Advising Students Toward Successful Opportunities in Mathematics Courses

By

Ashley L. Urban
M.S., Capella University, 2005
B.A., Pittsburg State University, 2002

Submitted to the graduate degree program in Educational Leadership and Policy Studies and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Education.

_____

Chair: Dr. Susan Twombly

_____

Dr. Lisa Wolf-Wendel

_____

Dr. Eugene Parker

_____

Dr. Marlesa Roney

_____

Dr. Estela Gavosto

The dissertation committee for Ashley L. Urban certifies that this is the approved version of the following dissertation:

Advising Students Toward Successful Opportunities in Mathematics Courses

Chair: Dr. Susan Twombly

Date Approved: 6 May 2019

Abstract

College algebra continues to cause a barrier for students seeking a college education. Many institutions require students who are less academically prepared to enroll in a remedial course before entering college algebra. This process is costly and time prohibitive to students; adding financial burden to the already present academic barrier that is college algebra. In order to alleviate the college algebra barrier, one public research university in the Midwest has implemented an Enhanced Math course. This course allows more students who previously did not meet the qualifications to enter college algebra to directly enroll into a supplementary course requiring less hours and time to complete the college algebra requirements necessary for a Bachelor's degree. The enhanced course integrates cooperative learning, time on task and self-regulation into a workshop format guided by student learning outcomes.

In order to ensure that eligible students enroll into the enhanced course, the focus of this study is to better understand how advisors talk to students about Enhanced Math and other math courses at the institution. Advisors make enrollment recommendations to students as they enroll. After speaking to an advisor, students are able to make their own selections for mathematics courses; the Enhanced Math course is just one of the choices students make as they enroll.

In this study, a qualitative research approach was used to interview advisors about how they discuss math course selection with students. Data was analyzed and categorized by subject. The study revealed that inconsistencies exist regarding how advisors understand the Enhanced Math course and how they describe it to students. Additional findings revealed that some departments represented in the study have alternative course offerings in place of college algebra; in some cases, algebra is not recommended by advisors. Based on these findings,

implications are discussed and recommendations are made to improve the lines of communication between advisors and the mathematics department.

Acknowledgements

Finishing this project was one of the most challenging things I have accomplished in my life. I could not have succeeded without the help of many important supporters along the way. To my village of advisors who walked me through my constant questions and doubts during my coursework and study, thank you for always offering advice at the right time and motivation to succeed. Estela, you always had an alternative way to look at things when I faced a roadblock, thank you for showing me how to think outside the box. Jim, you never failed to ask just the right questions to get me thinking. Often I would leave a simple discussion with you only to later realize you were helping me understand or articulate something. I greatly appreciate the support that you both provided to me over the last four years.

Most importantly, I want to thank my family. To Josh, thank you for never doubting my ability to finish what I started and always pitching in to help around the house while I was writing and studying. Despite your very hectic schedule, you always found the time to make my work easier and without complaint. To my boys, Tyler and Kole, thank you for always understanding when I had to stay late for class or I had to study instead of spend time with you. You were always there to greet me with a smile and a hug. I promise to support you in your future pursuits and I know you will do great things. This accomplishment belongs to all of us! I love you all so much and appreciate your unwavering support.

Table of Contents

Chapter 1: Introduction

A college education enhances the lives of individual students and society in many ways (Mayhew et al., 2016). College degree attainment should be an opportunity afforded to all, though some students encounter more barriers than others in their pursuit of a college education. College algebra, is a common barrier in that quest especially for students who do not have access to advanced placement courses in high school, such as minority and low-income students (Jeongeun Kim, Jiyun Kim, DesJardins, & McCall, 2015). Because mathematics skills have been shown to be of value in future educational attainment and career success, it is important for all students to succeed in college algebra (Jeongeun Kim et al., 2015). In order for students to succeed in college algebra and graduate on time, students must be correctly placed in college mathematics courses. Course selection typically happens when a student develops their course schedule with the help of an academic advisor. Students depend on academic advisors to guide them into the correct college algebra course based on their academic background and skills. The relationship between advisors and advisees is one key resource in place that is meant to ensure a successful student transition into college by helping students choose courses based on future career goals (Barbuto, Story, Fritz, & Schinstock, 2011). Due to the fact that advisors are often on the front lines of student success at the institution, they are frequently the subject of research in the areas of student satisfaction, retention, trust and morale (Barbuto et al., 2011).

Though academic advisors work with students toward the overall goal of college completion, research has shown that many students do not persist to graduation due to various reasons (Reason, 2009). As referenced above, one such stumbling block for many students is college algebra. Though college algebra is an important subject for students in the attainment of a bachelor's degree, many students find it challenging and intimidating at the college level.

Many underprepared college students do not meet academic requirements needed to take college algebra and are placed in a remedial prerequisite course (Dramatic Overhaul, 2012). However, remedial coursework, in and of itself, is often a stumbling block. In a joint statement from the National Coalition, Uri Treisman affirmed that for students placed in remedial mathematics courses, college algebra is the most significant barrier to college success (Dramatic Overhaul, 2012). The practice of placing students in remedial courses results in severe attrition rates: for students assigned to three or more semesters of remedial mathematics, only 1 in 10 successfully pass their first-year college-level mathematics course (Dramatic Overhaul, 2012).

Study Purpose

Due to the inherent importance of college algebra as a gateway to college graduation and potential problems of remedial mathematics placement, it is important to consider how students are placed in the correct college algebra courses. Students who do not meet academic qualifications for enrollment in college algebra are often referred to remedial courses through academic advisors, a practice that Treisman has found to negatively affect the likelihood of success (Dramatic Overhaul, 2012). This study will look at the placement process: academic advisors and how they place mathematics students into college algebra courses at the University of Kansas (KU). Specifically, this study will explore how advisors at KU communicate with students in reference to college algebra offerings and placement in intermediate college algebra, enhanced college algebra, and standard college algebra.

Because sending underprepared students straight to remedial college algebra has been shown to decrease a student's chances to graduate, institutions are seeking alternative ways to help these students be successful in college math (Dawson et al., 2014). Some institutions are attempting to improve retention rates by offering supplemental instruction (SI). Supplemental

instruction is an academic support program where faculty or successful later-year students facilitate additional learning sessions attached to high risk courses (Dawson, van der Meer, Skalicky, & Cowley, 2014). Common high-risk courses include first-year science, technology, engineering and mathematics courses (Dawson et al., 2014). During SI courses, typical activities include extensive class participation, often in small groups, worksheets completed in groups, peer instruction, kinesthetic and visual modeling of problems and practice tests. Emphasis is placed on concepts, content and vocabulary from lectures (Dawson et al., 2014). The U.S. Department of Education has validated the use of SI courses from multiple studies, claiming that participation in these courses lead to higher average grades for participants (Dawson et al., 2014). Research has shown that components of supplemental instruction such as time on task, collaborative learning and self-regulated learning have been found to have a positive influence on student achievement for all students regardless of ethnicity (Dawson et al., 2014; Schunk & Zimmerman, 1998; Ukpong & George, 2013). Findings have shown that despite ethnicity and prior academic achievement, students participating in SI courses within targeted high-risk classes succeed at a higher rate, withdraw at a lower rate and fail less courses than those that do not participate in SI courses (Dawson et al., 2014).

KU offers a supplemental mathematics course, enhanced mathematics 101. In order to accommodate more students though SI, the KU Mathematics Department is expanding the offerings for their SI course, enhanced college algebra. The challenge is to ensure that students who can benefit from the course, actually enroll in the class. The Mathematics Department at KU must rely on KU undergraduate advisors to steer students to the correct course. Academic advisors hold a very important role on campus; the quality of interaction between a student and a concerned individual on campus, often through academic advising, is a key contributor to college

retention (Habley, 2004). Academic advisors serve students by helping them to shape meaningful learning experiences; encouraging achievement of educational, career, and life goals (Young-Jones, Burt, Dixon, & Hawthorne, 2013). Advisors are responsible for helping students consider many classes, requiring them to possess a wealth of knowledge in all subject areas. Advising appointments are often brief; during appointments, advisors must work with students on many different subjects, not just mathematics and students are often unclear on their mathematics placement options when meeting with advisors (O'Banion, 1994). Advisors must provide students with information on the mathematics placement options available to them based on their academic background, giving the student a choice on which mathematics course to enroll into. It is unclear how students are advised regarding which mathematics course options. The KU Mathematics Department is concerned that advisors are unclear on mathematics placement options, unsure of who should be placed in which section, and how the information is being communicated to students. For the first academic year that enhanced math was offered, the math departmental advisor left notes in the advising portal to guide advisors to enroll the correct students. Because this practice may not continue, it is important for advisors to understand how to enroll students if recommendations are not made in the advising portal. Confusion over placement criteria can lead to incorrect placement of students in both standard college algebra and enhanced college algebra. The following study will analyze advisors' understanding of placement options in reference to enhanced math in an effort to clarify the process.

Research Questions

This study will explore the placement of students into college algebra courses at KU by investigating the perspective of the academic advisors who work to place students in

mathematics courses. The purpose of this study is to better understand how advisors talk to students about college mathematics placement. Specifically, this study will seek to answer the following research questions:

RQ1: How and in what ways do advisors introduce mathematics options to students who qualify for enhanced mathematics?

RQ2: How do advisors explain the differences between the two options (intermediate college algebra plus standard college algebra versus enhanced college algebra)?

RQ3: What recommendations do advisors make to students regarding the two choices (if they do) and what is the rationale for the recommendation?

Logic Model

To illustrate the process of how the enhanced math course is meant to work at KU, the program's logic model is depicted below. A logic model is the basic description of how a program works to address a problem, linking the problem, inputs and activities to the intended goals or outcomes and synthesizing the main program elements into a diagram (Twombly, 2019). In the case of enhanced college algebra, the problem that is being addressed is that students need to take remedial math (intermediate college algebra / Math 002) before taking college algebra (Math 101). The goal of the enhanced math course is to help students who do not qualify to enroll directly into college algebra by placing them into enhanced college algebra, in four credit hours instead of six and one semester instead of two. The intended audience for this program is students who are eligible for enhanced math. A detailed logic model is illustrated below.

Table 1: Logic Model for Enhanced College Algebra

Resources	Activities	Outputs	Short-Term Outcomes	Long-Term Outcomes
Resources to accomplish activities	In order to address the problem, we will conduct the following activities:	What is produced by activities: activities will produce following evidence of service delivery: workshops held, people trained.	Activities will lead to the following outcomes in the short-term:	If activities completed and outcomes achieved, these activities will lead to the following long-term outcomes:
• Math course instructors • Students • Advisors • Information about enhanced math	• Math 101 Enhanced College Algebra • Advisors advise students • Students enroll	The course is offered to those who are eligible for enhanced math but do not place directly into college algebra	• Students successfully complete the course • Students save time and money	Graduation, Increased retention, decreased time to graduation

Research Design

This study explores the placement of students into college algebra courses at KU by investigating the perspective of the academic advisors who work to place students in mathematics courses. The research is particularly focused on discovering how advisors talk to students about mathematics placement and what they suggest to students who qualify to enroll into enhanced college algebra. In order to gain the full picture of what happens during this process, I conducted interviews with ten academic advisors at KU. Following the interviews, data was analyzed and summarized. Additional details will follow in upcoming chapters.

Significance of the study

The implications of this study are potentially important. This research will assist academic advisors at KU, faculty in the mathematics department, and mathematics students. Academic advisors will hopefully benefit by receiving better communication from the

mathematics department based on the findings and recommendations of this study. With the data collected from academic advisors, faculty in the mathematics department can design and implement strategies to better inform academic advisors of the options available for the mathematics placement of students. Mathematics students can benefit from this study when advisors better understand the mathematics options available to them and pass it on to them during the enrollment process, ensuring a correct placement. Faculty in the mathematics department will benefit by having students in their course that have been correctly placed; students will be a good fit for the course which could result in better student outcomes. Though this study is specific to KU, the research conducted is transferrable and could also assist other higher education institutions regarding mathematics course offerings and mathematics placement procedures.

Definition of terms

For the purpose of this study, the following definitions were used.

- *Intermediate College Algebra (Mathematics 002)* – a three credit hour course for students who do not meet the requirements or do not have the background to take standard college algebra (Mathematics 101). For these students, this course does not count toward degree requirements but must be completed before enrolling in standard college algebra (Mathematics 101).
- *Enhanced College Algebra (Enhanced Mathematics 101)*- The enhanced version of Mathematics 101 is a four-credit hour class which includes the Mathematics 101 course plus a supplementary lab course that meets 5 times per week, fulfilling college algebra requirements all in one course and in one semester.

- *Standard College Algebra (Mathematics 101)*- The standard three credit hour college algebra course that meets three times per week fulfilling college algebra requirements.

Organization of the study

The following chapter will provide an in-depth description of the enhanced college algebra course at KU. Chapter two will include the background, course development and teaching techniques used in the course. Chapter three will provide an in-depth review of applicable literature, including a logic model for the study. Chapter four will describe the methodology of the study including the research design, data collection and data analysis procedures. Following the course description, literature review and methodology, chapter five will present the findings of the study and the interpretations of the data collected. Finally, chapter six will provide a summary of the research, conclusions, implications to practice and possible future research topics. All references and appendices will follow the final chapter.

Chapter 2: Mathematics 101 Enhanced: Program Description

Institutional Context

The University of Kansas (KU) is a public research university in Lawrence, Kansas and the flagship institution in the state. KU serves 28,447 students and employs 2,600 faculty on five campuses (Lawrence, Kansas City, Overland Park, Wichita, and Salina). KU's mission focuses on instruction, research, service, international dimension in the global economy, and values, including fostering a multicultural environment. In 2017 student demographics by race/ethnicity were as follows: .5% American Indian, 4.4% Asian, 4.3% Black, 6.8% Hispanic, 69.5% White, 4.8% two or more races, 8.8% non-resident alien and 1% unknown race (KU OIRP, 2017). The Lawrence campus employs 1,519 faculty members. In 2017, the Lawrence faculty demographics by race/ethnicity were as follows: .5% American Indian, 9.8% Asian, 3.4% Black, 4% Hispanic, 77% White, 2% two or more races, and 3% non-resident alien (KU OIRP, 2017). As stated in the mission statement of the university, KU serves as a center for learning, scholarship and creative endeavor.

Enhanced Math at KU

The Kansas Algebra Program (KAP) at KU, on average, enrolls about 2000 students in the fall and 1000 students in the spring semester (Kansas Algebra Program (KAP), 2018). Currently there are three courses fulfill mathematics requirements for most bachelor's degrees at KU: 1) college algebra (Mathematics 101) 2) intermediate algebra (Mathematics 002), which is considered a remedial course for which no college credit is given, and 3) enhanced college algebra (Mathematics 101 Enhanced). KU added the enhanced course in 2014 through KAP, Mathematics 101 Enhanced. College algebra (Mathematics 101), a three-hour course, fulfills the mathematics requirement for most bachelor's degrees. The path to achieving the college algebra

credits needed for a bachelor's degree is dependent upon a student's Mathematics ACT score and high school GPA. This information is analyzed by an academic advisor who suggests placement options to the student. In order to be placed directly into college algebra, students must have a mathematics ACT score greater than 22. If students do not qualify to enroll directly into college algebra, they are required to take a pre-requisite course, intermediate algebra, before being enrolled in college algebra. Intermediate algebra credits do not fulfill college algebra requirements for a bachelor's degree, but students who do not meet the above requirements must complete intermediate algebra prior to taking college algebra. Intermediate algebra is, thus, a remedial course. Previously, students that did not have a high school GPA and mathematics ACT score high enough to enroll directly into college algebra (mathematics ACT of 22), were given only one option, complete the pre-requisite of intermediate algebra in one semester (3 credit hours) and then enroll in college algebra the following semester (3 credit hours). This process is costly for students and time consuming; students were required to take 6 credit hours to fulfill mathematics requirements for a bachelor's degree over the course of two semesters. Only college algebra yielded credits toward graduation.

In 2014, the KU Department of Mathematics piloted a new mathematics course, enhanced college algebra (Mathematics 101 Enhanced). The extra two instructional hours in enhanced math provides students more time to integrate adaptive review, work in groups, and work through course content at a slower pace (KAP, 2018). This new offering was meant to both increase student achievement in mathematics courses and to accelerate progress through mathematics requirements by providing a more cost effective and quicker option than going through a remedial prerequisite course before taking college algebra (KAP, 2018). The enhanced college algebra course pilot was a success; the drop/fail/withdraw (DFW) rates were

significantly lower for the enhanced course opposed to standard college algebra (KAP, 2018). In addition, the final grades in enhanced mathematics also showed an important improvement in success rates (5-10 percent), when compared to regular mathematics 101 (KAP, 2018).

