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## **Advising for High School Mathematics Course-Taking: Action Research Identifying and Describing Students' Experiences, Selection Factors, Needs, and Preferences**

Andrea Lynn Goodson

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ADVISING FOR HIGH SCHOOL MATHEMATICS COURSE-TAKING: ACTION  
RESEARCH IDENTIFYING AND DESCRIBING STUDENTS' EXPERIENCES,  
SELECTION FACTORS, NEEDS, AND PREFERENCES

by

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## DEDICATION

This dissertation is dedicated to my family and friends who supported me on this journey.

To my parents, Joyce and Larry Goodson: You've been examples of responsibility, diligence and true love my entire life. You both walked the walk by never procrastinating, finding a way, and always getting the job done. You always supported my educational pursuits, assured me of my abilities, and you are the reasons I have never been bored. You showed me the world and made me interested in everything.

To my children, daughters-in-love, and grandbabies, Holden, MiryAm, Yosef, Hunter, Asia, Hayden, and Hannah: You are my reasons to lead by example. You have supported me by taking care of me, our home, my job, and family business. You motivated me to take breaks and do fun things. You are the reasons I smile.

To my friends, Amy, Kim, and Tina: You kept me sane with your calls, texts, and nights out. You understood my rainchecks and always rescheduled.

There has never been a more difficult time to put the world aside and focus on competing this journey: a pandemic, social distancing, school buildings closed, teaching from home, 65 students, isolated at home, six people in one house, the only one employed, protests, riots, hibernating... hallelujah! You've all been there for me and I love you for it. Thank you all for helping me refocus, through it all, to see this to completion.

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Finally, I thank Dr. Michael Grant for working so passionately to develop this curriculum and assemble this group of exceptional leaders in educational technology.

## ABSTRACT

The purpose of this action research study was to identify and to describe the needs of students in the advisement process of mathematics course selections at a suburban high school in South Carolina, in order to make recommendations for effective advisement for mathematics course selections. This study addressed three research questions. The first research question explored students' experiences in the advisement process of math course selections at a suburban high school. The second research question identified the factors affecting students' math course selections. The third question investigated students' needs and preferences in the mathematics course selection process.

This action research study used explanatory sequential mixed methods design. Data sources included surveys, discussion board posts, and focus group interviews. There were 61 student participants in the survey, 45 respondents to the discussion board, and 20 volunteers in focus group interviews. Quantitative data were analyzed by descriptive statistics while qualitative data were analyzed by inductive analysis.

In this descriptive study, students indicated teachers were the most sought and helpful sources for high school math course selections. Counselor knowledge, availability, and supportiveness were rated fair to good on average with the majority of students agreeing with counselor overall excellence and positively recommending them to friends. Overwhelmingly participants did not identify themselves as "math people". However, they agreed with math usefulness, especially for college. Additionally, respondents ranked college attendance and high school graduation as their most

significant motivators for selecting high school math courses. Most students indicated parents and counselors assisted them with developing college or career plans. Students rated themselves below the middle for self-efficacy while qualitative analysis revealed significant gaps in their school knowledge. Taken together, four themes emerged: (1) early and consistent advisement curriculum, (2) importance of student attitude and self-efficacy, (3) varied math course delivery options and scheduling, and (4) counselor quality and stakeholder influence on math course selections. Recommendations for effective advisement for high school math course selections were provided for parents, teachers, students, counselors, and school and district administrators.

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## LIST OF ABBREVIATIONS

ACT	American College Testing
AQS	Advisor Quality Survey
ARCS	Attention Relevance Confidence Satisfaction
ASSURE	Analyze State Select Utilize Require Evaluate
CAS	Council for the Advancement of Standards
CTE	Career and Technical Education
Ed.D.	Educational Doctorate Degree
ELS:2002	Educational Longitudinal Study of 2002
HSL:09	High School Longitudinal Study of 2009
IGP	Individualized Graduation Plan
KR21	Kuder-Richardson
MCSS	Math Course Selection Survey
MICC	Motivation in Course Choice
NACADA	National Academic Advising Association
NAEP	National Assessment of Educational Progress
NCES	National Center for Educational Statistics
NELS	National Educational Longitudinal Study
OECD	Organization for Economic Cooperation and Development
PISA	Program for International Student Assessment
RQ1	Research Question 1
RQ2	Research Question 2

RQ3 ..... Research Question 3  
SES ..... Socioeconomic Status  
STEM ..... Science, Technology, Engineering, and Mathematics  
TAM ..... Technology Acceptance Model  
TIMSS ..... Trends in International Mathematics and Science Study  
U.S. .... United States of America

# CHAPTER 1

## INTRODUCTION

### **National Context**

American students need to improve mathematics performance in order for the United States (U.S.) to compete in today's global economy (Chowdhury, 2016; Herges, Duffield, Martin, & Wageman, 2017; National Commission on Mathematics and Science Teaching, 2000). Persistent concern, specifically in science, technology, engineering, and mathematics (STEM) education has gained the attention of governments and policy makers worldwide (Lowell & Salzman, 2007; Osborne & Dillon, 2008). Noting the significance of grades, a large-scale Canadian study concluded course selection was more important, particularly in the U.S., where students had a wider range of choices that may or may not align with various collegiate fields of study (Adamuti-Trache & Sweet, 2014). Similar U.S. studies directly correlated mathematic achievement with high school mathematics course selections and further linked mathematics course selections to students' likelihood of success in college (Barnett, Sonnert, & Sadler, 2014; Froiland & Davison, 2016; Valadez, 2002; Weiner, 2010).

The U.S. Department of Education reports annual progress of many key educational indicators including mathematics performance data from the National Assessment of Educational Progress (NAEP). The NAEP reports consistent improvement in mathematics performance of the majority of fourth (80%) and eighth (70%) grade Americans who scored at or above basic performance, while there was a decline in



performance for twelfth graders, with 61% to 65% of them scoring at or above basic performance since 2005 (McFarland et al., 2018). Tracking similar data internationally, the Trends in International Mathematics and Science Study (TIMSS) rated the U.S. significantly above the median on mathematics scale scores in fourth and eighth grades, but just at the median in the twelfth grade (McFarland et al., 2018). Additionally, the Program for International Student Assessment (PISA), under the guides of the Organization for Economic Cooperation and Development (OECD), measured the performance of 15-year-old students in mathematics literacy every three years where the U.S. consistently performed in the bottom 50 % (McFarland et al., 2018). These national and international benchmarks confirm a gap in mathematical learning at the secondary education level which carries over to college and career readiness.

The National Center for Educational Statistics (NCES) reported in 2000, that 28% of U.S. college freshmen were required to take a remedial mathematics course, a course they should have taken in high school (Parsad & Lewis, 2003). While we cannot know all of the reasons students did not take specific courses in high school, studies have found advisement was a key contributor to student course-taking (Ross, 2014). The pervasiveness of this problem was evidenced by the doubling of the rate of college freshmen requiring remedial math courses in the past decade at both two-year and four-year institutions with a national annual cost of approximately \$2 billion (Burdman, 2015). Studies also have shown remediation at the college level is not often helpful. Remedial mathematics courses in four-year colleges reported a 30% pass-rate and have been linked to higher dropout rates as well as more transfers to two-year colleges (Attewell, Lavin, Domina, & Levey, 2006; Dudley, 2010). This implies earlier academic

intervention is needed. The significant evidence that many U.S. high school graduates are not college ready, particularly in mathematics, highlights concern with the practices for advising students about their high school mathematics course selections as well as other contributing factors (Dudley, 2010; Harwell, Dupuis, Post, Medbanie, & LeBeau, 2013). Using data from the National Educational Longitudinal Study (NELS), research shows while not all ethnicities are impacted in the same ways, early experience with mathematics, parental involvement, and socioeconomic status (SES) continue to influence high school mathematics course selections (Valadez, 2002). While many policymakers are concerned millions of students are spending their college time and money on high school material, some institutions are debating the validity of calculus-based requirements for many college majors and are considering moving to more statistics based requirements (Burdman, 2015). In the meantime, high schools should not prematurely restrict opportunities for students or create barriers where students are not prepared for traditional mathematic requirements at more selective institutions (Burdman, 2015). These types of fluid unresolved issues can be expected in today's rapidly evolving society from both an educational and a social perspective.

Credit and content recovery programs have been implemented at most U.S. high schools to realize a national graduation rate exceeding 80% (McFarland et al., 2018). However, not only are a significant number of these students unprepared for college, some may not even have a plan to enter the workforce (Gushue, Scanlan, Pantzer, & Clarke, 2006; Ross, 2014). Again, while the U.S. benefits from more students obtaining high school diplomas, what is gained if students are not prepared to be productive members of society? In many cases, high school course selections are not aligned to

student career choices (Ross, 2014). One study compared relationships with nontraditional courses in career and technical education (CTE) programs with gender and future wage earnings finding that although the U. S. enjoys a reduced gender wage gap relative to the past, future earnings are still highly correlated to programs of study that favor males (Fluhr, Choi, Herd, Woo, & Alagaraja, 2017). Research in this area can be overwhelming. Advisement is a key element to addressing concerns with high school decision making (Brown & Cinamon, 2015; Gushue et al., 2006).

Educational theory confirms the role of parents and their influence on course selections (Froiland & Davison, 2016; Hyde et al., 2016) while social theory indicates ethnic, cultural, and socioeconomic differences impact access to school knowledge and therefore limit the impact of parental involvement on students' mathematics course selections (Valadez, 2002). Teachers, counselors, and administrators bring educational expertise to the advisement process when guiding students and parents in course selections. As a team, one goal should be to place students in the most appropriate and challenging mathematics courses aligned with their post-graduation plans. As noted, this is a common problem for many students planning to attend college as well as for students planning to go directly to the workforce. Advisement intervention must begin in the primary grades for students to be prepared to align their coursework with their future plans and optimize the high school mathematics curriculum available to them. Current research indicates parent expectations have the greatest influence on students' mathematics course selections (Froiland & Davison, 2016).

## Local Context

This research was conducted in grades 10 through 12 at a large suburban, Title 1 public high school in South Carolina where the student population was nearing 2000. This state required four mathematics courses to earn a high school diploma. High school mathematics course selections in this district included 20 different course choices. In 19 years of teaching at this location, I encountered many current and former students consistently expressing regret they did not enroll in the high school mathematics courses that would best prepare them for their post-graduation goals.

Mathematics course selections concerned me early in my teaching career. Each year I surveyed my students regarding their post-graduation goals and often noticed they were not enrolled in the most beneficial mathematics course to prepare for their post-graduation plans. I consulted with students, their parents, counselors, colleagues, and administrators attempting to redirect these students towards their desired paths. It was often a complicated process and sometimes not possible to improve. Advisement on mathematics course selections for high school needed to begin before high school to balance scheduling issues, establish viable work habits, and address other factors leading to student success.

Collaboration with colleagues revealed other teachers in the mathematics department were equally concerned with student mathematics placements. The mathematics department developed a flow chart for mathematics course recommendation guidelines in hopes that more capable students would be recommended for higher level courses. At that time, our state offered three tracks for mathematics: technologies, college preparatory, and honors. The original flow chart encouraged recommendations to

raise the level of any student earning an A in a technologies or college preparatory course and to lower the level for any student earning a D in an honors or college preparatory course. For clarification, when dealing with multiple departments and campuses, the flow chart noted this was only one item of consideration in the course recommendation process. Ultimately, teacher course recommendations were the professional opinion of each teacher after working with each unique student. I, as the mathematics department chair, shared the flow chart with the guidance counselors at the high school and at district middle schools. Guidance counselors had frequently shared their appreciation for the guidelines and regularly requested updates to the flow chart prior to each recommendation season. This flow chart was also included in annual math teacher professional development for the course recommendation process. Math department members collaborated each year to revise the mathematics course recommendation flowchart. Several times, I requested to have the flow chart published in the school's course directory but administrative feedback indicated the chart was too complicated and could generate too many questions. While it seemed the flow chart brought some consistency to course recommendations of mathematics teachers and counselors, there were still an unacceptable number of students misplaced in their mathematics courses. Another component in the annual professional development for the mathematics course recommendation process was for each mathematics teacher to consider the career goals of each of their students prior to making recommendation for their next courses. While we attempted department-wide interventions, as noted above, students reported inconsistencies and continued being misplaced in their mathematics courses. Employee

attrition and absenteeism also appeared to contribute to disconnects in the teacher-student advisement process for mathematics course selections.

Additionally, the guidance department formally invited every student and their parents to an annual individualized graduation plan (IGP) meeting. The location of this study reported parents attending IGP conferences at 81.2% (S.C. Department of Education, 2018). At this level of participation, how could students still claim to be misplaced in their mathematics courses? As juniors and seniors, many expressed a desire to preview calculus in high school. Unfortunately, only accelerated mathematics students were on track to take calculus while they are still in high school. This gained importance each year as not only STEM majors required calculus, but most other undergraduate degrees at selective institutions also required calculus (Burdman, 2015). In order for the bulk of these students to preview calculus in high school roughly 87%, who were not accelerated in mathematics, needed to double block their mathematics courses or otherwise take more than one mathematics course in the same year. Participants in this action research study consisted of students in the classes I taught. This action research project explored the ways advisement impacted mathematics course selections that were aligned with post-graduation goals and sought recommendations for improvement.

### **Statement of the Problem**

Students consistently expressed regret that they did not enroll in the high school mathematics courses that would best prepare them for their chosen future paths. While they met the requirements for high school graduation, they may have been less than prepared mathematically for their post-graduation goals. This action research project utilized explanatory sequential mixed research methods to explore students' advisement

experiences, affective factors, needs, and preferences in the mathematics course selection process.

### **Purpose Statement**

The purpose of this action research study was to identify and to describe needs of students in the advisement process of mathematics course selections in a suburban high school in order to make recommendations for effective advisement of mathematics course selections. With the researcher's pragmatic worldview, both quantitative and qualitative methods were used to explore students' advisement experiences, affective factors, needs and preferences in the mathematics course selections process. This research was planned based on Creswell's (2014) description of inductive logic, including researcher's past experiences, literature, data collection, analysis for patterns, categories, themes, and findings. The initial data collection was primarily quantitative in nature, using a survey (see Appendix A) to collect data from my students followed by qualitative data obtained by an online discussion board (see Appendix B). Analysis of data from these sources guided the development of a focus group interview protocol (see Appendix C) used to collect rich descriptive data from student volunteers. Mixed methods were used to describe the findings.

### **Research Questions**

The following research questions were explored in this study:

1. What are students' experiences in the advisement process of mathematics course selections at a suburban high school?
2. What are the factors affecting students' mathematics course selections?

3. What are students' needs and preferences in the mathematics course selection process?

### **Researcher Subjectivities and Positionality**

Many of my students see me as an insider when they learn I attended this high school more than 40 years ago. I was raised within this rural community, by a blue-collar family with two working parents. I was a first-generation college graduate with little advisement on careers or collegiate fields of study. My only exposure to college was a field trip with my high school geometry class. Alternatively, some students view me as an outsider because I have always loved school and mathematics. As an only child, school was the place where I regularly interacted with friends. My family could not afford summer programs or extracurricular activities. I was happy to be at school. My students could not relate to liking mathematics or enjoying school at all. Mathematics could be viewed as a basic tool needed for the current technology driven labor markets (Adamuti-Trache & Sweet, 2014) and the door to higher income careers for students (Fluhr et al., 2017). My students differ from my situation because they have many more course options in high school. In fact, I did not have any choices in high school math classes. My students could choose from over 20 math classes. Their world changes so quickly that they need to prepare for careers that may not be known at the time of their schooling. This circumstance drove my desire to understand how advisement for mathematics course selections could impact students' choice in mathematics courses aligned with their post-graduation goals. My positionality as an insider in this process gives me the opportunity to affect the futures of students that I encounter by encouraging them to move forward with an aligned plan for their future. Additionally, by sharing



these values and beliefs with my colleagues, school counselors, administrators, and parents, we have the opportunity to impact young people exponentially beyond the few involved in this study.

As a college educated professional with a financially stable adult life, I wanted to guide all high school students to safe and financially secure positions in their lives. In my experience, education, and career empowered me to live with my choices. As a high school teacher, I met many teens in difficult family situations both financially and emotionally. I encouraged them by telling them they were at an age and in a position where they could begin to take control of their situation. I attempted to position myself as an insider, sharing my experiences as a white, female, raised in a lower income family, in this community, that broke the glass ceiling as an engineer, and returned home to retire as a teacher at my high school alma mater. In my pragmatic worldview these students needed a plan to meet their post-graduation goals in their rapidly changing, high technology world. In an effort to stay abreast of current technology and educational issues, I pursued an Educational Doctorate Degree (Ed.D) in Curriculum and Instruction with an Educational Technology concentration.

Additionally, my pragmatic world view guided my belief that studying the social world in the same quantitative way as the natural world was incomplete. A person's reality was socially constructed and we should attempt to understand research from the point of view of the participants' lived experiences with respect for their time and situation. There is a single real world with individuals who have their own interpretation of the world. I enjoyed research via mixed methods appropriate to bring about positive change to my value system. In my view, pragmatism is common sense and practicality.

I recognized my personal beliefs and experiences were connected to any research I performed. Taking the time to define my paradigm helped me better understand my research interest and the appropriate research design. I was interested in exploring the advisement process of mathematics course selections and providing recommendations for improvement based on students' perceptions. I originally hypothesized all high school students should be on a path towards calculus. Although they may never reach calculus, they should always stay on the most challenging path where they could be successful. I believed consistently taking the most rigorous courses available also addressed several other observed problems of practice like: high school graduates being placed into remedial college mathematics courses, athletic scholars failing to meet academic requirements, minority underrepresentation in higher level mathematics courses, only 4% of seniors reaching the most rigorous mathematics course at this school, and others. The pragmatist in me knew part of the reason this was not automatically happening was that common sense was not common. Many students were not putting their education first. Some wanted to take the easiest path and then find themselves in peril when they were not prepared for their next step in life whether that was college or career. This research was complex and required mixed methods.

In pragmatism, the ontology, or study of reality, establishes that there is one reality with individuals having their own interpretation of that reality (O'gorman & Macintosh, 2015). In this research the single reality was that the state of South Carolina required every high school student to take four mathematics courses. This district further stipulated a mathematics course must be taken each year while enrolled in high school. While these were objective truths, each student interpreted their own reality to meet their

needs with individualized course selections. Students who requested the lowest level courses available took Foundations of Algebra, Intermediate Algebra, Geometry, and Algebra 2. While each of these courses earned a Carnegie unit, and fulfilled high school graduation requirements, these courses alone might not prepare a student for collegiate success. This study explored the factors that could enable students to make a more informed decision when defining their own reality and thus improve their preparedness for their next step in life.

The epistemology, or the way we obtain knowledge, determines how we know what we know. In pragmatism the relationship between the researcher and the participants is based on what the researcher feels is required to complete the study. In this research, knowledge was based on personal experience with higher education, employment as both an engineer and teacher, and feedback from former students about their high school course selections and post-graduate experiences. The knowledge of the participants was mostly independent of personal knowledge. The participants, my students, interacted with parents, peers, teachers, coaches, and counselors when selecting mathematics courses. Each had their own independent experiences relating to the research.

The methodology to obtain the desired knowledge and understanding in this research utilized mixed methods. Mertler (2017) pointed to the main goal of mixed methods as ensuring the researcher understands and can explain their research problem. Initially, survey findings explained students' experiences, affective factors, needs, and preferences in the mathematics course selection process. These findings guided the development of a focus group protocol to clarify those findings. As Sauro (2015)

described ethnography, I felt as though my role as a mathematics teacher for the last 19 years prepared me for action research. The research process continued to evolve as data was collected and needs were identified.

The axiology, or role of ethics and values, not only ensured the participants were respected, treated fairly, and not exploited but also exposed my ethics and values as a researcher, along with my student participants. As an educational team, we all value the best lives possible for these young people in our difficult world. There was no standard set of specific mathematics courses that was perfect for every student. For example, would it be fair to expect our special education population to take calculus? My words were chosen carefully as not to exclude or offend anyone. This research sought to identify and describe the students' needs in the mathematics course selection process. Students should not be placed in courses where the student would not be expected to be successful. However, just because a student was classified for special education does not mean they should automatically be placed in lower level courses. This thinking is needed to develop a culture of learning where students take ownership of their learning and are guided to reach their optimum potential.

Finally, Given's (2017) article discussing paradigm wars heightened my awareness that researchers and participants are passionate about their experiences and beliefs. Some participants and stakeholders could be easily offended. In particular, focus groups would need to be facilitated with these sensitivities in mind while acknowledging all participants. It was critical to move forward in this process respecting all involved and recognizing that our biases, values, and experiences all affect the process.

## Definition of Terms

**Advisement** is defined as the decision-making process of students, parents, teachers, counselors, and administrators as they guide each other in selecting high school mathematics courses for students.

**Advisement Process** is defined as the steps and interrelationships needed for each participant to make informed decisions about mathematics course selections that optimize each student's future endeavors.

**Double block** describes course scheduling where students use two of their available course periods in the same year. Double block implies one period each semester would be used taking up a single period all year to complete two courses during that single year-long period.

**Math Course Selection Survey (MCSS)** is the survey instrument developed to collect data in this action research study focused on the stated research questions.

**Participants** include my students who have the permission of their parents and chose to participate in this study.

**Recovery programs** refers to an educational intervention used to assist students when they struggle or fail a course.

**Remedial mathematics courses** refer to developmental courses that typically do not earn a major credit but help students prepare for required courses in their major.

**Self-efficacy** is a person's belief they will obtain their goals.

**Stakeholders** include students, parents, teachers, counselors, and administrators.

**Students' needs** are factors students identify as necessary to support them in achieving their goals. This study focuses on students' needs specific to the mathematics course selection process.

**Students' preferences** are factors students identify as having a greater liking over other alternatives.

## CHAPTER 2

### LITERATURE REVIEW

#### Introduction

The purpose of this action research study was to identify and to describe the needs of the students in the advisement process of mathematics course selections at a suburban high school in order to make recommendations for effective advisement of mathematics course selections. The following research questions were explored in this action research study.

1. What are students' experiences in the advisement process of mathematics course selections at a suburban high school?
2. What are the factors affecting students' mathematics course selections?
3. What are students' needs and preferences in the mathematics course selection process?

Based on the research questions, five variables were used to guide the literature search: (1) the role of advisement in mathematics course selections, (2) attitudes towards mathematics, (3) alignment of mathematics course-taking with post-graduation goals, (4) roles, interrelationships, needs, and preferences of stakeholders in the mathematics course selection process, and (5) the impact of technology and online tools on advisement.

Electronic academic databases, such as *Education Source*, *ERIC*, *ProQuest*, and *Google Scholar* were queried to seek out related publications from peer-reviewed academic journals and texts. Initial searches such as “secondary math course selections” were

unsuccessful. Combinations of the following keywords were more revealing: math attitude, secondary math, secondary course selections, course alignment, online advisement, advisement math, math counseling, motivational theory, math self-regulation, math self-efficacy, math achievement, remedial math, academic advising, graduation, college and career readiness, math action research, and math course-taking. Ancestral searches were also performed based on the reference lists of articles closely related to these research variables in order to locate related materials connected to this research.

With a wealth of articles, the focus narrowed to articles published within the past five years. The process of outlining the literature review initially revealed weaknesses in the annotated bibliography such as the details of supporting theories to solidify the framework for this study. I continued the cycle of investigation, revision, and reflection to strengthen this study. I searched further specifically on motivational theories, self-regulation, and self-efficacy as they connect to math attitudes influencing course selections.

This literature review is organized according to the variables addressing the research questions in this action research study: the role of advisement in mathematics course selections, factors affecting mathematics course selections, and the roles, interrelationships, needs, and preferences of students in the mathematics course selection process. In this chapter, the first section addresses the role of advisement in mathematics course selections. The second section investigates factors such as attitudes towards mathematics and post-graduation goals as they affect students' course selections. Section three addresses the roles, interrelationships, needs, and preferences of students in the



mathematics course selection process. The next section addresses the impact of technology and online tools on advisement. The intersection of these variables reveals the current literature related to this study.

### **The Role of Advisement in Mathematics Course Selections**

This section defines advisement and describes the characteristics of good advisement for course selections as stated in published research found in peer-reviewed academic journals and texts.

#### **Define Advisement**

Academic advising requires a collaborative relationship including stakeholders such as students, parents, mentors, advisors, and counselors, focused on an educational process designed to achieve desired learning outcomes, ensure student success, and outline the sequence for meeting the students' personal, academic, and career goals including course selections (Noaman & Ahmed, 2015; Ross, 2014; Steele, 2018). Jayne Drake, past president of the National Academic Advising Association (NACADA) defined academic advisement as “the very human art of building relationships with students and helping them connect their personal strengths and interests with their academic and life goals” (Drake, 2011, p.8). Studies and experts show a direct link between advisement (Drake, 2011; Noaman & Ahmed, 2015; Steele, 2018) and course selections (Ling & Radunzel, 2017; Parsad & Lewis, 2003) aligned with post-graduation goals (Ross, 2014).

#### **Characteristics of Good Advisement**

Both NACADA and the Council for the Advancement of Standards (CAS) promoted a three pronged approach to good academic advising: (1) incorporating an

advising curriculum, (2) learning outcomes aligned with goals, and (3) critical thinking pedagogy, guided by either the Wilcox model or the Steele model, to take aim at two important issues in the field of advising today: technology and data analytics (Steele, 2018). The Wilcox model describes an advising curriculum that consists of service-oriented pushing of information out to students for them to prepare in advance of their traditional meeting where advisors pulled unique, open-ended information from students. Similarly, Steel's (2018) model incorporated service, engagement, and learning; but emphasis was placed on student accountability measured by assessment with the primary advisement occurring with a counselor. Based in Bloom's Taxonomy, these models moved learning through advisement from simple to complex by not only providing accurate information for students to remember but also exploring how students could create their own unique academic plan to address their post-graduate goals (Steele, 2018). Both models also contended that good advisement could be advanced through the use of technology as expected by modern students (Steele, 2018). Although these models were intended for collegiate advisement, it is feasible that high schools could use concepts from the Wilcox model, often described as flipped advisement, where content modules for advising would be available asynchronously to address student planning for post-graduation plans and alignment with mathematics curriculum including self-assessment, educational planning, career planning, and decision-making (Gordon, 1992; Steele, 2018).

Research shows that early timing and consistency are also key characteristics of good advisement for course selections aligned with post-graduation goals (Alexander & Cox, 1982; Larkin & Jorgensen, 2016; Noaman & Ahmed, 2015; Radunzel, 2014;

Reynolds & Conaway, 2003). The early timing of advisement is supported by studies showing that mathematics feelings and attitudes develop in primary school when there are no options for mathematics course selections but later affect mathematics course selections in high school (Larkin & Jorgensen, 2016). Consistent relationship building with students, teachers, and advisors throughout their educational experience empowers students to stay focused on their goals and builds student knowledge about the course selection process. Regrets of high school students' course-taking are well documented. Radunzel's (2014) research includes 6,820 high school seniors who voluntarily participated in surveys when taking the American College Testing (ACT) and found that earlier planning was often needed to ensure that students were prepared for college. Additional studies specifically found that one reason female students were not properly prepared for college entrance was that they didn't start taking advanced mathematics courses early enough (Adamuti-Trache & Sweet, 2014; Reynolds & Conaway, 2003). Other studies contended that early advisement may not always be the cause of misalignment since the overwhelming majority of students that make A(s) and B(s) in college preparatory high school programs were still unprepared for either college or career (*The opportunity myth*, 2018).

Additional factors identified for good advisement with the greatest influence on high school course selections included peer's educational plans, parental encouragement (Froiland & Davison, 2016), and the desire to go to college (Alexander & Cox, 1982). Drake (2011) contended that a solid advisement program was key to bringing these multi-faceted characteristics together to help students focus on meeting their end goals. This

action research study considered each of these factors in the data collection and measurement instruments.

### **Factors Affecting Mathematics Course Selections**

This section describes mathematics attitude and various motivational theories highlighted in published research peer-reviewed academic journals linking mathematics attitude with achievement and course-taking. These studies found many factors affecting mathematics course selections.

#### **Mathematics Attitude**

Historically, studies show that mathematics attitude began to decline at varied degrees for many students prior to and throughout their high school years (Oyedeji, 2017) as they began to put forth less effort, displayed lower persistence in problem solving, and lost mathematics confidence (Beesley, Clark, Dempsey, & Tweed, 2018; Herges et al., 2017). This section highlights specific studies that cite motivational theories such as attribution theory, control-value theory, and expectancy-value theory, self-regulation, and self-efficacy as key concepts in understanding mathematics attitude and its impact on mathematics course selections.

Mixed methods action research studies evaluating interventions to combat negative mathematics attitude and resulting motivational decline found that strategies such as feedback practices (Beesley et al., 2018), instructional practices (Ruff & Boes, 2014), service learning integration (Henrich et al., 2016), home/school environments, peer groups, and taking appropriately challenging courses tended to improve mathematics motivation and student confidence (Herges et al., 2017; Oyedeji, 2017). Beesley, Clark, Dempsey, and Tweed's (2018) study used descriptive statistics from quasi-experimental

methods to compare student work samples, focus groups, and pre- and post-test content knowledge of students with teachers receiving specific professional development for feedback methods, versus students of teachers without said professional development, to measure its impact on student engagement and persistence in middle school mathematics. Students' engagement in complex problem solving improved with feedback (Beesley et al., 2018). Similarly, this study used descriptive statistics from survey items and inductive analysis of focus group interviews to investigate mathematics attitude as a factor of selecting mathematics courses. Students confirmed their declining math attitude from elementary to middle and high school. Additionally, participants voiced their desired engagement in courses as well as with teachers and counselors who promptly respond with feedback.

### **Motivational Theory**

**Attribution theory.** Mathematics achievement resulting from motivational theories of effort involves a complex linkage of variables that impact a student's course-taking and future opportunities. In terms of attribution theory, many students perceived mathematical aptitude as a result of natural ability more than effort (Weiner, 2010). However, in the article "Productive and Ineffective Efforts: How Student Effort in High School Mathematics Relates to College Calculus Success", researchers found that effort varied, in terms of whether it was productive or ineffective, in connection to mathematics achievement, and impacted student motivation to take advanced high school mathematics courses (Barnett et al., 2014). This quantitative study of survey results from 10,437 U.S. college calculus students questioned their high school mathematics habits and revealed that telling a student to study or work harder was only effective if students exhibited the

type of effort that lead to understanding, like working problems versus reading texts or notes as a way of studying which was negatively correlated to mathematics achievement (Barnett et al., 2014). In this scenario, the type of effort exerted was often more effective than the type of course selected in high school mathematics. The detailed consideration of study habits was a limitation in the measurement portion of this study which sought to identify and describe the needs of students in advisement of mathematics course selections at a suburban high school in order to make recommendations for effective advisement of mathematics course selections. Knowledge of this key contributor to student goal attainment was anticipated as a factor that affects students' mathematics course selections.

**Control-value theory.** Pekrun's control-value theory of achievement emotions noted two criteria thought to be especially important to students' emotions and motivations in mathematics education: perceived control (expecting that effort improved mathematics performance) and perceived value (importance of high performance in mathematics) (Schukajlow, Rakoczy, & Pekrun, 2017; Stembom, Hrastinski, & Cleveland-Innes, 2016). Stembom and Cleveland-Innes (2016) used data from a Community of Inquiry survey and associated transcript coding to measure emotional presence in online mathematics coaching and concluded that a student's perceived control and value affected motivation to selecting more advanced courses if they felt they were part of that community or course of study. Other studies showed students considered selecting courses based on the courses their peers were selecting (Froiland & Davison, 2016). This decision may not have any relationship to students' post-graduation goals but offered students a more comfortable environment. A comfortable learning

environment was an important consideration in this study to address when exploring the factors affecting students' mathematics course selections.

**Expectancy-value theory.** The expectancy-value theory linked a complex web of student behaviors and contended that students exhibited the behavior they believed would yield the highest value based on their expected level of success (Froiland & Davison, 2016; Hyde et al., 2016; Schukajlow et al., 2017). This cognitive theory explained both mathematics achievement as well as emotions including mathematics anxiety which may impact a student's mathematics course selections. Froiland and Davison's (2016) study, *The Longitudinal Influences of Peers, Parents, Motivation, and Mathematics Course-taking on High School Math Achievement* specifically analyzed the longitudinal data of 18,623 U.S. students from the NCES to evaluate the intersections of parent expectations, mathematics motivation, and mathematics course-taking in high school as they impacted mathematics achievement. The researchers found parent expectation, student expectation, and peer influences all significant to mathematics intrinsic motivation for mathematics course-taking and achievement (Froiland & Davison, 2016). The large-scale study directed this action research study by identifying parent expectation, student expectation, and peer influence as variables to consider in exploring advisement for mathematics course selections while also acknowledging the influence of mathematics anxiety on the process.

