your level of agreement with the following statements:

3. People will think less of me if I go to the Math Learning Lab, Student Learning Center Private or Group Tutoring or Supplemental Instruction Sessions

☐ Strongly Agree ☐ Agree ☐ Neither Agree nor Disagree ☐ Disagree ☐ Strongly Disagree

4. I can be successful in math when I apply myself.

☐ Strongly Agree ☐ Agree ☐ Neither Agree nor Disagree ☐ Disagree ☐ Strongly Disagree

5. Math is needed to be successful later in life.

☐ Strongly Agree ☐ Agree ☐ Neither Agree nor Disagree ☐ Disagree ☐ Strongly Disagree

6. I believe I will be successful in anything I try.

☐ Strongly Agree ☐ Agree ☐ Neither Agree nor Disagree ☐ Disagree ☐ Strongly Disagree

7. People are either good at math or they are not.

☐ Strongly Agree ☐ Agree ☐ Neither Agree nor Disagree ☐ Disagree ☐ Strongly Disagree

8. I prefer to work on math in a group.

☐ Strongly Agree ☐ Agree ☐ Neither Agree nor Disagree ☐ Disagree ☐ Strongly Disagree

Please answer the following prompts as thoroughly and as honestly as you can:

9. What do you think the purpose of tutoring is? Other related resources?

10. Think of a time in your life when you got stuck while solving a math problem. How did you feel while you were struggling? What did you do to move past the problem? (Please mention any tutoring, supplemental instruction or other additional resources if they apply.)

11. Describe a good math student.

Semi-structured Interview

1. Would you describe to me how you felt when going or preparing to go to a tutoring session?

2. When you are not in class or with a tutor, what does "doing" math look like for you.

3. Would you describe to me your typical experience at a tutoring session?

    a. How did you feel about your experience at the session? (more or less confident)

    b. What would you have done differently, if anything?

    c. What do you wish your experience would have been like?

4. What was your experience like (with other students) in your math class?

    a. What was your experience (with other students? The instructor?) like in your parent course?

    b. What was your sense of your instructor's feelings about using outside resources?

5. What do you think the purpose of tutoring is? Other related resources?

6. Think of a time in your life when you got stuck while solving a math problem. How did you feel while you were struggling? What did you do to move past the problem? (Please mention any tutoring, supplemental instruction or other additional resources if they apply.)