Due to this success, the Mathematics Department has expanded the offerings of enhanced college algebra, making it available to more students. The challenge now is how to get the right students into the course. A recent study by Coggin and colleagues (2017) analyzed the data over the past 11 fall semesters in reference to what placement tools were most effective in predicting success in the pilot course, enhanced college algebra. Coggin's findings were used to develop a new placement model taking into account more than 20,000 student data records for 11 fall semesters (Coggin, Gavosto, Huang, & Torres, 2017). The study used a variety of machine learning algorithmic models to predict whether students would be successful in college algebra, intermediate college algebra, or enhanced college algebra based on all four components of their ACT score in addition to their high school GPA. Coggin's study showed in a conclusive way that only high school GPA combined with Mathematics ACT are significant predictors of success in algebra courses (Coggin et al., 2017). Using the algorithmic model designed by Coggin to place students based on the combination of high school GPA and mathematics ACT score, the mathematics department at KU decided to expand the offerings for enhanced college algebra in an effort to more effectively place all incoming students in light of the successes found in the pilot study for the enhanced mathematics course. By increasing student learning outcomes though SI in college algebra courses, retention rates can be increased, making the course useful not only to individual students but to the university as a whole. Figure 1 below shows the historical method for math placement and figure 2 illustrates the new method.

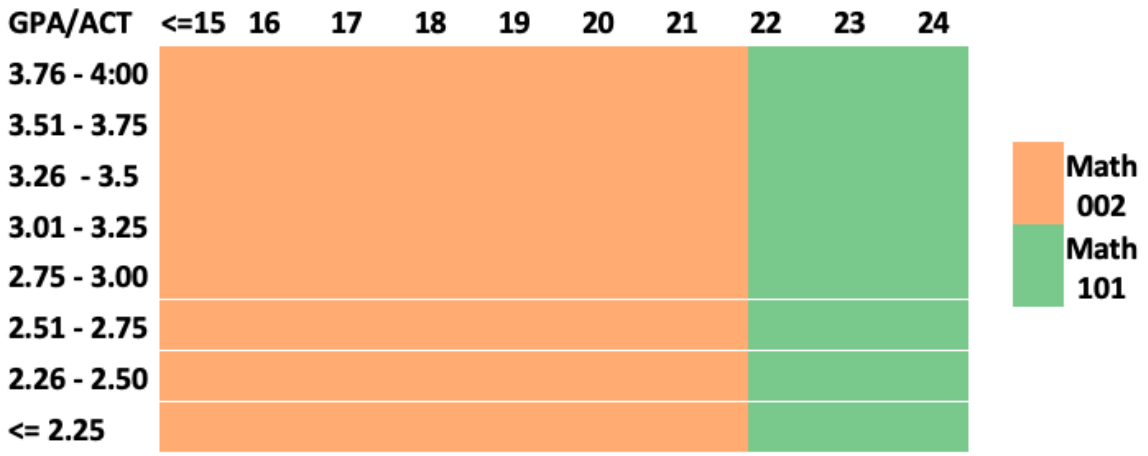


Figure1: Historic Placement

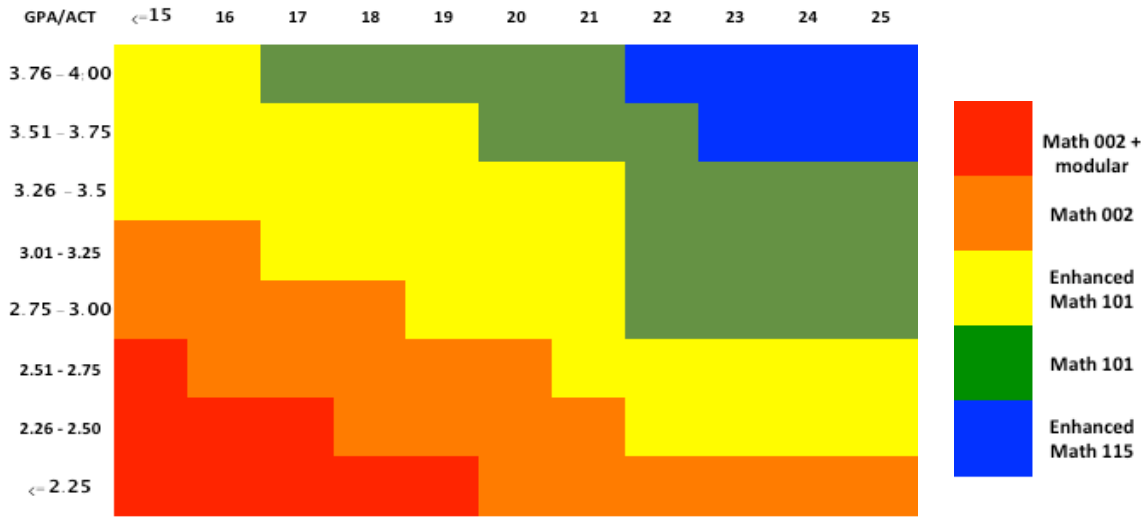


Figure 2: New Math Placement Model

Enhanced college algebra provides an alternative course for students who do not qualify for standard college algebra but have a higher high school GPA (greater than 3.5) combined with a lower mathematics ACT score (between 15-16, as shown in yellow area of Figure 2). Students who fit into this category now have the option to complete enhanced college algebra, a four-credit hour course that provides a supplementary hour of instruction, all in one semester. Prior to 2014, these students would have had to take a remedial math course followed by college algebra,

totaling two semesters at a cost of six credit hours for only three hours of credit. This course fulfills the college algebra requirements, equal to completing standard college algebra. Students benefit from taking enhanced college algebra in many ways. First, the enhanced math option will provide those who do not possess a strong academic mathematics background (Mathematics ACT 15-16) with supplemental algebra instruction. This supplemental instruction provides an extra two hours per week of access to mathematics instructors, and can help students to better understand the concepts, allowing for more time to process and learn algebra. In addition, the extra hour of instruction will allow students more time-on-task, collaboration with other students, and opportunities to rework problems for corrections on quizzes and homework, often opportunities not provided to standard college algebra students. Second, by replacing six credit hours (intermediate college algebra plus standard college algebra) with four credit hours (enhanced college algebra), students will save money by fulfilling mathematics requirements in fewer credit hours and as a result, spend less money. Lastly, choosing enhanced college algebra will save students time. By taking enhanced college algebra over the course of one semester instead of two (intermediate college algebra plus standard college algebra), a student can complete mathematics requirements for a bachelor's degree in one semester, freeing their schedule up to complete a required course in another subject and accelerating their time to a degree.

Enhanced Mathematics Course Details

Background. As previously discussed, academic advisors face many students who are academically underprepared for college (Brock, 2010). This challenge highlights the need for remedial courses. Research suggests that many students assigned to remedial education courses drop out of the class, and often out of college, and those that continue make slow progress to

graduation (Brock, 2010; Treisman, 1992). Based on this idea, and the knowledge that mathematics courses are a common barrier to graduation for students, the Mathematics Department at KU created the enhanced college algebra course.

Treisman's Workshop Model. The idea for the enhanced college algebra course was based on research conducted at the University of California at Berkeley (Carlson & Rasmussen, 2013; Treisman, 1992). The authors analyzed the contrasting study habits of black students and Chinese students in mathematics and science courses under the direction of Uri Treisman (Carlson & Rasmussen, 2008). In the study, the researchers discovered that black students, who were more likely to fail, showed a propensity to study in isolation, keeping their social lives separate from their academic pursuits (Carlson & Rasmussen, 2008). Chinese students, who were more likely to score high marks in the course studied differently; they formed cohesive support groups that played a major role in their success in the classroom. This project, conducted in 1977, had implications to practice regarding public research universities. The research conducted by Treisman suggested that a mathematics workshop program could be used to increase student achievement by creating small, diverse communities of learners who come together to work on challenging mathematics problems through student collaboration (Carlson & Rasmussen, 2008; Treisman, 1992). Treisman's workshop program was intended to foster an academic environment in which minority students could excel in college level mathematics and science courses (Treisman, 1985). The objectives of Triesman's workshops were as follows: 1) build a community of minority freshman focused on achieving academic excellence and become a source of peer support to one another, 2) provide extensive semester-long supplementary instruction to minority students, 3) orient minority students to the university and assist them with their adjustment, where necessary, to advocate for their collective and individual success, and 4)

monitor students' academic progress and furnish ongoing academic advising (Treisman, 1985). While Treisman's study was only in reference to minority students, the benefits of such a workshop can be applied to any student population. The basis of the workshop idea is that instructors increase learning outcomes by providing additional time on task for students by meeting more frequently and spending more student contact time with them during extended class time. In addition, the workshops foster a cooperative learning environment through increased group work and collaboration with other students. Lastly, the workshop format encourages student self-regulation through working on problems at a slower pace, allowing time for revisiting topics for further review before moving on to new problems.

The development of enhanced college algebra at KU. The key aspects of the enhanced college algebra course at KU, were based on Treisman's research and the lessons from his workshops (Carlson & Rasmussen, 2008). The mathematics department at KU started the enhanced mathematics course to meet the needs of students at risk of failing algebra courses. The course was meant to provide the necessary background for students who do not have the academic skills to take mathematics 101 (KAP, 2018). Based on the structure used in Triesman's workshops, the KU Mathematics Department developed the enhanced mathematics course using a similar format. The new format includes challenging content as opposed to remedial, workshop sessions opposed to long lectures, smaller groups opposed to large classes, and longer time dedicated to working on problems, i.e. time on task (Carlson & Rasmussen, 2008; Treisman, 1985, 1992). Instructors are present during the extended hours of the workshop to help groups when they get stuck on a problem while challenging them to work together to learn to solve them on their own. Research has shown that this style of learning leads to positive effects including higher grades (Carlson & Rasmussen, 2008; Fullilove & Treisman, 1990).

Teaching techniques used in enhanced college algebra. Based on the workshop format used in Treisman's research, success in the enhanced college algebra course was found to be based on the following learning techniques: cooperative learning, time on task and self-regulation. The following section will be used to briefly describe these techniques and how they are used in the enhanced college algebra course.

Cooperative learning. One style of learning, cooperative learning, has gained popularity in the past few decades. Cooperative learning is described as students working in small groups to achieve a shared set of goals regarding academic assignments (Johnson & Johnson, 2008). In 1966, David and Roger Johnson formed a Cooperative Learning Center at the University of Minnesota to study cooperative learning groups (Johnson & Johnson, 1999). Based on this research, clear distinctions were made in the difference between simply working in groups and forming a cooperative learning group. Rather than simply putting students in groups and expecting them to learn together with each other's best interests in mind, cooperative learning focuses on students working on shared goals by seeking outcomes that will benefit the entire group. Students help each other understand material and as a result, student outcomes in the course are better than if the student had worked alone. Each student is checked on by instructors to ensure they are contributing, but students see the benefit of contributing to help not just themselves but the group as a whole (Johnson & Johnson, 1999).

According to the Director of the Kansas Algebra Program, during the enhanced mathematics course, students are paired or put into small informal groups at different times throughout the semester, based on the needs and learning styles of each student. Instructors have the autonomy to decide how to pair students and often pair them to work together on quizzes, problems on the

board for the class, or a difficult homework problem (Peterson, 2018). The flexible nature of cooperative learning can assist instructors in doing what works best in each particular classroom.

Time on task. Time on task has been found to contribute positively to student learning outcomes. Through more than fifty years of research, numerous good practices for higher education have been identified, one emphasizing the importance of time on task (Chickering & Gamson, 1989). Another important aspect of time on task is part of a students' learning process toward efficient time management techniques. Students should allot sufficient and realistic time for their course work which has been found to increase achievement in college (Admiraal, Wubbels, & Pilot, 1999; Chickering & Gamson, 1989; Ukpong & George, 2013).

The concept of time on task is utilized in the enhanced college algebra course. As previously discussed, the course requires students to enroll in one extra credit hour (two extra hours of instruction), above and beyond what they would enroll in for the standard college algebra course. During this time, instructors' direct students on practicing in effective ways to broaden their skills, including collaborative learning in the form of group work as well as extra instructor assistance on working out mathematics problems. This allows students the extra time needed to revisit difficult content so they can find solutions together. The extra time allotted during the enhanced class allows students more time to spend on learning and retaining content, contributing to a better course grade.

Self-regulation. Zimmerman, one of the most notable scholars in the area of self-regulated learning, began to develop his research on the topic in the mid-1980's (Panadero, 2017; Schunk & Zimmerman, 1998). Schunk and Zimmerman found that self-regulated learners stand out in a classroom due to their view of academic learning as something personal; an act of learning for themselves based on their own actions, rather than something that is done for them

(Schunk & Zimmerman, 1998). These students work through self-initiated processes such as setting goals for themselves, monitoring their work and behavioral learning and displaying resourcefulness in critical thinking (Schunk & Zimmerman, 1998). Self-regulation does not have anything to do with intelligence or academic skills; rather, it is a self-directed process where students become motivated to transform their mental abilities into academic skills (Schunk & Zimmerman, 1998).

The idea of the self-regulated learner is one that is demonstrated throughout the enhanced mathematics course at KU. The course is set up to help students take control of their learning by enrolling in a course that will take extra effort and work on their part, offering a payback of increased understanding of mathematics and the prospect of a better outcome in the course grade. Part of the extra time in the class is spent on students regulating their learning by stepping back and looking at problems they have struggled with both in groups and with the help of the instructor, so they can find errors, correct them, and build on their understanding going forward.

Advisor Training on Math Placement

Regarding math placement, the math departmental advisor is responsible for informing other advisors at KU of the placement methods and models. Before orientation, the math advisor speaks to advisors during a training session where she is given a brief period to present information about math placement. During this time, a "Special Permissions Sheet" is distributed to advisors outlining where a student's math ACT and high school GPA would fall in a list of courses they would be eligible for, reflected in figure 2 above. The "Special Permissions Sheet" outlines only courses that would need permission to enroll, such as those who do not

qualify to enroll directly into college algebra. A copy of the "Special Permissions Sheet" is included in Appendix III.

In this chapter, the enhanced college algebra course was outlined in detail in reference to the course components including background, the Treisman workshop model, course development and teaching techniques. The following chapter will include an in-depth review of applicable literature framed with a logic model in reference to math placement advising. Following the literature review chapter, chapter four will outline the study methodology, followed by the study findings and conclusions.

Chapter 3: Literature Review

A literature review was conducted to provide context to the study. Because advisors are responsible for helping students decide which math course to choose, they are the primary focus of this study. The literature review is framed by using a logic model in reference to advisors. The academic advising section will look at academic advising perspectives and advising models and how they fit into mathematics placement at KU as well as views on math anxiety.

Logic Model

A logic model is useful in this study to show how the process of advising for math placement is supposed to work. A logic model is the basic description of how a program works to address a problem, linking the problem, inputs and activities to the intended goals or outcomes and synthesizing the main program elements into a diagram (Twombly, 2019).

The problem that this study aims to address is the need for students to be placed in the correct math course. Broadly, the purpose is for students to successfully pass college algebra courses with fewer credits and in less time. The specifc logic model for the advising/course selection aspect of Math 101 Enhanced is illustrated below in Table 2. As shown in the logic model, the actions and outcomes of math placement in advising are broken down into categories. The first category, resources, refers to the resources available to complete the activities.

Table 2: Logic Model for Advisors during Math Placement

Resources	Activities	Outputs	Short-Term Outcomes	Long-Term Outcomes
Resources to accomplish activities:	In order to address the problem, we will conduct the following activities:	What is produced by activities: activities will produce following evidence of service delivery: workshops held, people trained.	Activities will lead to the following outcomes in the short-term:	If activities completed and outcomes achieved, these activities will lead to the following long-term outcomes:
Academic Advisors have information about placement options Prior training to assist student in course selections	Advising sessions where information is communicated to students What advisors do: O'Banion's Model Advising Perspectives Advisor training on course requirements	1-2 advising sessions per semester/per student used to help students make decisions	Eligible Students choose Math 101 enhanced course	Students are successful in Math 101 enhanced and successful in college

In this case, advisor resources include information advisors have about math placement and prior training on choosing courses. Activities refer to what advisors do with students, which includes communicating information to students during advising sessions based on their training. The outputs of this process result in one or two advising sessions per semester to determine math placement and other course selections. Short-term outcomes of these advising sessions are that students are placed correctly into courses, specifically, eligible students are placed into enhanced math. The long-term outcomes are that students are successful in enhanced math and are successful in college. The following review covers major points in the logic model shown above.