**Self-determination theory.** Similar to intrinsic motivation in expectancy-value theory, self-determination theory identified intrinsic motivation as the highest form of motivation (Froiland & Davison, 2016). Although expectancy-value theory used cognitive processes to describe interaction, achievement, choice, and emotional

processes, like anxiety, self-determination theory focused on emotional experiences resulting from needs fulfillment to understand both intrinsic and extrinsic motivation (Nenthien & Loima, 2016; Schukajlow et al., 2017). Self-determination theory proposes that satisfaction of psychological needs like competence, autonomy, and relatedness are important to life satisfaction (Deci & Ryan, 2008). As previously noted, the Froiland and Davison (2016) study specifically explained how parent expectations for students' post-graduation plans, students' expectations, and peer interests affect mathematics motivation for students taking advanced high school mathematics courses to promote mathematics achievement (Froiland & Davison, 2016). These variables were considered as factors affecting students' mathematics course selections.

### **Self-Regulation**

Self-regulation describes a person's strategies for achieving their goals including students' strategies for proactive goal setting in preparation for learning, self-monitoring during learning, and self-reflection after the lesson. In a study of early middle school students, Cleary and Chen (2009) used linear regression analysis on data from a New York middle school with 2100 students, and interview data from their school administrators and department heads, to show that student motivation and self-regulation varied across grade levels and mathematics course type relative to mathematics achievement. In the quantitative study, 880 sixth and seventh graders completed a modified Self-Regulation Strategy Inventory-Self-Report where researchers then concluded that seventh graders in advanced mathematics classes exhibited more sophisticated self-regulatory strategies in an effort to obtain their goals (Cleary & Chen, 2009). A noted limitation of the Cleary and Chen (2009) study is the lack of



consideration of student's self-efficacy or environmental perceptions. Self-regulation was crucial to this action research study as high school students are allowed to self-select all of their high school courses but may not have enough knowledge or skill to make informed decisions regarding course selections.

### **Self-Efficacy**

While self-regulation primarily consists of strategies for achieving goals, self-efficacy is a person's belief that they will obtain their goals. As previously discussed, in a study of middle school mathematics assessment practices, Beesley et al. (2018) found teacher feedback directly correlated to improved student mathematics self-efficacy and further linked to mathematics perseverance in problem-solving in preparation for advanced courses leading to their post-graduation goals. Throughout elementary school (Xu & Jang, 2017), middle school (Beesley et al., 2018), high school (Yüksel, Geban, & Anatolian, 2016), and college (Locklear, 2012), studies showed that belief in their mathematics ability more directly correlated to students' perseverance than their ability (Morris, 2016). The Morris (2016) and Xu and Jang (2017) studies were both large scale quantitative analysis studies; one in the U.S. and one in Canada, linking self-efficacy to advanced mathematics course-taking. The Yüksel and Anatolian's (2016) study was a smaller scale Turkish study with similar results including 210 high school students completing a self-efficacy questionnaire. Additional studies also noted self-efficacy concerns regarding students' goal setting (Steele, 2018). These variables were all important to consider as potential factors affecting students' mathematics course selections for this action research study.

## **Alignment with Post-graduation Goals**

This section defines alignment, reveals the impact on students of aligning mathematics course-taking with post-graduation goals like college and career readiness, points out diversity issues, SES, and introduces the role of rigor in alignment as described by current literature. Alignment is defined as a position or state of agreement or support (“alignment,” 2018). This study investigated students’ consideration of aligning mathematics course-taking with their post-graduation goals as a factor affecting course selections whether that be for college or career as a factor in their decision. The economic impact of misalignment was staggering. In the U.S., many employers cited inadequate mathematics skills in the available workforce while millions of college students spent time and money taking remedial mathematics courses on material they should have learned in high school (Burdman, 2015; Chowdhury, 2016; Dudley, 2010; Ling & Radunzel, 2017; Parsad & Lewis, 2003).

**College readiness.** Collegiate remedial mathematics course enrollment is a persistent problem that is not improving or even stabilizing. Instead, collegiate remediation has grown rapidly in recent years with many college freshman required to take at least one remedial course (Attewell et al., 2006; Burdman, 2015; Dudley, 2010; Ling & Radunzel, 2017). Would this knowledge affect students’ mathematics course selections in high school? Statistics also showed that students required to take multiple remedial courses were less likely to ever complete their college degree compared to students who entered college academically prepared for collegiate coursework and that mathematics was the most common subject area requiring remediation (Attewell et al., 2006; Dudley, 2010). A positive relationship was found between high school

mathematics and college mathematics course-taking from a sample of 32 colleges to inform advisement on mathematics course-taking (Harwell et al., 2013). Similarly, Ling and Radunzel’s ACT report stated that “Taking higher-level mathematics courses in high school was associated with increased chances of meeting the Benchmarks in every subject area...” (Ling & Radunzel, 2017, p.3). This study sought to identify the factors affecting students’ mathematics course selections including predictors for college readiness.

Internationally, the PISA under the guides of the OECD and the TIMSS conducted benchmark tests for 15 year old students, representing various countries in mathematics, science, and reading, where the U.S. had consistently performed in the bottom half of countries (Chowdhury, 2016; McFarland et al., 2018). Studies proposed that while course-taking was a key contributor to mathematics achievement, there was a complex web of other significant issues such as instructional strategies like inquiry-based learning (Chowdhury, 2016; Dudley, 2010). This study sought to identify factors such as these affecting students’ mathematics course selections in high school.

**Career readiness.** In *The Condition of Education 2018*, the U.S. Department of Education reported that 17% of U.S. citizens in the 20-24 year old’s range were neither working nor enrolled in an educational program (McFarland et al., 2018). Ross’ (2014) action research study noted the need for high school graduation standards to align with careers describing some students as “graduated into a world of no opportunity or dropped out of school before they received this dead-end diploma” (p.2). These studies documented that many high school graduates were not ready for careers. This study

determined students' needs and preferences in the mathematics course selection process to address this concern.

**Diversity issues.** Studies showed that course selection patterns from both females and ethnic minorities underrepresented high school mathematics and science course selections and those students were often unaware of the expectations for college or career entrance (Adamuti-Trache & Sweet, 2014; Dudley, 2010). This inadequate high school preparation, low socioeconomic status, ethnicity, and first generation college students, have been directly linked to concerns about graduation and post-graduation goals (Attewell et al., 2006). Kotok's (2017) study found African American and Latino students particularly experienced a widening mathematics achievement gap throughout high school with a tendency to avoid advanced courses often thought of as white courses where minorities may feel alienated. This study acknowledges such diversity issues as potential factors affecting students' mathematics course selections but did not explore these variables individually.

**Gender.** Some studies found the female population still are underrepresented in typical male dominated fields even though the gender gap was almost non-existent in advanced high school mathematics courses (Fluhr et al., 2017; Haciomeroglu & Chicken, 2012; Reynolds & Conaway, 2003). Additionally, Fluhr's (2017) study of the gender relationship to non-traditional career and technical course-taking supported preference theory's contention that even in the 21<sup>st</sup> century high school, males tended to plan for careers while females still thought more of a work-family balance, therefore leading to a gender-to-course selection imbalance by a choice that was related to social role theory. The results studied by Fluhr et al. (2017) suggest the theory of circumscription and

compromise (Gottfredson, 1981) and social role theory (Eagly, 1997) revealed how young males and females expanded their occupational roles due to active shifts in social roles and thus their course selections (Fluhr et al., 2017).

**Socioeconomic status.** Studies reported that low socioeconomic status reduced students likelihood of graduating from high school and attending college (Attewell et al., 2006). Compensation theory, illustrated how schools could make up for possible disadvantages faced by low socioeconomic students when it came to opportunities for cognitive and educational development (Dudley, 2010; D. Kim & Downey, 2016). Morris' (2016) study found that while extracurricular activities were related to academic achievement and college attendance for all students, it did not show varied improvement for low socioeconomic students. Contrary to common belief, Attewell, Lavin, Domina, and Levey's (2006) study found that SES alone was not a significant factor in remedial course-taking.

**Rigor.** Many studies noted the positive relationship of rigorous high school course-taking as it related to post-secondary success (Barnett et al., 2014; Beesley et al., 2018; Gibson, 2013; Grant, Crombie, Enderson, & Cobb, 2016; Ling & Radunzel, 2017; Radunzel, 2014). ACT research indicated that students taking rigorous high school mathematics courses like calculus are 4.5 to 5 times more likely to meet benchmarks in mathematics, indicating college readiness, than their non-calculus taking peers (Gibson, 2013; Ling & Radunzel, 2017). Additionally, Barnett's (2014) study found that the effectiveness and achievement in the most rigorous high school mathematics courses were equally as important as the course itself. Noting that rigorous courses were required to align with post-graduation goals, Beesley's (2018) study linked mathematics self-

efficacy to motivation for students to take mathematics courses aligned with their post-graduation goals. This study explored students' experiences in the advisement process of rigorous mathematics course selections: college preparatory, honors, advanced placement, and dual credit.

### **Roles, Interrelationships, Needs, and Preferences of Stakeholders**

This section identifies the roles, interrelationships, and needs of stakeholders in the mathematics course selection process as published in peer-reviewed literature. Ecological systems theory explains the complex interrelationships of stakeholders in complex processes like mathematics course selections in high school. A significant characteristic of ecological theory is that it focuses on the intersection of multiple factors in child development like family, peers, school, and society (Kotok, 2017). Kotok's (2017) study of the achievement gap in mathematics for high achieving high school minorities paralleled the factors affecting students in this study and specifically found course-taking as a key factor in mathematics achievement. This action research study focused on the students' needs and preferences in the mathematics course selection process.

### **Students**

The Alexander and Cox (1982) landmark study of course tracking pointed out that students' high school course-taking was primarily based on their prior performance in early grades and not on their future intentions. Students primarily played a responding role in their course-taking. For example, if they performed well in Algebra 2, they moved on to Precalculus. If they did not do well in Algebra 2, they took Probability and Statistics. With this type of retrospective thinking, students could have graduated from

high school unprepared to pursue fields of study that required calculus. More recent studies also found prior course-taking as a key influencer to mathematics course-taking along with a focus on student expectations grounded in self-determination theory (Froiland & Davison, 2016). Studies also found that middle school students had a strong desire to please people in authority like teachers and parents and may select courses based on what they think others wanted (Herges et al., 2017; Hyde et al., 2016). While it was logical for students to base their course-taking decisions partially on their past performance and advice from teachers and parents, this study asked students for their perspective on the factors, needs, and preferences in their mathematics course selections. Froiland and Davison's (2016) study of longitudinal data concluded that student expectations were heavily influenced by peer intentions which affected mathematics intrinsic motivation in ninth grade. Student attitude toward course-taking incorporated family and peer influences, as well as school and community relationships (Kotok, 2017). These complex interrelationships were investigated in this study.

### **Teachers**

Studies noted the role of teachers in achievement and as counselors regarding students' future plans and course selections (Alexander & Cox, 1982; Herges et al., 2017). Teachers' relationships with students and families allow them to introduce the value of a pre-focused career pathway based on students' post-high school goals (Ross, 2014). This study further defined the students' perspective of the role of teachers in the mathematics course selection process.

## **Parents**

Many studies confirmed the role of parental encouragement in course-taking (Alexander & Cox, 1982; Chowdhury, 2016; Froiland & Davison, 2016; Herges et al., 2017; Hyde et al., 2016). Froiland and Davison's (2016) study specifically examined how parent expectations affected mathematics course-taking under the guides of expectancy value and self-determination theory noting that parent expectations were a stronger predictor than student expectations of intrinsic motivation for mathematics course-taking. Parental lack of school knowledge was identified as a concern for the parental role in course selections (Valadez, 2002). Likewise, parents' education and personal connection with their adolescent was found to affect students' high school math course-taking (Hyde et al., 2016). This study explored the students' perspective of the role of parents in high school mathematics course selections.

## **Counselors**

Studies found the frequency of contact was a key factor for school counselors to develop a relationship with students for proper identification of academic and personal needs (Alexander & Cox, 1982; Ruff & Boes, 2014). Radunzel's (2014) study also took issue with counselors aligning with high school graduation requirements instead of post-graduation plans. This study investigated the students' perspective of the role of high school counselors in the mathematics course selection process.

## **Administrators**

Lochmiller's (2016) study of administrator instructional feedback to mathematics teachers paralleled this study's exploration of students' needs and preferences in mathematics course selections which sometimes involved their administrators. Similar to



Lochmiller's (2016) qualitative research design, focus group interviews to understand the students' needs and preferences regarding the role of administrators in the mathematics course selection process were conducted in this study. Additionally, suggestions on feedback were applied to advisement including intervals of communication and the need for administrators to show support and confidence in the process (Lochmiller, 2016).

### **Peers**

Studies showed the educational plans of peers highly influenced student course selections (Alexander & Cox, 1982; Beesley et al., 2018; Froiland & Davison, 2016). Pairing with peers that wanted to go to college helped students develop a culture of learning and lead to the school's college bound culture (Ling & Radunzel, 2017; Radunzel, 2014). Peer relationships represented the intersection of school, community, and social identity (Kotok, 2017). This action research study explored the students' preferences regarding each stakeholder in order to understand the interrelationships and needs of students.

### **Impact of Technology/Online Tools on Advisement**

This section highlights peer-reviewed literature regarding the impact of technology on education, advisement, and mathematics as well as outlining concerns with the use of technology. Many studies confirmed that the rapid growth and success of educational technology contributed to student expectations of regular technology use in education with various benefits including personal and career enrichment, convenience, geography, and learning environment (Guidry, 2013; Guo, Zhang, & Guo, 2016; D. Kim & Downey, 2016; McKnight et al., 2016; Thurmond, 2011). Several action research studies used the Heinich, Molenda, Russell, and Smaldino (1999) ASSURE (Analyze

learners; State standards; Select strategies, technology, media, and materials; Utilize technology, media, and materials; Require learner participation; and Evaluate and revise) instructional design model to introduce the use of technology in k-12 classrooms showing improved achievement (Karakis, Karamete, & Okeu, 2016; D. Kim & Downey, 2016). These studies guided research for this study by highlighting the sensitivities to online advisement that may be offered while exploring students' needs and preferences.

### **Advisement**

Research contended that good advisement can be advanced through the use of technology as expected by today's students (Noaman & Ahmed, 2015; Steele, 2018). Noaman and Ahmed's (2015) research specifically addressed university online academic advising and realized a 30% increase in freshmen participation for advisement after implementing the online tool and acknowledged that the global community for academic advising, NACADA, identified the need for advisors to implement technology into their practice. Both NACADA and CAS defined advising as a purposeful teaching and learning activity helping students develop their academic and career goals (Steele, 2018). Another study emphasized a relationship of inquiry framework in a one-to-one online mathematics coaching setting finding that emotional presence was a key feature of successful online relationships (Stenbom et al., 2016). Coaching parallels advisement in relationship status and was helpful in planning this research.

Theories associated with the use of technology in distance education apply to using an online tool for advisement whether distance be defined as in the next room, the next state, or the next country. The Technology Acceptance Model (TAM) focusses on the technology's perceived usefulness and ease of use to develop users' attitudes towards

adopting the new tool (Angolia & Pagliari, 2016). These studies guided this action research exploring students' needs and preferences in mathematics course selections in high school.

### **Mathematics**

Karakis, Karamete, and Okeu's (2016) study used both ASSURE instructional design and Attention-Relevance-Confidence-Satisfaction (ARCS) motivational model to assess students' mathematics attitude in a computer assisted environment which provided a constructivist learning environment that could boost student interest and motivation. In the Stenbom et al. (2016) study of online mathematics coaching, researchers used data from a Community of Inquiry survey and associated transcript coding to measure emotional presence in online mathematics coaching and concluded that a student's perceived control and value affects motivation to selecting more advanced courses if they feel they are part of that community or course of study. This links to other studies that show that students consider selecting courses based on the course selections of their peers. This may not have any relationship to their post-graduation goals which informed the development of the focus group protocol in this study. An additional study specifically investigated the use of screencast videos in mathematics learning and found that students favored the use of screencast videos (Tunku, Tunku, Doheny, Faherty, & Harding, 2013). This knowledge also informed the exploration of students' needs and preferences in the mathematics course selection process.

### **Concerns**

Using the self-determination theory model to explore students' perceived motivations in online environments, studies found that online experiences involve

autonomy, competence and relatedness but limit personal interactions, such as body language, in communication (Angolia & Pagliari, 2016; Barreto, Vasconcelos, & Orey, 2017). These findings heightened the awareness that students need to be able to express their feelings throughout the course selection process. Other factors considered were student technology sophistication, infrastructure, and self-motivation to engage with new technology (Angolia & Pagliari, 2016; Barreto et al., 2017).

### **Conclusion**

This literature review organized peer-reviewed journal articles and texts that addressed the five variables: the role of advisement in mathematics course selections, the influence of mathematics attitude on course selections, the alignment of mathematics course-taking with post-graduation goals, the roles, interrelationships, needs, and preferences of stakeholders in the mathematics course selection process, and the impact of online tools on the advisement process. Section one addressed the role of advisement in mathematics course selections. The second section investigated factors such as attitudes towards mathematics and post-graduation goals as they influence students' course selections. Section three addressed the roles, interrelationships, needs, and preferences of students in the mathematics course selection process. The intersection of these variables revealed the current literature related to this study.

The purpose of this action research extended the current literature by specifically identifying and describing the needs of students in the advisement process of mathematics course selections in high school in order to make recommendations for effective advisement of mathematics course selections. This study addressed the research questions, "What are students' experiences in the advisement process of mathematics

course selections in high school? What are the factors affecting students' mathematics course selections? What are students' needs and preferences in the mathematics course selection process?"

## CHAPTER 3

### METHOD

The purpose of this action research study was to identify and to describe the needs of students in the advisement process of mathematics course selections at a suburban high school in order to make recommendations for effective advisement of mathematics course selections. This study specifically addressed the following research questions:

1. What are students' experiences in the advisement process of mathematics course selections at a suburban high school?
2. What are the factors affecting students' mathematics course selections?
3. What are students' needs and preferences in the mathematics course selection process?

This chapter describes the research design, setting, participants, data collection, data analysis, procedures, timeline, rigor, trustworthiness, plan for sharing and communicating findings of the study.

#### **Research Design**

Research design links the purpose of the study with the most effective research methods and procedures (Morgan, 2014). Action research is particularly suited for situations where the researcher has an existing, participatory relationship with those studied and collaborates using scientifically rigorous methods to collect and analyze data used to improve a problematic situation (Greenwood & Levin, 2007; Mertler, 2017;

Rudestam & Newton, 2007). One benefit to action research is the flexibility for the researcher, as an insider, to fully investigate interrelated complex contexts as a participatory problem solver (Rudestam & Newton, 2007). This study involved interrelated stakeholders with complex intertwined roles and relationships making action research an appropriate research design.

Action research was relevant to all stakeholders interested in optimizing the mathematical development of students. Defining the problem of practice fleshed out the intricate and complex nature of the mathematics course selection process at a suburban high school. With students, parents, teachers, administrators, counselors, and other stakeholders all involved in the ever-changing educational planning process that extended vertically throughout a student's education and horizontally across multiple schools, this descriptive study focused on students' experiences, selection factors, needs, and preferences in the mathematics course selection process.

The complexity of the study lent well to participatory action research where the researcher could continuously monitor and adjust throughout the study in order to stay focused on the research questions, uncover confounding variables contributing to the problem, and implement the most beneficial research methods (Mertler, 2017; Morgan, 2014; Rudestam & Newton, 2007). Additionally, action research worked well in this evergreen situation where curriculum was continuously updated and post high-school requirements were in flux. As Greenwood and Levin (2007) stated, "there is no substitute for learning by doing" (p. 2).

Having identified mathematics course selections as a problem of practice, I was in a position to plan an action research project with students as collaborators, who provided

data on their experiences, decision factors, needs, and preferences in the mathematics course selection process at a suburban high school. By its very nature, practitioner-based research in the researcher's classroom is suited for action research (Mertler, 2017). As a lifelong learner, course-taking and collaboration with committees and peers moved me from biased opinion and feelings about the mathematics course selection process to research-based scientific methods of reviewing other studies and data to bring validity and reliability to this action research study founded in self-determination theory.

Like Creswell (2014) described, my pragmatic worldview drives my continuous desire to solve problems of practice. A review of literature offered insight into advisement studies, course selection factors, and processes. In an attempt to fully understand the problem, exploring the research questions in this study required a mixed methods design to collect both quantitative and qualitative data (Creswell, 2014). I was attracted to the systematic and efficient procedures of quantitative research for general knowledge regarding the research questions but desired full understanding of the context that came from qualitative, open-ended explanations by the participants. To adequately address the research questions, this study deployed a mixed methods research design.

Quantitative data specific to the research questions was gathered efficiently by survey and summarized via descriptive statistics. In this part of the design, well developed survey instruments grounded in self-determination theory were used to treat each participant objectively based on variables that were identified prior to data collection (Morgan, 2014; Rudestam & Newton, 2007). Measures of central tendency and spread were used to describe the quantitative data. Due to the small sample size and localized sampling, inference was not made to a larger population. However, variations



and interesting findings were noted for further investigation with qualitative methods (Mertler, 2017; Morgan, 2014).

Qualitative methods were particularly suited to this study in order to bring understanding to the quantitative findings and to explore unexpected results from the point of view of the participants (Mertler, 2017; Morgan, 2014; Rudestam & Newton, 2007). This study incorporated multiple data sources: surveys, discussion posts, and focus group interviews. Additionally, diverse participants included students at varied grades levels, ethnicities, sex, gender, and SES. The complexity of exploring their experiences, affective factors, needs, and preferences was qualitative by nature as many elements could not be anticipated or quantified. Descriptions in context were fundamentally qualitative (Morgan, 2014). A discovery oriented approach was used with consistent procedures to collect data and interpret the meaning as viewed by participants (Creswell, 2014; Rudestam & Newton, 2007).

Additionally, I was a key instrument in the data collection process and brought my biases to the dynamics. To counteract bias, scientifically-based qualitative methods were used to generate a more complete understanding where participants fully described and explained their experiences and perceptions bringing validity to the study. Details are provided in the data collection and analysis sections.

In summary, mixed methods required more than singular quantitative and qualitative methods. Data could not simply be looked at separately but required integration throughout the study (Morgan, 2014). The triangulation of multiple data sources and mixed methods research design brought both validity and credibility to the study (Mertler, 2017). The research was conducted in the natural school setting where

mathematics course selections take place. Explanatory sequential mixed methods research design was used where the quantitative cycle preceded and informed the qualitative cycle (Creswell & Plano Clark, 2018; Creswell, 2014). Data collection was thorough, analysis was rigorous, and results were shared to ensure ongoing process improvement.

### **Setting**

The physical setting for this research was a mathematics classroom at one of the largest high schools in South Carolina. This Title 1 public school was located in a suburban community. The campus included 126 teachers, each with their own classroom, and served approximately 1835 students in grades 10 through 12.

On-campus mathematics class sizes ranged from 10 to 33 students with a mean of 23 students. The 16 mathematics classrooms were each equipped with 30 student desks with chairs, a promethean board, a router for 30 student Wi-Fi access points, 30 graphing calculators, rulers, protractors, compasses, scissors, and other tools for student use. Each teacher was given \$275 annually to purchase consumable classroom supplies and the mathematics department shared an additional \$2000 annual budget for additional resources which could be located in the classrooms. For example, my classroom displayed basic machine physics sets, world maps with longitude and latitude demarcations, solar system models, globes, and wall thermometers in an attempt to help students connect mathematics to their real world. Other budgets were also available for additional technology, advanced placement supplies, and staffing.

This low SES high school provided each student with a setting that contained the resources needed for students to take ownership of their learning and to stimulate their

real-world interests. As described in chapter one, when considering their role in the real-world, students often expressed concern and confusion when selecting mathematics courses aligned with their post-graduation goals.

In this high school, students were provided with a school-issued laptop. Both students and parents were also given access to the online student learning management systems (Schoology and PowerSchool) which provided 24-hour access to grades, attendance, finances, assignments, and other information. Additionally, Kajeets were available to families that did not have home Wi-Fi access in an attempt to lessen the digital divide. For this study, I communicated with students and parents via email and Remind.com, a professional communication platform documenting text exchanges from mobile devices without disclosing private information, to aid relationship-building.

At the time of this study, the annual course recommendation process opened with a one-week window of time for each mathematics teacher to access the student management system and digitally recommend their students' next mathematics course(s). During the fall semester this opportunity occurred near the end of the semester when teachers knew their students relatively well in the classroom environment. However, in the spring semester, teachers may only have a couple of weeks with their students before making course recommendations. After teachers input their recommendations, students had a week to select their eight courses for the following school year and two alternate courses. In the next step, parents and/or students requested appointments for spring IGP meetings. Later in the spring semester, guidance counselors scheduled IGP meetings for every student and invited their parents. During IGP meetings, students, parents, and counselors finalized course selections for the next school year. In the event of parent and

student absence, the counselors input course requests according to their professional judgment. Students were given three registration days prior to the start of school to pick-up their schedules. The school district prohibited any course changes after the fifth day of class.

### **Participants**

The participants in this research included students within my realm of influence. I selected Algebra II courses for data collection to avoid working with any former students. I did not want any participant to feel a conflict of interest when providing their honest feedback regarding their mathematics course advisement or experiences at a suburban high school.

As with any action research, the researcher was as an active participant in this study (Mertler, 2017). While I acknowledged my potential bias towards high school mathematics course selections, as the mathematics department chair I was in a position to actively take steps to address issues brought forth by participants throughout the study. Additionally, as a graduate of this high school, I was positioned as an insider where I was also employed as a teacher of mathematics for 19 years at the time of data collection.

The campus student population of 1835 included high school freshmen 1.20%, sophomores 34.66%, juniors 32.86%, and seniors 31.28% (NCES, 2019). The student gender was approximately equally represented at 50.79% male and 49.21% female (NCES, 2019). School ethnicity was typical of the local community. The majority of the school population was Caucasian (63.32%), with minorities including Black (18.91%), Hispanic (10.41%), Two or more races (4.58%), Asian (2.62%), and other (less than one percent) (NCES, 2019). Students receiving free or reduced lunch (34.60%) were

considered as economically disadvantaged (NCES, 2019). The majority of students were native to their suburban community.

Pursuant to purposive sampling, in the fall of 2019 I invited my students to participate in a voluntary response survey and discussion board to share their perspectives of the mathematics course selection process. At the time of data collection, I taught three sections of Algebra 2 and one homeroom group. Participants of this study consisted of 61 volunteer students with their parents' permission in my courses. A survey completion rate of 88.41% represented sophomores (11.48%), juniors (55.74%), and seniors (32.79%). Gender, SES (32.79%), Black (19.67%) and Asian (1.64%) ethnicities representations were within one percent of the school population. However, white students were lower than the school population (55.74%) while Hispanic (16.39%) and multi-racial (6.56%) students were higher.

Subsequently, I invited student survey participant volunteers from three classes to participate in focus group interviews. Seven volunteers participated in two focus groups and six volunteers participated in a third focus group. Table 3.1 describes focus group participants including an assigned pseudonym, gender, ethnicity, age, grade, and SES. This stratified sample included female (45%), male (55%), white (55%), black (20%), Hispanic (25%), 2 or more races (5%), sophomores (15%), juniors (55%), and seniors (30%), and low SES (50%). I chose grade level as one strata to account for varied experience levels among the student population.

### **Data Collection Methods and Sources**

This section describes a variety of data collection methods and sources that were used to explore students' mathematics course advisement experiences, factors affecting

Table 3.1 *Focus Group Participants (n=20)*

<b>Pseudonym</b>	<b>Gender</b>	<b>Ethnicity</b>	<b>Age</b>	<b>Grade</b>	<b>SES</b>
Aben	Male	White	15	10	Not Low
Bret	Male	White	18	12	Not Low
Cam	Female	Hispanic	17	12	Not Low
Dan	Male	White	17	12	Low
Ed	Male	Black	17	11	Not Low
Fawn	Female	White	15	10	Not Low
Grey	Female	Hispanic	17	12	Low
Hope	Female	White	17	11	Not Low
Ivan	Male	White	19	12	Low
Jes	Female	Hispanic	18	12	Low
Kay	Female	Black	16	10	Low
Leo	Male	White	16	11	Not Low
Mat	Male	White	17	11	Low
Nel	Male	2 or more	16	11	Not Low
Opra	Female	Black	17	11	Low
Pat	Male	Hispanic	16	11	Low
Que	Male	White	16	11	Low
Rick	Male	Black	16	11	Not Low
Sis	Female	White	16	11	Not Low
Tia	Female	White	17	11	Low

their mathematics course selections, and their needs and preferences in the mathematics course selection process at a suburban high school. Surveys, discussion board posts, and focus group interviews were used to collect both quantitative and qualitative data aligned with the research questions. Table 3.2 shows the various data collection sources and instruments aligned to each research question: research question one (RQ1), research question two (RQ2), and research question three (RQ3).

### Surveys

After gaining consent (see Appendix D) and assent (see Appendix E), I used a Google Form to administer a voluntary student survey. Surveys provide a low-cost method of treating each participant objectively based on a wide range of variables that

Table 3.2 *Research Questions and Data Sources Alignment*

<b>Research Questions</b>	<b>Data Sources</b>
1. What are students' experiences in the advisement process of mathematics course selections at a suburban high school?	<ul style="list-style-type: none"> <li>• MCSS</li> <li>• Student Discussion Board</li> <li>• Focus Group Interviews</li> </ul>
2. What are the factors affecting students' mathematics course selections?	<ul style="list-style-type: none"> <li>• MCSS</li> <li>• Student Discussion Board</li> <li>• Focus Group Interviews</li> </ul>
3. What are students' needs and preferences in the mathematics course selection process?	<ul style="list-style-type: none"> <li>• MCSS</li> <li>• Student Discussion Board</li> <li>• Focus Group Interviews</li> </ul>

were explored prior to data collection (Morgan, 2014; Rudestam & Newton, 2007). A review of literature revealing focus areas relevant to each research question guided the adoption of a variety of valid and reliable survey items found in the PsycTests database and in other studies described in the following narrative. The aim of the Math Course Selection Survey, MCSS, (see Appendix A) developed for this study was to gather data that addressed the research questions. Sixty-one students completed the MCSS.

The MCSS consisted of 31 question prompts divided into four sections: students' experiences in the advisement process of math course selections, factors affecting students' math course selections, students' needs and preferences in the math course selection process, and participant demographics. The students' experiences section contained eight question prompts aligned with RQ1. The factors affecting students' course selections section aligned with RQ2 and the needs and preferences section aligned with RQ3 each contained nine question prompts. One prompt in each of these three sections allowed open-ended responses for participants to provide rich descriptive data.

Each question prompt established a scale for multiple items as outlined in detail in the following paragraphs. In total there were 122 individual items in the MCSS; approximately 40 items for each research question. There were five demographic questions.

Table 3.3 shows the alignment of survey questions with RQ1 which involved students' experiences with advisement and course-taking. For example, one MCSS prompt in this section was adapted from the U.S. Department of Education's NCES Education Longitudinal Study of 2002 (ELS: 2002) which specifically asked high school students for broader information about where they went for academic advice (Ingels, Pratt, Rogers, Siegel, & Stutts, 2005). A study of the relationship between family background and high school students' academic self-efficacy and career/success expectations also relied on data from ELS:2002 to address counselor knowledge (Kim, 2014). While the NCES described a rigorous process to ensure reliability, it did not report Cronbach's alpha values for subscales. In the MCSS, for this prompt participants identified advice sources from nine sources (siblings, coaches, friends, guidance counselors, other relatives, parents, publications or websites, teachers, or none of these).