Advising Literature

The following sections will outline literature that has been used in reference to the practice of academic advising. Common aspects of advising are described, including advising models, history of advising, the role of advising and approaches to advising. To put advising into context for the purposes of math placement, literature is included on remedial and supplemental math as well as the topic of math anxiety, a subject that advisors commonly face during advising sessions.

History of advising. Prior to the early 1970s, academic advising was seen primarily as a faculty responsibility. However, with the increase in students attending college after World War II, the demand for increased student services became common on most campuses (Tuttle, 2000). The increased attention to the field of academic advising as a profession was brought to the surface in research conducted throughout the 1970s by Crookston and O'Banion (as cited in Tuttle, 2000). The increase in both the number of students and the types of students attending college and the added focus on advising as a profession led to professionalization in the field (Habley, 1983; Tuttle, 2000). The National Academic Advising Association (NACADA) was chartered in 1979, bringing to light the increased need for advising centers on college campuses (Tuttle, 2000). The importance of academic advising is rooted in retention initiatives of institutions. Many studies have confirmed the importance of academic advising, specifically by retaining students though connections with the institutions, and increasing student motivation and involvement (Chickering, Gamson, Poulsen, & Johnson Foundation; Racine, 1987; Chickering et al., 1987; Ernest T Pascarella & Terenzini, 1991). Over the last twenty years, the addition of advising centers at institutions has tripled to 73 percent (Tuttle, 2000). The majority

of the advising at large institutions is done by professional advisors, replacing the traditional method of using faculty members as advisors (Self, 2015). KU is one such institution. Much of the undergraduate advising is provided through the Undergraduate Advising Center (UAC). Established in 1997, the UAC at KU now advises nearly 13,500 students per year (University of Kansas Advising Center (UAC), 2018). Advising appointments can range from 30 – 45 minutes and are meant to assist students with choosing a major, making schedule changes, finding academic and professional rescources and successfully advancing to a college degree (UAC, 2018).

Role of Advising. Academic advisors are some of the first campus representatives that students encounter when starting college. Student advisors provide an environment for students to develop and flourish by offering them clear and specific information about the university (Tinto, 1987). Academic advising is important to faculty and students, and contributes to the success of the university as a whole. In a 2009 survey by Hale, Graham and Johnson of over 225,000 undergraduates at over 425 institutions, academic advising was found to be second only to the quality of instruction, as the most important component in the college experience (as cited in Mosher, 2017). At high-enrollment research intensive institutions, a strong student-advisor relationship will result in multiple positive student outcomes (Mosher, 2017). Advisors ensure that students are enrolled in the correct courses that will lead toward graduation and reflect a student's personal and professional interests, while developing them into good citizens (Christian & Sprinkle, 2013). In addition, quality advising has been linked to positive retention and graduation when advisors sufficiently address the needs of students (Pascarella & Terenzini, 2005; Tinto, 1987). One specific function of academic advisors is to help students plan their

educational program correctly regarding the sequences of courses and the logic in the educational program they choose (Mccormick, 2003).

Approaches to advising. Various perspectives on advising methods exist including developmental and prescriptive advising. Developmental advising is described as helping students to problem solve and make decisions (Christian & Sprinkle, 2013). The developmental method is used to make suggestions to the student. Instead of dictating what the student should do, advisors let the student decide. Developmental advising highlights the growing interest in educating the whole student by stimulating and supporting them in their quest for a better quality of life. This is done through a systematic process based on a close student-advisor relationship intended to aid students in achieving their educational and personal goals (as cited in Grites, 2013). This process is augmented with the full range of institutional and community resources passed from the advisor to the student (Grites, 2013). In developmental advising, the mission of the institution should be reflected in the process of total student development (Grites, 2013).

In prescriptive advising, the advisor tells the student which courses to take and is viewed as the authority in the matter, giving the student little say in the process (Christian & Sprinkle, 2013). The prescriptive advising approach was most commonly used by faculty members when advising students (Crookston, 2009). Faculty found this relationship convenient; having provided the student with a cut and dried solution to be taken as a directive (Crookston, 2009). Because the faculty advisor gave the student specific instructions, if the advice turned out badly, the student felt no responsibility, placing the blame solely on the faculty advisor (Crookston, 2009). This process can lead to misunderstandings on the part of both parties, resulting in problems not being resolved.

Another way to see the big picture of how advising happens at institutions is to refer to Habley's organizational model for academic advising, showing the seven roles held by faculty in reference to advising (Habley, 1983). Habley's model includes two types of decentralized advising structures: faculty only and satellite models. In the faculty-only model, faculty members advise students within their specific discipline or volunteer to work with a specific population of students. In the satellite model, students may work with a combination of faculty and professional advisors. In both decentralized models, supervision and coordination of advising is left to the individual department, which often leads to inconsistent advising experiences for students, causing problems for students who transfer between majors or programs. In any advising model, coordination of advising services between departments is a critical element to the success and development of students (Gordon & Habley, 2011).

O'Banion's model of academic advising. In 1972, Terry O'Banion developed a model of academic advising that outlines the steps advisors go through when meeting with students. These steps include five dimensions during advising sessions: (1) exploration of life goals, (2) exploration of vocational goals, (3) program choice, (4) course choice, and (5) scheduling choices (Burton & Wellington, 1998; O'Banion, 1994). In most institutions, advisors meet with students at least once each term. The significance of these meetings between advisors and students cannot be overlooked; few student personnel functions occur as often as advising meetings or directly affect so many students (O'Banion, 1994). During student advising meetings, O'Banion suggested that advisors guide students toward identifying life goals; which would then lead to the discussion of vocational goals, more specifically, what career the student would like to pursue (1994). In this model, advisors act as teachers to help guide students to choose a career path based on their vocational and life goals, in hopes that the student will be

able to select a major. Upon selection of a career path and a major, the advisor will share course options with the student. Ideally, the student will select the courses that they believe will be the best fit in meeting their goals. In later years, O'Banion reinterpreted his previous model, creating what he called the integrative advising model, adding a component where advisors initiate a conversation with the student and seamlessly make connections back to the five dimensions throughout the conversation (1994). During this process, every session or encounter between students and advisors involves the topic of life and vocational goals in order to refocus the student. This permits the advisor to help the student focus though self-reflection, on interests and goals so the advisor can easily asses the level of understanding on the part of the student (Burton & Wellington, 1998).

In reference to this study, it is expected that academic advisors at KU will execute each of the five dimensions of academic advising as presented by O'Banion (1994). During this process, I paid particular attention on the course choice dimension; during when advisors will likely discuss mathematics placement with students. Careful consideration was given to this part of the advising process; interview questions were focused on this area of student advising sessions. Ultimately, the idea is that students decide on mathematics placement based on the conversation with their advisor during this point of the advising session.

Math Literature

Remedial and supplemental math. Academic advisors face many challenges in advising students for mathematics placement in a culture where students enrolling today have an increasing amount of discretion when choosing courses (Park, Woods, Hu, Bertrand Jones, & Tandberg, 2018). In reference to math course selection, advisors can suggest and students will choose between a remedial path or a supplemental course if they do not directly place into

college algebra. When advising students that do not qualify for college algebra, the situation is particularly volatile; mis-advisement can have a negative impact on students who enroll in courses above their level of knowledge by causing them to loose precious financial aid in an unsuccessful attempt to pass the course (Hollis, 2009). However, advisors can help students feel comfortable by encouraging their academic growth with a strong advisor/advisee relationship (Hollis, 2009).

When students come to the University of Kansas and at many other colleges and universities, if they do not place directly into a college-level math course, they must enroll in either a remedial course or a supplemental course, if available. Remedial courses, otherwise known as developmental courses, are meant to raise skills to a college level (Bailey & Cho, 2010). In this remedial system, students are expected to navigate through, at times, multiple remedial courses, in order to enroll into a college-level course. Research has shown that students who progressed though remedial courses did no better on several outcome measures than similar students who enrolled directly into college-level courses (Bailey & Cho, 2010). In addition to less-than-stellar outcomes, remedial courses can discourage students from completing their studies (Benken, Ramirez, Li, & Wetendorf, 2015). The additional courses make the path to completing math requirements longer and students often give up before they finish the sequence of courses. Taking extra courses is costly, and the entire process can dissuade students from enrolling in majors that require math (Benken et al., 2015; Zientek, Schneider, & Onwuegbuzie, 2014). In addition, students who require remediation are less likely to complete a degree, becoming a barrier for future academic achievement (Benken et al., 2015; Mangan, 2019). For this reason, many states have eliminated remedial courses, including California and Tennessee (Mangan, 2019).

Because of the negative effects of remedial courses, some states are transitioning to a supplemental or corequisite remediation structure, which is being implemented in Colorado, Georgia, Indiana, Texas and Tennessee (Mangan, 2019; Weisburst, Daugherty, Miller, Martorell, & Cossairt, 2017). This supplemental form of instruction is associated with adding a companion course to a college-level class to help students catch up to a better understanding of the material. Support can consist of extra tutoring, peer study sessions or work in a lab with an instructor (Mangan, 2019). In Texas, a new initiative started among community colleges to offer alternatives to developmental math. These alternative pathways included augmenting coursework with study skill improvement content, adding tutoring resources, developing learning communities and pairing a developmental course with college-level courses (Weisburst et al., 2017). These practices have produced positive results, Texas community college systems reported a 4% increase in students passing college-level algebra courses (Weisburst et al., 2017). At the University of Texas at Austin, the Dana Center Mathematics Pathways program implemented alternative pathways to accelerate students' through developmental math courses. The 2015 and 2016 cohorts in the study saw a course pass rate increase of 11% (Zachry Rutschow, 2018). Because of the positive results associated with supplemental and corequisite programs, it is likely this trend will continue.

Math anxiety. Advisors also face challenges with students who often have mathematics anxiety (as cited in Ramirez, Gunderson, Levine, & Beilock, 2013). This anxiety has led to individual and national consequences; the number of students in the country pursuing STEM-related degrees has declined from 32 percent in 1995 to 27 percent in 2004 (Brown, 2014). Sheila Tobias of the University of Arizona, has conducted extensive research on math anxiety. In some of her first work, she conducted 600 interviews with college-age and returning students

and found three factors that affected their ability to do college level math: fear of mathematics, the conviction that mathematics is a white male domain, and the idea that a person is either good at mathematics or language arts, never both (Tobias & Weissbrod, 1980). This research is based on the idea that two myths exist, one is that college-level mathematics is too difficult for otherwise intelligent students to learn and another is that people can lead productive lives without learning mathematics (Tobias & Weissbrod, 1980). Tobias explains math anxiety as an emotional "static" in the brain (1980). This is related to thinking of the brain in three parts: an input area, a memory bank, and a pathway between the two for recall and understanding. In thinking of the process of working on a math problem, if the system is working correctly, a student will recall the right formula and approach. If the student needs assistance, they can go back to the memory bank for help, think outside the box by drawing a diagram or try hypothetical numbers to find a solution. They keep moving along the path in the brain until they find the solution. Math anxiety happens when the student's memory bank is intact and memory recall skills are developed but each time they look at a problem, negative emotions and panic ensue. The student's lack of confidence leads to tension and uncertainty. The memory and recall pathway become unclear and cluttered with emotions or "static." The student is unable to think because they have locked up their thought process with self-doubt, leading the student to give up. Tobias suggests that the reverse has happened, the student cannot think because they have stopped working.

Tobias's work suggests using self-monitoring and self-permission to overcome math anxiety. This involves the student writing down their negative thoughts in addition to the process they use to solve problems. This process is meant to help the students identify when they start to feel inadequate so they can identify it and address it before they encounter too much

static. Self-permission is the process of teaching math anxious students to give themselves permission to explore their own confusions, instead of quitting, and to ask themselves what about the problem is making it too difficult. During this exercise, students learn about their idiosyncrasies and know how to manage them better (Tobias & Weissbrod, 1980). Tobias refers to this process as math mental health. She suggests that math mental health can translate into better career choices, better self-awareness of strengths and a more positive way to deal with uncertainty (1980).

In dealing with students that have math anxiety, Tobias suggests that academic advisors can set up math-anxiety workshops with the help of a math instructor, or they can train themselves to conduct a workshop by enrolling themselves in a challenging math course and keep a record of their own feelings (Tobias & Weissbrod, 1980). If an advisor shows confidence in themselves and in their students, they can be in a better place to encourage them to challenge themselves to take a difficult math course. Based on all the factors that can come into play in math placement, including the common problem of math anxiety, it is important that advisors better understand the significance of mathematics placement decisions and the details of course content and options so they can have a better-informed conversation with students.

Alternative courses to college algebra at other institutions. To counter the effect of math anxiety, and to ease the barrier of college algebra, some institutions are offering alternative paths to traditional mathematics requirements, such as college algebra. Many institutions are already offering alternatives to students in majors that would not later require higher level math courses, such as calculus. Some of these institutions include Michigan State University, the University of Georgia and the City University of New York.

Michigan State developed a set of quantitative literacy courses, Math 101 and Math 102. The courses are quite different from traditional college algebra courses. These courses are meant to be context-driven, engaging and pragmatic in content (Tunstall et al., 2016). In addition, the course is structured to counteract math anxiety. The University System of Georgia has recently developed a pathways approach to address the issue of low student success rates in college algebra (Blumenthal, 2016). Students who will need college algebra, those who must take calculus for their major, are directed to the traditional college algebra path. Other students in the University System of Georgia who are not majoring in an area that requires calculus still must fulfill college math requirements to graduate. These students are given the option to choose from two courses that are designed with mathematics topics in mind, but with a more meaningful approach rather than a review of high school algebra (Blumenthal, 2016). It is stated that these courses are taught at the same challenging level as the college algebra course. The University System of Georgia enacted these courses with the overall goal of providing students with skills necessary in today's world; enabling students to be able to evaluate quantitative information, make logical deductions and arrive at reasonable conclusions. City University of New York developed an alternative path focused on the students that were not eligible to enroll directly into college algebra and were directed to remedial math. Instead of sending these students to remedial math, the City University of New York sent students to a college-level statistics course. Most of the students who enrolled in the statistics course passed, 55.69%. Furthermore, those students assigned to statistics passed a rate that was 16 percentage points higher and accumulated more credits than the students in remedial math (Logue, Watanabe-Rose, & Douglas, 2016).

To provide further context to this up-and-coming development, at least ten additional institutions have also implemented alternative pathways for college algebra in the form of

quantitative literacy. Some of the larger institutions on this list include Boston University, Central Washington University, Ohio State University, UC Irvine, UC Boulder, Iowa State University, Duke University and the University of North Carolina Chapel-Hill (Tunstall et al., 2016).

Summary

The coordination of advisors is particularly important in the case of mathematics advising. As shown the logic model, advisors have resources available to learn about math placement prior to meeting with students. They then meet with students to discuss course options, including math courses, one or two times per semester. The short-term goals of this process is that eligible students will choose the enhanced math course, which will lead to the long term outcome of being successful in enhanced math and, overall, being successful in college. Students who are eligible for enhanced mathematics must rely on their advisor to guide them to choose either enhanced mathematics or the two-semester sequence, intermediate college algebra followed by regular college algebra. As previously mentioned, advisors need to be able to properly describe the options available for mathematics courses and how each course is different from one another. O'Bannon's model of academic advising (1994), suggests that advisors should discuss in detail mathematics placement options with students in the dimension of course choice.

The purpose of this research project is to gain a better understanding of how advisors talk to students regarding mathematics placement at KU. In this study, research was conducted with academic advisors in an effort to understand the processes used at KU during student advising appointments regarding mathematics placement. Specifically, this study will examine how mathematics placement advising is discussed with students during advising appointments. This

will provide clarification on how students and their advisors make choices about which mathematics course to take.

The literature review was framed with the logic model for math placement advising and also included literature on supplemental math, remedial math, academic advising history, math anxiety, as well as advising perspectives and models, including O'Banion's Model of Academic Advising. In addition, literature was included on alternative pathways to math requirements at other institutions, which is becoming more common because of the issue of math anxiety. Now that the literature has been presented, the following section will outline the research methods that were used to conduct the study.

Chapter 4: Methodology

This chapter describes the research methods used in this study. The problem this study aims to address is centered on how academic advisors at KU introduce and place students who qualify for enhanced mathematics into mathematics courses. This research focuses on how advisors explain the different offerings to the students who qualify for enhanced mathematics. The following research questions guided this study: RQ1**)**: How and in what ways do advisors introduce mathematics options to students who qualify for enhanced mathematics? RQ2) How do advisors explain the differences between the two options (intermediate college algebra plus standard college algebra versus enhanced college algebra)? RQ3) On what basis do advisors make recommendations to students regarding the two choices (if they do)? Within this chapter, I will discuss the design of the study, sample selection, data collection, data analysis, validity, reliability, and researcher bias.

Design of the Study

A qualitative research design was utilized for this study. A qualitative design is a flexible method of research in which the research process should be reflexive through each stage of the study (as cited in Maxwell, 2012). Based on the fact that this study is meant to gain a better understanding of how the process of mathematics placement works, a qualitative study is appropriate. Qualitative research focuses on understanding experiences naturally through observation and discovery (Merriam, 2016). The process of discovering and understanding mathematics placement will take place through interviews with academic advisors. As cited in Merriam (2016), qualitative researchers study things in their natural settings, attempting to interpret things based on the meanings people bring to them. Because my research questions are based on communication that happens from advisors to students, academic advisors are the best

source of information regarding this process. I conducted face-to-face interviews with academic advisors. The questions will be based specifically on mathematics advising for students who qualify for enhanced mathematics. With the questions asked, I hope to better understand how advisors interpret the information provided by the mathematics department in reference to the enhanced mathematics course and how advisors communicate this to students.

Sample Selection

Given that this study sought to understand academic advisors' understanding of mathematics course options and their communication with students regarding mathematics placement at KU, the sample was selected from the current advisors at KU. Purposeful sampling was used. Purposeful sampling is when the investigator wants to better understand and gain insight on something, in this case communication between advisors and students during mathematics placement (Merriam, 2016). Advisors are the only reliable source to divulge this information as they are on the front lines of academic advising for entry level students seeking mathematics placement. Therefore, the sample will be comprised of academic advisors. Ten advisors from various departments were interviewed based on specific selection criteria. The selection criteria to be used during the study included advisors who have worked at KU for one year and advisors who work with first-year students. Each advisor has worked through at least one summer orientation, Summer orientation is where first-year students are given enrollment instruction for their first semester of college enrollment. Because mathematics course placement commonly happens during summer orientation, advisors who have worked through this process should have a reasonable amount of experience to share during an interview. The advisors chosen have worked with first year students because college algebra courses are most commonly taken by students in their first year of college.

In order to find participants to use in my sample, I utilized network sampling. Network sampling, the most common form of purposeful sampling, is the process of finding a few key participants who meet the criteria and asking them to refer other qualified participants (Merriam, 2016). First contact was made with the Director of the Undergraduate Advising Center (UAC). A solicitation was made and shared with the Director, which she distributed to all advisors in the UAC (see Appendix I). The first solicitation email distributed resulted in three advisor participants from the UAC. Via the advisors I interviewed from the UAC, I was able to make contact with other potential participants. In this manner, I secured two more interviews with departmental advisors within the College of Liberal Arts and Sciences. For the remaining five interviews, I manually solicited participants via email requests. During this time, I evaluated the departments that were being represented with my other participants to be sure that I directed my solicitations to other schools not represented in the initial sample. Upon determining which areas were not represented in the study, I found contact information for advisors on the KU webpage and emailed interview requests to these advisors. In addition, my goal was to interview at least one advisor from a high-impact support program, such as TRIO. High-impact support programs such as TRIO are common at KU and advisors in these programs often help students with course selections. I solicitated four departmental advisors in schools that were not previously represented from the school of journalism, the biology department and the chemistry department. I directly emailed solicitations to these departmental advisors. The advisor in the School of Journalism, referred me to another advisor within journalism. Lastly, I contacted an advisor in TRIO who agreed to be interviewed. This process rounded out my group of ten interview participants. An interview participant list which includes advisor participants'

department, years of experience, and the advisor's undergraduate degree is included below in Table 3. Pseudonyms were used for each participant, as listed under "advisor name."

Table 3: Participant List

Advisor Name	Advisor Department	Years of Advising Experience	Advisor Undergraduate Degree
Participant 1	University Advising Center	3 years of experience	Psychology
Participant 2	University Advising Center	1 year of experience	Music
Participant 3	University Advising Center	5 years of experience	Business
Participant 4	History, East Asian Languages, Classics and Humanities	1 year of experience	Psychology
Participant 5	School of Journalism	2 years of experience	Education
Participant 6	School of Journalism	13 years of experience	Social Work
Participant 7	Psychology, Sociology, Behavioral Neuroscience	1 year of experience	Psychology
Participant 8	Biology	1 year of experience	Social Work
Participant 9	Chemistry, Biology, Physics	2 years of experience	Engineering
Participant 10	TRIO advisor- SES & STEM	5 years of experience	Psychology

In addition to academic advisors, to better understand the process of how information is transferred from the mathematics department to the academic advisors, I spoke with the mathematics departmental advisor. The mathematics departmental advisor is responsible for

communicating mathematics placement procedures to KU advisors. Because I seek to better understand how advisors communicate mathematics placement options to students, it was necessary to understand what information they received from the mathematics department in reference to how they should place students in mathematics courses.

Data Collection

Data for the study was collected during the course of interviews. Other information about what materials were distributed to advisors by the math department was collected from the mathematics departmental advisor and from the proposal that was approved to expand courses for enhanced math. Each of these sources of information was used to answer the research questions guiding this study.

Interviews. This study utilized in-person interviews for data collection. Because all of the interview participants are at the same institution, in-person interviews were conducted. Interviews can be conducted in three different formats; highly structured, semi-structured or unstructured (Merriam, 2016). For this study, I used semi-structured interviews. Semi-structured interviews include a mix of more and less structured questions while looking to address specific questions or issues to be explored (Maxwell, 2016). The interviews were based on a mixed question format with questions more and less structured, guided by a preset list of questions meant to learn about my specific topic. While a list of questions is necessary to keep focus on the research problem, flexible probes and follow up questions were included to allow for conversations to flow naturally. A complete list of the final interview questions can be viewed in the appendix (Appendix II). The interview portion of the study started with a list of seven questions total. After completing the first interview it became clear that the advisors might have ideas that could provide valuable information for the recommendations portion of the study.

Because of this, I added a question meant to solicit ideas for how communication could be improved between the mathematics department and advisors. With the new question, I was able to get more focused information about my topic.

Data Analysis

Following Merriam (2006)**,** data collection and data analysis was conducted simultaneously. During the process of conducting the interviews, I carefully reflected after each interaction on how the questions could be adjusted to ensure that I was asking the right questions in reference to what I hoped to learn based on my research questions. Interviews were recorded via iphone Voice Memo and then transcribed to allow for a more thorough analysis. Following each interview, notes about the interview were made based on initial findings or items that stand out. Once the interview was transcribed, it was reviewed for the purpose of identifying potential findings based on the research questions. Each finding was categorized and coded, based on the process suggested by Merriam (2016). Initially, open coding was used until categories were determined based on the interview responses and results. During the process of open coding, I highlighted and circled responses that I felt were pertinent to the interview questions and that provided answers to my research questions. Each highlighted comment was coded and given a name. Once each interview was conducted, I reviewed the data and established official categories to use in the write up of my results through the process of the constant comparative method. The constant comparative method is process used in qualitative studies that is both inductive and comparative in nature (Merriam, 2016). I divided the categories into two sections, those to be used in my analysis and findings on math placement and those to be used as possible recommendations for the mathematics department.

Following the development of categories, electronic folders were made for each category. The pieces of text that were used as data from the transcribed interviews was divided into each folder based on their category. Categories were evaluated to ensure they are responsive to the purpose of the research, exhaustive and mutually exclusive (Merriam, 2016). This information provided me with a list of data for each category found during the data analysis process. The categories then provided a foundation for the results section of my study.

Trustworthiness and Ethics

It is important to consider the concept of trustworthiness and ethics of the data produced. While methods and procedures do not guarantee validity, they are essential to the process of ruling out validity threats and increasing the credibility of conclusions found in a study (Maxwell, 2012). With this idea in mind, I strived to ensure trustworthiness by seeking information from multiple sources; not only interviews with academic advisors in various departments and capacities, but also from the mathematics department academic advisor that communicates mathematics placement methods to all advisor's campus wide. In addition, data on the enhanced mathematics course had already been collected in a prior quantitative research project. This data is presented in the literature review section of this study. One possible validity issue is a small sample size, only ten academic advisors. In addition to the limitation of a small sample size, my study was also limited to one institution. While it would be impossible to interview all advisors at KU and time consuming to seek advisors from other institutions, it is my hope that interviewing advisors from various departments at KU will offer me a variety of thoughts regarding mathematics placement in advising. Each piece of data collected, including interviews and previously conducted quantitative research, will be triangulated into the

categories used in my results section. By triangulating multiple sources of data I hope to increase the reliability and validity of this study.

Researcher Bias and Assumptions

Though it is impossible to eliminate researcher bias in a study, it is feasible to present potential bias that may exist on the part of the researcher (Maxwell, 2012). One interesting point that I considered when planning this study is that I have not had personal experience with any part of this issue; as an advisor, as a representative in the mathematics department, or as a mathematics student at KU. It is my hope that this impartiality will help the interviewees feel more comfortable sharing their perspective on the issue based on my research questions. However, having worked closely with instructors in the mathematics department in my current position, I need to be careful to collect all opinions and perspectives on this matter, not just from those in the mathematics department, in order to ensure that I am evaluating and researching all sides of the issue in reference to my research questions. By seeking answers on my own, I hope to establish a full picture of how communication happens during the process of mathematics placement at KU with as little bias as possible.

In this chapter, I discussed my study in reference to research methods and methodology. The information provided included the design of the study, sample selection, data collection, data analysis, validity, reliability, and researcher bias. In the following chapter, I will discuss my research findings, followed by the conclusions of my project in the final chapter of the study.

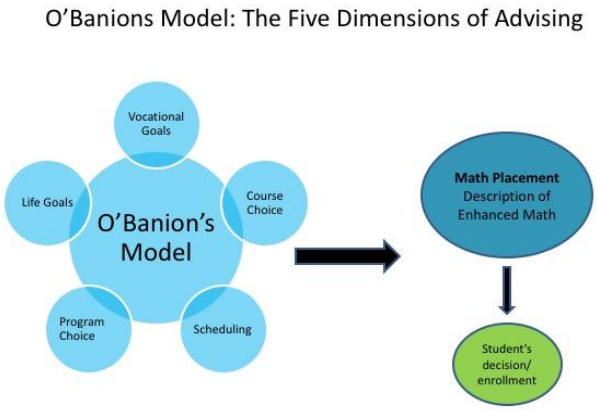
Chapter 5: Findings

Over the course of one semester in Fall 2018, I conducted interviews with ten advisors at KU. As previously discussed, I sought out interview participants from multiple areas of the institution in an attempt to represent each area of the university as much as possible. At KU, two areas that house the most advisors are the UAC and the College of Liberal Arts and Sciences (LA&S). Because of the large number of advisors housed in these two areas, they are more heavily represented among the interviewees. My interviewees consisted of three UAC advisors, four LA&S advisors, each within a department in the college, two departmental advisors and one TRIO advisor. This combination of interview participants provided me with a variety of information from different areas of advising at KU. Having a variety of advisors in different areas of the university proved beneficial in the study; many different perspectives were shared and are further explored in the following section.

To illustrate a chronological picture of an advising appointment, I first asked the participant about their advising philosophy. O'Banion's Model of advising outlined in Chapter 2 can be used to describe the philosophy of advising used by the interview participants (O'Banion, 1994). Advisors touch on all five dimensions described in the model; exploration of life goals, exploration of vocational goals, program choice, course choice, and scheduling choices. The diagram below shows in greater detail the process by which advisors discuss courses and decisions with students.

Beginning with discussions about a student's life goals and vocational goals, advisors weave a conversation together that will solicit informaiton from the student that indicates to the advisor a potential educational path for the student based on their interests. As part of this

conversation, the advisor is evaluating the responses of the student to determine the student's comfort level with mathematics.



Each interview participant was asked how they approach the topic of mathematics placement with first year students, including details on what specifically they say to the student during this conversation. After asking advisors about their advising philosophy, I asked what sources of information they use to decide how to place students in math courses. Advisors base math course recommendations on various resources and sources of information that they have at their disposal. In the first section of this chapter, I will discuss the sources of information used by advisors to make recommendations to students. After reviewing where advisors get information about math placement, I will address each research question based on interview responses.

Sources of Information for Mathematics Placement

As previously mentioned, a logic model was used to frame this study. The first step in the logic model focuses on the resources available to advisors as they place students in math courses. The Mathematics department advisor shared with me a "Special Permissions Sheet"

that she distributes to advisors during New Student Orientation training (Department of Mathematics, 2018). She mentioned that she provides this sheet, along with a brief ten-minute description during the training. In addition, advisors are provided other resources to help place students, usually by their department. These additional resources are described below.

When asked about available resources regarding mathematics placement, all the advisors in the study mentioned first and foremost, they refer to the "Special Permission Courses" sheet distributed by the mathematics department (Appendix III) One advisor stated, "I use the sheet that the math department advisor sends out, and she will answer any questions we have about it" (Participant 5) This is most commonly used for mathematics placement and has been widely distributed to the advisors on campus. The following section outlines additional resources used for mathematics placement by each area of advising represented in this study.

The UAC was represented by three advisors in this study. Based on the interview feedback received, it seems that the UAC advisors have more resources available for information on mathematics placement then other advisors on campus. Between the three interviewees in the UAC, six resources were mentioned as sources of information on mathematics placement. These include access to a "headquarters" advisor via skype, an internal staff notebook, the orientation field guide, and a six-week new advisor training where the mathematics department presents to advisors. Participant 1 noted, "We do an extensive 5-6-week training where we hear from the math department". The skype headquarters is a system used by UAC advisors during orientation where advisors have a direct help line to an advisor that is trained to answer difficult questions and has access to additional information if needed. Participant 1 added, "A first resource we have is our internal staff notebook." Another advisor in the UAC mentioned "if I need help during our live orientation, I would call our internal skype headquarters, via the headquarters

advisor or liaison. In most cases the liaison can even ask questions via skype directly to the math advisor" (Participant 2). This headquarters advisor works closely with the mathematics department advisor and can help with any possible problem in real time with an immediate turn around.

Advisors for the College of Liberal Arts & Science also attend a six-week training period where they receive a presentation from the mathematics departmental advisor. Outside of this resource and the "Special Permissions Course" sheet, no other resources were noted as common among advisors in the College of Liberal Arts and Sciences. Within the group of advisors interviewed, two were from a science department. Both advisors in the science department pointed out that within their department they had developed a visual aid for showing a full chart of the mathematics classes and the paths that can be taken for each section. One advisor noted, "What helped in addition to the permissions sheet, we have a full chart within the science team. We actually made it; I think a former math advisor that works with us made it first" (Participant 9). One advisor reported that this visual aid was shared with some other advisors in the College of Liberal Arts and Sciences as well but it was not mentioned by them during interviews.

Two of the departmental advisors in this study are employed to advise students in a particular field of study. These advisors are not supervised through a larger advising group; they report to the department. Because these advisors do not work in a larger advising group, they do not have specific training available to them. Participant 10 stated, "I feel like when I was working previously at the UAC that information was more for sure to get to me". In each of these cases, the departmental advisors had previous experience at KU as advisors, often at the UAC, where they received an initial six-week training to advise students. One departmental advisor stated, "Our last seven advisors in this department came out of the UAC and the reason is

because we had functional knowledge" (Participant 6). However, one departmental advisor noted that the initial training received had been many years ago and further training had not been available. Both departmental advisors in this study mentioned that they were given an advising notebook as a KU advisor, the same notebook that advisors at the UAC receive during orientation. Participant 6 added, "At the UAC, we all got an internal notebook that we brought with us". In addition, one of the two departmental advisors mentioned "during meetings I always pull up the admissions website to look up degree requirements" (Participant 5). Each of the advisors in these circumstances stated that they wished they had access to additional and more regular training as course information and requirements often change frequently. One advisor stated, "I would like to see cross-training, university wide for advisors so they know they are right on point" (Participant 6). This information would prove useful to them and their student advisees.