The remaining prompts addressing RQ1 were adopted from the Sheldon, Garton, Orr and Smith (2015) Advisor Quality Survey (AQS). Noaman and Ahmed's (2015) study on a framework for e-academic advising highlighted the importance of advisor access, convenience, face-to-face contact, and online advising effects on the relationships with advisors. Other studies connected academic advising to student success (Drake, 2011; Ross, 2014; Sheldon, Garton, Orr, & Smith, 2015) and student success to higher



level mathematics course-taking (Froiland & Davison, 2016; Gottfried, Owens, Williams, Kim, & Musto, 2017).

Table 3.3 *Survey Questions Alignment with RQ1*

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**RQ1:** What are students' experiences in the advisement process of mathematics course selections at a suburban high school?

**MCSS Questions**

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1. Where have you gone for advice/information about math course selections at a suburban high school? Check all that apply.
  - Brothers or sisters
  - Friends
  - Other relatives
  - Publications or websites
  - None of the above
  - Coaches
  - Guidance counselors
  - Parents
  - Teachers
  
2. During the past year, how often have you met with your guidance counselor about your math courses? Mark only one oval.
  - Never
  - Twice
  - four or more times
  - Once
  - three times
  
3. Was the number of meetings indicated in the previous question sufficient for your math course advising needs? Mark only one oval.
  - Yes
  - No
  - Undecided
  
4. Which of the following is your primary method of communicating with your guidance counselor about math courses? Mark only one oval.
  - e-mail
  - telephone
  - face-to-face meeting
  - other: \_\_\_\_\_
  
5. Please read the following items related to mathematics advising and rate your guidance counselor's performance in each are. (see Appendix A for scale)

My counselor provides information about using online resources for math courses. (MathXL Aleks, and Khan Academy)

My counselor is available when I need assistance.

My counselor encourages me to assume an active role in planning my math coursework.

My counselor provides information regarding math study skills.

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My counselor suggests academic resources for math (Rebel Success Center, Power Hour Tutoring, etc...)

My counselor maintains an open line of communication.

My counselor responds to my requests about math courses in a timely fashion (e.g. e-mail, phone calls, calls me to their office, ...).

My counselor respects my math course decisions.

My counselor refers me to the appropriate office to obtain financial assistance (e.g. student fees, scholarships, dual credit, ...).

My counselor refers me to employment opportunities (e.g. part-time).

My counselor is on time for advising appointments with me.

My counselor provides sufficient time for advising appointments.

My counselor is knowledgeable and provides me with math course choices and options.

My counselor encourages mathematics academic success.

My counselor seems to understand my perspective on math courses.

My counselor provides information about math courses offered online.

My counselor provides information about math courses offered in summer school.

6. Please rate your agreement with each statement below:

(see Appendix A for scale)

Overall, my guidance counselor has been excellent.

I would recommend my guidance counselor to a friend.

7. Rank the following as 1=most helpful to 8=least helpful in advising your selection of your math courses each year. In this section use each number 1-8 only once.

Who's number 1? Who's number 8?

Mark only one oval per row.

Coaches

Parents

Friends

Teachers

Guidance Counselors

Siblings

Yourself

Other: \_\_\_\_\_

8. Please share any additional information about your guidance counselor or the advising process in a suburban high school. \_\_\_\_\_

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The Advisor Quality Survey (AQS) was the primary source of survey items relating to RQ1 with 15 items addressing advisor quality (Sheldon et al., 2015). The AQS established a scale to rate student satisfaction with collegiate academic advisors (Sheldon et al., 2015). Founded in self-determination theory, survey items addressed

advisor knowledge, availability, and autonomy supportiveness (Sheldon et al., 2015). Authors considered items from their established teacher quality survey referencing excellent validity and reliability data when developing the AQS scale (Sheldon et al., 2015). Using grounded theory, researchers conducted three studies and used confirmatory factor analysis to confirm construct validity (Sheldon et al., 2015). The 15 items addressing advisor quality were adopted in the MCSS along with other survey items used in the Sheldon et al. (2015) study. Additionally, I created two items in this scale for local interest. Historically, suburban high school students at this location complained they were not aware of opportunities to take online or summer school mathematics courses for first time credit. I added the items “My counselor provides information about math courses offered online for first time credit” and “My counselor provides information about math courses offered in summer school for first time credit”.

Similar to the AQS (Sheldon et al., 2015), the MCSS measured counselor quality by 17 items using a 5-point Likert-type scale (1=poor, 2=fair, 3=satisfactory, 4=good, 5=excellent) addressing counselor knowledge, availability, and supportiveness. Of those items, 15 were modified from the AQS (Sheldon et al., 2015) and two were added to address local concerns with awareness of online and summer school courses. Reliability of the 17 scale items addressing counselor knowledge, availability, and supportiveness with the MCSS were evaluated with JASP, a statistical analysis program, yielding standardized Cronbach’s alphas of .93 each, varying in the thousandths.

Two items used a 3-point scale (1=no agreement, 3=some agreement, 5=much agreement) to address overall satisfaction with counselor and counselor recommendation status. Reliability of these two scale items addressing counselor satisfaction and

recommendation with the MCSS were evaluated with JASP yielding standardized Cronbach's alpha of .89.

Other items provided categorical responses to describe students' experiences in the advisement process of math course selections at a suburban high school. One item counted the number of student-counselor visits (never, once, twice, three times, four or more times). In another item, participants indicated whether or not the number of counselor meetings was sufficient (no, yes, undecided). One item identified the primary method of communication with counselors regarding math courses (e-mail, face-to-face meeting, telephone, other). Finally, participants ranked coaches, friends, guidance counselors, yourself, parents, teachers, siblings, and other according to their helpfulness with math course selections (1=most helpful to 8=least helpful). The eighth prompt in this section was an open-ended question providing rich descriptive detail.

RQ2 addressed the factors affecting students' mathematics course selections. Multiple studies noted peers (Radunzel, 2014), parents (Herges et al., 2017; Hyde et al., 2016; Kim, 2014; Valadez, 2002), and motivation (Beesley et al., 2018; Cleary & Chen, 2009) as factors affecting students' course-taking and achievement (Froiland & Davison, 2016; Gottfried et al., 2017). Additionally, a study on the motivation and choice of degree paralleled the choice of high school mathematics courses and provided a Motivation in Course Choice (MICC) scale with descriptive statistics (Skatova, 2014). Survey items were adopted from both the Skatova and Ferguson (2014) and Froiland and Davison (2016) studies as described in detail below.

Eight prompts addressing RQ2 were adapted from the U.S. Department of Education's NCES High School Longitudinal Study of 2009 (HSL:09)(Ingels et al.,

2011). One study, Froiland and Davison (2016), used HSLs:09 findings to show peer interest in school, parent expectations, intrinsic motivation, and mathematics course-taking had the greatest influence on high school mathematics achievement. Founded in expectancy-value theory and self-determination theory, Froiland and Davison (2016) analyzed longitudinal data from HSLs:09 citing rigorous statistical controls. The HSLs:09 was a study of over 23,000 U.S. ninth graders, parents, mathematics and science teachers, administrators and counselors in 2009 with follow-up questioning in 2012 (Ingels et al., 2014). The HSLs:09 student survey consisted of a total of 170 items from seven distinct sections seeking data regarding varied factors affecting students particularly in mathematics and science curricula (Ingels, et al., 2014). A committee including representatives from NCES, Institute of Education Sciences, and the U.S. Department of Education determined HSLs:09 to have Cronbach's alpha for student scales on mathematics identity (.88), mathematics usefulness (.82), mathematics efficacy (.89), mathematics interest (.69), and mathematics effort (.74) (Ingels et al., 2014).

While Skatova and Ferguson's (2014) MICC addressed many of the same items as HSLs:09, MICC additionally addressed students' who chose the easiest course, which was termed "loafing". Validity of the MICC scales were evaluated with the Aspirations Index and the Big Five (Skatova & Ferguson, 2014). Kasser and Ryan's (1996) Aspirations Index aids in assessing intrinsic and extrinsic personal goals while the Big Five is known to explore personality traits. Reliability was assessed with Cronbach's alpha calculations in two studies (Skatova, 2014). I adapted three items from Skatova's (2014) 18 item MICC survey. Mean Cronbach's alphas for the loafing items used in the MCSS were 0.72 and 0.71 in the two studies (Skatova, 2014).

Table 3.4 shows the nine prompts from HSLS:09 with three loading items from the MICC that address the factors affecting student’s mathematics course selections as they were provided in the MCSS.

Table 3.4 *Survey Questions Alignment with RQ2*

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<b>RQ2: What are the factors affecting students' mathematics course selections?</b>
<b>MCSS Questions</b>

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1. Since the beginning of the last school year, which of the following activities have you participated in? (Check all that apply)
  - Math Club/Team
  - Math Competition
  - Math Camp
  - Math study groups or a program where you were tutored in math
  - I have not participated in any math related activities beyond my scheduled math class.
2. How much do you agree or disagree with the following statements?  
Mark only one oval per row. (see Appendix A for scale)
  - You see yourself as a math person.
  - Others see you as a math person.
3. Why are you taking this math course? (Check all that apply.)
  - I really enjoy math
  - I like to be challenged
  - I had no choice, it is a school requirement
  - The school counselor suggested I take it
  - My parent(s) encouraged me to take it
  - My teacher recommended me take it
  - My friends are taking this course
  - There were no other math courses offered
  - I will need it to get into college
  - I will need it for my career
  - It was assigned to me
  - It seemed to be easy to pass
  - I knew that I’d manage to pass the course without doing too much work
  - It was the easiest option for me
  - Some other reason
  - I don’t know why I am taking this course
4. How much do you agree or disagree with the following statements about your expectations for this math course? (see Appendix A for scale)
  - I will enjoy this course very much

- 
- I think this class will be a waste of my time
  - I think this class will be boring
5. How much do you agree or disagree with the following statements about the usefulness of your math course? (see Appendix A for scale)
- What I learn in this course...
    - is useful in everyday life.
    - will be useful for college.
    - will be useful for a future career.
6. As far as you know, are the following statements true or false for your closest friend?
- My closest friend...
- gets good grades
  - is interested in school.
  - attends classes regularly.
  - plans to go to college.
7. How much do you agree or disagree with each of the following statements? Mark only one oval per row. (see Appendix A for scale)
- If I spend a lot of time and effort in my math classes...
- I won't have enough time for hanging out with your friends.
  - I won't have enough time for extracurricular activities.
  - I won't be popular.
  - People will make fun of me.
8. During a typical weekday during the school year how many hours do you spend... Working on math homework and studying for math class?
- |                    |                   |
|--------------------|-------------------|
| ○ Less than 1 hour | ○ 1 to 2 hours    |
| ○ 2 to 3 hours     | ○ 3 to 4 hours    |
| ○ 4 to 5 hours     | ○ 5 or more hours |
9. Please share additional information you would like to about the factors affecting your math course selections.
- 

In this section, the first prompt contained five selections for mathematics activities from HSLs:09 in the check all that apply, yes/no, format (math club, math competition, math camp, math study groups/tutoring or no participation). The second prompt contained two items regarding mathematics identity (identifies self as a math person and others identify you as a math person), also from HSLs:09, using the 4-point Likert-type scale (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). The third

prompt included 16 exploratory items regarding why students are taking their current math course. Three items were from MICC. The other 13 items were from HSLs:09. All exploratory items used the check all that apply (yes, no) scale. The fourth prompt contained three items from HSLs:09 addressing math interest using a 4-point Likert-type scale (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). The first item assessed math enjoyment. The remaining two items (waste of time, boring) required a reversed scale (4=strongly disagree, 3=disagree, 2=agree, 1=strongly agree) so that positively and negatively worded items were coded to reflect the same direction on the construct. The fifth prompt explored math usefulness with items from HSLs:09 also using the 4-point Likert-type scale (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). The sixth prompt included four items from HSLs:09 addressing peer influence using a true or false scale (1=false, 2=true). The seventh prompt offered four items from HSLs:09 addressing the perceived effect of time and effort in math courses (effect on time with friends, extracurricular activities, popularity, and being ridiculed). These four items used the 4-point Likert-type scale (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). The eighth prompt involved a single multiple choice selection from HSLs:09 regarding mathematics effort (less than one hour, 1 to 2 hours, 2 to 3 hours, 3 to 4 hours, 4 to 5 hours, 5 or more hours). That's a subtotal of thirty-eight individual items aligned to research question two.

Reliability of the scale items addressing RQ2 in the MCSS were evaluated with JASP using standardized Cronbach's alpha. Table 3.5 shows reliability analysis for items addressing RQ2 for factors affecting students' math course selections.



Table 3.5 Summary of Cronbach's  $\alpha$  for RQ2 Subscales

Subscale	Cronbach's $\alpha$
Math Identity	.88
Math Interest	.76
Math Usefulness	.68
Peer Influence	.61
Time and Effort	.74

Acceptable values of Cronbach's alpha range from .70 to .95 as a measure of internal consistency (Tavakol & Dennich, 2011). While low Cronbach's alpha could be attributed to a low number of items in the scale, it could also suggest low relatedness of the items. In this study, Cronbach's alphas for math usefulness and peer influence were .68 and .61 respectively. In both cases, there were a small number of items where the responses for one item in each scale varied significantly from the others.

RQ3 explored students' perceptions of their needs and preferences in the mathematics course selection process. Table 3.6 details the nine prompts in the MCSS addressing RQ3 as they were adapted from HSLS:09 and the Self-Efficacy in Selecting a Major in High School Scale. Literature supports the need for students to make a plan for their mathematics course selections as early as possible (Hudson & O'Rear, 2014; Radunzel, 2014; Reynolds, 2003) while several studies linked advanced mathematics course selections with student self-efficacy (Beesley et al., 2018; Locklear, 2012; Morris, 2016; Xu & Jang, 2017; Yüksel et al., 2016).

HSLS:09 provided five survey prompts suitable to address RQ3. As noted previously, the HSLS:2009 student survey consisted of 170 items from seven distinct sections. A committee including representatives from NCES, Institute of Education

Table 3.6 Survey Questions Alignment with RQ3

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**RQ3:** What are the students' needs and preferences in the mathematics course selection process?

**MCSS Questions**

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1. How many total math courses do you expect to take during high school?  
Mark only one oval.
  - One
  - Two
  - Three
  - Four
  - Five
  - Six
  - Seven
  - Eight or more
  
2. What are the reasons you plan to take more math courses during high school?  
Check all that apply.
  - Taking more math courses is required to graduate
  - My parents will want me to
  - My teachers will want me to
  - My school counselor will want me to
  - I am good at math
  - I will need more math courses for the type of career I want
  - Most students who are like me take a lot of math courses
  - I enjoy studying math
  - Taking more math courses will be useful in college
  - My friends are going to take more math courses
  - I don't know why, I just probably will
  - Some other reason.
  
3. An "education plan" or a "career plan" is a series of activities and courses that you will need to complete in order to get into college or be successful in your future career. Mark only one oval.  
Have you put together...
  - a combined education and career plan
  - an education plan only
  - a career plan only or
  - none of these?
  
4. Who helped you put your plan together? Check all that apply.
  - A counselor
  - A teacher
  - Your parents
  - Someone else
  - No one
  
5. As things stand now, how far in school do you think you will get?
  - Less than high school
  - High school diploma or GED
  - Start but not complete Vocational Training or an Associate's degree, 2 year.
  - Complete Vocational Training or an Associate's degree, 2 year.
  - Start but not complete a Bachelor's degree, 4 year.

- 
- Complete a Bachelor's degree, 4 year.
  - Start but not complete a Master's degree
  - Complete a Master's degree
  - Start but not complete a Ph.D., M.D., law degree, or other high- level () professional degree
  - Complete a Ph.D., M.D., law degree, or other high-level professional degree

6. Rate yourself on the following abilities ....

0=not sure at all to 9=fully confident

- Gather information about math classes that interest me.
- Plan my academic goals for the next 3 years.
- Choose a math class from a list of possible math classes that I am considering.
- Decide which math class would be best for me.
- Resist my parents' or friends' attempts to push me to a math class that I think is not right for me.
- Describe the academic skills necessary for the math class I might want to learn in.
- Choose a math course in which most students are of the opposite sex.
- Decide which areas of study are relevant to future areas of study.
- Find out the grade point average of students in the math class.
- Talk with a person who is already taken the math class which I would like to take.
- Specify a number of academic areas that interest me.
- Accurately assess my academic skills.
- Specify what steps should I take to take the math classes I want.
- Persist toward my academic goal, even when I feel frustrated.
- Choose a particular math class even if my parents do not approve it.
- Rate my academic and social priority regarding the math class.
- Be assisted by the guidance counselor in choosing a math class.
- Determine what field of study I am talented.
- Choose a math class that will fit my interests.
- Choose a math class that will fit my preferred lifestyle for the next 3 years.
- Make a decision about a math course without worrying if it was right or wrong.
- Prepare properly to be accepted to the math class I am interested in.
- Finding out the teachers' attitude toward students studying in the math class.

7. Do you need more information regarding online math course options?

8. Do you need more information on summer school options for math courses?

9. Please share additional information you would like to about your needs and preferences in the math course selection process.

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Sciences, and the U.S. Department of Education determined HSLs:09 to have reliability of .92 for all scale scores which were derived from item response theory (Ingels et al., 2014).

In the MCSS RQ3 section, the first prompt from HSLs:2009 used a multiple choice selection quantifying the expected number of mathematics courses (one, two, three, four, five, six, seven, eight or more). The second prompt from HSLs:2009 offered 12 items regarding students' reasoning for taking more math courses in a check all that apply scale (yes, no). The third prompt from HSLs:2009 used a single multiple choice item regarding students' educational and career plan (combined education and career plan, education plan only, career plan only, none of these). The fourth prompt from HSLs:2009 addressing who helped the participant put said plan together, offered five items using the check all that apply yes/no scale (a counselor, a teacher, my parents, someone else, no one). The fifth prompt from HSLs:2009 addresses the student's anticipated level of education (less than high school, high school diploma or GED, start but not complete a Vocational Training or Associate's degree, complete a Vocational Training or Associate's degree, start but not complete a Bachelor's degree, complete a Bachelor's degree, start but not complete a Master's degree, complete a Master's degree, start but not complete a Doctorate of higher level professional degree, complete a Doctorate or higher level professional degree, don't know).

The sixth prompt in the MCSS offered 23 items using Brown and Cinamon's (2015) study of Self-Efficacy in Selecting a Major in High School. Brown and Cinamon's (2015) 23 items addressing self-efficacy used a 10- point Likert-type scale. (0=not sure at all to 9=fully confident). Brown and Cinamon (2015) applied this scale to 680 Israeli

Jewish high school students. Brown and Cinamon (2015) reported a median internal consistency reliability of 0.80 in their Self-Efficacy in Selecting a Major in High School scale.

The seventh and eight prompts addressing additional locally identified informational needs for online and summer school options for math courses each offered yes/no responses. That's a subtotal of 44 individual response items for RQ3. Reliability of the self-efficacy subscale of the MCSS was evaluated with JASP yielding standardized Cronbach's alpha of .94.

In the semester preceding the data collection for this study, I incorporated a draft of the MCSS as an option in a routine assignment where students explored their post high school graduation goals to align their course selections accordingly before teacher course recommendations were due. Twenty-nine students completed the draft MCSS. Although this data was not included in this study, an informal class discussion provided feedback to validate MCSS items, check the time required, and consider student interpretations.

While I did not record the discussion, I did make detailed notes. Students indicated that approximately 30 minutes were needed to complete the survey and that the items were appropriate regarding importance to their math course selections. They made recommendations to improve the directions and alter the nomenclature to be more appropriate for high school students at this suburban high school. For example, they felt specifically directing students to "mark only one oval" in some cases would clarify intent. Alternatively, when directed to "check all that apply", they suggested adding a Yes/No option for each item to require a response so that less mature students would not skip items. They also indicated that using "counselor" instead of "advisor" in the AQS

(Sheldon et al., 2015) items was more understandable for high school students since they typically worked with guidance counselors and were confused about who to consider as an “advisor”. They also revealed that when asked about summer school or online classes, they did not realize that those options were available for first time credit locally since those options were historically reserved for recovery of failed courses. Additionally, they pointed out that they were not familiar with terms like “Associate’s Degree”, “Bachelor’s Degree” and “Master’s Degree”. Although their data was not included in this study, I used their input to improve the MCSS using Google forms. In the fall semester of 2019, I made the finalized MCSS assessible to students via Schoology, this suburban high schools’ online student information system. Items were self-reported as indicated and student volunteer participation in the MCSS was 88.41 %.

### **Student Discussion Board**

After the MCSS was complete, I opened an online discussion board in the high school’s student learning management system, Schoology. The student discussion board remained open for three weeks. The discussion board prompt follows:

Thank you for participating in the Math Course Selection Survey. As you reflect on your responses and think of other information that may be helpful, please enter your thoughts as comments. You may also reply to each other.

Research Questions:

1. What are your experiences in the advisement process of math course selections at a suburban high school?
2. What are the factors affecting students’ math course selections?

3. What are students' needs and preferences in the math course selection process?

In this explanatory study, the results of the MCSS informed the collection of qualitative data. In the discussion board, 45 participants added comments to continue the conversation beyond the MCSS. Experience showed that students enjoyed discussing their future coursework and its alignment with their plans. The discussion board not only allowed students to post open comments but, also allowed them to provide feedback to each other. The discussion board functioned similarly to a class journal or focus group where participants fed off of each other and had equal opportunity to share their perspectives (Mertler, 2017). One benefit of the online discussion board was that it automatically served as a written record or transcription of student data.

### **Focus Group Interviews**

The third method of data collection was focus group interviews. I conducted three focus group interviews in order to obtain rich descriptive data to clarify findings regarding students' experiences, selection factors, needs, and preferences with the math course selection process that developed from the MCSS and discussion board. A total of 20 students participated in the focus group interviews. There were seven student volunteers in each of the first two focus groups and six participants in the third focus group. The interviews explored unplanned factors that were revealed by participant survey responses and discussion board posts. The focus group interview protocol is provided in Appendix C. These semi-structured, open-ended interviews were critical to understanding to what degree the findings aligned with the research questions and varied among participants.

Each semester my students participated in an open class discussion regarding their math course selections and teacher recommendation for their next math course. In the semester prior to data collection for this study, I tested the initial pool of focus group interview questions with students in a routine class assignment. I asked students for feedback on their understanding of the questions and whether or not the wording clearly conveyed my intent. Although I did not record the discussion, I took detailed notes in order to modify the interview protocol and address the validity of the interview questions.

In this study, I used this modified interview protocol to first listen for original student input addressing questions that brought clarification to the survey data. Peer comfort level led to dynamic exchange which enabled me to mark off keywords from the protocol and then inquire for additional detail as time allowed. Focus group interviews were recorded and took approximately 30 minutes each. I made participants as comfortable as possible by inviting them to interview in the classroom, where they normally had class, and used my cell phone to record since most people were comfortable with a cell phone in sight. I sat in a student desk near the participants to thank and welcome them to the focus group interview. I used a printout of my interview guide with keywords to aide in notetaking throughout the interview beginning with easy-open inquiries like, “Tell me about your experiences with mathematics course selections”. I made field notes, recorded, transcribed, and member checked each interview for accuracy.

### **Demographic Data**

Demographic data was collected primarily to ensure that characteristics of the participating sample were representative of our local population. Demographic items included gender, ethnicity, age, grade, and SES.



## Data Analysis

In this explanatory mixed-methods study, a variety of data analysis methods were used to describe students' experiences in the advisement process, the factors affecting students' mathematics course selections, and students' needs and preferences in the mathematics course selection process. Quantitative data was analyzed by descriptive statistics to inform interview questions that were used to obtain qualitative data. Inductive analysis (Mertler, 2017) was used to evaluate the qualitative data in order to produce themes representing the study's findings. Table 3.7 shows the alignment of the research questions, data collection sources, and the data analysis procedures.

Table 3.7 *Research Questions, Data Sources and Analysis Methods Alignment*

Research Questions	Data Sources	Analysis Method
1. What are students' experiences in the advisement process of mathematics course selections at a suburban high school?	<ul style="list-style-type: none"> <li>• MCSS</li> <li>• Student Discussion Board</li> <li>• Focus Group Interviews</li> </ul>	<ul style="list-style-type: none"> <li>• Descriptive statistics</li> <li>• Inductive analysis</li> </ul>
2. What are the factors affecting students' mathematics course selections?	<ul style="list-style-type: none"> <li>• MCSS</li> <li>• Student Discussion Board</li> <li>• Focus Group Interviews</li> </ul>	<ul style="list-style-type: none"> <li>• Descriptive statistics</li> <li>• Inductive analysis</li> </ul>
3. What are students' needs and preferences in the mathematics course selection process?	<ul style="list-style-type: none"> <li>• MCSS</li> <li>• Student Discussion Board</li> <li>• Focus Group Interviews</li> </ul>	<ul style="list-style-type: none"> <li>• Descriptive statistics</li> <li>• Inductive analysis</li> </ul>

## **Quantitative Data Analysis**

Quantitative data from the MCSS was analyzed by descriptive statistics in this study to identify and describe the needs of students in the advisement process of mathematics course selections at a suburban high school in order to make recommendations for effective advisement of mathematics course selections. Descriptive statistics, including measures of central tendency like mean and measures of dispersion like standard deviation and range, were used to describe students' responses. These results were used along with qualitative data for an objective understanding of students' advisement experiences, course selection factors, and students' needs and preferences in the mathematics course selection process.

Validated surveys, previously described, were used to develop the MCSS to treat each participant objectively based on variables that were identified prior to data collection and to ensure validity and reliability in the data. Reliability measured the quality of the quantitative research data, "did we measure what we intended to measure, based on the focus of our research?" (Creswell, 2014, p.154). Since the primary source did not provide numeric quantities reliability on items selected for the MCSS, reliability coefficients (Cronbach's alphas) were calculated to ensure reliability. JASP was used to analyze the quantitative data.

## **Qualitative Data Analysis**

In this explanatory mixed methods design, qualitative data from open-ended questions in the MCSS, discussion board, and focus group interviews was used to provide additional detail to the quantitative data from the MCSS. For example, focus group interviews allowed me to ask if students had attempted more meetings with their

counselors since almost 33 percent responded that the number of meetings was not sufficient. Inductive analysis was appropriate for this study since questions emerged from the data collection instead of focusing on preconceived questions (Bogdan & Biklen, 2016). Inductive analysis was used to analyze the qualitative data in order to summarize findings into a manageable number of themes (Mertler, 2017, Tunku et al., 2013). Interviews were recorded, transcribed, and member checked for accuracy. Additional qualitative data collected from the discussion and open-ended questions in the MCSS were also transcribed, organized, and coded in search of categories leading to patterns within the data that were cross referenced across groups to identify themes based on the qualitative data. Codes evolved according to the data. Detailed information about the qualitative data analysis is provided in chapter 4.

### **Procedures and Timeline**

This data collection for this study took place during the fall 2019 semester with analysis spilling over into the spring of 2020. The procedures for this study were categorized into three phases: consent, data collection, and data analysis. Table 3.8 summarizes the activities and timeline for this study.

Phase 1, consent, took place at the beginning of the course to minimize any conflict of interest with my role as students' mathematics teacher regarding advisement or math course selections. Separating my role as researcher versus advisor validated their responses in this study. I previously instructed one participant and therefore, played a role in past math course recommendations for that student.

I described the study and invited volunteers to participate. I explained that I was looking for honest student input regarding their advisement experiences, factors affecting

Table 3.8 *Procedures and Timeline*

<b>Phase</b>	<b>Activities</b>	<b>Duration</b>
Phase 1: Consent	<ul style="list-style-type: none"> <li>• Describe the Study</li> <li>• Obtain Consent and Assent</li> </ul>	2 Weeks
Phase 2: Data Collection	<ul style="list-style-type: none"> <li>• Surveys</li> <li>• Discussion Board</li> <li>• Focus Group Interviews</li> </ul>	9 Weeks
Phase 3: Data Analysis	<ul style="list-style-type: none"> <li>• Descriptive statistics for Surveys</li> <li>• Transcripts for Open-Ended Survey items, Discussion Board entries, and Interviews</li> <li>• Member Checking</li> <li>• Coding</li> <li>• Sharing Preliminary Results</li> </ul>	16 Weeks

their mathematics course selections as well as their needs and preferences with their mathematics course selections at a suburban high school in hopes of improving the overall process. Since many students were under age 18, I provided consent (see Appendix D) and assent (see Appendix E) forms. Students completed the consent and assent forms, obtained parent signatures, and submitted the completed forms in two weeks. Prior approval for research was obtained from the university's institutional review board (see Appendix F) and from the local school district (see Appendix G).

Communication with participants took place on campus via in person contact for meetings, surveys, and focus group interviews. Schoology, the student learning management system, was used for voluntary response surveys and the online discussion board. Remind.com was used as needed for individual reminders about appointments and deadlines.

In phase 2, data was collected via a voluntary response survey, an online discussion board, and focus group interviews over a nine week period. Participants were given class time to either complete the survey or an alternate course assignment designed to take roughly the same amount of time. The survey took approximately 30 minutes.

Pursuant to the MCSS, a student discussion board was established in Schoology for three weeks of student reflection. Subsequently, 20 volunteers participated in one of three face-to-face focus groups in a semiformal discussion intended to glean additional clarification regarding the research questions as informed by the MCSS and the discussion board.

Phase 3, data analysis, took approximately 16 weeks. I summarized survey data with descriptive statistics and transcribed open-ended survey items, discussion board entries, and interviews. I shared focus group interview transcripts with participants via email while discussion board entries were available to all participants for three weeks in the student learning management system. At the end of the semester, I hosted a final meeting to share the descriptive statistics and provided students with a small reward for their participation. Coding the qualitative data continued into the next semester followed by integrating data from all sources to complete the analysis.

### **Rigor and Trustworthiness**

This action research study explored students' mathematics course advisement experiences, factors affecting their mathematics course selections, and their needs and preferences in the mathematics course selection process at a suburban high school. Its purpose was to identify and to describe the needs of students in the advisement process of mathematics course selections at a suburban high school in order to make

recommendations for effective advisement of mathematics course selections. Maintaining a standard of quality or rigor, in the research process brought validity and reliability to the quantitative data as well as accuracy, credibility, and dependability to the qualitative data (Mertler, 2017). A variety of strategies including prolonged exposure to the math course selection process, triangulation of the data, member checking, peer debriefing, and audit trail were used to ensure the rigor and trustworthiness of this action research study.

### **Prolonged Exposure to the Math Course Selection Process**

With 19 years of experience teaching mathematics at a suburban high school, I brought a multilayered perspective to the research. The majority of my students were 10th and 11th graders. Therefore, I was frequently advising them about their math course selections. Recommending their next mathematics course was one of my responsibilities. As the mathematics department chair, I also worked routinely with the guidance department to explain mathematics course options and evaluate mathematics transfer credits. To complete the circuit, I maintained a social networking relationship with many former students to observe their ongoing development and the role that math course selections continued to play in their lives. Such prolonged exposure provided a deep understanding of the process with the participants in this setting and brought trustworthiness to this study and rigor to the findings (Mertler, 2014).

### **Triangulation**

Triangulation was achieved by using a variety of instruments, methods, and sources to collect data in this action research study bringing rigor to the findings (Mertler, 2017). Factual accuracy was maintained for descriptive rigor by quantifying closed-end and closed-response rating scales on survey responses and carefully recording,

transcribing, and coding open-ended survey items, interview responses, and discussion board posts (Mertler, 2017). As a practitioner-researcher, I spent nine weeks collecting data. This significant time investment built a foundational understanding of the linkage between the multiple data sources: survey, discussion board, and interview. Daily participation in the research setting allowed me to determine if the interview responses supported the survey findings or if there were interview participants with responses that varied significantly from the survey's descriptive statistics. Interview transcripts were emailed to participants so that they could provide additional feedback to ensure accuracy.

In this study, multiple methods have been described to collect data to ensure triangulation: qualitative and quantitative. Methodological triangulation is accomplished by using multiple methods of data collection (Carey, 2010; Mertler, 2017). In this study, qualitative methods including interviews, a discussion board, and open-ended survey questions were used to collect data. Students were encouraged to offer input via the MCSS and an online discussion board or directly via email. Interviews with open-ended questions provided detail to the study by allowing stakeholders to elaborate and interact fully on the research topic without being limited by the researcher or data collection instruments. This descriptive rich data was used to explain quantitative data collected by Likert-style survey items on the MCSS that helped identify trends and themes in the data.