In order to diversify the data collected in this study, I sought out an advisor in a high-impact program on campus, the TRIO program. The TRIO program is funded by the federal government and meant to provide educational opportunities to low-income, first generation and disabled college students. Advisors in this program, as well as other high-impact programs on campus, see students much like advisors in the UAC or the College of Liberal Arts and Sciences and, at times, help students enroll in classes or advise them on what classes to take. Though they are not always directly responsible for helping students enroll in classes, they often advise first time freshmen during the OPTIONS program that takes place a week before fall classes start. One advisor stated, "We did start a new initiative where we were trying to do some early outreach to incoming freshmen, particularly those going through OPTIONS. Last summer we tried to assign advisors early to students before they come to campus so they would have a point

of contact over the summer and prior to getting here. It would definitely be good for our advisors to have that information (on enhanced math) in case students are reaching out about math classes" (Participant 10).

Advisors in externally funded programs are not sent to the six-week advisor training that other KU advisors attend. The TRIO advisor in this study mentioned "when I worked at the UAC, I was trained as an advisor and I was updated constantly about new things. Now I don't get it always" (Participant 10). The TRIO advisor had not recently been given any resources directly to assist in advising, "you just don't get the information over here" (Participant 10). This advisor mentioned that other than items that were distributed to them through networking channels on campus by chance "we have to reach out to different pockets to get information" (Participant 10). In discussions about enhanced mathematics, this advisor mentioned that the course might be of particular importance to her students as they are all from disadvantaged backgrounds and as such, often come less academically prepared then other students at KU.

As mentioned in the proposal from the KU Mathematics department, enhanced math was specifically designed for students that need additional help, in particular those who are from disadvantaged backgrounds and are less academically prepared. Students in TRIO are the population of students that could benefit the most from enhanced math. Based on the interview with the TRIO advisor, improvements in communication about enhanced math can be made, specifically in high-impact support programs.

Advising appointment preparation

All of the interview participants stated that they start by analyzing the student record before they meet with them in reference to their mathematics ACT score and their high school GPA. In addition, some of the participants stated that they also take into consideration any AP

credits or dual credit courses. Based on the background characteristics of each student, advisors would decide where a student should be placed in mathematics before meeting with the student. The advisor would prepare a recommendation for each student before their first meeting with them for two reasons. First, this helps advisors to streamline the appointment by doing the leg work before the student arrives to their appointment, saving time for other conversations that may need to happen. Second, this method is a way that advisors connect with students and make them more comfortable and confident in the advisor's ability to help them. By showing the student that they have already spent time on their behalf by reviewing their academic records before the meeting, advisors are building trust between them and the student. This groundwork is set with the student so that conversations about their goals and career path will come more naturally. Based on the information found in the student's record, students would either place directly into standard college algebra (Mathematics 101) or above (with a mathematics ACT score of 22+) or they would be below the threshold, in which case it would be necessary for the advisor to explain other mathematics options.

Now that I have described what sources of information advisors use to make recommendations on math placement and what they do to prepare to meet with students prior to advising appointments, the following section will present the findings of my study in reference to specific research questions. Each research question will be addressed based on the interview responses. In addition, findings will be presented in detail, divided into categories by topic and subject area.

RQ1: How and in what ways do advisors introduce mathematics options to students who qualify for enhanced mathematics?

The advisors in this study each had their own specific major area they advised, and this distinction often provided the basis for how advisors approached students in reference to enhanced mathematics. For example, participant 7 stated "the conversation I have with students about math courses depends on which of the three majors I advise for (psychology, behavioral neuroscience, sociology). Not all of these majors require math, so the conversation is different for each." Like participant 7, not all advisors represented in this study advise students who are required to take college algebra. Four of the advisors in the study explained that if students do not place in standard college algebra, they initiate a conversation with the students about their major and their career goals to determine if the student should enroll in college algebra at all or pursue an alternate route, as specified by their major. Participant 7 stated, "if a student is not eligible for college algebra right away, they would have to take intermediate math or take a placement test to become eligible. Some options aren't as directly tied to placement, such as Finance 101 or LA&S 108 so we would discuss that. Usually if they are eligible for at least enhanced math, we will recommend that." The majors represented in this study that have bachelor degree programs that do not require college algebra include history, psychology and journalism (2 participants). Though advisors in these majors did still discuss college algebra options, in hindsight, it may have been more beneficial to only interview advisors that advise majors that require college algebra instead of those that offer alternate paths had this information been known. For the majors that offer alternate paths outside of only college algebra, the advisor and the student discussed other options available to fulfil the mathematics requirement in addition to the options for college algebra. One advisor in the Psychology department stated, "differing levels of psychology majors do not require a math class" (Participant 7). Participant 4, a history advisor, stated "this year for Bachelor of Arts students, they changed the requirements

so students could take personal finance along with an LA&S course (Personal Numeracy) and they wouldn't need college algebra." Another advisor in journalism stated "our faculty said 'no the math credit doesn't have to be from college algebra, it can be from quantitative literacy'" (Participant 5). Another advisor added the following:

> Because of journalism's specific requirements, there is the possibility of doing personal numeracy. The relationship with personal numeracy of why some students appeal to it is because it doesn't have a prerequisite requirement of math 002. They can tend to prefer that because of the fact that it bypasses the two-semester sequence with college algebra. I'm speaking in very general terms, many journalism students are not enthusiastic about math, so within that situation, what we are talking about is 'I can do two math courses or I can do one course instead?' We often see students who immediately have a 'hot stove' reaction to that four-letter word 'math.' When we see those cues, we are thinking, there is another option for you (Participant 6).

For all advisors, once the advisor and student determined that college algebra was the chosen path, advisors explained the options available to the student. 1) take the two-semester route: one semester of intermediate college algebra plus one semester of standard college algebra (6 credit-hours), or 2) enroll in one semester (4 credit hours) of enhanced mathematics. One advisor interviewed said "enhanced mathematics is the exact same thing as standard college algebra, just done within one semester instead of two" (Participant 2). All participants mentioned that it involved the regular college algebra lecture plus two extra hours of class meant to provide extra study time. Of the ten advisors interviewed, few seemed very clear on the specifications of college algebra, including who should be referred to enhanced mathematics. One of these advisors sees Psychology, Sociology and Behavioral Neuroscience students. She explained:

> When students need to take algebra for their degree, with that, we do take a little bit more of an intense look at what their placement is. Are they calculus eligible? If not, how can we get through the process to be calculus eligible the fastest? Definitely looking that if they don't already have math 101 or SAT/ACT eligibility coming in, I'm trying to get them into enhanced math if that is the best route for them (Participant 7).

Based on the responses, it is clear that advisors explain math options to students in different ways depending on their math ACT scores, high school GPA, major and career objectives. Each of these factors can sway the conversation into different directions.

RQ2: How do advisors explain the differences between the two options (intermediate college algebra plus standard college algebra versus enhanced college algebra)?

The second research question asked how advisors explain the differences between the two options. All of the interview participants stated that when students did not place into standard college algebra, they first referred to the "special permissions" sheet provided to them by the mathematics departmental advisor (Appendix III). One advisor noted "the math department provides a placement form document that is sent to all of us. It's a chart guide with arrows and such that shows you where to place them if they have had a particular class" (Participant 3). Another advisor mentioned "I just use whatever comes out from the math department advisor" (Participant 5). The special permissions sheet outlines the range of mathematics ACT scores plus high school GPA that students could fall under to be placed into alternate mathematics courses if they do not place directly into standard college algebra (see Enhanced College Algebra placement diagram in Chapter 1). Based on the student's mathematics ACT score and their high school GPA, the advisor could determine if they were eligible to take enhanced mathematics. All of the advisors in the study confirmed that they

looked for notes in the advising portal from the mathematics advisor to see if she had recommended enhanced mathematics. For example, participant 4 described the process:

> Usually during orientation, we would look at the portal notes ahead of time. If the math advisor left a note that students qualified for enhanced math I would mention that the student has an opportunity to do enhanced math. Those notes helped because a lot of times you don't have time to dig through everything and say, okay, this student has a GPA and an ACT score of XXX, they can take enhanced math. It would be helpful to have those notes in there. If you see a student that has a low ACT score then you know they don't qualify for enhanced math and they need to start with math 002. It helps with prepping (Participant 4).

In reference to the portal notes, it is clear that advisors use them and benefit from them. The notes save advisors time when prepping for advising appointments and they take the guesswork out of determining which course should be suggested based on the student's math ACT and high school GPA. However, there was confusion on the purpose of the portal notes. Two of the advisors in the study understood the portal notes as a directive, telling them that the student needed to enroll in enhanced mathematics; in these cases, they did not explain the options to the student, they simply told them they would be taking enhanced mathematics. One advisor in the study often worked at the headquarters during orientation. Advisors working at the headquarters are responsible for fielding questions that come up throughout the day during enrollment. She noted "I don't know why it was confusing and I'm not sure in which advising units it was the biggest problem, but in some areas we saw it come up through the headquarters system that advisors thought that the portal note meant the student should be automatically enrolled into enhanced math. They didn't realize it meant that the advisor should consider

enrolling the student (they took it as a directive). I think that some offices understood this and others didn't" (Participant 1). Additionally, some participants stated that they did not consider enhanced mathematics at all unless there was a note in the portal. When asked when enhanced math would be suggested to a student, one advisor stated "I talk about enhanced math if the math advisor leaves a note in the system about it" (Participant 4).

For the advisors who did explain the differences between the two-semester route (intermediate plus standard college algebra) or the one semester route (enhanced mathematics), the conversation varied somewhat. In all cases where advisors explained the difference between the two options, advisors let students know that they could complete mathematics requirements in either one semester or two semesters. Each of the advisors in these cases explained that the two-semester route would require them to pay for a three credit-hour course that would not count toward their degree requirements. One advisor explained the difference between enhanced math and the two-semester route in the following way:

> Enhanced college algebra is a course that meets 5 days per week and costs the student an extra credit hour. The student takes the same lecture as other students in Math 101 plus Math 197 which is extra time to work on problems with an instructor present. It's a little more hands-on and you will be in it every day, this will allow more time for things not to slip away. I bring up that sometimes the best way to learn things is seeing it every day. I tell them if they are uncomfortable with math that they will have access to a math instructor every day for that extra layer of comfort with the material. The 101 lecture is the same as everyone else's, but the 197 lecture is just time to break it down further (Participant 3).

In this case, participant 3 had a very clear understanding of the enhanced math course, the hours required and the extra help provided to students. Some advisors explained that the enhanced mathematics course would provide the content at a slower pace. One participant said the following to students, "the course is a relatively slower pace and more importance is given to the concepts so you can feel good about it. It's easier for you to get help from an instructor" (Participant 9). Two advisors simply described it as the exact same course only with two extra hours per week, "it's essentially mathematics 101 but it meets five days per week instead of three," participant 8 said.

One advisor thought that because students enrolled in four credit hours for enhanced mathematics that the course only met four hours per week, telling his students "it's really only one extra hour" (Participant 2). Based on the quotes above, it is clear that there is a variation in how advisors explain the differences between the two options for mathematics requirements. Some advisors have a complete understanding of the course while others are unclear on the hours required and the difference in content between enhanced math and the two-semester route. Based on this information, it may be beneficial for advisors to have additional information on enhaneced math.

RQ3: On what basis do advisors make recommendations to students regarding the two choices (if they do)?

Part of the philosophy of all the advisors in the study involved helping students to better understand their career path in reference to their major. One advisor stated the following:

> On our first initial meeting before we enroll we wouldn't start talking about academics. We talk about, you know, who they are as people and get to know their strengths and their perspective, what their weaknesses are and then try and see what we can fit in based

> on what their career interests are. And you know, how we can work their strengths toward successes in academics and other things on campus (Participant 9).

Advisors are dedicated to ensuring that students select the correct courses for their major and that they are as successful as they can be while at KU. With this in mind, advisors start conversations with students about their study skills, what types of courses and instruction they enjoy and what subjects they are successful with or struggle to understand. Participant 4 said,

> For the first meeting, I try to make it very conversational, 'how are you doing, how is your semester, tell me about yourself, how are classes going?' With freshmen we go a little deeper, asking them how they are acclimating from high school to college. It's starting that conversation and getting to know them and what I do as an advisor, providing them that system of support (Participant 4).

As previously mentioned, advisors lay the groundwork for students to become comfortable with them at the beginning of their first appointment, by showing the student that they have invested time on their behalf by reviewing their academic record. One advisor stated,

> When I meet with first year students, I always look at their math ACT scores first and their high school GPA. We also always talk about their major or their career goals so I know what level of math they need to take. If you show them that you already know what they have in their record it seems to make them feel better (Participant 3).

During this time, advisors speak to students frankly about their experience with mathematics, their confidence in mathematics and in general, how they feel about taking mathematics courses. Each advisor in the study related that they listen to and observe verbal cues from the student regarding their comfort level with mathematics courses. Based on their response, advisors would

decide to suggest or not suggest enhanced mathematics. A journalism advisor stated the following:

> We prep everyone for enrollment with an internal document and survey asking what they are excited about and what courses they want to take. What are you best at? Even on the survey we could detect that they didn't want to take math and sometimes they would even write it on the page. We would put this data in our check sheet. They would hear about the two quantitative courses or college algebra during our presentation and we would navigate from there. For some students it felt like quantitative classes made more sense to them (Participant 5).

For students who suffer from mathematics anxiety (discussed in more detail below), most felt more comfortable with a course that allowed time for extra help, regardless of the extra hours in class.

Some advisors noted that some students had such a fear of mathematics that they would still elect to take the two-semester route because they felt it would be their best chance of passing the course. One advisor stated "I explain to students that enhanced math will get you credit for math 101 but with an extra system of support, and not being thrown into math 101. Some students still feel like they need a whole semester of remedial math and in that case I make sure they understand that they are paying for it, but sometimes if you feel like you really need it you probably do" (Participant 4).

In addition to responding to verbal cues from students about mathematics anxiety, advisors often spoke to students about the additional cost involved with the two-semester route versus the one semester route. This conversation usually involved finances and the student's projected graduation timeframe. A biology advisor stated "I would say falling behind is

definitely a big part of the choice on math courses" (Participant 8). This advisor also mentioned that some students were hesitant to pay for the additional credit hour for enhanced mathematics, as were parents involved in the conversation, when they realized that the hours didn't technically count toward their degree requirements. One advisor stated "Sometimes it is hard to talk students into taking enhanced math because it comes with an extra credit hour that students have to pay. Oddly enough, usually if you explain the extra help part to the parent, normally they are good with it and approve the extra hour" (Participant 3). In addition, another consideration for students in their discussions with advisors, was the potential extra time to graduation that could be a factor if the student was to choose the two-semester route. One advisor stated, "If students don't come in eligible for Math 101 there is a good chance they will have to take summer classes. They worry about 'can I afford it.' I live by the four-year graduation plan, and this can cause problems" (Participant 8). However, once faced with the alternative of an extra semester and two additional credit hours with the two-semester route, parents and students were normally supportive of enhanced mathematics.

Based on the interview responses above, adviosrs make recommendations on math courses based on a few different factors. These factors can include major, career interests, verbal cues, and comfort level with previous math courses. Once advisors collect this information from students during initial conversations, they will decide what course to recommend to the student.

Additional Findings

The findings above by research question answer the basic research questions. However, some actually more interesting findings emerged that don't directly fit neatly into the sections above.

Lack of Understanding of Enhanced Mathematics

Knowledge of course content. When advisors were asked about the course content of enhanced mathematics, it became clear that advisors don't know that much about enhanced math. All but one of the ten participants said they did not have enough information on the course content and would like more. One advisor stated, "I feel like we could have gotten more information about the enhanced option with some kind of curricular piece that we could use over the summer to help explain it to students" (Participant 5). Four advisors thought that the course involved supplemental instruction and additional time on task. This was described by participant 9 in the following manner:

> We let the student know that this class, you have a relatively slower pace and you have more importance given to the concepts and it will actually make them feel good about it. I let them know that this is how it's going to make them a stronger candidate when they take their biology and chemistry or other major requirement courses. They actually like it more when they have to meet more often, which means that, you know, they are doing math more often so they don't forget a lot of things (Participant 9).