### **Member Checking**

Member checking required sharing data and findings with participants to ensure accuracy in the qualitative data (Dudley, 2010; Mertler, 2017). Quantitative findings were shared with participants in class and discussed further on the discussion board and

in focus group interviews. I emailed each interview participant the transcript of their focus group's interview for member checking purposes. Participants had the opportunity to provide corrections. The accuracy of the data was critical to the believability of the findings (Mertler, 2017).

### **Peer Debriefing**

Peer debriefing was achieved by consulting colleagues and advisors throughout the study to verify findings (Creswell, 2014). In this study, the dissertation chair acted as an external auditor in every step of the process, including data collection and analysis. Peer writing groups met weekly throughout the study to critique and support cohort members. These forms of peer debriefing also established rigor and trustworthiness in the study throughout the action research process.

### **Audit Trail**

An audit trail documented the progression of the entire study, noting steps and consistent procedures (Buss & Zambo, 2014). A researcher's journal, memos, and reflections were maintained to support the details of how the study evolved and lead to its findings. I organized Google folders for every course in the Ed.D program with all of my work and course notes for all research. Mendeley was used to organize all research materials referenced in this study. This detail provided evidence supporting rigor and trustworthiness. These strategies, addressing rigor and trustworthiness, were intended to establish the credibility and believability of the findings.

### **Plan for Sharing and Communicating Findings**

Sharing and communicating the findings of this action research study was paramount to bringing process improvement to the mathematics course selection process



at a suburban high school. This study identified and described the needs of students in the advisement process of mathematics course selections at a suburban high school in order to make recommendations for effective advisement of mathematics course selections and future research. As the study focused on the main campus, findings will be shared in person by presentation with the principal, mathematics department, and other stakeholders.

All data will be anonymized prior to any summary, discussion, or presentation of findings. Participants' input will be completely confidential. I summarized their input as recommendations for future study.

I will make an appointment to share a hard copy of written findings with local administration, the principal. Pursuant to his feedback and approval, the findings will be presented to local stakeholders that were identified as part of the study. I anticipate that there will be valuable learnings for both the mathematics and guidance departments.

A local conference room will be used for a joint department meeting to share findings. These coworkers are in the best position to provide professional feedback noting additional limitations or concerns. They may also provide additional input on how the findings could affect day-to-day classroom practices and recommend process improvements. Pursuant to these reviews, recommendations for future study could extend to our district's vertical alignment team and extend in collaboration with our stakeholders in earlier grades.

## CHAPTER 4

### ANALYSIS AND FINDINGS

The purpose of this action research study was to identify and to describe the needs of students in the advisement process of mathematics course selections at a suburban high school in order to make recommendations for effective advisement of mathematics course selections in high school. This chapter shares the findings from both quantitative and qualitative data collection to answer the following research questions: (1) What are students' experiences in the advisement process of mathematics course selections at a suburban high school? (2) What are the factors affecting students' mathematics course selections? (3) What are students' needs and preferences in the mathematics course selection process? This chapter presents the analysis and findings of data collected by surveys, online discussion board, and focus group interviews. The chapter includes two sections: (1) quantitative analysis and findings and (2) qualitative analysis and findings.

#### **Quantitative Analysis and Findings**

Surveys were used to collect quantitative data. This section includes the method of analysis and descriptive statistics for the quantitative findings.

#### **Surveys**

The MCSS included three open-ended and 28 closed-ended survey questions divided into four sections: participant demographics, students' experiences in the advisement process of math course selections, factors affecting students' math course

selections, students' needs and preferences in the math course selection process. Sixty-one students completed the survey. Data were entered into a spreadsheet and then imported into JASP for statistical analysis. Table 4.1 summarizes the reliability analysis of the MCSS scale items and resulting standardized Cronbach's alphas.

Table 4.1 *Summary of Cronbach's Alphas for MCSS Subscales*

<b>Subscale</b>	<b>Cronbach's <math>\alpha</math></b>
Counselor Knowledge	.93
Counselor Availability	.93
Counselor Supportiveness	.93
Counselor Satisfaction	.89
Math Identity	.88
Math Interest	.76
Math Usefulness	.68
Peer Influence	.61
Time and Effort	.74
Self-Efficacy	.94

Acceptable values of Cronbach's alpha range from .70 to .95 as a measure of internal consistency (Tavakol & Dennich, 2011). While low Cronbach's alpha could be attributed to a low number of items in the scale, it could also suggest low relatedness of the items. In this study, Cronbach's alphas for math usefulness and peer influence were .68 and .61 respectively. In both cases, there were a small number of items where the responses for one item in each scale varied significantly from the others.

Demographic information was collected in questions one through five. Tables 4.2 to 4.5 summarize the demographic responses for surveyed students. Participants were 51% ( $n = 31$ ) male and 49% ( $n = 30$ ) female. Survey respondents self-identified as white 55% ( $n = 34$ ), black or African American 20% ( $n = 12$ ), Hispanic or Latino/Latina 16% ( $n = 10$ ), two or more races 7% ( $n = 4$ ), and Asian 2% ( $n = 1$ ). Students' ages ranged

from 15 to 19 years with a mean of 16.75 years. Eight percent ( $n = 5$ ) of participants were age 15, 33% ( $n = 20$ ) were 16 years old, 39% ( $n = 24$ ) were age 17, 15% ( $n = 9$ ) were 18 years old, and 5% ( $n = 3$ ) were age 19. Regarding their grades most of them (56%) were 11<sup>th</sup> grade, followed by 12<sup>th</sup> grade (33%), and 10<sup>th</sup> grade (11%). Thirty-three percent of students reported that they received free or reduced lunch.

Table 4.2 *Demographics of Participants: Gender (n = 61)*

<b>Gender</b>	<b>Frequency</b>	<b>Percentage</b>
Male	31	51%
Female	30	49%

Table 4.3 *Demographics of Participants: Ethnicity (n = 61)*

<b>Ethnicity</b>	<b>Frequency</b>	<b>Percentage</b>
White	34	55%
Black or African American	12	20%
Hispanic or Latino/Latina	10	16%
Two or more Races	4	7%
Asian	1	2%

Table 4.4 *Demographics of Participants: Age (n = 61)*

<b>Age</b>	<b>Frequency</b>	<b>Percentage</b>
15	5	8%
16	20	33%
17	24	39%
18	9	15%
19	3	5%

Table 4.5 *Demographics of Participants: Grade (n = 61)*

Grade	Frequency	Percentage
10	7	11%
11	34	56%
12	20	33%

Survey questions 6 to 13 asked students about their experiences in the advisement process of math course selections. Figure 4.1 ranks responses for specified sources of advice or information about math course selections from question 6. Participants identified their most frequent sources of advice about math course selections as teachers (69%), friends (67%), and parents (66%). To a lesser degree, respondents selected counselors (39%), publications or websites (33%), siblings (30%), other relatives (26%), and coaches (18%). A small percentage of students indicated none of these (8%).

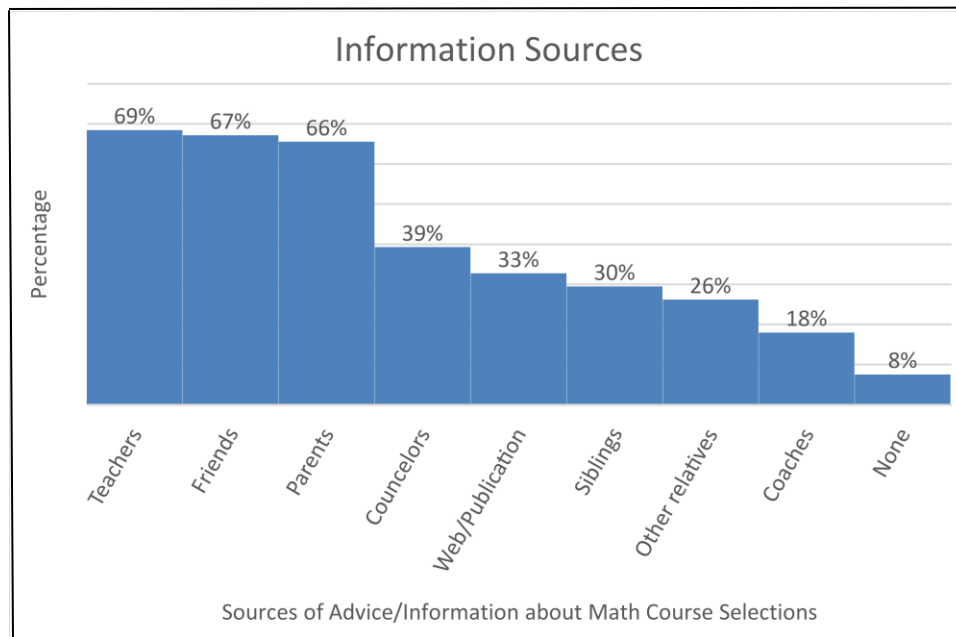


Figure 4.1. Percentages for Information Sources for Math Course Selections

In question 7, participants reported the number of times they met with their guidance counselor about math course selections in the previous year. Table 4.6

summarizes students' recollections of how often they met with their guidance counselor about their math courses in the prior school year. Respondents indicated never (39%), once (49%), twice (10%), three times (2%), and none of them met with their guidance counselor four or more times.

Table 4.6 *Percentages for Number of Counselor Meetings About Math Course Selections*  
(*n* = 61)

<b>Counselor Meetings</b>	<b>Frequency</b>	<b>Percentage</b>
Never	24	39%
Once	30	49%
Twice	6	10%
Three times	1	2%

Question 8 asked students if the number of meetings with their guidance counselor was sufficient to meet their advising needs. Table 4.7 presents participant feedback. Respondents marked yes (41%), no (33%), and undecided (26%).

Table 4.7 *Percentages for Sufficiency of Advising Meetings* (*n* = 61)

<b>Sufficient</b>	<b>Frequency</b>	<b>Percentage</b>
Yes	25	41%
No	20	33%
Undecided	16	26%

Question 9 canvassed the primary method of communication between students and guidance counselors about math courses. Table 4.8 lists respondents' answers. The majority of students selected face-to-face meeting (77%), followed by e-mail (20%), and telephone (3%). Students were given the option of selection "other" and to enter their own response but no students entered a unique response.

Table 4.8 Percentages for Communication Methods (n = 61)

Communication Methods	Frequency	Percentage
face-to-face meeting	47	77%
e-mail	12	20%
telephone	2	3%

Question 10 explored counselor knowledge, availability, and supportiveness constructs with 17 items. Students were asked to rate their guidance counselor's performance in each item using a 5-point Likert-type scale (1=poor, 2=fair, 3=satisfactory, 4=good, 5=excellent). Of those items, 15 were modified from the AQS (Sheldon et al., 2015) and two were added to address local concerns with awareness of online and summer school courses. Reliability of the 17 scale items addressing counselor knowledge, availability, and supportiveness with the MCSS were evaluated with JASP, a statistical analysis program, yielding standardized Cronbach's alphas of .93 each, differing in the thousandths.

Table 4.9 categorizes the descriptive statistics for counselor quality. The means for counselor knowledge items ranged from 2.59 to 3.07 which indicates that on average most students rated counselor knowledge between fair and satisfactory. The overall mean for the category (counselor knowledge) was 2.85 with standard deviation of 0.16. The means for counselor availability items ranged from 3.07 to 3.48 which means that on average most students rated counselor availability between satisfactory and good. The overall mean for the category (counselor availability) was 3.25 with standard deviation of 0.16. The means for counselor supportiveness items ranged from 2.97 to 3.36 which means that on average most students rated counselors between fair and good. The overall

mean for the category (counselor supportiveness) was 3.21 with standard deviation of 0.16.

Table 4.9 *Descriptive Statistics for Question 10: Counselor Quality (n = 61)*

<b>Items</b>	<b>M</b>	<b>SD</b>
<b>Counselor Knowledge</b>		
1. Provides information about using on-line resources for math courses (e.g., MathXL, Khan Academy)	2.59	1.44
2. Provides information regarding math study skills	2.80	1.36
3. Suggests academic resources for math (e.g., Rebel Success Center, Power Hour Tutoring)	3.05	1.35
4. Refers me to the appropriate office to obtain financial assistance (e.g., student fees, scholarships, dual credit)	3.07	1.26
5. Refers me to employment opportunities (e.g., part-time)	2.85	1.38
6. Provides online course for first time credit information	2.82	1.43
7. Provides summer school for first time credit information	2.80	1.33
<b>Counselor Availability</b>		
8. Is on time for advising opportunities with me	3.31	1.32
9. Provides sufficient time for advising appointments	3.20	1.25
10. Maintains an open line of communication	3.18	1.23
11. Available when I need assistance	3.48	1.22
12. Responds to my requests about math courses in a timely fashion (e.g., e-mail, phone calls, calls me to their office)	3.07	1.24
<b>Counselor Supportiveness</b>		
13. Respects my math course decisions	3.36	1.16
14. Encourages mathematics academic success	3.34	1.34
15. Provides me with math course choices and options	3.18	1.30
16. Encourages me to assume an active role in planning my math coursework	2.97	1.40
17. Seems to understand my perspective on math courses	3.18	1.26

Question 11 asked students to rate their agreement with two additional items:

overall counselor excellence and peer recommendation with a 3-point scale (1=no agreement, 3=some agreement, 5=much agreement). Table 4.10 lists the descriptive statistics for counselor satisfaction. Reliability coefficient of this two-item subscale, counselor satisfaction and recommendation, with the MCSS was evaluated with JASP



yielding standardized Cronbach's alpha of .89. The means for counselor satisfaction items ranged from 3.46 to 3.79 which means that on average students marked some agreement or much agreement. The overall mean for the category (counselor satisfaction) was 3.63 with standard deviation of 0.23.

Table 4.10 *Descriptive Statistics for Question 10: Counselor Satisfaction (n = 61)*

Items	<i>M</i>	<i>SD</i>
Overall, counselor has been excellent.	3.79	1.38
Recommend counselor to a friend.	3.46	1.48

Question 12 asked students to rank who was most helpful in advising their math course selections. Participants' first, second, and third choice for most helpful were teachers (43%), themselves (39%), and parents (30%). Figure 4.2 shows frequencies of rankings for most helpful advisors. Comparatively, Figure 4.3 shows frequencies of rankings for least helpful advisors. First, second, and third choices for least helpful advisors were other (34%), coaches (33%), and siblings (23%).

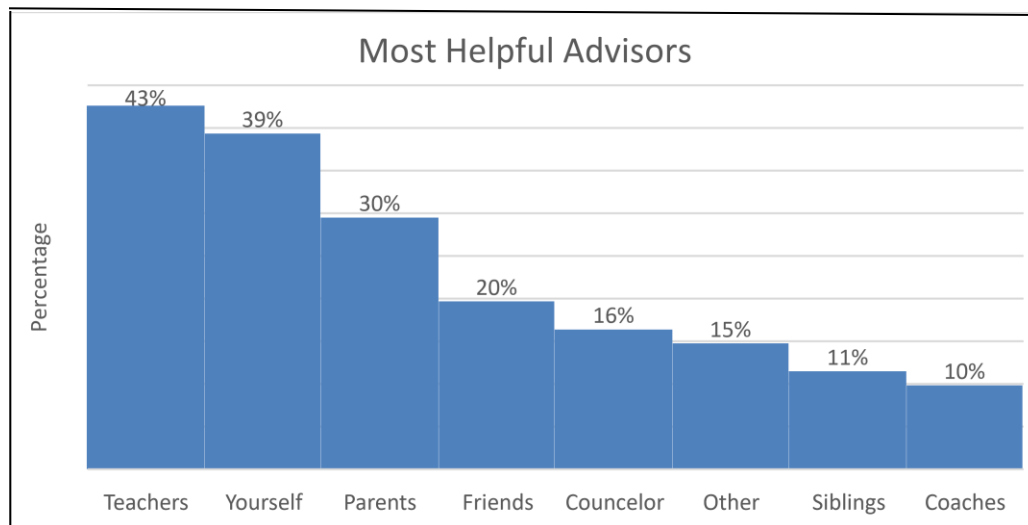


Figure 4.2. Percentages for Most Helpful Advisors

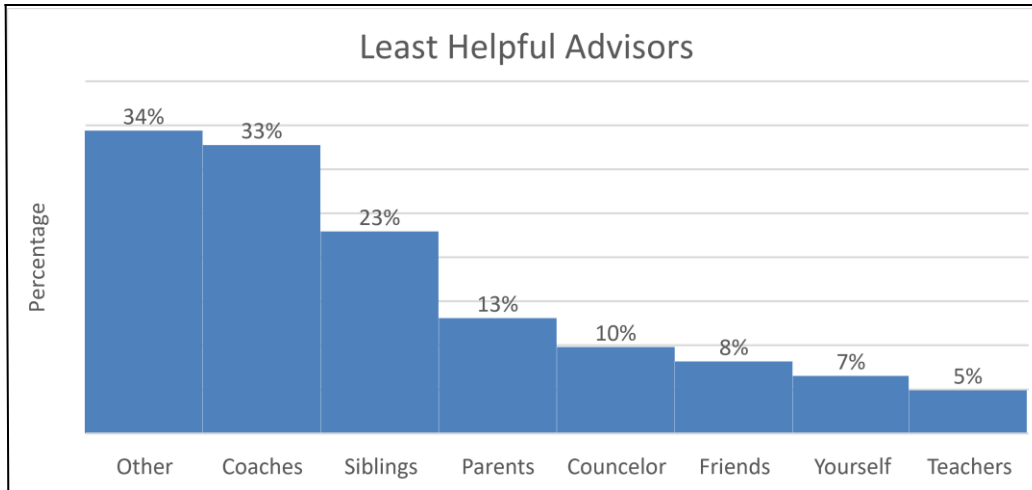


Figure 4.3. Percentages for Least Helpful Advisors

Question 13 is open-ended and will be addressed in the qualitative findings section.

Questions 14 to 22 inquired about factors affecting students' math course selections. Figure 4.4 illustrates responses for question 14, student participation in mathematics activities outside of the classroom. The majority of participants (64%) indicated they do not participate in math activities. Small percentages of students reported they participated in math study groups (15%), math club/team (3%), math competition (2%), and math camp (2%).

Question 15 asked students to rate their agreement with items relating to their math identity with a 3-point scale (1= disagree, 2= agree, 3= strongly agree). Table 4.11 shows the descriptive statistics for math identity. Reliability coefficient of this two-item subscale addressing math identity with the MCSS were evaluated with JASP yielding standardized Cronbach's alpha of .88. The means for math identity items ranged from 1.41 to 1.43. The majority of students marked disagree on both items. The overall mean for the category (math identity) was 1.42 with a standard deviation of .01.

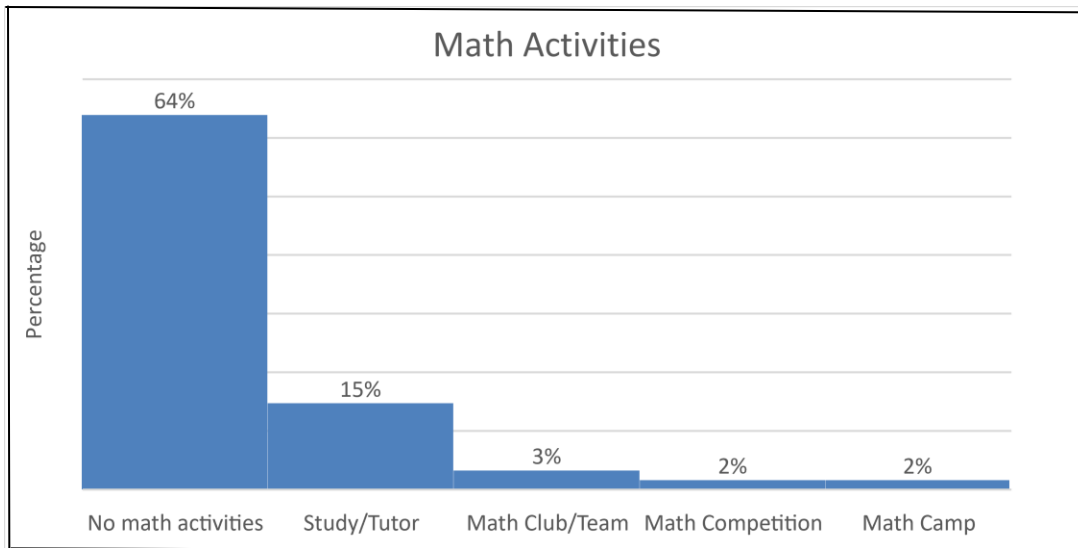


Figure 4.4. Percentages for Math Activities

Table 4.11 Descriptive Statistics for Question 15: Math Identity ( $n = 61$ )

Items	<i>M</i>	<i>SD</i>
I see myself as a math person.	1.41	0.64
Others see me as a math person	1.43	0.64

Question 16 asked students to consider reasons that they were taking their current math course. Figure 4.5 illustrates the reasons students marked. The most common reason representing 84% ( $n = 51$ ) was that students would need their current math course for getting into college. Second, at 82% ( $n = 50$ ) was that the course was a school requirement. Seventy percent ( $n = 43$ ) of participants marked teacher recommendation. Sixty-nine percent ( $n = 42$ ) of students indicated that the course was assigned. Sixty-one percent ( $n = 37$ ) of respondents marked that the course would be needed for their career. Other responses, each less than 50%, included counselor suggested, like challenge, parents encouraged, no other choices, do not know, easiest option, friends taking, easy to pass, enjoy math, and little effort to pass.

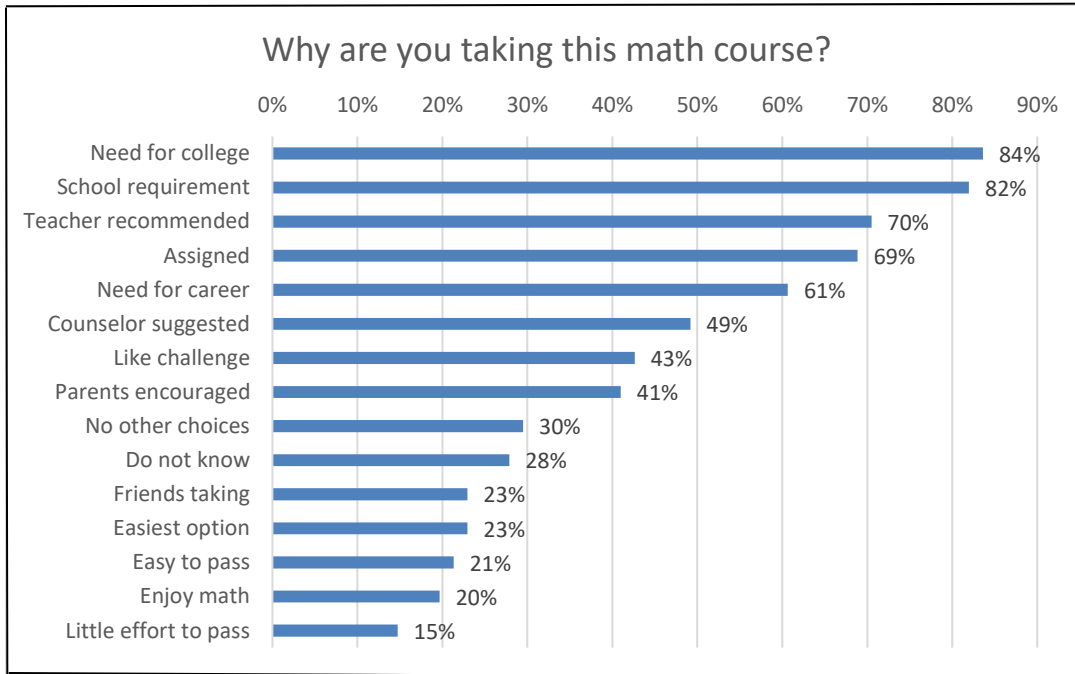


Figure 4.5. Percentages for Reasons to Take Current Math Course

Question 17 asked students to rate their agreement with items relating to their math interest using a 4-point Likert-type scale (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). The first item assessed math enjoyment. The remaining two items (waste of time, boring) required a reversed scale (4=strongly disagree, 3=disagree, 2=agree, 1=strongly agree) so that positively and negatively worded items were coded to reflect the same direction on the construct (Ingels et al., 2014). Table 4.12 shows the descriptive statistics for math interest. Reliability coefficient of this three-item math interest subscale was calculated with JASP yielding standardized Cronbach's alpha of .76. The means for math interest items ranged from 2.07 to 2.64. The majority of students selected either agree or disagree for enjoyment and boring. However, the most common selection for waste of time was strongly disagree. The overall mean for the math interest was 2.37 with the standard deviation of .29.

Table 4.12 *Descriptive Statistics for Question 17: Math Interest (n = 61)*

<b>Items</b>	<b><i>M</i></b>	<b><i>SD</i></b>
I will enjoy this course very much.	2.39	0.86
I think this class will be a waste of my time.	2.07	1.01
I think this class will be boring.	2.64	0.97

Question 18 asked students to rate their agreement with items relating to the usefulness of their math course using a 4-point Likert-type scale (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). Table 4.13 shows the descriptive statistics for math usefulness answers to the prompt “What I learn in this course...”. Items included useful in everyday life, college, and future career. Reliability coefficient of this three-item subscale addressing math usefulness was calculated with JASP yielding standardized Cronbach’s alpha of .68. The means for math usefulness items ranged from 2.41 to 3.08. The most common selections for everyday life usefulness and career usefulness were either agree or disagree. However, the most common selections for college usefulness were agree and strongly agree. The overall mean for math usefulness was 2.70 with standard deviation of .34.

Table 4.13 *Descriptive Statistics for Question 18: Math Usefulness (n = 61)*

<b>Items</b>	<b><i>M</i></b>	<b><i>SD</i></b>
Is useful in everyday life.	2.41	0.40
Will be useful for college.	3.08	0.86
Will be useful for my future career.	2.61	0.99

Question 19 asked students to reflect on characteristics of their closest friends including grades, school interest, school attendance, and college plans using a true or false scale. Table 4.14 ranks student responses to the prompt “My closest friend ...” followed by peer influence characteristics. Ninety percent of respondents indicated their

closest friends attended classes regularly. Eighty-four percent of participants reported that their closest friends got good grades. Seventy-seven percent of students replied that their closest friends plan to go to college. Thirty-seven percent of participants specified that their closest friends were interested in school. Reliability coefficient of the peer influence subscale was evaluated with JASP yielding standardized Cronbach's alpha of .61.

Table 4.14 *Percentages for Peer Influence (n = 61)*

<b>Peer Influence</b>	<b>Frequency</b>	<b>Percentage</b>
attends classes regularly.	55	90%
gets good grades.	51	84%
plans to go to college.	47	77%
is interested in school.	24	37%

Question 20 asked students to rate their agreement with items relating to the effect of spending a lot of time and effort in their math classes using a 4-point Likert-type scale (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). Table 4.15 shows the descriptive statistics for time and effort answers to the prompt “If I spend a lot of time and effort in my math classes...”. Completing items included not having enough time for hanging out with friends, not having enough time for extracurricular activities, not being popular, and being made fun of. Reliability coefficient of this four-item subscale addressing the effects of time and effort in math classes was calculated with JASP yielding standardized Cronbach's alpha of 0.74. The means for time and effort items ranged from 1.62 to 2.48. The most common selections for hanging out with friends and affecting extracurricular activities were either agree or disagree. However, the most

common selections for popularity and being made fun of were disagree and strongly disagree. The overall mean for the category (time and effort) was 2.08 ( $SD = .46$ ).

Table 4.15 *Descriptive Statistics for Question 20: Time and Effort (n = 61)*

Items	<i>M</i>	<i>SD</i>
I won't have enough time for hanging out with my friends.	2.46	0.77
I won't have enough time for extracurricular activities.	2.48	0.77
I won't be popular.	1.74	0.79
People will make fun of me.	1.62	0.64

Question 21 asked students how many hours they spent working on math homework and studying for math class outside of class. Figure 4.6 illustrates the proportions for self-reported time spend on math homework and studying outside of class. The most common student response representing 56% ( $n = 34$ ) was less than 1 hour. Second at 30% ( $n = 18$ ) was 1 to 2 hours. All other selections were less than 10% of participants. Question 22 is open-ended and will be addressed in the qualitative findings section.

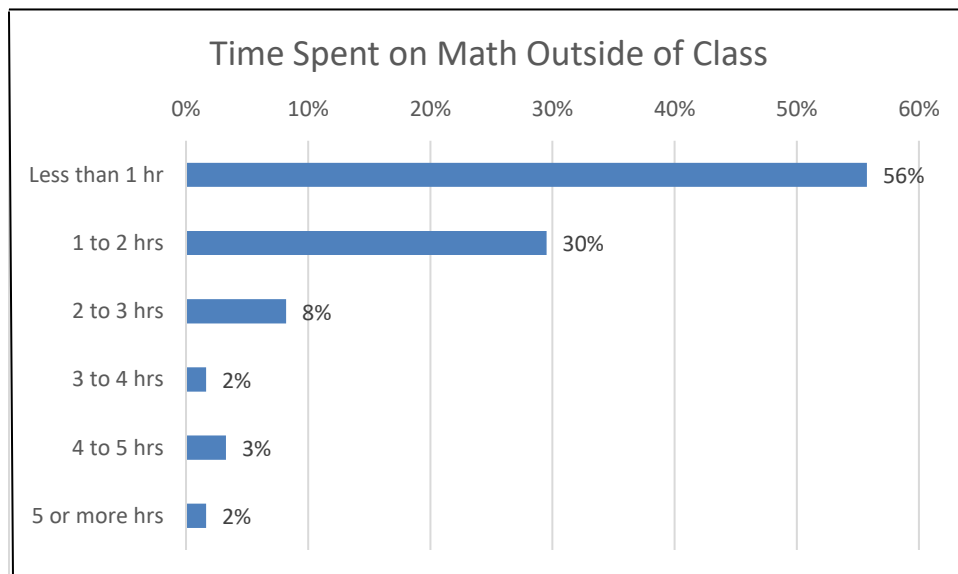


Figure 4.6. Percentages for Time Spent on Math Outside of Class

Questions 23 to 31 had students consider their needs and preferences in the math course selection process. Question 23 asked students how many total math courses they expected to take during high school. Figure 4.7 illustrates the proportions for self-reported expectations of students' total number of high school math courses. The most common student response (54%) was four math courses. Twenty percent of respondents expected to take five math courses. Thirteen percent of participants indicated they planned to take three total math courses in high school. Seven percent of students reported that they expected to take seven math courses in high school. Three percent of respondents marked that they would only take one math course in high school. Selections of six and eight or more were marked by 2% of participants each.

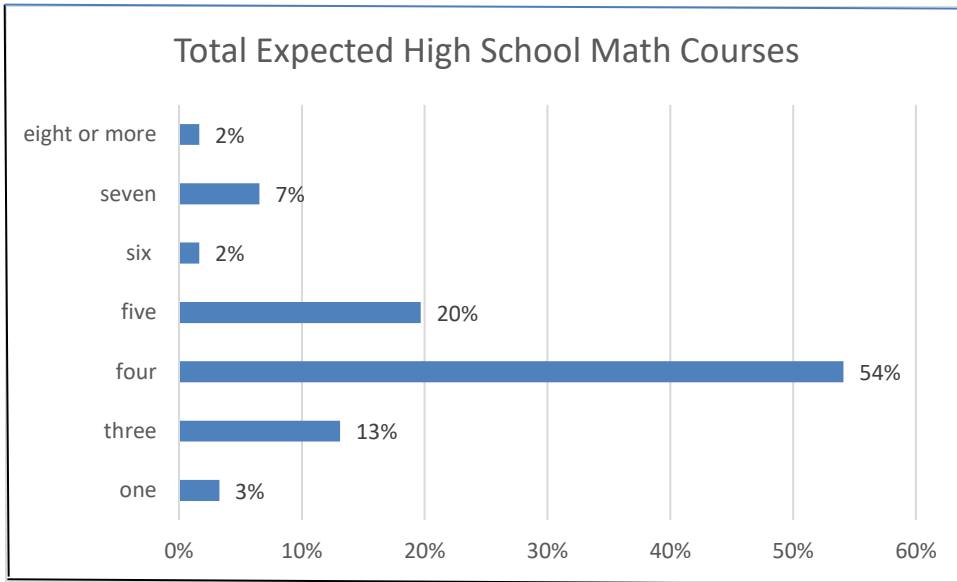


Figure 4.7. Percentages for Total Expected High School Math Courses

Question 24 asked students to select reasons they planned to take more math courses during high school. Table 4.16 ranks student responses. The most popular reason (72%) to take more math courses in high school was that it would be useful in college. A close second (70%) was high school graduation requirements. Next, 57% of



participants indicated that they would take more math courses because their teachers wanted them to. Fifty-four percent of respondents specified that their school counselor wanted them to take more high school courses. Fifty-one percent of participants reported that their parents wanted them to take more high school math courses. Thirty-six percent of students replied that although they did not know why, they would probably take more math courses in high school. Thirty-one percent of participants specified that more math courses were required for the type of career they wanted. Lesser marked reasons are detailed in Table 4.16.

Table 4.16 *Percentages for Reasons to Take More Math Courses in High School (n = 61)*

Items	Frequency	Percentage
Taking more math courses will be useful in college.	44	72%
Taking more math courses is required to graduate.	43	70%
My teachers will want me to.	35	57%
My school counselor will want me to.	33	54%
My parents will want me to.	31	51%
I don't know why, I just probably will.	22	36%
I will need more math courses for the type of career I want.	19	31%
I am good at math.	17	28%
Some other reason.	13	21%
Most students who are like me take a lot of math courses.	11	18%
I enjoy studying math.	11	18%
My friends are going to take more math courses.		

Question 25 started with an explanation of an “education plan” or a “career plan” which was a series of activities and courses that students would need to complete in order to get into college or be successful in their future career. Then question 25 asked students to mark the type of plan that they had put together. Figure 4.8 illustrates the proportions for education or career plans. The most common participant response representing 41% (n = 25) was a combined education and career plan. The second most

common response at 28% (n = 17) was a career plan only. Sixteen percent (n = 10) of participants indicated they prepared an education plan only. Fifteen percent (n = 9) of respondents reported none of these but did not offer additional identification.

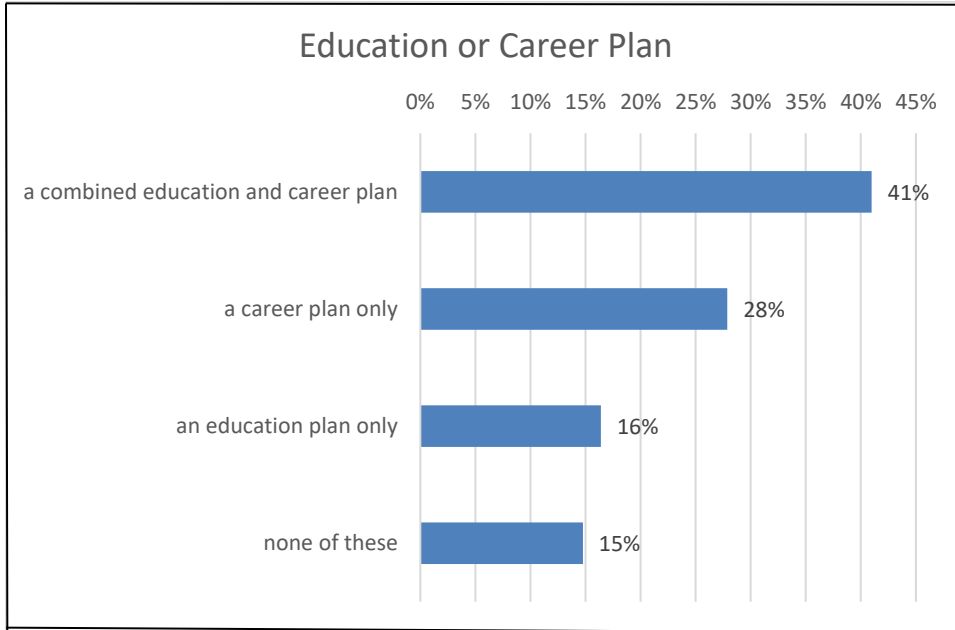


Figure 4.8. Percentages for Education or Career Plan

Question 26 asked students who helped them put together their plan. Table 4.17 shows the proportions for responses indicating who helped the participant put together their education or career plans. The most common participant response representing 56% (n = 34) was parents. Second at 48% (n = 29) was a counselor. Thirty-one percent (n = 19) indicated that no one helped them prepare a plan. Eighteen percent (n = 11) reported

Table 4.17 Percentages for Persons Helping with a Plan (n = 61)

Answers	Frequency	Percentage
My parents	34	56%
A counselor	29	48%
No one	19	31%
A teacher	11	18%
Someone else	7	11%

a teacher as their helper. Eleven percent marked someone else help them.

Question 27 asked students how far in school they thought they would get. Table 4.18 lists the proportions for self-reported expectations of students' education attainment. The most common student response representing 38% ( $n = 23$ ) was completing a bachelor's degree. The second most prevalent reply at 21% ( $n = 13$ ) was high school diploma or GED. Third at 16% ( $n = 10$ ) was completing a vocational training or associate's degree.

Table 4.18 *Percentages for Expectations of Education Attainment (n = 61)*

Answers	Frequency	Percentage
High school diploma or GED	13	21%
Start but not complete a Vocational Training or Associate's degree, 2 year.	1	2%
Complete a Vocational training or Associate's degree, 2 year.	10	16%
Complete a Bachelor's degree, 4 year.	23	38%
Start but not complete a Master's degree.	1	2%
Complete a Master's degree.	6	10%
Complete a Ph.D., M.D., law degree, or other high-level professional degree.	7	11%

Question 28 asked students to rate themselves on a list of 23 items addressing self-efficacy using a 10- point Likert-type scale (0=not sure at all to 9=fully confident). Table 4.19 provides descriptive statistics for self-efficacy items. Reliability of these 23 scale items addressing self-efficacy were evaluated with JASP yielding standardized Cronbach's alpha of .94. The means for self-efficacy items ranged from 3.43 to 4.74. The overall mean for the category (self-efficacy) was 4.09 ( $SD = 2.67$ ).

Table 4.19 *Descriptive Statistics for Self-Efficacy Items (n = 61)*

Questions	<i>M</i>	<i>SD</i>
Gather information about math classes that interest me.	3.80	2.75
Plan my academic goals for the next 3 years.	4.25	2.69
Choose a math class from a list of possible math classes that I am considering.	3.70	2.61
Decide which math class would be best for me.	4.43	2.54
Resist my parents' or friends' attempts to push me to a math class that I think is not right for me.	4.15	1.98
Describe the academic skills necessary for the math class I might want to learn in.	3.93	2.48
Choose a math course in which most students are of the opposite sex.	3.70	2.80
Decide which areas of study are relevant to future areas of study.	4.44	2.55
Find out the grade point average of students in the math class.	3.80	2.49
Talk with a person who is already taken the math class which I would like to take.	4.18	2.72
Specify a number of academic areas that interest me.	4.15	2.68
Accurately assess my academic skills.	3.87	2.51
Specify what steps should I take to take the math classes I want.	4.02	2.72
Persist toward my academic goal, even when I feel frustrated.	4.08	2.57
Choose a particular math class even if my parents do not approve it.	3.43	2.64
Rate my academic and social priority regarding the math class.	4.03	2.54
Be assisted by the guidance counselor in choosing a math class.	3.93	2.74
Determine what field of study I am talented.	4.46	2.67
Choose a math class that will fit my interests.	4.74	2.84
Choose a math class that will fit my preferred lifestyle for the next 3 years.	4.49	2.78
Make a decision about a math course without worrying if it was right or wrong.	3.75	2.72
Prepare properly to be accepted to the math class I am interested in.	4.13	2.67
Finding out the teachers' attitude toward students studying in the math class.	4.51	2.81

Questions 29 and 30 asked students if they needed additional information regarding online or summer school math course options to get ahead. Table 4.20 shows that 31% ( $n = 19$ ) of respondents indicated “yes” to both questions. Respondents indicated that they needed additional information regarding online course options for first time credit and summer school math course options for first time credit.

Question 31 is open-ended and will be addressed in the qualitative findings section.

Table 4.20 *Positive Responses for Questions 29 and 30 (n = 61)*

Question	Frequency Yes	Percentage Yes	Frequency No	Percentage No
Q29: Do you need more information regarding online math course options to get ahead?	19	31%	42	69%
Q30: Do you need more information regarding summer school math course options to get ahead?	19	31%	42	69%

**Quantitative summary.** Taken alone, the quantitative findings indicated that teachers were the most sought and most helpful source for students’ math course selections. Counselor knowledge, availability, and supportiveness were rated fair to good on average with the majority of students agreeing with counselor overall excellence and positively recommending them to friends. Overwhelmingly participants did not identify themselves as “math people”. However, they did agree with math usefulness, especially for college. Respondents also ranked college and high school graduation as the number one and number two motivators for taking their current math course and additional math

courses. Only 15% of students indicated that they did not have a college or career plan. They indicated that parents and counselors provided the most assistance in developing their plans and most participants did plan to attend college or vocational training after high school. They rated themselves at the middle for self-efficacy and the majority indicated they did not need additional information on online or summer math courses for first time credit. Quantitative analysis alone is an incomplete picture. Following is an analysis of the qualitative findings that will be combined for a more accurate depiction of the overall findings.

### **Qualitative Analysis, Findings, and Interpretations**

Qualitative data sources deployed in this study included three open-ended survey questions, an online discussion board, and three focus group interviews. Sixty-one students responded to the survey, 45 posted on the discussion board, and 20 participated in focus group interviews. I coded verbatim transcriptions from all data sources with a sentence-by-sentence unit of analysis. Consistent peer debriefing with cohort colleagues weekly and dissertation chair bi-weekly provided feedback on alignment, code, category, and theme development throughout data analysis.

I included three open-ended questions in the MCSS to capture students' initial recollections of their math course selection experiences and ideas without peer influence. Following the MCSS (see Appendix A), the voluntary online discussion board (see Appendix B) opened for participants to reflect on their responses and continue the conversation beyond the MCSS for three weeks asynchronously. Rich descriptive data from these two sources informed the focus group interview protocol (see Appendix C). I facilitated three focus group interviews to clarify my understanding of students'

experiences in the advisement process, factors affecting students' math course selections, and students' needs and preferences in the math course selection process. These semi-structured interviews were held conversational style, for approximately 30 minutes each, and audio recorded to capture data in students' own words. Transcripts from all sources initially yielded 234 structural codes in a sentence-by-sentence analysis. Table 4.21 summarizes qualitative data sources used in this study. This section addresses the study's qualitative data analysis and emergent themes.

Table 4.21 *Summary of Qualitative Data Sources*

<b>Types of Qualitative Data Sources</b>	<b>Number</b>	<b>Number of Codes Applied</b>
Survey Questions	3	23
Discussion Board Posts	1	91
Focus Group Interview Transcripts	3	172
Totals	7	234

### **Qualitative Data Analysis**

The qualitative data was analyzed by inductive analysis to reduce, identify, and organize the vast amount of qualitative data collected into patterns and themes (Mertler, 2017). Strict attention to the inductive process allowed these patterns and themes to emerge from the data not from the researcher's past experiences (Bogdan & Biklen, 2016). Verbatim transcripts of focus group interviews were shared with participants to ensure accuracy. After a few weeks, verbatim transcripts of the open-ended survey questions, discussion board posts, and focus group interviews were pasted into Delve, a web-based qualitative data analysis tool, to code individual sentences from each participant. I attended a one-day face-to-face workshop with cohort colleagues and dissertation committee members to practice first round coding in Delve.

In the first round of qualitative analysis, I used structural coding where content-based codes or conceptual phrases were applied to portions of data relating to specific research questions which categorized the data (Saldana, 2016). Simultaneously, I used methodological codes (Bogdan & Biklen, 2016) by applying a code for each research question: *experiences, affecting factors, needs and preferences*. The following codes were prevalent: *did not know my options for course selections/pathways, I don't know/understand, did not know about summer school for first time credit, need early advisement, advisement by coaches, and advisement limited to high school graduation requirements*. I applied these codes and others to portions of each transcript. I continued to consult my cohort partners and my dissertation chair for added views on the developing categories. My dissertation chair logged into Delve to ask for clarification and provide input on some codes. Figure 4.9 shows the initial application of codes in Delve.

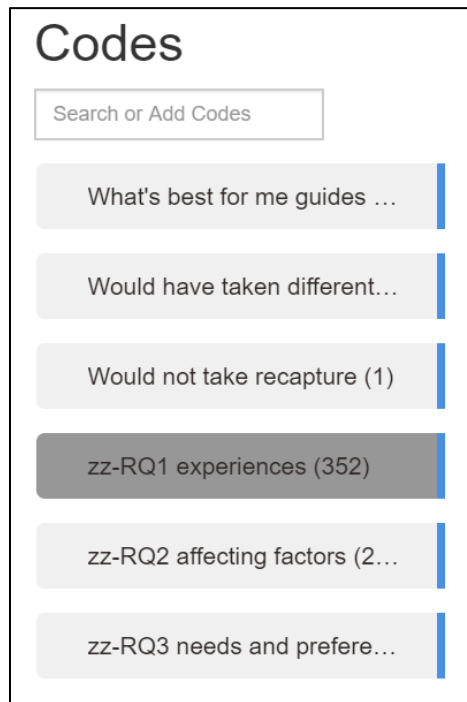


Figure 4.9. First Round Coding in Delve



In an attempt to accurately interpret the participants' input, I often additionally applied in vivo coding where the code is a participant quote (Saldana, 2016). Since the aim of this study was to identify and describe the needs of students, accurately “hearing” the participants was paramount to describing their needs with their voice. In vivo coding was particularly suited for qualitative research that values and respects participants' voice (Saldana, 2016). Figure 4.10 shows in vivo coding in Delve. Additionally, Table 4.22 outlines sub-codes that emerged as coding progressed.

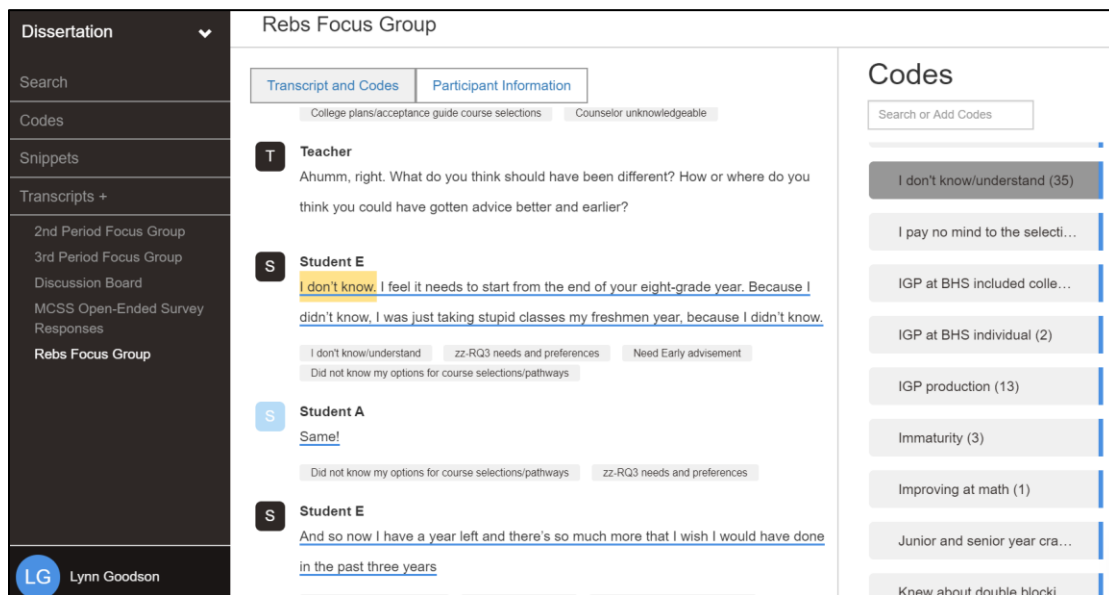


Figure 4.10. In Vivo Coding in Delve

Simultaneous coding was also used in first round coding; meaning that multiple codes applied to a single datum (Saldana, 2016). During focus group interviews, most student explanations were detailed and involved. Typically, several codes applied to most statements. For example, Hope said, “I just didn’t know I could have taken more classes throughout my years and I could have had a better resume going into college”. This statement touched on all three research questions and several content codes including *experiences, affecting factors, needs and preferences, did not know my options for course*

Table 4.22 *First Round Codes and In Vivo Subcodes*

<b>First Round Codes</b>	<b>In Vivo Subcodes</b>	
Advisement	Coaches Friend's parent High school graduation None Not Good RD options	College Good Middle school parents Not about success Power hour Unnecessary courses
Affecting Factors/Influences	Certification College Courses What I want	Challenge Content Sports
Counselor	Contact Did not Ignored IGP Not helpful Too busy	Course change Email Just tells you Most kids Not personable Unless I ask
Did not know	Career alignment Classes Course change Online Summer school	Certification Counselor Double block Options
Needs and Preferences	Activities Easy class Flow chart Get ahead Graduate Job Resume	College Failed it Games Good grades Hard Know Push myself harder
Plans	Academic College Military	Career Future
Scheduling	Directory online Online classes Summer school	Early bird Study hall Year crammed
Understanding	Course options Graduation requirements I can do well Not good at math	Failed it Hands on Misunderstood Serious

*selections/pathways, need college entrance requirements/collegiate success, need to take more math classes, and I don't know/understand, as shown in Figure 4.11.*

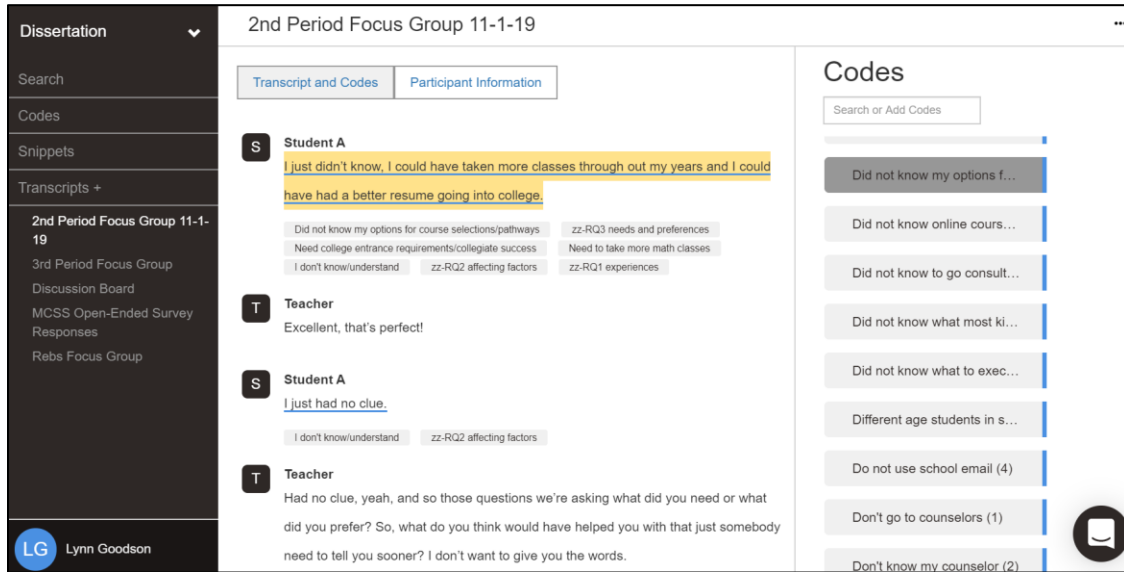


Figure 4.11. Simultaneous Coding in Delve

As the list of codes became extensive, I took a break from coding and listened to the interview audio recordings again for inflection, emotion, and student attitude. I interrogated the codes in Delve to combine and reduce common codes without losing meaning. I searched for common words and phrases across all transcripts, prompts, and research questions to appreciate the cross-relationship and totality of student needs throughout the mathematics course selection process.

I used pattern coding for second cycle coding to organize similarly coded data (Saldana, 2016). I printed and cut out each code to manually sort codes while looking for patterns and similar categories. I sorted and resorted, placing conceptual similarities in rows, then research question alignment in columns. Figure 4.12 illustrates codes sorted by conceptual categories. Twelve categories emerged: *understanding course options, understanding high school graduation requirements, post education plans, college plans,*

*student understanding self and accountability, scheduling issues, alternative scheduling, course requests, teacher influences, other influences, sports impact, and advisement.* I duplicated this alignment in a spreadsheet color coded by category to facilitate peer debriefing with my cohort colleagues and dissertation chair to get feedback on alignment and theme development.

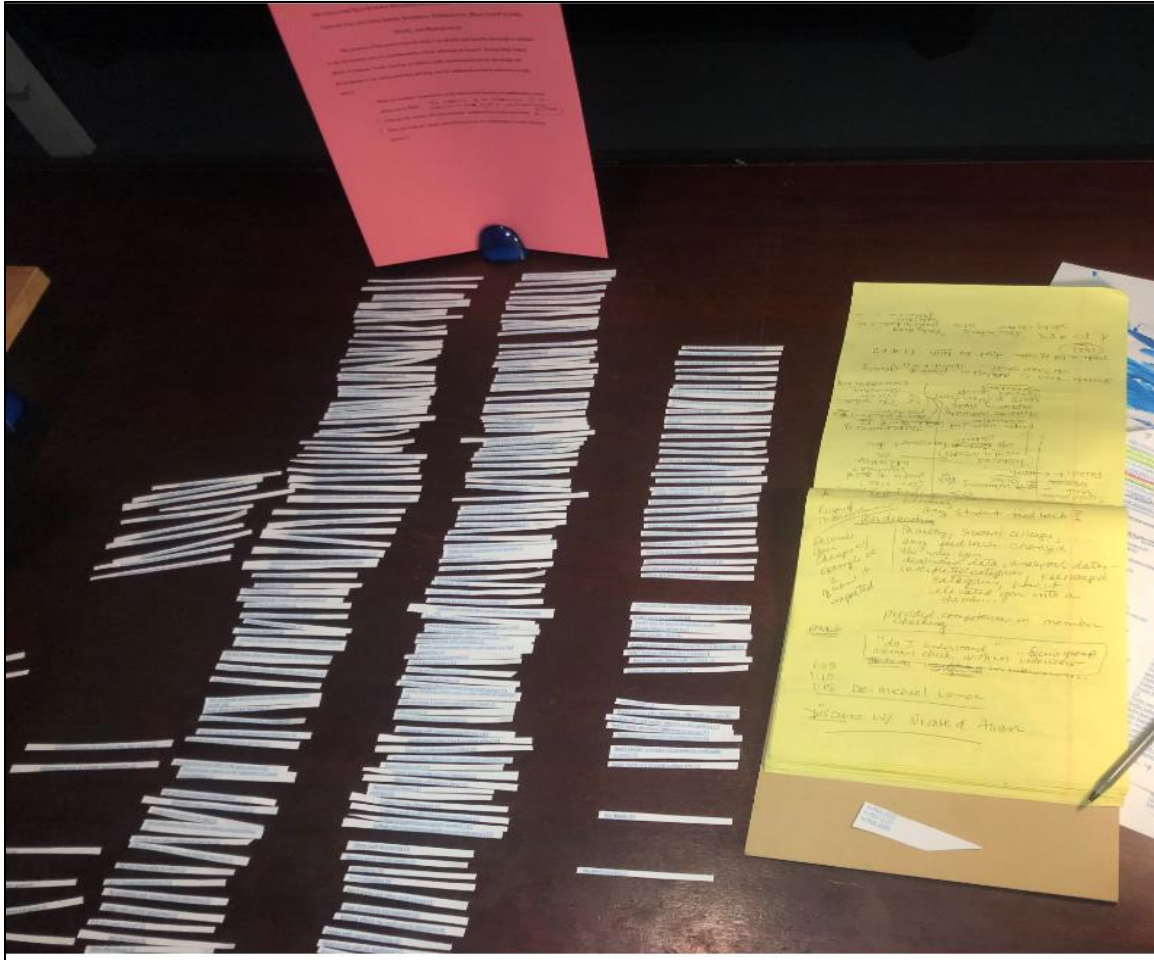


Figure 4.12. Codes Sorted by Conceptual Categories

Figure 4.13 illustrates the codes to categories spreadsheet. Emerging themes were analyzed for both connections and contradictions to the research questions and to the quantitative findings (Mertler, 2017). This cyclical review and introspection were crucial to remain objectively focused on the data. In this iterative process, I continued to dissect

categories in various ways based on emerging themes with the goal of identifying a small number of themes that were pertinent to this study (Creswell, 2014) and ultimately identified student needs in the mathematics course selection process at a suburban high school.

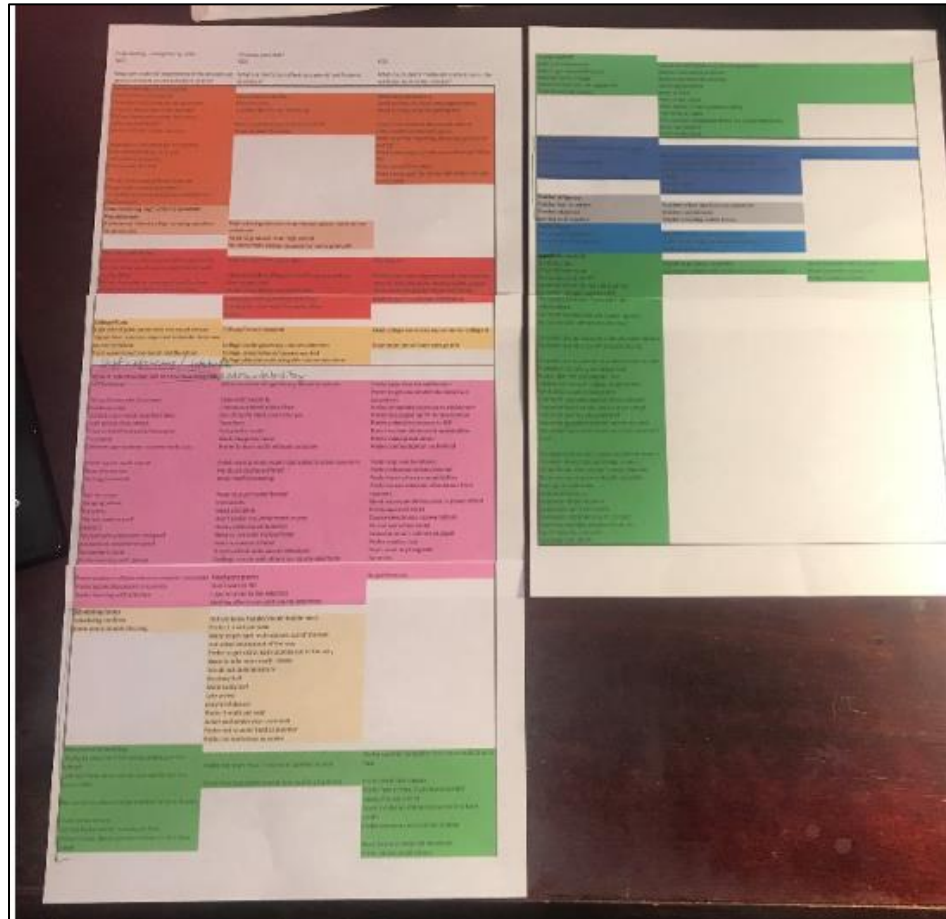


Figure 4.13 Codes to Categories Spreadsheet

I combined interrelated categories into four distinct themes describing students' needs in the math course selection process and consulted with educator colleagues, cohort partners, and dissertation chair to determine if the wording was meaningful. These themes were (a) early and consistent advisement curriculum, (b) importance of student attitude and self-efficacy, (c) varied math course delivery options and scheduling, and (d)

counselor quality and stakeholder influence on math course selections. Figure 4.14 illustrates the amalgamation of categories into themes.

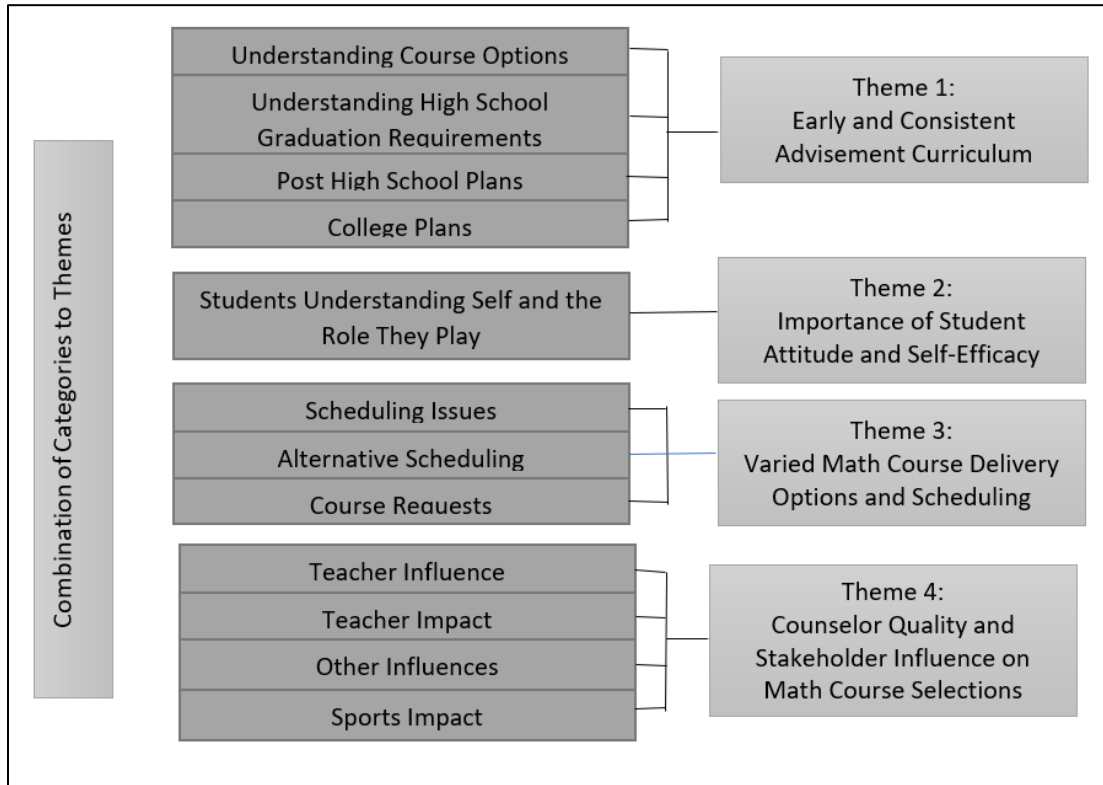


Figure 4.14. The Amalgamation of Categories to Themes

The categories *understanding course options*, *understanding high school graduation requirements*, *post high school plans*, and *college plans* were incorporated into Theme 1: Early and Consistent Advisement Curriculum. The codes in these categories related to information students needed to make informed decisions on their high school math course selections and when they needed that information. Analysis showed that the variation and volume of information that students and parents needed about high school course options, graduation requirements and their linkage to post high school plans warranted curriculum development. The category *student understanding self and the role they play* became Theme 2: Importance of Student Attitude and Self-

Efficacy. The codes that comprised this category described student perceptions of themselves, their reasons for choosing math courses, and their preferences for their roles in the math course selection process. The categories *scheduling issues, alternative scheduling, and course requests* subsumed into Theme 3: Varied Math Course Delivery Options and Scheduling. The codes that composed these categories linked structural issues like double-blocking, block schedules, early bird classes, online classes, summer school, and study hall opportunities with their integration and resulting conflicts that often landed students in the wrong math course or prevented them from reaching their goals. The categories *role of advisement, teacher influence, other influences, and sports impact* led to Theme 4: Counselor Quality and Stakeholder Influence on Math Course Selections. The codes that made up these categories focused on knowledge, availability, and supportiveness of counselors and stakeholders advising students on their math course selections.

### **Qualitative Themes and Interpretations**

Thorough analysis of transcript data from open-ended survey questions, discussion board posts, and focus group interviews generated four themes: (a) early and consistent advisement curriculum, (b) importance of student attitude and self-efficacy, (c) varied math course delivery options and scheduling, and (d) counselor quality and stakeholder influence on math course selections.

**Early and consistent advisement curriculum.** Research has shown that early timing and consistency were key characteristics of good advisement for course selections aligned with post-graduation goals (Alexander & Cox, 1982; Larkin & Jorgensen, 2016; Noaman & Ahmed, 2015; Radunzel, 2014; Reynolds & Conaway, 2003).