Two advisors even thought that the course is exactly the same as standard college algebra, just spread into five hours, one advisor noted, "I tell students that enhanced math and the two-semester route is the exact same thing, just combined into one semester" (Participant 2). One advisor thought enhanced mathematics was only a four-hour course "it's really only one extra hour for them" (Participant 2). Clearly, no consistency was found in the responses about enhanced mathematics.

Knowledge of course hours. When advisors were asked about the hours required for enhanced college algebra, a few were unclear. As mentioned above, one advisor was under the

impression that the course was only four in-class hours, basing that idea on the fact that students only enrolled in four hours, despite the fact that the course actually requires five in-class hours. Another advisor was aware that the course required five in-class hours but also thought students enrolled in five hours, instead of four. One advisor mentioned, "I know students have to enroll in an extra lab to make the five credit hours a week" (Participant 8). It seems that if two advisors represented in this sample group are unsure about the required hours for enhanced college algebra, it is likely other advisors on campus may also need clarification.

Knowledge of grading. When advisors were discussing their knowledge of enhanced college algebra, two noted that they were unaware of how the course was graded. One advisor noted "Now that I have a student in enhanced math, I was surprised to learn that they have different grades for the two courses in 197 and 101 and you can do credit or no credit. I didn't know that" (Participant 2). Another advisor mentioned "I would like to see the actual structure of the class because incoming students often ask about it and how it is graded between the lecture and lab" (Participant 4). The grading component of enhanced mathematics is an important piece of information and advisors should have this information so they can share it with their students.

What Algebra Courses Are Available and To Whom?

Because so many options are available at KU to meet the mathematics requirements, it can be difficult for advisors to keep all of the available options straight. Depending on a student's major and their career goals, they may be eligible for any number of paths to complete their degree requirements, including a version of college algebra or an alternate path away from college algebra. For students who decide on college algebra, in many cases, they still have options available based on their previous academic record including their mathematics ACT

score and high school GPA. This confusion was evident among advisors interviewed. Many advisors were unclear on exactly who enhanced mathematics was meant for. The following sections will provide specific details on the points that need clarification.

Students place in Mathematics 101 but suffer from mathematics anxiety. Other secondary issues were brought up by the interviewees regarding the details of which algebra courses were available for students and which students are eligible to enroll in these courses. In particular, three advisors were unclear if they could enroll students into enhanced college algebra who place into standard college algebra. This topic was discussed in reference to the prevalent issue of mathematics anxiety. Fear of math or mathematics anxiety was a subject brought up by eight of the ten study participants. One advisor mentioned verbal cues that she observes, "Students will say 'I don't like math' or 'math and I don't get along,' those verbal cues I get a lot and if they say they are scared of math I'll mentioned enhanced" (Participant 1). Another advisor stated "I would say that globally, when we talk about the math piece that goes into this scenario, we have the students who just immediately have a hot stove reaction to the four letters M-A-T-H. So, when you see those cues, you're thinking, oh well there is this other option" (Participant 6). Mathematics anxiety was discussed in greater detail in the literature review portion of this study. These eight advisors related that they evaluate their students' comfort level with mathematics during mathematics placement discussions, observing verbal cues about their confidence level. One advisor mentioned "we ask students, do you have letter or number anxiety? Are you good at math? What don't you like about math?" (Participant 5). At times, advisors wondered about who was eligible to take enhanced math "If someone qualifies for math 101 but is uncomfortable with math, should we suggest that they could look at doing enhanced? Some students choose to do this because they will have more support and they are open to doing

that even with the extra hours in class" (Participant 2). Though the student's record may show they are eligible for standard college algebra, some students worry about their success in the course and are intimidated by college level algebra. Advisors were unsure if they were allowed to enroll these students into enhanced college algebra. Further clarification on who has priority to enroll in enhanced mathematics could help this situation.

Which students should be guided to second-semester mathematics? Within the discussions about mathematics enrollment, most of the advisors in the study brought up the process of attaining a permission code to enroll in enhanced mathematics and how difficult it can be to get students into enhanced mathematics during the final orientation sessions because courses at convenient times are full. One advisor described the process in the following way:

> It's hard during orientation, a lot of times we request permission codes and that section is full already. I don't know if there would be a way to keep it updated. I know (available seats) are available on the schedule of classes but sometimes it's unclear because it doesn't show an accurate number of spots left so sometimes we are asking permission for spots in a class that is already closed. Once the enrollment process starts it's hard to know what is available or fill without going through them individually. When that happens, it takes a whole hour out per week in the student's schedule, so then we have to start over and rebuild their entire schedule (Participant 1).

Another advisor added a similar comment:

When mathematics 101 starts filling up during orientation, we are balancing a few things. I don't know what the math department's preference would be, is it annoying to be asking about sections that are full? Is it their belief that they could wait to take math the following semester or do they feel we need to get students into math during their first semester some way, somehow?

Everyone's understanding (advisors) is that we have to put students into math during their first semester (Participant 2). In reference to the problem of courses being full, advisors questioned which students they could steer toward a second semester of mathematics, such as students who will not need a math course as a prerequisite for their major area of study. One advisor brought up this fact, "Our conversations are driven by interests as well. If they are interested in a STEM field then math is a bigger conversation than students interested in history or German studies. They may not even need to take a math course in the first semester" (Participant 1). If advisors were directed to place those students into second semester enhanced mathematics, more spots would be available in the first semester for the students who had to have mathematics to move forward with their major, such as engineering or pharmacy. This idea matches up with the issue faced by the mathematics department where fall courses are heavily sought after and spring courses lag in enrollment numbers.

Confusion with Course Numbers and Course Names

Points of confusion over math placement started on a basic level for one advisor that had just completed summer orientation for the first time. This advisor pointed out that there is little consistencey with how math courses are labeled and discussed in the advising world.

This participant felt frustration over the confusion invoked by both verbal interactions with the mathematics department and visual aids distributed that refer to mathematics courses by numbers in some places and by name in others. One advisor noted, "I think talking and using the class numbers is hard, 101 plus 103 equals 104 confuses me. I like it being called by name, calculus I or calculus II" (Participant 2). As a new advisor, this participant felt he needed to spend extra time learning about mathematics courses due to the unclear and inconsistent way the information was presented to him during training. He added, "I found it baffling the first time I heard it"

(Participant 2). This confusion was because the title of the course was given to him in numbers in some locations but in words in others. This participant had to invest extra time in "translating" the course name to the course number in order to understand the information. He described, "I had at least three passes over the information. It definitely took me a few passes over the material to understand it" (Participant 2). For example, on the sheet distributed by the mathematics department, courses are referred to as "Mathematics 101" but when speaking to people in the mathematics department and to other advisors, they would refer to the same course as "college algebra." This advisor noted that "gearing more time toward this during training could help or maybe a visual aid" (Participant 2). Clarifying this process both verbally and on paper could cut down on the mathematics requirements learning curve for new advisors.

Majors that do not Require College Algebra

Throughout the process of speaking to advisors from various departments on campus, it became obvious that more and more departments are no longer requiring college algebra to fulfil the mathematics requirements for some of their bachelor's degree programs. In particular, I spoke to advisors in the departments of Psychology, Journalism and History who all had bachelor degree programs that offered an alternative to college algebra in order to finish mathematics requirements. Both advisors in journalism mentioned they do not require math. They described this in the following way:

> In the past two years we have gotten permission to really shy away from college algebra. We discovered that algebra itself was not a requirement and that students only needed to take the quantitative literacy classes in reference to the Bachelor of Science in Journalism degree. Faculty was tuned in and making changes, our faculty wanted clarification

> because on the DPR it said math 101 but in other materials we had it said two quantitative literacy classes so we asked for clarification (Participant 5).

The psychology department also houses bachelor's degree programs that do not require college algebra. The psychology advisor I spoke too said "it is very feasible that a psychology major does not take a mathematics class" (Participant 7). According to participant 7, for psychology majors seeking a bachelor of arts degree, they need one class that counts toward their KU core goal requirement 1.2; this requirement can be fulfilled by quantitative literacy instead of college algebra.

Regarding the bachelor of arts degree in history and the bachelor of general studies, one participant stated that they offer students an alternative to college algebra on a regular basis. Oftentimes, this suggestion is offered after an advisor determines a student might be math adverse. Participant 4 mentioned, "I'll ask them if they think they will ever need calculus and if not, I'll offer them other alternatives. I try to gage their comfort level with math and where they plan to go in the future". Students seeking a bachelor of arts in history can take two courses in place of college algebra; personal finance and personal numeracy. For students who seek a bachelor of general studies, they only need one course in place of college algebra, Finance 101. Participant 4 stated that the alternative options to college algebra are popular with both students and parents; parents feel a finance course is more relatable to their student. She stated the following:

> Most of our students think that they have to take some type of math, and they have that expectation. Depending on the major, we offer a Bachelor of General Studies and a Bachelor of Arts and you can take classes in place of algebra. When students hear that they mention that they thought they would need to take algebra and, no, they don't. I tell

> them they can do just the finance class to fulfill the requirement for the bachelor of general studies. Bachelor of arts students, we have the conversation that most likely you will need to take college algebra. This year they changed the requirements so bachelor of arts students could take personal finance along with Personal Numeracy and then students do not need to take college algebra (Participant 4).

Each participant that advised students in degree programs that do not require algebra mentioned that students and parents rarely come to enroll knowing that they can avoid taking algebra. Within the group of study participants, advisors were always the first person to inform students of the other options available to fulfil mathematics requirements besides college algebra. According to the four participants in this study that advised in majors that provide alternatives to college algebra, students and parents are often pleasantly surprised when this option is made available to them via their advisor.

Conclusion

In this chapter, each of the three research questions were addressed and study findings were presented in reference to the questions. In addition, I presented other findings of interest relevant to the research questions. The study findings reveal that there are areas of confusion regarding mathematics placement, particularly in reference to enhanced mathematics, that advisors discussed during their interviews. Broadly, these areas include a lack of understanding of enhanced mathematics and confusion on who should enroll in enhanced mathematics. Another significant finding is that it is becoming more common for departments at KU to offer alternative courses to college algebra, based off of the feedback from three departments represented in this study. Based on this information, the following chapter will include discussions, conclusions and implications to practice.

Chapter 6: Conclusions, Implications, Recommendations

The findings discussed in the previous chapter revealed that there is some confusion and points of clarification needed regarding mathematics placement options at KU. Many areas of confusion and lack of clarity exist, including the lack of understanding surrounding advanced mathematics. During advising appointments, advisors provide students with all the information available about course choices and explain to them the differences in the options. However, the information that is included in the description portion of math courses depends on the advisor and on the major of the student. The following section will summarize the study in reference to the research questions.

There were varying responses and a wide range of knowledge regarding enhanced math. Advisors learned about enhanced math from the math departmental advisor through a brief training session prior to orientation where they are given a "Special Permissions" sheet to use for math placement. In addition to the information from the math department, advisors also have internal training material and resources that have been created within their advising group.

Advisors place students into enhanced math in a variety of ways. First, advisors consider the high school GPA and math ACT score of the student to decide if they qualify for college algebra. If they do not qualify for college algebra, advisors consult the "Special Permissions" sheet to see what classes the student might be eligible for. If a student is eligible for enhanced math, some advisors will explain that the course is available and elaborate on the differences between the two paths for math; the two-semester route (intermediate college algebra plus standard college algebra) or the one semester route, enhanced math. Some advisors will only recommend enhanced math if there is a note in the advising portal stating that they are eligible. At least one advisor thought that a note in the advising portal meant that a student should be

enrolled in enhanced math and did not give the student any other options. Overall, if a student is eligible for enhanced math, some advisors do discuss this option with them but there is not one consistent way the course is described. In addition, if a student is in a major where algebra is not required, the discussion may not get far enough to discuss enhanced math.

If a student is eligible for enhanced math and the advisor determines that the student does need an algebra course based on their major, advisors explain the differences between the two options (the two-semester route of intermediate plus college algebra or enhanced math) in a variety of ways. Some advisors state that enhanced math is the exact same thing as standard college algebra but with an extra two hours of class time. Other advisors tell students that enhanced math will offer extra time to work on problems with additional help from instructors. If a student asks about grading, some advisors mentioned that they do not know how the course is graded between the lecture portion and the lab portion. Overall, some advisors seem unclear on the differences between the two-semester route compared to the one-semester route for college algebra completion.

Another variable to consider in math placement is that some advisors in certain majors stated that their department offers alternate routes for math requirements such as taking a personal finance course or a personal numeracy course in place of college algebra. During the conversation about math requirements, some advisors stated that they notice verbal cues or hear a statement from the student indicating that they are math adverse. In this case, math becomes a much smaller and insignificant conversation as these advisors start to suggest an alternate course in place of algebra. If the student shows interest in an alternate path, some advisors do not get far enough into the conversation to discuss enhanced math at all.

In reference to the recommendations made by advisors to students about choosing the two-semester route over the one-semester route, most advisors simply offer the information to students and let them make the final selection, much like Christian and Sprinkle suggested (2013). In this manner, it seems that KU advisors practice developmental advising techniques when advising students (2013). A variation of this process can happen when students are in majors that offer alternative courses to college algebra. If a student is in one of these majors and the advisor determines the student is math adverse, math placement may not be discussed. The conversation over math placement may go no further than a student stating they are uncomfortable with math.

Overall, the study resulted in some interesting findings. One finding is that not all departments are encouraging students to take math and for those that do not require algebra to fulfill degree requirements, they can take alternate courses. In addition, advisors are evaluating how a student feels about math based on verbal cues or how a student responds when asked about their comfort level with math. If they interpret a student's cues as math adversity, they offer alternatives to algebra. Despite the fact that enhanced math could potentially help students who do not have the strongest math academic background, it is possible that some of these students do not get far enough into the subject of taking a math course to even find out about enhanced math.

It is known that college algebra is a challenging subject for many college students; a recent nationwide study found that only 50% of college students who took college algebra passed the course with an A, B or C (Saxe et al., 2015). During the course of interviews, four advisors out of ten revealed that because students are sometimes apprehensive about taking college algebra, their department decided to offer an alternative path. The majors represented in this

study that already offer alternatives to college algebra are history, psychology and journalism. Advisors mentioned the reason for these alternative paths stemmed both from the common problem of mathematics anxiety and documented or undocumented mathematics disability. In addition, advisors in the School of Journalism noted that part of their philosophy is to make the student as comfortable as possible, especially during their first year, to ensure that they are successful in acclimating at KU. This advisor noted that starting a student in a difficult course such as college algebra that can invoke fear, can often set a student up for failure. In addition, the advisor noted that many students get a poor grade and start their GPA out "in the hole." This can cause a student to lose confidence and feel like they are not meant for college. The reasons for departments to offer alternate paths around college algebra are notable, however, the importance of keeping college algebra in the curriculum also has its merits, as discussed in the literature review.

Implications

Advisors as gatekeepers. One of the issues discussed in the first chapter of this study was the fact that the mathematics department at KU was concerned about advisors not referring students to the enhanced mathematics course now that they have expanded the sections available to students. Based on the findings of this study, that is a real concern. One advisor noted that she suggests enhanced mathematics when she is alerted by a note in the portal from the mathematics advisor and if a note is not present, she does not consider bringing it up to the student. Another advisor mentioned that she has never had a student bring up the course, enhanced mathematics discussions are always initiated by the advisor. In addition to this, advisors in the study based placement suggestions on verbal cues and a students' self-identified math anxiety. This information suggests that academic advisors at KU are gatekeepers in

reference to mathematics placement, more specifically enrollment into enhanced college algebra. This is the exact problem this study is focused upon.

Math Placement Considerations. College students often enroll in courses based upon the recommendations of their academic advisor. Academic advisors play a major role in the decisions made by students about their course choices. Advisors have the knowledge and resources available to help students to enroll in the correct courses based on their major and their career goals. The resources and knowledge that advisors have is only as good as the information passed on to them by the departments and administrators at the university. College students place their full trust in their advisors to suggest the right courses based on their academic and professional goals and advisors facilitate this process based on courses required for the student's major.

Advisors have many resources at their fingertips to help them correctly advise students; however, the resources they have available may not be enough information in some cases. Mathematics placement in particular can be considered an important aspect of a student's trajectory in college. Correct placement can lead to better grades, less money spent, less stress on the student and a foundation that will open the door to other possibilities, such as an alternative major at a later time, or graduate school. Incorrect placement can limit a student's success by causing them to receive a poor grade in a course they are not academically prepared for or worse yet, causing them to believe that they are not college material by affecting their confidence and potentially their chance to graduate.