*Understanding course options.* Prior research concluded that course selection was more important particularly in the U.S. where students had a wider range of choices that may or may not align with various collegiate fields of study or careers (Adamuti-Trache & Sweet, 2014; Burdman, 2015). Literature also supported the need for students to make a plan for their mathematics course selections as early as possible (Hudson & O’Rear, 2014; Radunzel, 2014; Reynolds, 2003). In this study, the majority of students across all data sources declared a desire to have known their math course options sooner and realized how those choices impacted their future. For example, Tia sadly commented, “No one ever really educated me on what to do and what not to do and like I don’t know about math course options”. While we cannot know all of the reasons that students did not take specific courses in high school, studies have linked advisement as a key contributor to student course-taking (Ross, 2014). Pat added “Because I didn’t know, I was just taking stupid classes my freshmen year, because I didn’t know”. Opra referred to advisement on math course options by saying, “I guess, just like my main point is like start them young, so they know”. In frustration, Leo stated, “I think that we should like start telling eighth graders, because my cousin he’s playing football but he wanted to do stuff at (the vocational center)”, implying that it was too late to fit all desired options into his schedule. In each focus group, students nodded in agreement or commented that they did not know the various math course options that students brought up on the discussion board or in the focus group interviews. The early timing of advisement was also supported by studies showing that math feelings and attitudes developed in primary school when there were no options for math course selections but later affected math course selections in high school (Larkin & Jorgensen, 2016). The following are student



quotes supporting this prior research. In a concerned tone, Jes said “What if you start too late?” Angrily, Ivan proclaimed “I was just like wow, I didn’t have that chance when I was a freshman”. David’s discussion board post contributed “I didn’t know that there were so many options choosing courses”. These examples demonstrate students’ sense of lost opportunities.

Participants also pointed out inconsistencies between guidance counselors. Sis recalled getting conflicting advice from multiple counselors on the correct math course options for college preparation by saying, “and she (a guidance counselor) was like Miss Vale (another counselor) didn’t tell you”? Ivan, a senior, sighed “there’s a girl in my class that is taking a course with me and she’s a sophomore because she had already taken geometry here when she was a freshman. So, she’s already college ready as a sophomore”. In a discussion board post, Amanda added “nobody really told me about all the options that you could do”, indicating disparity with the advisement of students

Prior research also indicated that students taking rigorous high school math courses were more likely to meet benchmarks in math, indicating college readiness, than their non-rigorous math course-taking peers (Gibson, 2013; Ling & Radunzel, 2017). In this study, Opra expressed concern that her counselor discouraged her from taking more rigorous courses saying, “I said I was taking two AP classes. She was like are you sure you want to do that? I was like I’m sorry do you know me?”. Conversely, Fawn insisted her counselor always suggested the most rigorous courses. Fawn said, “She just tried to force me into honors”. These examples show that students were advised differently.

Prior research described an advising curriculum that consists of service-oriented pushing of information out to students for them to prepare in advance of their traditional

meeting where advisors pull unique, open-ended information from students (Steele, 2018). In this study, students voiced concerns about not receiving information about math course options with discussion board posts like Brandon's revealing "guidance counselors not telling me everything about what's offered unless its asked". In a focus group, Mat exclaimed "nobody told me about anything and I just think it sucks!" Nel sighed "I just had no clue that, that (math course option) was available". Similarly, in another discussion board post, Carley expressed "I didn't know what to expect and I always haven't been aware of all these different routes I could have taken just to understand how things work". These examples support students' lack of knowledge regarding their math course options.

Research has shown that good advisement can be advanced through the use of technology as expected by today's students (Steele, 2018). Kay recalled "I don't think they're still doing Power School [student management system], but it usually shows you the plan you had with your IGP". The TAM focusses on the technology's perceived usefulness and ease of use to develop users' attitudes towards adopting the new tool (Angolia & Pagliari, 2016). Participants in this study were comfortable with technology and used school issued laptops daily. Leo recalled "we would go onto this website or something, take a test on what we're good at, and then look at colleges with careers around that field". These examples show students' expectation for using technology to support their education.

***Understanding high school graduation requirements.*** A prior study also took issue with counselors aligning with high school graduation requirements instead of post-graduation plans (Radunzel, 2014). In this study, students expressed their realization that

often counselors were solely focused on ensuring students fulfilled high school graduation requirements in lieu of preparing students for their post-graduation goals. Que noted “I feel like in education today they’re [guidance counselors] so focused on trying to help the people who aren’t going to college”. Similarly, in a different discussion, Ivan recalled “yeah, it’s about [high school] graduation it’s not really into your situation”. Jes stated “they [guidance counselors] say they’re recommending you courses due to our career plan but it’s just every year they’re just going by what you need for [high school] graduation”. These examples show how students perceived a lack of individualized advisement.

***Post high school plans.*** Previous research supported providing accurate advising information for students and exploring how students could create their own unique academic plan to address their post-graduate goals (Burdman, 2015; Drake, 2011; Steele, 2018). In focus group interviews, a few students recalled assignments in middle school to identify courses needed for future careers. For example, Kay insisted, “No, we did it, we would take time off a certain class and go to the computer lab and we would all search all the credits needed or classes you need for a certain career you wanted”. Others described assemblies focused on programs available at our affiliated vocational center. Nel said, “I thought that it was helpful at the beginning or before we went to ninth grade, we had a whole meeting at freshmen academy, about the courses that were available to us but it was only at [the vocational center]”. While others exhibited agreement with head nods and gestures, Jes acknowledged her confusion with “but I did not know anything about nursing or medical or anything”. Additional research shows that an advising curriculum, learning outcomes aligned with goals, and critical thinking are some of the

most important issues today with advising students (Steele, 2018). Grumbling that counselors only focus on high school graduation and do not consider post-graduation plans, Ric exclaimed “it’s to get every kid enough credits just to graduate high school”. In a different discussion, Ivan offered, “yeah, it’s about graduation it’s not really into your situation”. Other research has suggested exploring how students can create their own unique academic plan addressing their post-graduate goals (Steele, 2018). Like others, Hope confirmed, “I was going to say, when I was in like I think middle school we did something called career clusters. We looked at all these jobs and stuff”. Others exclaimed that no connections were made between available math courses in high school to help prepare for these careers.

***College plans.*** Prior research correlated mathematic achievement with high school math course selections and further linked math course selections to students’ likelihood of success in college (Barnett et al., 2014; Froiland & Davison, 2016; Valadez, 2002; Weiner, 2010). Studies have also found that the occurrence of required remedial math courses in the past decade at both two-year and four-year institutions has grown rapidly with a national annual cost of approximately \$2 billion (Burdman, 2015). Furthermore, studies also found that remediation at the college level was not often helpful as four-year colleges reported a 30% pass-rate and have been linked to higher dropout rates as well as more transfers to two-year colleges (Attewell et al., 2006; Dudley, 2010). The significant evidence that many U.S. high school graduates were not college ready, particularly in mathematics, highlighted concern with the practices for advising students about their high school mathematics course selections and other contributing factors (Dudley, 2010; Harwell et al., 2013).

In this study, Liz posted, “my experience is that they [counselors] didn't tell me what's needed for college, just what's needed to pass high school or that there were extra classes”. Concerned in an interview, Hope stated “I just didn't know, I could have taken more classes throughout my years and I could have had a better resume going into college”. When discussing advice from counselors, Leo offered “It's not necessarily what we want for college”. In a different group, Ed said that he always had to ask the counselor, “What math class do you think that you should know to succeed in college?” Freda's discussion board post summarized “my preference for a math course is to prepare me for when I go to college”. Students were clear on their motivation to prepare for college.

**Summary.** This theme, early and consistent advisement curriculum, explored students' understanding of their course options, high school graduation requirements, post high school plans, and college plans as they relate to the math course selection process. This data included open-ended survey question responses, discussion board posts, and interview statements across all focus groups. The analysis contributed to the goal of this study by identifying students' individual views and emotionally charged interactions with their peers on these topics. There were obvious conflicts and gaps in students' perceptions of these topics. The integration of students' perspectives generated the theme: early and consistent advisement curriculum.

**Importance of student attitude and self-efficacy.** Studies have verified that math attitude begins to decline at varied degrees for many students prior to and throughout their high school years as they begin to put forth less effort, display lower persistence in problem solving, and lose mathematics confidence (Beesley et al., 2018;

Henrich et al., 2016; Herges et al., 2017; Oyedeji, 2017; Ruff & Boes, 2014). This study revealed how students understand themselves and their role in the high school math course selection process. Interrogation of data across all sources in this study generated the theme “importance of student attitude and self-efficacy”.

*Students understanding self and the role they play.* Multiple codes filled the category “students understanding self and the role they play” including: (1) effort and persistence, (2) confidence, (3) motivation, (4) self-efficacy, and (5) attitude towards course-taking. In vivo coding revealed students’ voice on these topics.

*Effort and persistence.* Previous researchers concluded that students in advanced mathematics classes exhibited more sophisticated self-regulatory strategies in an effort to obtain their goals (Cleary & Chen, 2009). Self-regulation was crucial to this action research study as high school students are allowed to self-select all of their high school courses but may not have enough knowledge or skill to make informed decisions regarding course selections. In this high school study, some students confirmed their low effort levels and lack of persistence in the math course selection process. For example, Evan’s discussion board post shared “the things affecting my math course selection is that I’m really just trying to graduate from high school and that I pay no mind to the selection”. Also, by discussion board, Grace contributed “nothing really is affecting my math course selections, I’m just taking the courses I need to take to graduate”. Bret summed up the attitude of many high school participants when asked what influenced his math course selections, he replied “If it was easier”. His comment was followed with giggles and lots of affirmative head nods.

*Confidence.* Some students expressed confidence that they were improving in mathematics while also acknowledging a need to continue to improve with appropriate math course selections. In a discussion board post Hemza revealed “I feel like I have gotten better at math over the years and I feel like I have a long way to go before I am where I need to be”. Kelly’s post explained “math was easy but when you grow up and now that you are in high school math has gotten really hard”. In an interview, Dan exposed his vulnerabilities by acknowledging “I’m a senior in algebra two. She’s [pointing to another participant] a sophomore in algebra two”. He was illustrating that some students had chosen to accelerate their math course choices while other students, like himself, took the minimum course requirements. Bret blurted out “failed it” and laughed. Perhaps he was seeking comic relief for his lack of confidence in math course-taking. Iza’s discussion board post evidenced his low math confidence stating “When selecting a math course, I really need to know what I am about to step into because I really am not that good at math so I need to know my resources and what I am getting into”. Mary posted “the factors affecting my math course selection is where I didn’t take school serious back in middle school and failed and now it has had an impact on my selections because I don’t know the material.” These comments highlight the prior experiences leading to a lack of confidence in mathematics that affect high school math course selections.

*Motivation.* Other mixed methods action research studies evaluating interventions to combat negative math attitude and resulting in motivational decline revealed that strategies such as feedback practices (Beesley et al., 2018), instructional practices, service learning integration, home/school environments, peer groups, and taking

appropriately challenging courses tended to improve math motivation and student confidence (Henrich et al., 2016; Herges et al., 2017; Oyedeji, 2017; Ruff & Boes, 2014). Laura's discussion board post noted her motivation to take appropriately challenging courses exclaiming "the factors affecting my course selection is what I feel I can do well in and get me into a four-year college". Jack noted his desire for a challenge with the post "I want a challenge and I want to choose a course that maximizes my abilities". However, there were also some negative motivations. Bret shared times when he was so unmotivated saying, "I don't even remember going to math class." Dan admitted to his negative math attitude by describing when he had no connection with the instructor or the instructional practices so he focused on "getting in trouble". He went on to explain that he "started bumping heads [with the instructor] in intermediate [math class] and I started making bad decisions". Focus group participants were respectful and supportive of each other when describing their experiences.

*Self-efficacy.* As previously discussed, in a study of middle school mathematics assessment practices, Beesley et al. (2018) found that teacher feedback directly correlated to improved student mathematics self-efficacy and further linked to mathematics perseverance in problem-solving in preparation for advanced courses leading to their post-graduation goals. On the discussion board, Que provided evidence of his math self-efficacy explaining "I need to push myself harder to do better in math and get into a higher-class level". Likewise, Rhonda's post exhibited her self-efficacy as she described her math course selection process: "when choosing math courses, I always go for what's best for me". Students cited times of perseverance. For example, Opra revealed "Miss Evans [a teacher] knows more about how to apply to college than my



guidance counselor does”. Her actions indicated that she was motivated to self-advocate and sought out advice from others to prepare for her post-graduation goals.

Beesley’s (2018) study linked mathematics self-efficacy to motivation for students to take mathematics courses aligned with their post-graduation goals. Students like Que insisted they were focused on their post-graduation goals even when their language indicated the opposite. Que wrote “factors that would affect my course selection would be my choice of college education and finding a path that would be easiest to me”. His lack of school knowledge was evidenced by the association of “college” and “easiest”. These types of disconnections illustrated the lack of educational experience in high school aged participants. Prior research has confirmed that ethnic, cultural, and socioeconomic differences also impact access to school knowledge and impact students’ mathematics course selections (Valadez, 2002).

Throughout elementary school (Xu & Jang, 2017), middle school (Beesley et al., 2018), high school (Yüksel et al., 2016), and college (Locklear, 2012), studies showed that belief in their mathematics ability more directly correlated to students’ perseverance than their ability (Morris, 2016). Several participants noted faith in their math ability as a factor contributing to their math course selections. On the discussion board, Sam posted “once I understand what the teacher is teaching me it becomes really easy and I won’t have to worry about anything”. Terri posted “I really want to learn the things that we are learning because I don’t want to fail. I want to pass and have a great understanding”. He went on to link this desire with his post-graduation success. Others grumbled about times when they had escalated their math course choices because counselors did not believe in the students’ ability to succeed in a particular math course. Sis explained “and so, I had

to call the principal”. Pat advised “I went to Miss Adams [an administrator] and I was in [a higher-level course] the next day”. Ric blurted out “Miss Adams will hook you up”. These statements illustrated students’ belief in their own abilities and its effect on their perseverance with their math course selections.

Several studies linked advanced mathematics course selections with student self-efficacy (Beesley et al., 2018; Locklear, 2012; Morris, 2016; Xu & Jang, 2017). Often students noted regret at their lack of self-efficacy in their earlier grades. Cam lamented “if I was doing what I was supposed to do, I would be here” [pointing to a higher-level course on a math course recommendations flow chart]. Grey cautioned “I would be in pre-cal right now, but I almost failed pre-algebra in seventh grade”. On the other hand, Aben exhibited his self-efficacy and intent to take advanced math courses when he proclaimed “so in junior year I’ll take calculus and then senior year I will take another math”. These quotes support the prior studies relating self-efficacy and mathematics course selections.

Additional studies also noted self-efficacy concerns regarding students’ goal setting (Steele, 2018). During focus group interviews, some students clearly expressed their academic plans. For example, Leo stated “I look at my present year and then all my others and what I need to get into those classes to be able to do a four-year college whatever or what I want to do for my career”. Alternatively, Fawn gasped “no, I change my major every week”. Kay wrote about her goal setting saying, “the experiences are selecting the right course for you and getting the classes you need to get to where you want to go in life”. Uriah summed up the effect of her goal setting on math course selections by posting “all I really want is to be successful in school to the best of my

abilities and perhaps enter into the military or law enforcement”. These examples show how students consider their post high school plans.

*Attitude towards course-taking.* The early timing of advisement is supported by studies showing that mathematics feelings and attitudes develop in primary school when there are no options for mathematics course selections but later affect mathematics course selections in high school when there are more choices (Larkin & Jorgensen, 2016).

Student attitude toward course-taking incorporates family and peer influences as well as school and community relationships (Kotok, 2017). These complex interrelationships were investigated in this study. In a focus group interview, Tia noted her disconnect with peers saying, “I didn’t know what most kids take”. Ed’s posted, “I don't really need anything but I do prefer that my math classes be active in discussions and that the other students and I can collaborate on getting answers together”. During focus group interviews, Ed verified he really meant that he wanted to take courses with his friends. Additionally, several participants mentioned their parents’ and siblings’ attempts to tell them to take higher level math courses were of no use at the time. Cam stated “I didn’t want to listen”. Dan proclaimed his rebellious nature with “I needed some butt whopping”. In a discussion board post, Velma simplified her school relationship to course choices in her criteria, “does this class seem like a course I can make a very good grade in?” Hope shared her feelings of despair with school relationships saying:

I don’t know. It [course directory] doesn’t tell me who they (counselors) are. They’re [counselors] not really neighborly. When I go to see the principal or something and they’re like, well you didn’t want to be in this class. Who told you this misinformation? Who is your IGP counselor? And I’m like, I don’t know.

Other students confirmed that they just did not know who to go to for assistance. This fracture in school and community relationships contributed to students' attitude toward course-taking.

**Summary.** This theme examined students' perceptions of understanding self and the role students played in the math course selection process. This data included open-ended survey question responses, discussion board posts, and interview statements across all focus groups. The analysis contributed to the goal of this study by highlighting students' individual views and interactions with their peers on these topics. The amalgamation of this data illuminated the importance of student attitude and self-efficacy in the math course selection process.

**Varied math course delivery options and scheduling.** Prior research has shown that lack of school knowledge does not affect all groups in the same ways (Brown & Cinamon, 2015; Valadez, 2002). This study divulged students' perceptions of traditional and alternative course scheduling and course requests in the high school math course selection process. Participants discussed their lack of school knowledge concerning available scheduling options, delivery methods, course options, and procedures. Analysis of data across all sources in this study generated the theme "varied math course delivery options and scheduling".

**Scheduling issues.** In this study, students disclosed their experiences with traditional scheduling issues like face-to-face content delivery, scheduling conflicts, double-blocking of math courses, study hall, late arrival, multiple campus options, and course loading as factors affecting their math course selections. Disparity in school knowledge of these topics was prevalent. Prior research has confirmed that ethnic,

cultural, and socioeconomic differences also impact access to school knowledge and impact students' mathematics course selections (Valadez, 2002).

*Face-to-face.* In this school setting, all students are provided with a laptop and teachers are expected to use educational technologies. While some students enjoy technology integration in education, others long for traditional face-to-face teaching. In an open-ended survey response, Andrea stated “I would like one math class where the teacher actually teaches and helps the student one-on-one instead of just leaving it all to technology and frowning on them if they get something wrong that they supposedly taught”. There were many posts and discussions both for and against face-to-face content delivery.

*Schedule conflicts.* The traditional course schedule at this location allows eight courses per year, four each semester. Students highlighted math course scheduling conflicts resulting from their other interests like sports, fine arts, leadership classes, and other academic pursuits. Participants shared that some coaches required team members to register for team sports every semester. Mat exclaimed “That’s year-round, all year”. Jes explained the impact on course-taking: “But now that they [coaches] made PE all around him [her brother] he’s not able to do it [take additional math courses], or he’s like give up football and do medical”. Other students mentioned the pervasiveness of this issue sitting not only football, but also baseball, basketball, lacrosse, volleyball, and other sports teams. Setting aside team sports, Kay offered schedule options “Like online PE?” Several recalled Xander’s discussion board post stating “I would have taken PE online and got more math classes in my high school years”. Hope and Kay agreed.

Hope:            You can do that in like seventh and eighth grade.

Kay: Yeah, yeah, I knew that, I did mine in middle school.

Other students were not aware of these alternative scheduling options. Additional examples included conflicts with vocational course offerings, like cosmetology, welding, and other programs that require significant time commitments.

*Double-block math courses.* Participants revealed a desire to double-block math courses in order to take higher level math courses while still in high school. Yolanda stated in a discussion board post, “I want to go ahead and get the hard math classes out of the way, so that the math courses at college will be more understandable”. Highlighting the disparity in school knowledge about scheduling, Zephra posted “I learned that you are able to double-block math classes”. Others were aware. Grey confirmed, “She [guidance counselor] said I didn’t have to double-block so I didn’t”. Grey went on to explain that she regretted not understanding her teacher’s recommendation to double-block math in order to prepare her for college. Cam described a similar instance. She explained “I said I don’t want two maths” and the counselor let her register for only one math course without further explanation of the benefits of double-blocking math.

Dan challenged the proponents of double-blocking math saying, “So basically, I think a lot of y’all underclassmen are wanting to do this, because y’all think when you’re a senior you get like that class period is free. You don’t get that class free. They just fill you into another class higher”. In other words, Dan did not believe that students were motivated to take higher level math courses in high school. Bret confirmed, “She [counselor] tried to say that they had to put you in something and they wouldn’t put you in study hall”. These discussions highlighted the inconsistent information provided to students in the math course selection process.

Thinking of other scheduling issues, Ed mentioned late arrival for students that “weren’t morning people”. Fawn bravely stated, “That’s just being lazy”. There were clear discrepancies in whether or not scheduling options would be applied for the purpose of increased math course-taking or for other non-academic reasons. As discussions continued, more discrepancies in school knowledge were revealed about course scheduling. For example, some students mentioned taking courses on the 10 through 12 campus when they were freshman. In disbelief, Hope said, “So, I didn’t know that when you’re a freshman, they can take courses here [the 10<sup>th</sup> – 12<sup>th</sup> campus]”. This is another example, of a student not aware of the options available.

*Course loading.* Older students conveyed the pressure they felt to complete higher level math courses in their last two years of high school. Pat proclaimed “Like I want to cram as much as I can into my senior and junior year but, I could have done it in my sophomore year too and made it so much easier”. In a frustrated tone, Sis said, “I just didn’t know my junior and senior year would be so stuffed crazy full”. Opra also mentioned “I didn’t know that the junior and senior year would be so crammed”. Frankie honestly admitted in a discussion board post, “I know I do not want to take anymore math classes next semester because I know I'm not going to want to work that hard my last few months of high school”. Although skipping math in the senior year was not advised, Ed said he was looking forward to “not having it [math] senior year”. Ultimately, students will live the consequences of their course selections.

**Alternative scheduling.** Although there was a disparity in school knowledge about the scheduling issues previously mentioned, those scheduling options have been in place for several years at this location. In more recent years, administration has been a

proponent of flexible scheduling such as online courses for first time credit, summer school for first time credit, and early bird classes. These are discussed below as alternative scheduling issues because they were significantly lesser known to students.

*Online courses for first time credit.* Historically, failed courses at this school could be recovered via an online credit recovery course. Open discussion board posts and interview exchanges revealed inconsistencies with student knowledge that there were also online core courses available for first time credit. For example, Jane's discussion board post stated, "I knew that they offered online classes but I didn't know that core classes could be taken online too". Igor wrote, "I actually didn't know about the online courses in order to be ahead, I wish I would've known". Hannah posted, "I did not know we had online classes and wish someone would have told me this in 9th grade". Even students with online class experience, were unaware that core courses could be taken online. Ric explained, "The only thing I thought you could take online in the summer is PE and I did that my freshmen year". A few respondents specifically mentioned online math courses. Greg posted "I wish I would have known we had online classes, so that I might have been able to get extra math classes out of the way, like precalculus". Fred posted "I did not know that we could take classes online during school and its free". Subsequent focus group interviews revealed that most students were unaware that online courses for first time credit were also available during the school day at no cost. Que explained, "Yeah, the only thing I had to come into school for was like the final exam and we just went to the computer lab in the freshmen academy and took it". While a few students were aware of online core courses for first time credit, most participants were not aware of this course option. Those would not have taken an online math course,



suggested that taking other courses online could have cleared space in their schedule to take more math courses with a face-to-face instructor.

*Summer school for first time credit.* Discussion board posts revealed a similar lack of knowledge that summer school courses were available for first time credit. Ephrem posted, “I didn't know they had extra classes during summer school for those who didn't fail and also, they have online classes you can take”. Dani posted “I didn't know that I could take courses during summer school without having to fail a grade to take it and I could just get other courses out of the way”. As some students described the process, others commented. Caron posted, “I didn't know that you could request to take certain courses over the summer”. Barbara posted, “I didn't know that if at least 10 people requested a course during the summer, the school would provide them with that course and you could get that credit in a matter of a couple months”. Opra shared that it was not a simple process, saying, “And so, it was like, they didn't want you to take it and they were trying so hard to keep me from taking summer school”. Others were not aware that face-to-face courses were offered in summer school for first time credit. Sis specified, “I knew it was face-to-face for kids who failed but like I thought that face-to-face was only for kids who failed not for like kids who want to take something else”. Others shared limited knowledge. Tammy posted, “Just didn't know you could take math and English credits over the summer”. Most shared historical knowledge with posts like “I thought summer school for here was for people that failed a class here”. Others made it clear they were not interested in summer school options at all. Aben said, “I wouldn't take summer school”. Likewise, Cam stated, “But, I wouldn't go to like school in the summer”. Even though students indicated they would not want to go to summer school,

these quotes also show their lack of knowledge that the option was available to them for first time credit

*Early bird classes.* A few students expressed interest in early bird classes. Most had no knowledge of early bird classes. The following conversation transpired regarding interest in early bird classes:

Fawn            Yeah, because you can have the rest of the day for yourself.

Bret            That's is a negative for me.

Aben            That's a positive.

Cam            Heck no.

Grey            What is that?

While it is human nature to have differing opinions, most participants' concern was focused on the disparity in school knowledge about varied course delivery and scheduling options.

*Course requests and changes.* The third category contributing to theme three was *course requests*. In addition to the inconsistencies in school knowledge about course options and scheduling concerns, students reported that they often did not get the courses they requested. They also specified changing courses was a difficult process. Hope explained, "Some classes that I got in I didn't register for and they just put me in that by accident I guess but they won't let me switch any of them". Wayne posted, "I told her [counselor] I wanted to change the class to a core math class". Gloria posted, "I wanted to change Spanish 3 to a math course so I can help prepare myself for college". In an open-ended survey response, Carmen wrote, "I have talked to the counselor about my plans for college etc. and electing new classes and she signed me up for the wrong class

even though I told her multiple times the class name”. Others felt they had no choice in their math course selections due to their initial high school math placement. Grey explained, “I had to take intermediate because I took foundations. And now I’m stuck here [Algebra 2] senior year”. Cam said, “Eighth grade is where everything went wrong for me. Because I took a fat right to foundations [the lowest level math course]”. These examples also support early advisement.

**Summary.** This theme explored students’ perceptions of scheduling issues, alternative scheduling, and course requests. This data included open-ended survey question responses, discussion board posts, and interview statements across all focus groups. This analysis contributed to the goal of this study by identifying students’ individual views and the emotionally charged interactions with their peers on these topics. The integration of this data led to the theme varied math course delivery options and scheduling.

#### **Counselor quality and stakeholder influence on math course selections.**

Noaman and Ahmed's (2015) study on a framework for e-academic advising highlighted the importance of advisor access, convenience, face-to-face contact, and online advising effects on the relationships with advisors. In this study, high school students disclosed their experiences with counselors and other stakeholders as they advised students in the math course selection process. Categories leading to this theme included the *role of advisement, teacher influence, other influences, and sports impact.*

**Role of advisement.** Students conveyed both positive and negative experiences with their counselors during advisement for math course selections. In an open-ended survey item, Derek wrote “She’s the only counselor I’ve had at the district that actually

listened to me and talked to me about what I can do for my future instead of forcing SC Colleges down my throat”. While Keith posted, “Previous experiences that I’ve had with advisement on the process of my math course selections has not ever been very helpful nor informative”. Larry described collaboration with his counselor by posting, “When selecting Algebra 2, it was really a decision me and my counselor both made”.

Participants expressed counselor advisement concerns with privacy, frequency, and knowledge. Students wanted counselors to get to know them, describe all course options, and help them with an educational plan.

Several students expressed concern that their advisement meetings in middle school were not private. These students reported:

Opra            It (IGP) wasn’t private at all.

Sis              Wasn’t it a group IGP?

Opra            It’s very like Ok let’s just pump them out.

Sis              Ok next kid.

Opra            Ok, let’s sign off on it.

Sis              You’re good.

Tia              It wasn’t even specific for you.

Pat              Well now, now when I was by myself last year with the IGP with my dad, it was private.

Tia              I feel like they just half of the time I don’t know what they are taking about and it’s just a general statement; and it’s like well most kids do this.

Many reported that the annual IGP meeting was their only advisement experience with their counselor. Ivan recalled, “I just don’t pay attention to the handbook, so every time I go to my IGP meeting, that’s the first time I see that counselor and that’s the last time I hear from them”. In a different discussion, Ric stated, “A GPA [IGP] meeting That’s the only time I have been”. In an open-ended survey item, Grace replied, “never really used the consular unless I had to”. Que claimed, “I never went to a counselor in my high school years”. When thinking of their relationship, Leo recalled, “They (counselors) don’t ever email us back”! Hope described looking in the handbook for her assigned counselor and thought “I don’t know who that person is”. These examples demonstrate students’ lack of relationship with counselors.

Some students expressed negative perceptions or concerns about their counselor experiences. In an open-ended survey item, Ester wrote, “My counselor was not helpful what so ever and seemed to not be able to answer any questions I had about any course”. Mary’s open-ended survey response, encompassed many of the topics that informed the interview. Mary wrote, “We discussed important things about my future and what I may need and she acted like she knew nothing and just pointed to the career planning sheet that we already looked at”. Novi wrote, “She [counselor] seemed as if she didn’t know any information about any extra math classes during summer or tutoring which was very unhelpful so we had no answers at all”. Pat recounted getting misinformation from her counselor. “So, I knew it was possible [to register for a certain course] but miss counselor didn’t think it was”. Ric described one counselor calling to correct another counselor’s error. “Yeah, so, I don’t know like my brother wants to go to a four-year school and we got a call from a guidance counselor a week before school started and she was like they

switched it (his math course)”. Opra specified a counselor’s lack of knowledge regarding out of state colleges. She said, “She wrote like Texas and A and M. She was like, what was that last one?” Ric explained, “And that’s why those kids don’t go to guidance counselors”. Many students perceived that their counselors didn’t really know them:

Ric            They don’t talk to you about what classes you should take and what you’re trying to do when you get older.

Tia            They aint trying to talk.

Sis            She didn’t ask me a single question about like the courses that I want to take.

Tia            Because they don’t help you do anything like extra.

Sis            They’re not taking into consideration and like looking deeper into ways of explaining and showing kids this to set them up.

Ric            Then they call you individually and just sign off. They talked about elective classes.

Sis            That’s the only thing they talked about; nothing about like real classes.

Expressing disgust that counselors wait too late to try to address individual needs, Que recalled a time when a counselor called home about classes for his brother and said, “And so she [counselor] called [mom] and was like does he (brother) want to go to a four-year school? [mom replied] He’s a senior”. These examples show students’ perception of late advisement.

Many students expressed a desire for counselors to present all course options when advising. Jackie’s discussion board post said, “I never asked much about math

courses so she didn't tell me much about them". In an interview, Ed stated, "Guidance doesn't tell you everything though". Dylan posted, "I wish that my guidance counselor would have told me about my path in mathematics". Tia said the only thing for me that ever happens in an IGP is "hey these are the classes you're taking next year". Pat said, "they aren't helping the people who are trying to go to college and trying to be successful". Wayne posted, "My experience is that they (counselors) didn't tell me what's needed for college, just wants needed to pass high school or that there were extra classes". On the other hand, Opra recalled a time when her counselor "was actually talking about what colleges and big stuff". These examples demonstrate the disparity in advisement of students.

Lastly, several participants desired advice to make a personal education plan. Pat indicated that there is a form to help students complete an education plan. He said, "They have that [form] but it's just blank. Opra said, "I didn't see nothing like that [form]". These examples support the need for an advisement curriculum to provide consistent information to all students.

***Teacher influence.*** Studies proposed that while course-taking was a key contributor to mathematics achievement, there was a complex web of other significant issues such as instructional strategies like inquiry-based learning (Chowdhury, 2016; Dudley, 2010). Nora's post cited instructional practices that affected her choices offering "I do better in an environment where I can speak out and ask questions freely". Ozzie's post added "I prefer a math course that is more hands on and open". Pham's discussion board post noted a desire for peer group environments. He revealed "I prefer to learn

math without computer and in activities like participation in groups or games”. These examples show factors affecting students’ math course selections.

Previous studies also noted the role of teachers in achievement and as counselors regarding students’ future plans and course selections (Alexander & Cox, 1982; Herges et al., 2017). Participants recounted how teachers influenced their math course selections. Tia said, “That’s the only reason I know [what math course to take] is because of my math teachers”. Opra said, “Listen the only way I got to where I’m at is because my ninth-grade teacher told me to take your class”. A couple of students posted that they simply “choose the recommended course” from their math teachers. Others indicated they choose math courses based on teacher qualities. For example, Bret stated, “teacher was never in class”. Dan described his relationship with a particular teacher as “bumping heads”. He would never take a course with this teacher again. Cam exclaimed that she and a certain teacher did not “float in the same boat”. Donna posted, “My experience with math has been good except for last year because my teacher barley tried to teach”. These experiences affected how students chose their math courses.

***Other influences.*** Prior studies found the greatest influences on high school course selections included not only peer’s educational plans but also parental encouragement (Hyde et al., 2016), and the desire to go to college (Alexander & Cox, 1982; Froiland & Davison, 2016; Valadez, 2002). Drake (2011) contended that a solid advisement program was key to bringing these multi-faceted characteristics together to help students focus on meeting their end goals. Research has also found that the role of parents and their influence on course selections were affected by access to school



knowledge and therefore could limit the impact of parental involvement on students' mathematics course selections (Hyde et al., 2016; Valadez, 2002).

In this study, participants expressed concerns that their parents' and other stakeholders lacked school knowledge and could not help with their course selections. Tia said, "My parents don't know nothing about doing math". Jes explained that her sibling influenced her course selections. Jes said, "I had an older brother here so he told me that it would be better for me to do it at middle school then to do it here". Fawn described her mother's influence as "My mom is making me take it and go to college now". In a different interview, Nel proclaimed, "My mom made me do it [take a higher-level math course], so I had to!" Pat recalled a time when he was caught in a conflict between mom and his counselor. He said, "She (mom) was not ok. And so, my mom like went off". Aben described selecting math courses based on his peer's selections. He said, "because of my friend and she always like ooo look at my work". Pat also described getting course advice from "my friends' parent". These examples demonstrate disparity in school knowledge among different families.

**Sports impact.** Not only did students describe the impact of sports on scheduling courses they also revealed how their coaches influenced their course selections. They specified that only the football coaching staff advised athletes on their course selections. One focus group explained:

Bret I know in football, they do [academic advice].

Dan But you have to realize that football is more respected at high school than any other sport.

Bret So, they have an academics person.

Dan So of course, they are going to take care of football before any other sport. When asked about other sports, Cam replied, “They don’t talk about it [course selections]”. Fawn confirmed, “No, a lot of coaches don’t”. These examples also support a defined advisement curriculum to ensure information accessibility for all students.

**Summary.** This theme explored students’ perceptions of the role of advisement, teacher influence, other influence, and sports impact. This data included open-ended survey question responses, discussion board posts, and interview statements across all focus groups. This analysis contributed to the goal of this study by identifying students’ individual views and the emotionally charged interactions with their peers on these topics. The integration of this data led to Theme 4: Counselor Quality and Stakeholder Influence on Math Course Selections. These results were used along with quantitative data for a better understanding of student needs in the mathematics course selection process.

## CHAPTER 5

### DISCUSSION, RECOMMENDATIONS, IMPLICATIONS, AND LIMITATIONS

The purpose of this action research study was to identify and to describe the needs of students in the advisement process of mathematics course selections at a suburban high school in South Carolina, in order to make recommendations for effective advisement for math course selections. This chapter addresses the findings as they relate to the research questions and literature linked to the advisement of math course selections in high school. This information is organized into a discussion, recommendations, implications, and limitations of this study.

#### **Discussion**

The quantitative and qualitative data were jointly considered along with literature related to advisement of course selections in order to answer the research questions guiding this study. To present the integrated findings, this discussion is divided into three sections, one for each research question: (a) Research Question 1: What are students' experiences in the advisement process of math course selections at a suburban high school? (b) Research Question 2: What are the factors affecting students' math course selections? (c) Research Question 3: What are the students' needs and preferences in the math course selection process?

## **Research Question 1: What are students' experiences in the advisement process of math course selections at a suburban high school?**

Prior research showed academic advising requires a collaborative relationship among stakeholders focused on an educational process designed to achieve desired learning outcomes, ensure student success, and outline the sequence for meeting the students' personal, academic, and career goals including course selections (Hyde et al., 2016; Noaman & Ahmed, 2015; Ross, 2014; Steele, 2018). Stakeholders included students, parents, teachers, mentors, advisors, counselors, and others. Findings from all data collection methods in this study were incorporated to illustrate students' experiences in the advisement process of math course selections in high school. During analysis of the surveys, discussion board posts, and interviews three categories emerged: (a) stakeholder relationships, (b) advisor quality, and (c) advising process.

**Stakeholder relationships.** Jayne Drake, past president of NACADA, defines academic advisement as “the very human art of building relationships with students and helping them connect their personal strengths and interests with their academic and life goals” (Drake, 2011, p.8). In this study, survey data confirmed students' relationships with stakeholders when seeking advice for math course selections. Respondents identified teachers (69%), friends (67%), parents (66%), and counselors (39%) as their top choices when asked where they had gone for advice or information about math course selections. Subsequently, they ranked teachers (43%), themselves (39%), and parents (30%) most helpful with their math course selections; followed by friends (20%) and counselors (16%). Alternatively, participants ranked other (34%), coaches (33%), and siblings (23%) least helpful with math course selections.

Students' discussion board posts and interviews elaborated on these complex relationships by additionally describing advising experiences with administrators, parents of friends, and community members. Students described stakeholder relationships of all extremes with "love Ms. Mack", "He's not very neighborly", "very helpful", and "rude". As experiences were shared, the overwhelming consensus was that experiences in advisement for math course selections were unique, often conflicting, and course options were frequently misunderstood or unknown. The culmination of varied data sources in this study, supported prior studies describing complex interrelationships in high school math course selections (Froiland & Davison, 2016; Hyde et al., 2016; Itauma, 2019; Kelly & Zhang, 2016; M. Kim, 2014; Kotok, 2017).

Participants in this study specifically confirmed math teachers were their number one source and most helpful for advice about math course selections. These findings contradict studies that found parents were the greatest influencers to high school students' math course-taking (Froiland & Davison, 2016; Hyde et al., 2016), but support the numerous studies highlighting the varied stakeholder collaborations required for good advisement in high school (Noaman & Ahmed, 2015; Ross, 2014; Steele, 2018).

In this study, guidance counselor experiences dominated interview conversations since students' annual IGP meeting with guidance counselors is the summative step for students' course selections at this location. By survey, students ranked guidance counselors fourth on the list of sources for information specifically about math course selections and fifth most helpful. Like prior research, the convergence of all data sources in this study supports consistent relationship building with students, teachers, and

advisors throughout their educational experience to empower students to stay focused on their goals and build student knowledge about the course selection process.

**Advisor quality.** While we do not know all of the reasons students did not take specific courses, studies have shown that advisement was a key contributor to student course-taking (Ross, 2014; Sheldon et al., 2015). Prior studies emphasize that academic advisors should be available, knowledgeable, and supportive (Noaman & Ahmed, 2015; Sheldon et al., 2015). In this study, core teachers made course recommendations for their individual subjects and guidance counselors were responsible for an annual meeting with each student including their parent to finalize all course selections for the following school year. By survey, students rated guidance counselor quality on average “satisfactory” for mathematics advising. The participants rated on average their counselor’s knowledge slightly below satisfactory, availability slightly above satisfactory, and supportiveness was satisfactory on average. Respondents were overwhelmingly agreeable with survey items characterizing guidance counselors as overall excellent and recommendable. Some participants confirmed these qualities with comments like “She’s the only counselor I’ve had ...that actually listened to me and talked to me about what I can do for my future instead of forcing SC Colleges down my throat”. These kinds of descriptions implied satisfaction with one counselor and dissatisfaction with other counselors.

Open-ended survey items, discussion board posts, and focus group interviews overwhelmingly juxtaposed a satisfactory characterization of advisor quality. Many students became more dissatisfied with advisor quality during focus group interviews when they realized that they were unaware of course options, course-taking processes,

and effects of course choices that should have been communicated to them. Some described their counselor as “not helpful what so ever” or “not able to answer any questions about any course”. Others described counselor experiences as “discussed important things about my future and what I may need and she acted like she knew nothing” or “seemed as if she didn't know any information about any extra math classes”, “very unhelpful”, and “no answers at all”. These experiences support research indicating that advising is a key contributor to course-taking and advisors should be available, knowledgeable, and supportive (Drake, 2011; Sheldon et al., 2015). However, this study also identifies students' conflicting satisfaction with advisor quality.

**Advising process.** Prior research shows that early timing and consistency are also key characteristics of good advisement for course selections aligned with post-graduation goals (Alexander & Cox, 1982; Larkin & Jorgensen, 2016; Noaman & Ahmed, 2015; Radunzel, 2014; Reynolds & Conaway, 2003). Analysis across all data sources revealed student experiences resulting from multiple elements of the advising process. Two of these key experiences were (1) limited meetings and (2) communication with counselors. For example, 89% of respondents in the survey for this study indicated that they only met with counselors once or less in the prior year regarding their math course selections. Without an established process or curriculum with consistent interactions, students have not developed the strong relationships with counselors needed for a good advisement system. During focus group interviews, students explained that most often the annual IGP meeting was the only time they met with their guidance counselor with comments like, “that's the only time I have been”. Furthermore, less than half (41%) of survey respondents indicated that the number of counselor meetings was

sufficient for their advising needs and yet they rated counselors “satisfactory” on availability.

Interviews also revealed some students did not seek out their counselors due to a perception of lack of knowledge rather than availability. Some students cited a perception of accurate advice on math course selections that made them want additional advice from counselors while others indicated inaccurate or a lack of information. The latter perceived counselor meetings as a “waste of time” or “not ever helpful”. In either event, data suggested the lack of experiencing a process to help students and counselors develop the strong relationship needed for good advisement. Drake (2011) contended a solid advisement program was key to bringing these multi-faceted characteristics together to help students focus on meeting their end goals. The findings in this study confirm Drake’s contention.

Inquiries about methods of communication confirmed that most high school students (77%) experienced face-to-face meetings with guidance counselors followed by email (20%). During interviews, respondents indicated that middle school counselors held assemblies and gave group presentations on course options that were limited to vocational school information and electives. Participants did not recall any early interventions specific to math course selections, but they did make suggestions like “start them early” and “tell them by eighth grade” when referring to when they needed to know all math course options. The early timing of advisement is supported by studies showing that mathematics feelings and attitudes develop in primary school when there are no options for mathematics course selections, but later affect mathematics course selections in high school (Adamuti-Trache & Sweet, 2014; Burdman, 2015; Larkin & Jorgensen,



2016). Students' perceptions of these experiences or the lack thereof support current research noting that early and consistent advisement would be needed to establish a good advisement process for course selections aligned with post-graduation goals (Adamuti-Trache & Sweet, 2014; Burdman, 2015).

## **Research Question 2: What are the factors affecting students' math course selections?**

Prior research noted that students' high school course-taking was primarily based on their prior academic performance but factors for good advisement with the greatest influence on high school course selections included peer's educational plans, parental encouragement (Hyde et al., 2016), and the desire to go to college (Alexander & Cox, 1982). More recent research confirmed parent expectations and prior course-taking remained key influencers on students' mathematics course selections (Froiland & Davison, 2016). Additional research found that middle school students had a strong desire to please people in authority, like teachers and parents, and may have selected courses based on what they thought others wanted (Herges et al., 2017; Hyde et al., 2016). Findings from all data collection methods in this study were incorporated to describe students' identification of factors affecting their high school math course selections. During analysis of the surveys, discussion board posts, and interviews the following categories emerged: (a) math identity, (b) motivation, (c) math interest, (d) math usefulness, (e) peer influence, and (f) time and effort.

**Math identity.** Prior research confirms the effect of math identity on students' propensity to enroll in higher level math courses (Ingels et al., 2014; Itauma, 2019). The majority of students in the current study did not identify themselves as "math people".

Most, 64%, had not participated in any math related activities beyond their scheduled math class in the past year. Sixty-seven percent disagreed with the statement “I see myself as a math person” and 66% disagreed with “others see me as a math person”. Similarly, participants in focus group interviews readily admitted that their math identity was mostly confined to their math class. Outside of class they did not view themselves as “math people”. The triangulated findings in this study support prior research on math identity as these participants, self-confessed non-math people, were not enrolled in higher level math courses.

**Motivation.** Prior research shows that high school math course selections are particularly important in the U.S. where students have a wider range of choices that may or may not align with various collegiate fields of study (Adamuti-Trache & Sweet, 2014; Burdman, 2015; Larkin & Jorgensen, 2016) and too many college freshmen are required to take remedial math courses (Attewell et al., 2006; Burdman, 2015; Dudley, 2010), which they should have taken in high school (Parsad & Lewis, 2003). Prior research also showed that a student’s perceived control and value affected motivation to selecting more advanced courses if they felt they were part of that community or course of study (Stenbom et al., 2016). Most participants in the current study revealed a plan to attend college and therefore, should have been highly motivated to take math courses that would prepare them to meet their goals. Survey respondents identified their motivations for taking their current math course as: needed for college (84%), no choice school requirement (82%), teacher recommended (70%), assigned to me (69%), and needed for my career (61%). This is supported by students’ comments from open-ended survey responses, discussion board posts, and interviews, like “my course selections would be

what will help me better succeed in college” and “can help me accomplish my goals of getting my dream job”. However, when asked about how many math courses respondents expected to take in high school, 54% replied four, 13% said three, and 3% marked one. The 16% that indicated three or one show a lack of school knowledge since a minimum of four math courses are required to graduate from high school and no one selected that they did not intend to graduate from high school. Participants stated that they would take math courses that are “easier” or “no math” their senior year. Comparatively, only 30% of participants indicated that they plan to take more than four math courses in high school. This does not coincide with 79% of respondents indicating that they plan to attend college.

The triangulated findings in this study revealed mixed support of prior research that students’ perceived value affected students’ motivation to take more advanced courses. While participants acknowledged the value of math courses to meet their goal of attending college, only 29% indicated that they would be taking more than the required four math courses for high school graduation.

**Math interest.** Prior studies have shown that students’ math interest level predicted student work habits and regulatory behaviors (Cleary & Chen, 2009) that lead to higher achievement (Greene, 2016), which could affect math course selections (Alexander & Cox, 1982; Froiland & Davison, 2016). Survey respondents in this study were almost equally split on whether or not they expected to enjoy their current course and if they thought the course would be boring. However, the majority did not view their current math course as a waste of time. Focus group participants lamented on their regrets about not taking math courses seriously sooner with comments like “I didn’t take

school serious back in middle school”. The combined findings in the current study agree with prior research that showed how improved work habits and regulatory behaviors would affect their math course selections.

**Math usefulness.** Prior research has shown that students’ perception of math utility or usefulness predicts students course-taking in high school (Hyde et al., 2016). In this current study, only 46% of participants expected their current math course to be useful for everyday life, but the majority, 80%, indicated that it would be useful for college and their future career, 51%. The data aligns with information collected from discussion board posts and focus group interviews where the majority of participants indicated their belief that math course-taking was useful to prepare for college and careers. They also confirmed their doubt that their current math course would benefit their everyday life.

**Peer influence.** Peer relationships have been described as the intersection of school, community, and social identity (Kotok, 2017). Studies have shown that the educational plans of peers highly influenced student course selections (Alexander & Cox, 1982; Beesley et al., 2018; Froiland & Davison, 2016). Others studies showed that pairing with peers that wanted to go to college helped students develop a culture of learning and lead to the school’s college bound culture (Ling & Radunzel, 2017; Radunzel, 2014). In the current study, survey respondents supported past research regarding the influence of peers with good grades (84%), regular class attendance (90%), and plans to attend college (77%). However, the majority (61%) of these participants did not agree that their peers were interested in school. Discussion board posts and focus group interviews provided little insight into peer influence on math course-taking. A few

participants mentioned the role peers played in their math course experiences like sharing their work or enjoying working together in class.

**Time and effort.** Prior research has shown that the effect of students' time and effort in math courses depends on whether their effort was ineffective or productive and may vary with course level (Barnett et al., 2014). In the current study, survey respondents were approximately evenly divided on their agreement that if they spent a lot of time and effort on their math classes, they would not have enough time for hanging out with friends or for extracurricular activities. The majority (89%) of survey respondents did not agree that time and effort on their math classes would affect their popularity or that people would make fun of them (95%). In focus group interviews, students willingly admitted their desire to participate in time consuming extracurricular activities that could negatively affect their math course selections like sports teams and fine arts performance groups. Participants also shared their concerns with coaches and directors requiring elective "practice-type" courses, during the school day, in order for students to gain acceptance on athletic teams, fine arts groups, and others. Participants indicated that these extracurricular requirements have recently increased to year-round commitments and are affecting their available time and effort for their core academic courses.

### **Research Question 3: What are the students' needs and preferences in the math course selection process?**

Prior research found that in the U.S., many employers cited inadequate mathematics skills in the available workforce while millions of college students spent time and money taking remedial mathematics courses on material they should have learned in high school (Burdman, 2015; Chowdhury, 2016; Dudley, 2010; Ling &

Radunzel, 2017; Parsad & Lewis, 2003). To address this concern, findings from all data collection methods in this study were incorporated to portray students' needs and preferences in the high school math course selection process. During analysis of the surveys, discussion board posts, and interviews the following categories emerged: (a) education and career plan, (b) self-efficacy, (c) online course options, and (d) summer school math course options.

**Education and career plan.** Previous research supported the need for accurate advising information for students and exploring how students could create their own unique academic plan to address their post-graduate goals (Burdman, 2015; Drake, 2011; Steele, 2018). After a survey item described an education and career plan as a series of activities and courses needed to get into college or be successful in a future career, only 15% of students involved in the current study indicated that they did not have a college or career plan. Subsequent focus group interviews allowed students to explain their interpretation that the plan could reside in their thoughts or be documented. Survey respondents also indicated that parents and counselors provided the most assistance in developing their plans. In a self-efficacy item, respondents rated their ability to plan their academic goals for the next three years in the middle of the scale ( $M = 4.25$ ,  $SD = 2.69$ ). Participants further described their preference for assistance with planning in their focus group interviews recalling experiences like "I have talked to the counselor about my plans for college etc. and electing new classes" and "we discussed important things about my future and what I may need and she acted like she knew nothing and just pointed to the career planning sheet that we already looked at". The culmination of all data

methods, revealed that high school students need and prefer assistance with a personal education and career plan.

Other studies described content modules for advising that were available asynchronously to address student planning for post-graduation plans and alignment with mathematics curriculum including self-assessment, educational planning, career planning, and decision-making (Gordon, 1992; Steele, 2018). Moreover, studies confirmed early planning was often needed to ensure that high school students were prepared for college (Adamuti-Trache & Sweet, 2014; Ling & Radunzel, 2017; Radunzel, 2014; Reynolds & Conaway, 2003). In survey, discussion board, and interview data from this study, the majority of participants consistently indicated that college preparation was their greatest preference and motivator for their high school math course selections. By survey, only 21% of respondents planned to take more than the minimum required four high school math courses. Reasons selected for taking more high school math courses ranked useful for college (72%), required to graduate (70%), teacher influence (57%), counselor influence (54%), and parents influence (51%). The amalgamation of findings from all data methods in this study supports prior studies' recommendations for early and consistent advisement to develop education and career plans to prepare students for their post-high school goals. Students also indicated their preference for immediate feedback and convenience of advising. Participants expressed that they did not enjoy interrupting their social time at school to handle school business and would prefer an online option.

**Self-efficacy.** Previous studies have linked self-efficacy to advanced mathematics course-taking (Morris, 2016; Xu & Jang, 2017; Yüksel et al., 2016) and students' goal setting (Steele, 2018). In this study, students rated themselves at the middle of the self-

efficacy scale, which indicates students may not have high enough self-efficacy to choose advanced math courses that would prepare them for their desired post-high school goals. Focus group and discussion board participants shared feelings ranging from confidence to despair with their math course selection experiences. Many students identified their needs and preferences with comments like “I really need to know what I am about to step into”, “I need to know my resources and what I am getting into”, and “I would like to be informed on what’s offered so I can know what I can take and make the best selections”. The integration of all the data in this study agrees with prior research as students identified their needs and preferences in developing their self-efficacy to accomplish their education and career goals.

**Online math course options.** Prior research found that online experiences involve autonomy, competence and relatedness but limit personal interactions such as body language in communication (Angolia & Pagliari, 2016; Barreto et al., 2017). A study in online mathematics coaching emphasized emotional presence as a key feature of successful online relationships (Stenbom et al., 2016). An additional study specifically investigated the use of screencast videos in math learning and found that students favored the use of screencast videos (Tunku et al., 2013). While, the majority of current study survey respondents (69%) indicated that they did not need information regarding online math courses, discussion board and interview participants clarified that they had no idea that core courses, including math, were available online. At the time of their survey, most participants thought that online math courses were only available to recapture a failed math course. Many participants expressed interest in online core courses for first time credit via discussion board posts and interview comments. Many students made the



distinction they would prefer online core courses in other subject areas as they perceived mathematics as too difficult to take online at the high school level. The integrated findings from this study supported prior research on successful online relationships, but deviated from research that students enjoyed videos for math learning. These findings also heightened the awareness that students need to be able to express their feelings throughout the course selection process. Other factors considered were student technology sophistication, infrastructure, and self-motivation to engage with new technology (Angolia & Pagliari, 2016; Barreto et al., 2017). Students in the current study indicated they were confident in their technological skills, but some were under impressed with school's infrastructure to support technology stating that they often used their personal computers and hot spots in lieu of using school devices and internet access.

**Summer school math course options.** A previous study recommended that counselors be knowledgeable about summer opportunities and other educational options in order to enhance interactions between parents and students that focus on students' academic and career goals (Kim, 2014). While, the majority of survey respondents (69%) indicated that they did not need information regarding summer school math courses. However, during discussion boards and focus group interviews participants had mixed knowledge about the availability of summer school math courses for first time credit. Many participants expressed a preference for information regarding summer school math courses for first time credit and concern they were unaware of this option.

## **Recommendations for Effective Advisement for Mathematics Course Selections in High School**

The purpose of this action research study was to identify and to describe the needs of students in the advisement process of mathematics course selections at a suburban high school in South Carolina, in order to make recommendations for effective advisement for math course selections. The findings in this study warranted several recommendations for effective advisement for high school math course selections. The recommendations emerging from this study are organized by stakeholder in the order of their impact on students: (1) parents, (2) teachers, (3) students, (4) counselors, and (5) school and district administrators.

### **Recommendations for Parents**

Parents are children's first and most influential advisors. In my experience, parents want their children to do their best in school. Research has shown that taking higher-level math courses in high school was associated with improved performance in every subject area (Ling & Radunzel, 2017) and that in order to be ready for higher-level math courses in high school early planning was needed (Beesley et al., 2018; Ruff & Boes, 2014). The integration of prior research with the findings of this study generated recommendations for parents including: (1) develop positive math attitudes in children, (2) begin academic planning in primary school, (3) seek access to school knowledge, (4) maintain reasonable academic expectations, (5) aim for higher-level math courses in high school, and (6) align students' mathematics course-taking with their post-graduation goals.

Math enjoyment and understanding its usefulness begin at home. Studies have shown that parents who expect their children to study mathematics related courses should strive to develop positive math attitudes and connections to math usefulness in their children (Hyde et al., 2016; Oyedeji, 2017). Academic advisement intervention should begin in the primary grades in order for students to be prepared to align their coursework with their future plans and optimize the high school mathematics curriculum available to them. While educational theory confirms the role of parents and their influence on course selections (Hyde et al., 2016), social theory indicates that ethnic, cultural, and socioeconomic differences impact access to school knowledge and can limit the impact of parental involvement on students' math course selections (Froiland & Davison, 2016; Valadez, 2002). Teachers, counselors, and administrators bring educational expertise to the advisement process when guiding students and parents. Parents need to encourage children to enjoy math early and stay actively involved with academic stakeholders to develop school knowledge at all levels of their child's education. Developing reasonable academic expectations is recommended since parent expectations have a great influence on students' math course selections into middle school and high school (Froiland & Davison, 2016). Understanding that taking higher-level math courses was associated with improved performance in every subject area (Ling & Radunzel, 2017), parents should aim to prepare students for higher-level math courses in high school that align with students' post-graduation goals.

### **Recommendations for Teachers**

Prior research has shown that academic advising requires a collaborative relationship with stakeholders (Hyde et al., 2016; Noaman & Ahmed, 2015; Ross, 2014;

Steele, 2018). Teachers' relationships with students and families allow them to introduce the value of a pre-focused career pathway based on students' post-high school goals (Ross, 2014). Integration of prior research with findings in this study generated recommendations for teachers including the following: (1) relationship building and school knowledge, (2) math usefulness in everyday life, and (3) course rigor.

All teachers understand the value of building strong relationships with students and parents. Findings from this study revealed a significant breakdown in school knowledge involving the high school math course selection process. Teachers are in a position to educate students and parents about the early academic impact on students' future goals as well as their access to programs and procedures that may be unique to their district including after school programs, summer programs, gifted and talented programs, community programs, and others.

Additionally, students in this study confirmed their doubt that math course-taking would benefit their everyday life. People use so much math in their everyday life, that they are often unaware that they are calculating or problem solving. Teachers can heighten this awareness by consistently identifying math used in everyday life at the earliest levels and convincing students they are good at math, thereby building their math self-efficacy from the beginning.

Above all we, teachers, must listen to our students and advocate for them. Findings from this study support research showing that the vast majority of today's students expect to attend some form of college and that desire formed early in their lives. Teachers must strike a delicate balance between enjoyment and rigor in order to develop the math interest that leads to higher-level math course taking in high school associated

with improved performance in every subject area (Ling & Radunzel, 2017). Research shows that without rigor, high school graduates may lack the skills to be successful in either college or career (Ross, 2014). In short, teachers should establish a culture of learning within their realm of influence where students can experience the value of struggle and failure that leads to their success.

### **Recommendations for Students**

Prior research has shown that parent expectations for students' post-graduation plans, students' expectations, and peer interests affect students' motivation for taking advanced high school mathematics courses to promote mathematics achievement (Froiland & Davison, 2016). The integrated findings in this study revealed a mismatch between students' plans to attend college and mathematics course-taking that would prepare them to be successful in college. The combination of prior research and findings from this study generated recommendations for students related to: (1) self-efficacy and (2) perseverance.

**Self-efficacy.** In this study, students rated themselves at the middle of self-efficacy for selecting math courses, indicating that they may not be capable of selecting the most appropriate math courses that would prepare them for their post-high school plans. Additionally, focus group interviews revealed a lack of school knowledge about math course options available to students. Prior research recommends that students to explore their career goals and participate in career exploration activities to establish a link between academics and career as a means of improving their self-efficacy (Gushue et al., 2006; M. Kim, 2014). Another study recommended role models for improving self-efficacy (Locklear, 2012). Students in this study recommend that students build their

self-efficacy by taking a more active role with the team of expert stakeholders involved in students' success. Participants in this study pointed to their choices in middle school that lead to their high school math course-taking and they reflected on the effect of their late understanding of the impact on math course choices as they relate to academic and post-high school success.

**Perseverance.** Prior research has shown that improved self-efficacy is also related to students' perseverance (Locklear, 2012). While it is natural to point to the past, this study recommends that students persevere in their present circumstance, advocate for their success by investigating the math course options available to them, and take action by revising their plan to include the math course options that optimize their post-high school goals.

### **Recommendations for Counselors**

Noting the definition of academic advisement as “the very human art of building relationships with students and helping them connect their personal strengths and interests with their academic and life goals” (Drake, 2011, p.8), school counselors are challenged to develop relationships with large numbers of students. The integration of prior research and findings from this study generated recommendations for counselors involving: (1) relationship building, (2) counselor knowledge, and (3) effective advisement program.

Unlike parents and teachers that conveniently interact with students daily, counselors are disadvantaged in building relationships with students and parents due to limited contact and heavy caseloads. The majority of students in this study indicated that they met with their high school counselor one or fewer times in the past year and many

commented that they did not know their assigned counselor. Given that findings confirmed students' online confidence, it is recommended that counselors pursue an online presence to more efficiently build relationships with larger numbers of clients. Students indicated that they lacked school knowledge to seek out information. Therefore, pushing out age appropriate information to the counselor's assigned students, like a professional video introduction, meet and greet invites with counselor's picture, blogs, podcasts, and regular follow-up announcements, is recommended to build relationships with students. Social media research confirms the power of establishing online relationships.

Findings in this study also revealed students' perceptions of low counselor knowledge and inconsistencies in information provided by different counselors, teachers, and administrators. It is recommended that counselors receive regular professional development to ensure their college and career knowledge is updated. Students also shared their perceptions that counselors lacked school knowledge as evidence that counselors did not provide students with information about online or summer school course options for first time credit. Access to school knowledge will be addressed further in the Recommendations for School and District Administrators section. It is paramount that school counselors be knowledgeable about curricula including online and summer opportunities or other educational options in order to enhance interactions between parents and students that focus on students' academic and career goals.

The development of effective advisement programs should also address counselor attrition and absence. Students indicated they often experienced conflicting advice when they were assigned a different counselor due to employment changes or absences.

## **Recommendations for School and District Administrators**

Teachers, counselors, and administrators bring educational expertise to the advisement process when guiding students and parents in course selections. In this study, students indicated their preference to be placed in the most appropriate and challenging mathematics courses aligned with their post-graduation plans. However, students also expressed their concern that many had not considered their post-high school plans when selecting their high school math courses and furthermore, were unaware of the connection. Prior research and findings from this study revealed additional academic advisement intervention was needed in the primary grades in order for students to be prepared to align their coursework with their future plans and optimize the high school mathematics curriculum available in this district to balance scheduling issues, establish viable work habits, and address other factors leading to student success. The intersection of prior research and findings from this study generated recommendations for school and district administrators involving: (1) early and consistent advisement curriculum development and (2) advisement program accessibility.

**Early and consistent advisement curriculum.** Both NACADA and CAS defined advising as purposeful teaching and learning activities that help students develop their academic and career goals (Steele, 2018). Students in this study suggested advisement for core high school courses be pushed out to families in middle school and earlier. Lack of school knowledge in the math course selection process indicated that families were unaware of early opportunity programs that lead to advanced course-taking. Research has shown that advanced course-taking in mathematics translates to improved performance in every subject area (Ling & Radunzel, 2017). A district early and



consistent advisement curriculum including the following topics is recommended: (1) career plan linked to district course-taking and scheduling, (2) credit recovery program merged with career choices, and (3) calculus-based requirements for college majors.

***Career plan linked to district course-taking and scheduling.*** Many studies have shown the impact of post-graduation plans on high school course-taking (Burdman, 2015; Hudson & O'Rear, 2014; Ling & Radunzel, 2017; Reynolds & Conaway, 2003; Steele, 2018). In this study, students proposed that middle school assemblies for vocational school information be expanded to include core courses to provide students with a broader perspective of course-taking and scheduling. Students suggested that career emphasis shift from vocational school “or” college to vocational school “and” college to optimize students’ post-high school success. Unfortunately, course scheduling becomes increasingly difficult when students prefer to balance a vocational program, advanced course-taking, and courses of personal interest.

Students in this study viewed mathematics course-selections as particularly mysterious saying that they were previously unaware of the likelihood of college placement tests and resulting remedial course requirements in mathematics. Students suggested that the math course recommendations flow sheet be integrated into the middle school advisement program so that students understand there are over 20 high school math courses to choose from in this district, and those choices impact their post-graduation success.

Students were also concerned with the convenience of advisement for high school course selections and scheduling suggesting that career cluster performance tasks be regularly integrated into core courses in all grade levels and tied directly to course-taking

options. Students elaborated on their appreciation for experiences with stand-alone career cluster explorations but stated that these events fell short of linkage to high school math course-taking.

Although students were aware of counselor availability during power hour, a midday scheduled break for personal use, they readily admitted they would rather spend time with their peers than seek out course-taking advice during that time. Other studies described flipped advisement which is described in the advisement program accessibility section. Some students preferred the use of Remind texts over school email and suggested that counselor and scheduling information be easily available to them in Power School.

***Credit recovery program merged with career choices.*** Research has shown that credit and content recovery programs have been implemented at most U.S. high schools to improve graduation rates (McFarland et al., 2018). However, not only are a significant number of these students unprepared for college, some may not even have a plan to enter the workforce (Gushue et al., 2006; Ross, 2014). In light of research confirming the misalignment of high school math courses with career plans, it is recommended that math course recovery programs include a career choice component emphasizing the impact of high school math course-taking on careers.