As previously mentioned, some majors at KU have established alternative paths for students who do not wish to take college algebra. Allowing a student to avoid taking college algebra can lead to barriers down the road, such as not having sufficient prerequisites to other

programs if the student later decides to change majors or add a minor, or being underprepared to successfully take the GRE if the student later decides to attend graduate school. In many cases, when a student starts college, they have not considered graduate school or the ramifications of avoiding college algebra in reference to the GRE. As we know, many students graduate with a bachelor's degree and only years later realize they need further education in order to advance in their career. In some cases, algebra may be needed for an alternate career or educational path.

Based on the findings in this study, advisors often made recommendations based on if a student thought they would need calculus for their major or in the future. Many students do not know if they need calculus and they do not understand why they would need it down the road, especially as first year students. The assumption that they would be able to answer that question for themselves may not be the best way to assess the situation. Not only do they not understand the ramifications of not taking college algebra but there is a high likelihood of a first-year student changing majors later in their college career. By taking college algebra, students can avoid this potential problem later in their educational career if they decide to pursue an alternate major or a graduate degree.

Verbal Cues and Math Anxiety. The mathematics department and those who train advisors at KU should consider the implications of advisors suggesting or not suggesting college algebra based on verbal cues. In more than one instance during the course of interviews, advisors mentioned that they observe students and ask them questions about how they feel about math. Often these observations result in a suggestion by the advisor regarding taking a math course or taking an alternative path, if possible, based on the major. While the math department cannot control a students' disposition toward math courses, they would likely appreciate the chance to teach the student before an advisor steers them into another direction. Because

students will choose to take math courses during advising sessions, the math department should consider what is being said to students about their courses. Advisors should provide all math options to students in an unbiased way. If advisors offer students an out they are likely to take it without fully understanding the repercussions of the choice.

An underlying issue that was clear during interviews is how advisors reconcile math placement with a students' self-identified math anxiety. It is clear that many students either say they are not comfortable with math or show their distaste for math upon observation by advisors. Advisors are aware of the issue with math anxiety and often feel the need to assist the student, potentially in a manner that helps the student avoid taking math. Because this is often based on what the advisor feels is "math anxiety," it could be beneficial to the math department to look into this further. It seems that what advisors could be hearing or seeing from the student could simply be a dislike of math, not anxiety. In addition, a dislike for something could stem from something unrelated to math itself, such as poor academic preparation in high school. This should be a topic for discussion when the math department provides training to advisors. Additional training for advisors could include topics about the importance of math and research on why math is necessary for college students.

Alternative courses to college algebra at KU. Due to the fact that the discussion of alternative pathways to fulfil math requirements was so prevalent in this study, it is logical to review the alternative paths offered at KU. As previously discussed in the literature review, alternative paths to math requirements are becoming more common at other institutions due to rising concerns over math anxiety. While the literature review focused on atlterative paths at other institutions, the following section will provide more information about the changes taking place at KU regarding alternative paths to fulfil math requirements.

Advisors from three majors represented in this study mentioned that they offer alternatives to college algebra to fulfil mathematics requirements; history, psychology and journalism. Students seeking a bachelor of arts in history can take two courses in place of college algebra, personal finance and a LA&S course, personal numeracy. For the bachelor of general studies, also advised within her service area, only one course is needed to replace college algebra, personal finance. The following section will describe these courses in greater detail.

Personal Finance (Finance 101) is housed in the School of Business. It is a three-hour course designed to teach students about spending, investing, credit, mortgages, loans and credit cards. The course is designed to teach students about a budget and how to manage their finances, buying a home versus renting, savings and insurance.

Personal Numeracy (LA&S 108) is a three-hour course housed in the College of Liberal Arts & Sciences. The course is designed to introduce students to statistics by showing them how to read and understand data in reference to everyday decision making. Students will learn how to use excel to manage their personal finances and make sound budgeting and investing decisions.

While it is not the overall goal of this study to determine which path is best, it is important to understand the information that is being presented by advisors to students in reference to mathematics placement, or lack thereof. Because four advisors in the study revealed that they often steer students away from college algebra, information on the alternate courses is relevant to this research. Clearly, it can be noted that the objectives and course content of the college algebra course is much different than the content of the alternative courses, finance 101 and personal numeracy. In addition, it is important to note in the interest of cost and time to degree completion, for the bachelor of arts in history degree, both courses mentioned in the

alternative path would be required, totaling six credit hours. This six-hour alternative path would be more costly and time consuming for a student then taking enhanced college algebra. Students who opt to take advanced college algebra are only paying for 4 credit hours over the course of one semester.

In reference to the School of Journalism, students are also allowed to take two courses as an alternative path to one college algebra course. The school of journalism allows Accounting 205 as an alternative course in addition to Finance 101. Accounting 205, (Survey of Accounting) is an introduction to financial and managerial accounting. It is meant to introduce the content of business measurement systems and costing systems in reference to management planning and decision making. Again, like the bachelor of arts in history, a journalism major would be required to take two courses to fulfil mathematics requirements in place of potentially one mathematics course, enhanced mathematics, for those who qualify. Lastly, for a bachelor of arts in psychology, students can again take two courses to fulfil the quantitative reasoning requirement. These courses are normally Finance 101 and Personal Numeracy.

The implications to the mathematics department of degree programs at KU offering students alternative paths to complete degrees without the requirement of college algebra could be negative. Because of the small scope of the study, it is unclear just how many majors at KU are offering alternative paths to fulfil mathematics requirements for bachelor's degrees. Clearly, majors that require college algebra as a prerequisite to other required courses would not allow alternative pathways. Majors represented in this study that require college algebra include engineering, biology, behavioral neuroscience, sociology, pharmacy, physics and chemistry.

With all things considered, it is clear that there are many pathways to achieve mathematics requirements at KU and in colleges throughout the United States. The most

important consideration should be the students and what is best for their education and their career. In the long run, more education is beneficial to our global economy but improvements can always be made to the current system. For purposes of this study, the focus is on improving the communication between advisors and the KU mathematics department in hopes that math placement will be as accurate as possible and will offer students the best chance for success in math courses, degree completion and career goals. The following section will focus on implications for improvements that can be applied at KU to provide the best possible placement for students enrolling in algebra courses.

Recommendations

Each advisor in the study was asked about methods and resources used in their daily life during interactions with students to assist them regarding mathematics placement. To further elaborate on this, advisors were also asked what tools and resources they do not have that might help to clarify the process for them or assist them when placing students into mathematics courses. One valid concern of the mathematics department is that they feel advisors rely too heavily on the notes placed in the portal that explicitly state who is eligible for enhanced mathematics. Because the fall 2018 semester was the first semester where the enhanced mathematics course was expanded to include ten sections, the mathematics advisor at KU manually added these notes to the portal for each incoming freshman that was eligible to enroll in the course. This process was timely and labor intensive; with fall 2018 first-time freshmen enrollment numbers at 4,164, this process may not be feasible in the future (KU OIRP, 2018). The process required the mathematics department advisors to review the records to all incoming freshmen at KU to determine if they were eligible for enhanced mathematics and then open their file in the portal and add in notes to each individual record. This process paid off; all ten

advisors interviewed stated that they appreciated the notes left in the portal guiding them to suggest enhanced mathematics to students that they knew were eligible. Two advisors in this study noted that they only considered enhanced mathematics an option when they saw the notes in the portal.

Based on the data collected in this study, it seems necessary for the KU mathematics department to implement changes to improve communication to assist advisors during the mathematics placement process, especially in the event that the mathematics department advisor does not add notes to the portal about who is eligible to enroll in enhanced mathematics. The following section will be used to describe in greater detail possible recommendations and ideas to improve the communication between the KU mathematics department and academic advisors.

Advertisement for enhanced mathematics. In talking with advisors at KU for this study, each advisor was asked about their knowledge of enhanced mathematics. Responses varied, one advisor was very confident in her knowledge of enhanced mathematics, all except for the actual content of the course. The remainder of the participants interviewed knew less about the course, each of them especially noting that they had no knowledge of the course content. In addition, advisors were asked what the KU mathematics department could do to improve knowledge about mathematics placement and enhanced mathematics in particular and eight of the ten advisors interviewed asked for more information on the content of the course and what enhanced mathematics entails on a daily basis. Clearly, based on the data presented earlier on the confusion surrounding the course, more information on the specifics of the course would be beneficial, not just for advisors but for students as well.

A possible recommendation to provide more information to advisors and students on enhanced mathematics would be a flyer or advertisement for advisors to both refer to about the

course and to share with students. Based on the interviews in the study, possible points of interest to be elaborated upon in the flyer would include additional details on the course content, required hours, grading system for the course and lab, and eligibility information.

Specifically, in information distributed about the course, it might be useful for the mathematics department to elaborate on why the enhanced mathematics course has better success rates than standard college algebra and what those success rates are. In addition, it might be useful to provide information on why the enhanced mathematics course is successful; more time on task, collaborative learning and more time with instructors to revisit difficult problems. In reference to the overall course content, information on the time spent in the lecture versus the lab and an example of what the course offers on a daily basis could be useful to students. A bullet list of the advantages to taking enhanced mathematics over the two-semester route of intermediate college algebra in addition to standard college algebra could be used to help advisors explain the advantages of the course to students. As noted in the findings section of this study, advisors mentioned that once they explained the advantages of fulfilling mathematics requirements in one semester over two, most students and parents agreed to enroll in enhanced college algebra. In the case where some advisors do not explicitly review this, students could potentially see the flyer for themselves.

An advertisement should be brief and clear, otherwise there is a risk that a student will not read it. The flyer should highlight the major selling points of the course. Alternatively, two flyers could be constructed, one for students and one for advisors. Additional details could be given only to advisors to share when students express interest in the course. Flyers could be distributed at orientation events, on the KU mathematics website or via email to students and parents. This process could increase enrollment in enhanced mathematics because if parents

become aware of the course, they may guide their students to enrolling. By adding all the details of the course into one document for distribution to advisors, parents and students, information for the course will be more easily accessible and clear.

A visual aid: pathway to fulfilling math requirements via enhanced mathematics. In addition to a flyer to expand upon the enhanced mathematics course, advisors mentioned that they find visual aids helpful. The visual aid could be used to show the progression of mathematics requirements and the paths that could be taken to fulfil these requirements. As previously mentioned, each advisor in the study referred to the "special permissions" sheet that is distributed to advisors by the advisor in the mathematics department. This sheet proved helpful for all advisors, though a few noted that the sheet can be confusing. In addition, one advisor pointed out that the sheet only covers students that would use a permission code to enter a mathematics course; standard college algebra is not represented on the sheet. This advisor stated that in particular, a visual aid that represented all math courses, not just those that need special permission, could help advisors understand the overall picture of mathematics placement

Advisors in certain areas represented in the study mentioned that they already use an internal visual aid as a resource when placing students in enhanced mathematics. Advisors in the science majors mentioned a visual aid that they use within their departments, made by a former mathematics advisor, to help understand and explain mathematics placement. In addition, advisors in the UAC also referred to a resource they use, a visual aid created by someone in their center. One advisor in the UAC mentioned that this resource was the most useful to him as a new advisor. Based on this information, it seems that a widely distributed and consistent visual aid could assist other advisors with mathematics placement, especially advisors who are new to KU. In addition, this resource would be particularly helpful for advisors that

work with students that must take algebra as a prerequisite for their major. A visual aid could help clarify the mathematics placement process for advisors and in turn, pass the correct information on to students.

Permission codes: rules and procedures. Much discussion was given to the process of how advisors enroll students in enhanced math and the process of how advisors go about acquiring a permission code to do so. The mathematics advisor holds permission codes and advisors must possess one in order to enroll a student into any of the "special permissions" courses listed on the sheet distributed by the mathematics department. During the process of enrolling students into enhanced math, four advisors found the process confusing or thought that the process could be improved. The concern started over the portal notes in the system from the math advisor which were used to alert advisors on which students were eligible for enhanced math. One advisor in the study mentioned that he thought the note was his permission to enroll and that he would be able to directly enroll the student because of it, only to find out that he still needed to acquire a permission code, regardless of the portal notes. Another advisor saw the note as a directive, that she should simply enroll them in enhanced mathematics and not mention any other available options.

It seems that not only would advisors benefit from a step by step process to attain permission codes, but also some ideas or recommendations on what majors or students might be good candidates for second semester math. Streamlining the permission code process and coming up with a suggested major recommendation for second semester math could lessen the burden of advisors during end-of-summer orientation when courses are full. If advisors know to send certain majors to second semester math early in enrollment season, it could prevent the

issue of courses always being full for late enrollees. In addition, this could more evenly distribute enrollment into enhanced mathematics courses between the fall and spring semesters.

On the topic of suggested majors to enroll in second semester math, it is important to consider which majors require algebra as a pre-requisite in their degree program, such as pre-engineering, pre-pharmacy, chemistry, biology and behavioral neuroscience, which were represented in this study. It may be beneficial for the math department to poll departments to ask about their mathematics requirements in order to determine which departments do not require them as a pre-requisite to enter other courses within their major. With this information, the mathematics department could compile a list of majors that would be considered first priority to enroll in algebra during their first semester and potential suggestions for majors that could enroll in algebra during the second semester. This information could prove helpful to advisors by helping them to better understand math placement while simultaneously making algebra more evenly distributed across the fall and spring semesters.

Mathematics placement information. Mathematics placement exams became a popular topic during the course of the study. The mathematics placement exam is used by students who have lower mathematics ACT scores but feel that their scores may not reflect their mathematics ability. These students have the opportunity to take a placement exam to prove their ability in order to place in a higher-level mathematics course. Advisors in the study mentioned that the placement course is often a hang-up to enrollment into math courses. The KU mathematics department does have information on their website about mathematics placement exams. The information includes a chart about what SAT/ACT scores are needed to place in a particular course. It also provides information on available mathematics placement exam dates. Despite this information, one advisor suggested that students often are unaware of

placement exams or even the possibility that they may need one to place into a mathematics course based on their ACT/SAT score.

Information about math placement exams may not be clear enough to students and students could benefit from other options on locations for the mathematics placement exam. A possible recommendation could be to distribute math placement exam information to students prior to orientation via social media, mail or email. By starting the mathematics placement conversation earlier, the process of enrolling and placing into math courses could be streamlined during summer orientation and prevent students from missing out on courses that fill up while they wait to take their exam. In addition, many students that come to KU are not local; providing other alternatives to take the math placement exam before orientation could help both the students and advisors during enrollment by making the process more convenient and efficient. Having the knowledge of math placement prior to orientation could help students plan in advance for enrollment by determining the math class they will place into, giving them the opportunity decide early if they need to take the math placement exam. The information distributed prior to orientation could also include an advertisement for enhanced mathematics; some students could opt to enroll directly into enhanced math with their current scores, negating the need for the placement exam all together. This could also prevent the difficult conversations that advisors have with students when they explain that they do not place in the course they hoped to enroll into.

Campus wide advisor training. A suggestion that regularly came up during interviews with advisors is that they would appreciate additional training from the mathematics department on math placement options and requirements. More broadly, seven advisors mentioned needing additional training from the math department on math placement while two departmental

advisors noted that consistent training is needed for all advisors, not just those in the UAC or the College of Liberal Arts & Sciences. These two advisors stated that once they moved from these advising centers they were no longer given the opportunity to attend regular training like they had previously. In the case of math placement, this is of particular importance and can lead to confusion when new courses become available. Both advisors mentioned that they mostly had to seek out information on their own about all advising issues, including math placement. At times, they were excluded from information, not knowing something had changed until they ran across a problem.

Advisors mentioned that they received more training while previously employed in the UAC or LA&S but had not received any official training since. Clearly there are some improvements that could be made on the part of the university to ensure that information is pushed out to all advisors on campus, not just those working in the large advising centers. In addition, in the event that this does not happen in the near future, the mathematics department could make a more concentrated effort to push out more training opportunities to departmental advisors and advisors who work in high-impact programs and discuss enrollment with students, such as TRIO.

It may be beneficial to the math department to provide an additional aspect about the importance of math education during advisor training. Because advisors stated that they sometimes steer students away from algebra if the student is not comfortable with math, this subject should be discussed during training. Advisors should be informed of the possible implications to the student if they do not take algebra. At the very least, the student should be made aware of the future implications before choosing to take an alternate route and avoid college algebra.