***Calculus-based requirements for college majors.*** Research has shown that while many policymakers are concerned that millions of students are spending their college time and money on high school material, some institutions are debating the validity of calculus-based requirements for many college majors and are considering moving to more statistics based requirements (Burdman, 2015). In the meantime, studies have

shown that high schools should not prematurely restrict opportunities for students or create barriers where students are not prepared for traditional mathematic requirements at more selective institutions (Burdman, 2015). In this study, students expressed their preference in understanding calculus-based requirements for college majors early enough to plan for advanced math course-taking in high school. Participants shared their concerns that advisement was too often focused on the lower end of achievement in high school to meet the minimum graduation requirements and lacked encouragement for advanced course-taking in mathematics. This study recommends that the district include calculus-based requirements for college majors in an early and consistent advisement curriculum.

**Advisement program accessibility.** Prior research has confirmed that ethnic, cultural, and socioeconomic differences impact access to school knowledge and impact students' mathematics course selections (Valadez, 2002). Various advisement program accessibility issues emerged in this study including: (1) disconnects, (2) flipped advisement, and (3) online advising tool.

**Disconnects.** In this study, participants expressed concerns that their parents' and other stakeholders lacked school knowledge and could not help with their course selections. Additionally, participants discussed their lack of school knowledge concerning available scheduling options, delivery methods, course options, and course selection procedures. Students also expressed concern with missed early opportunities, like gifted and talented programs suggesting that they could be presented as goals instead of by invitation. These elements should be incorporated in a formal advisement curriculum to ensure that all stakeholders are accurately informed in the math course

selection process. Employee attrition and absenteeism also appeared to contribute to disconnects in the teacher-student advisement process for mathematics course selections.

**Flipped advisement.** Other studies described flipped advisement, where content modules for advising were available asynchronously to address student planning for post-graduation plans and alignment with mathematics curriculum including self-assessment, educational planning, career planning, and decision-making but emphasis was placed on student accountability with the primary advisement occurring with a counselor (Gordon, 1992; Steele, 2018). Students verified their communication preferences suggesting that all counseling and scheduling information be readily available asynchronously and suggested that all advising materials be easily available to them electronically.

**Online advising tool.** “Today, teachers in K-12 schools are educating students who will spend all their adult lives in a technology-rich society” (Ross, 2014, p. 20). Previous studies on a framework for e-academic advising highlighted the importance of advisor access, convenience, face-to-face contact, and online advising effects on the relationships with advisors (Noaman & Ahmed, 2015). Prior research contends that good advisement can be advanced through the use of technology as expected by today’s students (Noaman & Ahmed, 2015; Steele, 2018). In this study, students indicated they wanted asynchronous advisement with immediate feedback when requesting advice and they did not always want to use their personal time at school to seek out counselors face-to-face. One study revealed university online academic advising experienced a 30% increase in freshmen participation for advisement after implementing an online tool and acknowledged that the global community for academic advising, NACADA, identified the need for advisors to implement technology into their practice (Noaman & Ahmed,

2015). The same theories associated with the use of technology in distance education apply to using an online tool for advisement. An additional study specifically investigated the use of screencast videos in math learning and found that students favored the use of screencast videos (Tunku et al., 2013). Our recent experience with emergency distance education including video lessons, video conference meetings, and school management systems providing materials, supports the notion that advisement deserves the same accessibility.

Prior studies also found that online experiences involve autonomy, competence and relatedness but may limit personal interactions such as body language in communication (Angolia & Pagliari, 2016; Barreto et al., 2017). These findings heightened the awareness that students need to be able to express their feelings throughout the course selection process. Therefore, video conferencing should be an essential feature in order to maintain an emotional connection between students and advisors. Other factors considered included student technology sophistication, infrastructure, and self-motivation to engage with new technology (Angolia & Pagliari, 2016; Barreto et al., 2017). Students in this study indicated they were confident in their abilities with these factors but concerned regarding the school's infrastructure to support new technology. Several indicated they used their own computers or hot spots when experiencing problems with school issued devices of access.

### **Implications**

Since the selection of high school math courses impacts the futures of all students, proper advisement for high school math courses has far reaching implications.

The following section addresses categories of implications including: (1) personal implications, (2) student implications, and (3) implications for future research.

### **Personal Implications**

Performing this action research has expanded how I view my role as a high school mathematics teacher to include my responsibility as an advisor for high school math course-taking. Action research benefits teachers with their in-depth analysis of the students in their own classroom (Mertler, 2017). Consulting with my students when planning and conducting this action research heightened my awareness of students' limited knowledge of school inner workings and connections with life in general. Due to prolonged exposure during this process, I placed a higher value on students' opinions about school structure and processes outside of the math classroom. I longed to become their advocate in math course-taking. Moving forward, I will strive to listen to students' concerns and pursue solutions for their benefit including recommendations that have been documented in this study.

### **Implications for Students**

All students participating in this study indicated that they learned more about the math course selection process than they thought possible. Findings from this study imply that moving forward, these students are better equipped to self-advocate understanding their role and responsibility in their learning. Hopefully, they will no longer feel like victims in the course selection process but will hatch a plan leading to their ultimate success. They have been challenged to reflect on the factors affecting their math course selections and cautioned about choosing math courses because they are perceived as easy. Recent studies contend that the overwhelming majority of students that make A(s) and

B(s) in college preparatory high school programs were still unprepared for either college or career (*The opportunity myth*, 2018). Students that participated in this study were guided to respect and understand the value in the challenge of higher-level mathematics courses.

### **Implications for Future Research**

The findings of this study suggest implications for future research for: (1) counselor data, (2) online advisement tool development and evaluation, (3) additional study larger population, and (4) longitudinal study to measure the effect of math advisement on students' career selection.

**Counselor data.** The purpose of this study was to identify and to describe the needs of students in the advisement process of mathematics course selections at a suburban high school in South Carolina. Although no counselors were included in this study, literature indicated advisors' significance in the course selection process and student participants shared their experiences and beliefs about the advising role of guidance counselors' in the high school math course selection process. While significant research was available regarding advisement for high school math course-taking, no previous literature was located for studies specific to the role of high school guidance counselors in the math course selection process. Since no data was collected from counselors in the high school mathematics course selection process in this study, it would be beneficial for future research to explore counselor data for a more complete understanding of the high school math course selection process.

**Development of an online advisement tool for high school.** While this researcher created a rudimentary online advising tool with modules specific to high school math

course selections in preparation for this study, no such tool was used in this study. Although peer reviewed literature was available for online advisement of college students, no published studies were found using online advisement with high school students. Student participants indicated a preference for asynchronous advisement with immediate feedback. In light of the widespread use of technology, students' technological confidence, and recent policies on social distancing, further research is warranted to develop an online advisement tool for high school mathematics course selections and evaluate its effectiveness in the high school setting.

**Additional study with larger population.** Research confirms the local, national, and international significance of math achievement on the global economy (Chowdhury, 2016; Herges et al., 2017; National Commission on Mathematics and Science Teaching, 2000). Furthermore, studies showed that course selection patterns from both females and ethnic minorities underrepresented high school mathematics and science course selections resulting in a widening achievement gap and those students were often unaware of the expectations for college or career entrance (Adamuti-Trache & Sweet, 2014; Dudley, 2010; Kotok, 2017). This inadequate high school preparation, low socioeconomic status, ethnicity, and first generation college students, have been directly linked to concerns about graduation and post-graduation goals (Attewell et al., 2006). Kotok's (2017) study also found that African American and Latino students particularly experienced a widening mathematics achievement gap throughout high school with a tendency to avoid advanced courses often thought of as white courses where minorities may feel alienated. This study acknowledges such diversity issues as potential factors affecting students' mathematics course selections but did not explore these variables



individually. These findings imply that a continuation of this research cycle should be conducted with a larger population and different SES populations as well as other diverse characteristics documenting their relationship to school knowledge and high school mathematics course selections.

**Longitudinal study.** While there were longitudinal studies on how factors such as peers, parents, and motivation influence high school mathematics course-taking (Froiland & Davison, 2016; M. Kim, 2014; Kotok, 2017), there were no studies specific to measure the longitudinal effects of math advisement on students' career selections. It would be of interest to implement early math advisement in elementary school with advanced math course-taking goals and continue annual advisement and data collection with these participants through high school in order to document the effect of advisement on advanced math course-taking.

### **Limitations**

Limitations exist in all research. In this study limitations were recognized in two categories: (1) research limitations and (2) limitations with findings.

#### **Research Limitations**

Action research has inherent limitations. The most significant limitations in this study include the sample size, convenience, purposive sampling, short duration, and potential for researcher bias.

The small sample size, convenience, and purposive sampling used in this study prevent generalization of the findings. Only 61 survey respondents, 45 discussion board participants, and 20 focus group volunteers took part in this study. Therefore, the results of this study are not generalizable to a larger population. Likewise, I used convenience

sampling by inviting my own students to participate in the study and purposive sampling for focus group interview participants. I attempted to improve these limitations by teaching Algebra 2 during my data collection semester, instead of honors or advanced placement courses, hoping for a better representation of the student population. Algebra 2 was the most likely course on in this setting to include sophomores, juniors, and seniors and is required to meet the minimum high school graduation requirements. The small sample size also limited quantitative statistical data analysis to descriptive statistics. Inductive analysis was used with the qualitative data.

Triangulation was used to minimize these limitations. Data could not simply be looked at separately but required integration throughout the study (Morgan, 2014). Triangulation was accomplished by using multiple instruments, methods, and sources of data collection (Carey, 2010; Mertler, 2017). In this study, surveys, interviews, a discussion board, and open-ended survey questions were used to collect data.

Another limitation is the short duration of the study. As a practitioner-researcher I spent nine weeks collecting data and 13 weeks analyzing the data. While this time investment built a foundational understanding of the linkage between the multiple data sources: survey, discussion board, and interview, a longer study could have provided more data and opportunities to improve the reliability of the data.

Finally, I served as both teacher and researcher throughout the study. I minimized researcher bias with an audit trail. Factual accuracy was maintained for descriptive rigor by quantifying closed-end and closed-response rating scales on survey responses and

carefully recording, transcribing, and coding open-ended survey items, and interview responses (Mertler, 2017).

### **Limitations with Findings**

This study also has limitations associated with the findings. The accuracy of self-reported data is historically questionable (Teye & Peaslee, 2015). In this study, students were not only recalling past experiences but may also have been impacted by social desirability in focus groups or discussion boards with their peers. These limitations were minimized with triangulation of data from anonymous surveys, discussion board posts, and focus group interviews. Age and maturity also contribute to accuracy of the findings.

Another limitation in the findings was the difficulty for participants to differentiate their math learning experiences with their experiences in the math course selection process. In focus group interviews, participants corrected each other on the differences. However, the singularity of the survey and initial discussion board posts allowed participants' mind set to shift from the math course selection process to their math learning experiences. These limitations were best mitigated with triangulation.

Finally, low Cronbach alphas revealed limitations in the findings on two scales: math usefulness and peer influence. Acceptable values of Cronbach's alpha range from .70 to .95 as a measure of internal consistency (Tavakol & Dennich, 2011). While low Cronbach's alpha could be attributed to a low number of items in the scale, it could also suggest low relatedness of the items. In this study, Cronbach's alphas for math usefulness and peer influence were .68 and .61 respectively. In both cases, there were a small number of items where the responses for one item in each scale varied significantly from the others.

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## APPENDIX A

### MATH COURSE SELECTION SURVEY

These questions will be used to research the math course selection process at this high school. We understand you may not have thought a lot about some of these questions or you may not have all of the information right now. There are no right or wrong answers. We are just looking for your honest opinion. If you are unsure about how to answer a question, please make your best guess. Your thoughts are very important.

1. What is your sex?

*Mark only one oval.*

- Female
- Male

2. Which of the following best describes you? Select all that apply.

*Check all that apply.*

- White
- Black or African American
- Hispanic or Latino/Latina
- Asian
- American Indian or Alaska Native
- Native Hawaiian or other Pacific Islander

3. What is your birth year?

*Mark only one oval.*

- 2000
- 2001
- 2002
- 2003
- 2004

4. What grade are you currently?

*Mark only one oval.*

- 9<sup>th</sup> Freshman
- 10<sup>th</sup> Sophomore
- 11<sup>th</sup> Junior
- 12<sup>th</sup> Senior

5. Do you receive or qualify for free or reduced lunch?  
*Mark only one oval.*

- Yes
- No

**Research Question 1: What are students' experiences in advisement process of math course selections at this high school?**

6. Where have you gone for advice/information about math course selections at this high school? Check Yes for all that apply.  
*Check all that apply.*

	Yes	No
Brothers or sisters		
Coaches		
Friends		
Guidance counselors		
Other relatives		
Parents		
Publications or websites		
Teachers		
None of the above		

7. During the past year, how often have you met with your guidance counselor about your math courses?

*Mark only one oval.*

- Never
- Once
- Twice
- Three times
- Four or more times

8. Was the number of meetings indicated in the previous question sufficient for you advising needs?

*Mark only one oval.*

- Yes
- No
- Undecided

9. Which of the following is your primary method of communicating with your guidance counselor about math courses?

*Mark only one oval.*

- E-mail
- Face-to-face meeting
- Telephone
- Other:

10. Please read the following items related to mathematic advising and rate your guidance counselor's performance in each area.

*Make only one oval per row.*

	poor	fair	satisfactory	good	excellent
My counselor provides information about using online resources for math courses. (MathXL, ALEKS, and Khan Academy)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor is available when I need assistance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor encourages me to assume an active role in planning my math coursework.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor provides information regarding math study skills.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor suggests academic resources for math. (rebel Success Center, Power Hour Tutoring, etc...)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor maintains an open line of communication.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor responds to my requests about math courses in a timely fashion (e.g. e-mail, phone calls, calls me to their office, ...)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor respects my math course decisions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor refers me to the appropriate office to obtain financial assistance (e.g. student fees, scholarships, dual credit, ...)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor refers me to employment opportunities (e.g. part-time)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

My counselor is on time for advising appointments with me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor provides sufficient time for my advising appointments.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor provides sufficient time for my advising appointments.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor is knowledgeable and provides me with math course choices and options.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor encourages mathematics academic success.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor seems to understand my perspective on math courses.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor provides information about math courses offered online for first time credit.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My counselor provides information about math courses offered in summer school for first time credit.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. Please rate your agreement with each statement below using the following scale.  
*Mark only one oval per row.*

	no agreement	some agreement	much agreement
Overall, my guidance counselor has been excellent.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would recommend my guidance counselor to a friend.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. Rank the following as 1= most helpful to 8= least helpful in advising your selection of your math courses each year. In this selection use each number 1-8 only once. Who's number 1? Who's number 8?  
*Mark only oval per row.*

	1=most helpful	2	3	4	5	6	7	8=least helpful
Coaches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Guidance Counselors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Yourself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Parents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Siblings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. Please share additional information you would like to about your counselor or the advising process at this high school.

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**Research Question 2: What are the factors affecting students' math course selections?**

14. Since the beginning of the last school year, which of the following activities have you participated in? Check Yes for all that apply.  
*Check all that apply.*

	Yes	No
Math Club/Team	<input type="radio"/>	<input type="radio"/>
Math Competition	<input type="radio"/>	<input type="radio"/>
Math Camp	<input type="radio"/>	<input type="radio"/>
Math study groups or program where you were tutored in math.	<input type="radio"/>	<input type="radio"/>
I have not participated in any math related activities beyond my scheduled math class.	<input type="radio"/>	<input type="radio"/>

15. How much do you agree or disagree with the following statements?  
*Mark only one oval per row.*

	Strongly Agree	Agree	Disagree
I see myself as a math person.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Others see me as a math person.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. Why are you taking this math course? Check yes for all that apply.  
*Check all that apply.*

	Yes	No
I really enjoy math.	<input type="checkbox"/>	<input type="checkbox"/>
I like to be challenged.	<input type="checkbox"/>	<input type="checkbox"/>

I had no choice, it is a school requirement.		
The school counselor suggested I take it.		
My parent(s) encouraged me to take it.		
My teacher recommended I take it.		
My friends are taking this course.		
There were no other math courses offered.		
I will need it to get into college.		
I will need it for my career.		
It was assigned to me.		
It seemed to be easy to pass.		
I knew that I'd manage to pass the course without doing too much work.		
It was the easiest option for me.		
I don't know why I am taking this course.		

17. How much do you agree or disagree with the following statements about your expectations for this math course?

*Mark only one oval per row.*

	Strongly Agree	Agree	Disagree	Strongly Disagree
I will enjoy this course very much.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think this class will be a waste of my time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think this class will be boring.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. How much do you agree or disagree with the following statements about the usefulness of your math course? What I learn in this course ...

*Mark only one oval per row.*

	Strongly Agree	Agree	Disagree	Strongly Disagree
Is useful in everyday life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Will be useful for college.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Will be useful for my future career.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. As far as you know, are the following statements true or false for your closest friend?

Mark only one oval per row.

My closest friend ...

	True	False
gets good grades.	<input type="radio"/>	<input type="radio"/>
is interested in school.	<input type="radio"/>	<input type="radio"/>
attends classes regularly.	<input type="radio"/>	<input type="radio"/>
plans to go to college.	<input type="radio"/>	<input type="radio"/>

20. How much do you agree or disagree with each of the following statements?

Mark only one oval per row.

If I spend a lot of time and effort in my math classes...

	Strongly Agree	Agree	Disagree	Strongly Disagree
I won't have enough time for hanging out with my friends.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I won't have enough time for extracurricular activities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I won't be popular.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People will make fun of me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. During a typical weekday during the school year how many hours do you spend working on math homework and studying for math class outside of class?

Mark only one oval

- Less than 1 hour
- 1 to 2 hours
- 2 to 3 hours
- 3 to 4 hours
- 4 to 5 hours
- 5 hours or more

22. Please share additional information you would like to about the factors affecting your math course selections.

---

**Research Question 3: What are the students' needs and preferences in the math course selection process.**

---

23. How many total math courses do you expect to take during high school?

*Mark only one oval.*

- |                             |                                     |
|-----------------------------|-------------------------------------|
| <input type="radio"/> One   | <input type="radio"/> Two           |
| <input type="radio"/> Three | <input type="radio"/> Four          |
| <input type="radio"/> Five  | <input type="radio"/> Six           |
| <input type="radio"/> Seven | <input type="radio"/> Eight or more |

24. What are the reasons you plan to take more math courses during high school?

Check Yes for all that apply.

*Check all that apply.*

	Yes	No
Taking more math courses is required to graduate.		
My parents will want me to.		
My teachers will want me to.		
My school counselors will want me to.		
I am good at math.		
I will need more math courses for the type of career I want.		
Most students who are like me take a lot of math courses.		
I enjoy studying math.		
Taking more math courses will be useful for college.		
My friends are going to take more math courses.		
I don't know why, I just probably will.		
Some other reason.		

25. An “education plan” or a “career plan” is a series of activities and courses that you will need to complete in order to get into college or be successful in your future career. *Mark only one oval.*

Have you put together ...

- A combined education and career plan
- An education plan only
- A career plan only
- None of these



26. Who helped you put your plan together? *Check all that apply.*

- A counselor
- A teacher
- My parents
- Someone else
- No one

27. As things stand now, how far in school do you think you will get? *Mark only one oval*

- Less than high school
- High school or GED
- Start but not complete Vocational Training or Associate's degree, 2 year.
- Complete a Vocational Training or Associate's degree, 2 year.
- Start but not complete a Bachelor's degree, 4 year.
- Complete a Bachelor's degree, 4 year.
- Start but not complete a Master's degree
- Complete a Master's degree
- Start but not complete a Ph.D., law degree, or other high-level professional degree
- Complete a Ph.D., M.D., law degree, or any other high-level professional degree

28. Rate yourself on the following abilities ... 0= not sure at all to 9= fully confident

*Mark only one oval per row.*

	0= not sure at all	1	2	3	4	5	6	7	8	9= fully confident
Gather information about math classes that interest me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plan my academic goals for the next 3 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choose a math class from a list of possible math classes that I am considering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Decide which math class would be best for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resist my parents' or friends' attempts to push me to a math class that I think is not right for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Describe the academic skills necessary for math class I might want to learn in	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choose a math course in which most students are of the opposite sex	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decide which areas of study are relevant to future areas of study	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Find out the grade point average of students in the math class	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Talk with a person who is already taken the math class which I would like to take	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Specify a number of academic areas that interest me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accurately assess my academic skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Specify what steps should I take to take the math classes I want	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Persist toward my academic goal, even when I feel frustrated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choose a particular math class even if my parents do not approve it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rate my academic and social priority regarding the math class	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Be assisted by the guidance counselor in choosing a math class	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Determine what field of study I am talented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choose a math class that will fit my interests	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choose a math class that will fit my preferred lifestyle for the next 3 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Make a decision about a math course without worrying if it was right or wrong	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prepare properly to be accepted to the math class I am interested in	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finding out the teacher's attitude toward students in the math class	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

29. Do you need more information regarding online math course options to get ahead? *Mark only one oval.*

- Yes
- No

30. Do you need more information on summer school options for math course options to get ahead? *Mark only one oval.*

- Yes
- No

31. Please share additional information you would like to about your needs and preferences in the math course selection process.

---

## APPENDIX B

### DISCUSSION BOARD PROTOCOL

Thank you for participating in the Math Course Selection Survey. As you reflect on your responses and think of other information that may be helpful, please enter your thoughts below as comments. You may also reply to reach other.

Research Questions:

1. What are your experiences in the advisement process of math course selections at this high school?
2. What are the factors affecting your math course selections?
3. What are your needs and preferences in the math course selection process?

## APPENDIX C

### FOCUS GROUP INTERVIEW PROTOCOL

#### Introductory Script

*Thank you for agreeing to participate in this study. First, let me remind you about the purpose of the study. This study will describe student experiences in the advisement process of mathematics course selections at this high school, the factors affecting students' selections, and students' needs and preferences in the mathematics course selection process. Our interview questions will be broad, giving you the opportunity to explain your experiences and thoughts. There are no right or wrong answers and I will not be personally offended by anything that you say. The interview will take about 45 minutes. I will be recording our interview and taking notes to ensure that the data is accurate but your real name will not be used. I will provide a pseudonym to anonymize all data. Do you have any questions before we begin? Alright. Let's get started. I will begin the recording now.*

#### Questions

1. Tell me about your experiences in the advisement process of math course selections.
2. Where have you gone for advice or information about math course selections?  
Teachers, friends, and parents were first, second, and third. I was surprised that counselors and coaches were so low on the list from the MCSS.
3. Many of you indicated that you never met with your guidance counselor about your math courses. How can that be?
4. Most of you indicated that you met once or never. Tell me about that.
5. Over 30% of you indicated that the number of meetings was not sufficient for your advising needs. Tell me more about that.
6. Most of you indicated that face-to-face meetings were the primary method of communicating with your guidance counselor about math courses. What methods of communication would you prefer?
7. What do you know about:  
Aligning math course selections with your post-graduation goals  
Online math course options  
Summer school math course options
8. You ranked teachers, yourself, and parents as most helpful in advising your selection of your math courses each year and coaches and others as least helpful. Who is the other? Tell me about that.

9. Describe the perfect advisement system for math course selections.
10. Tell me what comes to mind when you think about choosing your math courses for next year.
11. What do you need to consider?  
High school graduation requirements versus college and career needs
12. What factors affect your math course selections?
13. Tell me about this combined education and career plan that over 40% of you have.
14. Describe the ideal math course selection process.
15. What do you want or need for your math course selections?

### **Concluding Script**

*Thank you all for your honest input. As a reminder, all of your comments are confidential and your names will be changed in the transcript and future publication of this study. Does anyone have any questions or final comments?*

## APPENDIX D

### INFORMED CONSENT FORM

September 3, 2019

To: Students and Parents

RE: Data Collection

While I am a math teacher at [REDACTED] High School, I am also a student. I am a doctoral candidate in the Department of Education, at the University of South Carolina where I am studying the needs of students in the advisement process of math course selections at [REDACTED] High School. I continue to be amazed that we offer over 20 math courses on this campus and constantly wonder how students choose their math courses. I will be collecting data this semester for my doctoral research. Details of the study are attached. I will be asking students to complete a survey in class and I will conduct focus groups where I ask follow-up questions. Please contact me if you do not want your student to participate in this study.

#### **KEY INFORMATION ABOUT THIS RESEARCH STUDY:**

You are invited to volunteer for a research study conducted by Andrea Lynn Goodson. I am a doctoral candidate in the Department of Education, at the University of South Carolina. The University of South Carolina, Department of Education is sponsoring this research study. The purpose of this study is to identify and describe the needs of students in the advisement process of math course selections at [REDACTED] High School in order to make recommendations for the design and development of an online academic advising tool for mathematics course selections in high school. You are being asked to participate in this study because you are responsible to select high school math courses. This study is being done at [REDACTED] High School and will involve approximately 60 volunteers.

The following is a short summary of this study to help you decide whether to be a part of this study. More detailed information is listed later in this form.

***Students will complete a survey providing their experiences, selection factors, needs, and preferences in the math course selection process. The survey is expected to take 45 minutes. Students will then be invited to participate in an online discussion board and a 45 minute focus group interview.***

#### **PROCEDURES:**

If you agree to participate in this study, you will do the following:

1. Complete a survey about your experiences, selection factors, needs, and preferences in the math course selection process.
2. Contribute to an online discussion board regarding the math course selection process.

3. Participate in a focus group discussing the math course selection process.
4. Have your focus group interview recorded in order to ensure the details that you provide are accurately captured.
5. Review a transcript of your focus group interview to confirm its accuracy.

**DURATION:**

Participation in the study involves two visits over a period of three months. Each study visit will last about 45 minutes/hours.

**RISKS/DISCOMFORTS:**

Discussion Board:

Others in the group will see what you write on the discussion board, and it is possible that they could tell someone. The researchers cannot guarantee what you write on the discussion board will remain completely private, but the researchers will ask that you, and all other group members, respect the privacy of everyone in the group.

Loss of Confidentiality:

There is the risk of a breach of confidentiality, despite the steps that will be taken to protect your identity. Specific safeguards to protect confidentiality are described in a separate section of this document.

**BENEFITS:**

Taking part in this study is not likely to benefit you personally. However, this research may help researchers understand how to improve the math course selection process at ██████████ High School

**COSTS:**

There will be no costs to you for participating in this study other than possible costs related to transportation to and from the research site.

**PAYMENT TO PARTICIPANTS:**

You will not be paid for participating in this study.

**INCIDENTAL FINDINGS:**

While researchers are not specifically looking for information about your math course choices, any incidental findings regarding your selections will be shared with you.

**COLLECTION OF IDENTIFIABLE PRIVATE INFORMATION OR IDENTIFIABLE BIOSPECIMENS:**

All information will be anonymized.

**COMMERCIAL PROFIT:**

No information from this study will be used for commercial profit.

**RETURN OF CLINICALLY RELEVANT RESEARCH RESULTS:**

Focus group interview transcripts will be emailed to each participant.

**STUDENT PARTICIPATION:**

Participation in this study is voluntary. You are free not to participate, or to stop participating at any time, for any reason without negative consequences. Your participation, non-participation,



and/or withdrawal will not affect your grades or your relationship with your teachers, school(s), [REDACTED] High School, or the University of South Carolina.

If research credit is required for successful course completion, other alternative means for obtaining credit is available and you may discuss these options with your course instructor.

**CONFIDENTIALITY OF RECORDS:**

Unless required by law, information that is obtained in connection with this research study will remain confidential. Any information disclosed would be with your express written permission. Study information will be securely stored in locked files and on password-protected computers. Results of this research study may be published or presented at seminars; however, the report(s) or presentation(s) will not include your name or other identifying information about you.

**RESEARCH RELATED INJURY:**

In the event you are injured while participating in this research study, a member of research study team will provide first aid using available resources, and if necessary, arrange for transportation to the nearest emergency medical facility. The University of South Carolina has not set aside funds to compensate you for any injury, complication or related medical care that may arise from participation in this study. Any study-related injury should be reported to the research study team immediately.

**VOLUNTARY PARTICIPATION:**

Participation in this research study is voluntary. You are free not to participate, or to stop participating at any time, for any reason without negative consequences. In the event that you do withdraw from this study, the information you have already provided will be kept in a confidential manner. If you wish to withdraw from the study, please call or email the principal investigator listed on this form.

I have been given a chance to ask questions about this research study. These questions have been answered to my satisfaction. If I have any more questions about my participation in this study, a study related injury, or I DO NOT WISH TO PARTICIPATE, I am to contact Lynn Goodson at [REDACTED] or email: Lynn.Goodson@[REDACTED].

Questions about your rights as a research subject are to be directed to, Lisa Johnson, Assistant Director, Office of Research Compliance, University of South Carolina, 1600 Hampton Street, Suite 414D, Columbia, SC 29208, phone: (803) 777-6670 or email: LisaJ@mailbox.sc.edu.

I agree to participate in this study. I have been given a copy of this consent form for my own records. If you wish to participate, you should sign below.

\_\_\_\_\_  
Signature of Subject / Participant / Guardian

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Qualified Person Obtaining Consent

## APPENDIX E

### STUDENT ASSENT FORM

#### Advising for Math Course-taking

I am a researcher from the University of South Carolina. I am working on a study about advising for high school math course-taking and I would like your help. I am interested in learning more about your needs and preferences. Your parent/guardian has already said it is okay for you to be in the study, but it is up to you if you want to be in the study.

If you want to be in the study, you will be asked to do the following:

- Answer some written questions about your experiences, thoughts, needs, and preferences in math advisement. It will take about 45 minutes.
- Meet with me individually and talk about your math course selections. The talk will take about 45 minutes and will take place at room 910 in ██████ High School.

Any information you share with me (or study staff) will be private. No one except me will know what your answers to the questions were. I will audio tape the interview and I will be the only person to hear it.

You do not have to help with this study. Being in the study is not related to your regular class work and will not help or hurt your grades. You can also drop out of the study at any time, for any reason, and you will not be in any trouble and no one will be mad at you.

Please ask any questions you would like to about the study.

\*For Minors 13-17 years of age:

My participation has been explained to me, and all my questions have been answered. I am willing to participate.

\_\_\_\_\_  
Print Name of Minor

\_\_\_\_\_  
Age of Minor

\_\_\_\_\_  
Signature of Minor

\_\_\_\_\_  
Date

APPENDIX F  
IRB APPROVAL LETTER



OFFICE OF RESEARCH COMPLIANCE

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH

DECLARATION of NOT RESEARCH

Andrea Goodson  
[REDACTED]

Re: Pro00089089

Dear Ms. Andrea Goodson:

This is to certify that research study entitled ***Advising for High School Mathematics Course-Taking: Action Research Identifying and Describing Students' Experiences, Selection Factors, Needs, and Preferences*** was reviewed on **5/14/2019** by the Office of Research Compliance, which is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). The Office of Research Compliance, on behalf of the Institutional Review Board, has determined that the referenced research study is not subject to the Protection of Human Subject Regulations in accordance with the Code of Federal Regulations 45 CFR 46 et. seq.

No further oversight by the USC IRB is required. However, the investigator should inform the Office of Research Compliance prior to making any substantive changes in the research methods, as this may alter the status of the project and require another review.

If you have questions, contact Lisa M. Johnson at [lisaj@mailbox.sc.edu](mailto:lisaj@mailbox.sc.edu) or (803) 777-6670.

Sincerely,

Lisa M. Johnson  
ORC Assistant Director and IRB Manager

APPENDIX G  
RESEARCH SETTING APPROVAL LETTER



May 30, 2019

Andrea Lynn Goodson  
[Redacted]  
[Redacted]

Dear Ms. Goodson:

This letter confirms your permission to conduct the research study entitled, "*Advising for High School Mathematics Course-Taking: Action Research Identifying and Describing Students' Experiences, Selection Factors, Needs, and Preferences*", at [Redacted] High School during the 2019-2020 school year. Furthermore, the committee has reviewed and approved the following three research questions and data collection method:

1. What are students' experiences in the advisement process of mathematics course selections at [Redacted]
2. What are the factors affecting students' mathematics course selections?
3. What are students' needs and preferences in the mathematics course selection process?

Please notify the chair of the [Redacted] Research Committee should any substantive changes in the research methods and/or scope of research occur.

Sincerely,



Assistant Superintendent for Curriculum and Instruction  
[Redacted]