Future Research Considerations

KU has successfully implemented the enhanced math course first via a pilot study and more recently, has expanded the course to reach more students. Following the implementation of the above recommendations, further research could be conducted with KU advisors to determine if the treatment was successful in reference to math placement. KU advisors could be further interviewed to find out if the new resources were helpful to them in placing students into enhanced math courses. Going forward, in reference to enhanced math, it could be useful to track the success of the student's once placements have been made. In order to measure the effectiveness of the placement, student outcomes should be reviewed to determine if the placement was beneficial to the student in reference to their academic and career goals.

In addition, further research could be considered regarding advisor's perspectives and interpretations of math anxiety. Math anxiety played a large role in the interviews conducted during this study. It could be beneficial to know what advisors think about math anxiety and how their views effect the course choices and opinions of the students regarding math. Further, it might be beneficial to find out what background advisors have to better understand how they form their opinions on math courses.

Conclusion

This study focused on how academic advisors at KU talk to students about math placement, particularly in reference to the newly expanded course of enhanced mathematics. Advisors are dedicated to the success of their students and as such, they use the resources available to them to make the best recommendations possible based on students' academic and career goals. After interviewing advisors at KU, I found that they could benefit from more information about the enhanced math course. Based on the interviews conducted, further

clarifications are needed in reference to the course content, grading system, eligibility for enrollment and required hours. Possible recommendations were made based on the interview feedback and further research was suggested. In the end, it is the overall goal of both the KU mathematics department and academic advisors to assist students in their academic pursuits. It is my hope that the recommendations in this study can be of assistance to both the mathematics department and advisors at KU so they can further assist students toward their goal of graduation.

References

Admiraal, W., Wubbels, T., & Pilot, A. (1999). COLLEGE TEACHING IN LEGAL EDUCATION: Teaching Method, Students' Time-on-Task, and Achievement. *Journal of the Association for Institutional Research*, *40*(6), 687–704. https://doi.org/10.1023/A:1018712914619.

Bailey, & Cho. (2010). *Developmental Education in Community Colleges*. Presented at the The White House Summit on Community Colleges Conference. Retrieved from https://www2.ed.gov/PDFDocs/college-completion/07-developmental-education-in-community-colleges.pdf.

Barbuto, J. E., Jr., Story, J. S., Fritz, S. M., & Schinstock, J. L. (2011). Full Range Advising: Transforming the Advisor-Advisee Experience. *Journal of College Student Development*, *52*(6), 656–670. https://doi.org/10.1353/csd.2011.0079.

Benken, B. M., Ramirez, J., Li, X., & Wetendorf, S. (2015). Developmental mathematics success: Impact of students' knowledge and attitudes. *Journal of Developmental Education*, 14–31.

Blumenthal, R. (2016, June 17). A Meaningful Math Requirement: College Algebra or Something Else? *The James G. Martin Center for Academic Renewal*. Retrieved from https://www.jamesgmartin.center/2016/06/a-meaningful-math-requirement-college-algebra-or-something-else/.

Brock, T. (2010). Young Adults and Higher Education: Barriers and Breakthroughs to Success. *The Future of Children*, *20*(1), 109–132.

Brown, J. (2014). The Effects of Math Anxiety on Mathematical Academic Success During the Freshman Year.

Burton, J., & Wellington, K. (1998). The O'Banion Model of Academic Advising: An Integrative Approach. *NACADA Journal*, *18*(2), 13–20. https://doi.org/10.12930/0271-9517-18.2.13.

Carlson, M. P., & Rasmussen, C. (2008). *Making the Connection: Research and Teaching in Undergraduate Mathematics Education* (Vol. MMA Notes #73). Mathematical Association of America.

Chickering, A. W., & Gamson, Z. F. (1989). Seven principles for good practice in undergraduate education. *Biochemical Education*, *17*(3), 140–141. https://doi.org/10.1016/0307-4412(89)90094-0.

Chickering, A. W., Gamson, Z. F., Poulsen, S. J., & Johnson Foundation (Racine, W. . (1987). *Seven principles for good practice in undergraduate education*. Racine, Wis.: Johnson Foundation.

Christian, T., & Sprinkle, J. (2013). College Student Perceptions and Ideals of Advising: And Exploratory Analysis. *College Student Journal*, *47*(2), 271–291.

Coggin, R., Gavosto, E., Huang, W., & Torres, R. (2017). *Optimizing Mathematics Placement: A Machine Learning Approach Comparing Predictive Algorithmic Models*. University of Kansas, ProQuest Dissertations and Theses.

Crookston, B. B. (2009). A developmental view of academic advising as teaching. *NACADA Journal*, *29*(1), 78–82.

Dawson, P., van der Meer, J., Skalicky, J., & Cowley, K. (2014). On the Effectiveness of Supplemental Instruction: A Systematic Review of Supplemental Instruction and Peer-Assisted Study Sessions Literature Between 2001 and 2010. *Review of Educational Research*, *84*(4), 609–639. https://doi.org/10.3102/0034654314540007.

Dramatic Overhaul Of College Remedial Education Is Needed, Says Report from National Coalition. (2012). *States News Service*.

Fullilove, R. E., & Treisman, P. U. (1990). Mathematics Achievement among African American Undergraduates at the University of California, Berkeley: An Evaluation of the Mathematics Workshop Program. *Journal of Negro Education*, *59*(3), 463–478 https://doi.org/10.2307/2295577.

Gordon, V., & Habley, W. (2011). *Academic advising: A comprehensive handbook*. John Wiley & Sons.

Grites, T. J. (2013). Developmental Academic Advising: A 40-Year Context. *NACADA Journal*, *33*(1), 5–15. https://doi.org/10.12930/NACADA-13-123.

Habley, W. (1983). Organizational Structures for Academic Advising: Models and Implications. *Journal of College Students Personnel*, *24*(6).

Habley, W. R. (2004). *The status of academic advising: Findings from the ACT sixth national survey*. National Academic Advising Association.

Hollis, L. P. (2009). Academic advising in the wonderland of college for developmental students. *College Student Journal*, *43*(1), 31–36.

Jeongeun Kim, Jiyun Kim, DesJardins, S. L., & McCall, B. P. (2015). Completing Algebra II in High School: Does It Increase College Access and Success? *Journal of Higher Education*, *86*(4), 628–662.

Johnson, D., & Johnson, R. (1999). Making cooperative learning work. *Theory Pract.*, *38*(2), 67–73.

Johnson, R. T., & Johnson, D. W. (2008). Active Learning: Cooperation in the Classroom. *The Annual Report of Educational Psychology in Japan*, *47*(0), 29–30. https://doi.org/10.5926/arepj1962.47.0_29.

Logue, A. W., Watanabe-Rose, M., & Douglas, D. (2016). Should students assessed as needing remedial mathematics take college-level quantitative courses instead? A randomized controlled trial. *Educational Evaluation and Policy Analysis*, *38*(3), 578–598.

Mangan, K. (2019). The End of the Remedial Course. *The Chronicle of Higher Education Trends Report*.

Maxwell, J. A. (2012). *Qualitative research design: An interactive approach* (Vol. Vol. 41). Sage Publications.

Mayhew, M. J., Pascarella, E. T., Bowman, N. A., Rockenbach, A. N., Seifert, T. A., Terenzini, P. T., & Wolniak, G. C. (2016). *How college affects students: 21st century evidence that higher education works* (Vol. 3). John Wiley & Sons.

Mccormick, A. C. (2003). Swirling and Double-Dipping: New Patterns of Student Attendance and Their Implications for Higher Education. *New Directions for Higher Education*, *2003*(121), 13–24. https://doi.org/10.1002/he.98

Merriam, S. B., author. (2016). *Qualitative research : a guide to design and implementation* (Fourth edition..). San Francisco, CA : Jossey-Bass, a Wiley brand.

Mosher, G. A. (2017). Professional Advisers in Engineering and Technology Undergraduate Programs: Opportunities and Challenges. *Journal of Technology Studies*, *43*(1), 26–34.

O'Banion, T. (1994). An Academic Advising Model. *NCADA Journal*, *14(2)*, 7.

Panadero, E. (2017). A Review of Self-regulated Learning: Six Models and Four Directions for Research. *Frontiers in Psychology*, *8*. https://doi.org/10.3389/fpsyg.2017.00422.

Park, T., Woods, C. S., Hu, S., Bertrand Jones, T., & Tandberg, D. (2018). What Happens to Underprepared First-Time-in-College Students When Developmental Education is Optional? The Case of Developmental Math and Intermediate Algebra in the First Semester. *The Journal of Higher Education*, *89*(3), 318–340. https://doi.org/10.1080/00221546.2017.1390970

Pascarella, Ernest T, & Terenzini, P. T. (1991). *How college affects students* (Vol. 1991). Jossey-Bass San Francisco.

Pascarella, E.T., & Terenzini, P. T. (2005). How college affects students: A third decade of research (Vol. 2).

Peterson, I. (2018, June). Kansas Algebra Program.

Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2013). Math Anxiety, Working Memory, and Math Achievement in Early Elementary School. *Journal of Cognition and Development*, *14*(2), 187–202. https://doi.org/10.1080/15248372.2012.664593.

Reason, R. D. (2009). An examination of persistence research through the lens of a comprehensive conceptual framework. *Journal of College Student Development*, *50*(6), 659–682.

Saxe, K., Braddy, L., Bailer, J., Farinelli, R., Holm, T., Mesa, V., … Turner, P. (2015). A common vision for undergraduate mathematical sciences programs in 2025.

Schunk, D. H., & Zimmerman, B. J. (1998). Self-regulated learning : from teaching to self-reflective practice.

Self, C. (2015). Implications of advising personnel of undergraduates 2011 National Survey. *National Academic Advising Association. Accessed*, *6*.

Tinto, V. (1987). Leaving college : rethinking the causes and cures of student attrition.

Tobias, S., & Weissbrod, C. (1980). Anxiety and mathematics: An update. *Harvard Educational Review*, *50*(1), 63–70.

Treisman, U. (1985). A Model of Academic Support. *Improving the Retention and Graduation of Minorities in Engineering*.

Treisman, U. (1992). Studying Students Studying Calculus: A Look at the Lives of Minority Mathematics Students in College. *The College Mathematics Journal*, *23*(5), 362. https://doi.org/10.2307/2686410.

Tunstall, S. L., Melfi, V., Craig, J., Edwards, R., Krause, A., Wassink, B., & Piercey, V. (2016). Quantitative literacy at Michigan State University, 3: Designing general education mathematics courses. *Numeracy*, *9*(2), 6.

Tuttle, K. N. (2000). Academic Advising. *New Directions for Higher Education*, *2000*(111), 15–24. https://doi.org/10.1002/he.11102.

Ukpong, D. E., & George, I. N. (2013). Length of Study-Time Behaviour and Academic Achievement of Social Studies Education Students in the University of Uyo. *International Education Studies*, *6*(3). https://doi.org/10.5539/ies.v6n3p172.

University of Kansas Advising Center (UAC). (2018). Retrieved from https://advising.ku.edu/uac-history-mission.

University of Kansas Algebra Program (KAP). (2018). Personal Interview with Program Director.

Weisburst, E., Daugherty, L., Miller, T., Martorell, P., & Cossairt, J. (2017). Innovative pathways through developmental education and postsecondary success: An examination of developmental math interventions across Texas. *The Journal of Higher Education*, *88*(2), 183–209.

Young-Jones, A. D., Burt, T. D., Dixon, S., & Hawthorne, M. J. (2013). Academic advising: does it really impact student success? *Quality Assurance in Education*, *21*(1), 7–19. https://doi.org/10.1108/09684881311293034.

Zachry Rutschow, E. (2018). Making It Through: Interim Findings on Developmental Students' Progress to College Math with the Dana Center Mathematics Pathways. Research Brief. *Center for the Analysis of Postsecondary Readiness*.

Zientek, L. R., Schneider, C. L., & Onwuegbuzie, A. J. (2014). Instructors' perceptions about student success and placement in developmental mathematics courses. *Community College Enterprise*, *20*(1), 67–85.

Appendix I

Dear KU Advisor,

I am a Doctoral student conducting research for my dissertation in the Educational Leadership and Policy Studies department. The purpose of my study is to gain a better understanding of how students are placed in math courses, primarily college algebra. Would you be willing to participate in a 45-60-minute interview in the next 3-5 weeks here on campus to discuss this topic? I am happy to meet when and where it is convenient for you.

If you will be able to participate in the study, please email me at ashleylu@ku.edu.

Thank you for your time and consideration!

Sincerely,
Ashley Urban

Appendix II

Interview Questions

1. Tell me about your philosophy or approach to advising first year students?

2. What is your understanding of math placement options for first year students? (in reference to required ACT, HS GPA, etc.)

3. Have you heard of enhanced college algebra? What do you know about it? (If they don't discuss this option)

4. How and in what ways do you introduce math options to students?

5. On what basis do you make recommendations to students regarding math placement? What criteria do you use, if any?

6. How have you acquired the knowledge that you have about math placement? From who or where?

7. If you are unclear on how to place a student in a math course, who do you contact? What other resources do you have available to help?

8. Do you have any advice to offer to the KU math department regarding communication to advisors about math placement?

9. What information would help you give better advice to students about math course selection?

Appendix III

Special Permission Courses
19893. 28745

Enhanced Math 101 Course	Corresponding Math 197 Course	Prerequisites
Section #12144 MWF 9:00 – 9:50	Section #28799 TR 9:00 – 9:50	MATH ACT ≥ 18 + HS GPA ≥ 3.25 (510) OR MATH ACT ≥ 19 + HS GPA ≥ 3.00 (520) OR MATH ACT ≥ 20 + HS GPA ≥ 2.75 (530) OR MATH ACT ≥ 21 + HS GPA ≥ 2.5 (540) **(NOTE: Students with a 20+ MATH ACT and HS GPA ≥ 3.75 can now take Regular Math 101)**
Section #15021 MWF 10:00 – 10:50	Section #22497 TR 10:00 – 10:50	
Section #15022 MWF 10:00 – 10:50	Section #24121 TR 10:00 – 10:50	
Section #15023 MWF 11:00 – 11:50	Section #28746 TR 11:00 – 11:50	
Section #12159 MWF 11:00 – 11:50	Section #24123 TR 11:00 – 11:50	
Section #12150 MWF 12:00 – 12:50	Section #19882 TR 12:00 – 12:50	
Section #19032 MWF 1:00 – 1:50	Section #28744 TR 1:00 – 1:50	
Section #23182 MWF 1:00 – 1:50	Section #23183 TR 1:00 – 1:50	
Section #12163 MWF 2:00 – 2:50	Section #24898 TR 2:00 – 2:50	

Data Driven Course	Prerequisites
Section #21145 MWF 9:00 – 9:50	This class is only for students who will not need calculus at any point in their program. MATH ACT ≥ 22 OR MATH ACT ≥ 20 + HS GPA ≥ 3.50
Section #12157 MWF 10:00 – 1:50	
Section #12147 MWF 11:00 – 11:50	
Section #12149 MWF 12:00 – 12:50	

Enhanced Math 115 Course	Corresponding Math 197 Course	Prerequisites
Section #17316 MWF 12:00 – 12:50	Section #16295 TR 12:00 – 12:50	25 Math ACT with HS Calculus OR 26 or 27 Math ACT & no HS Calculus OR Math 101 credit and needing extra instructional time or support for Math 115

Enhanced Math 125 Course	Corresponding Math 197 Course	Prerequisites
Section #21250 MWF 9:00 – 9:50	Section #16294 TR 9:00 – 10:15	27 Math ACT with HS Calculus OR 28 or 29 Math ACT & no HS Calculus OR Math 104 with C- or higher and needing extra instructional time or support for Math 125

Special Enhanced Courses	Corresponding Math 197 Course	Prerequisites
Math 126	Section #24907 TR 9:30 – 10:45	

Section #28020 MWF 10:00 – 10:50		These courses are for students who are repeating their course due to receiving a D or F or dropping after the second exam.
Math 127 Section #28073 MWF 1:00 – 1:50	Section #28131 TR 1:00 – 2:15	

PLEASE NOTE:

1. For enhanced classes, students must enroll in the corresponding Math 197 course. They cannot mix and match.
2. Students can get into the enhanced classes even if they meet the requirements to get into the regular class. These are really classes for students needing extra assistance. If the student does not need that, please do not ask for permission for them just because it fits their schedule better. There is only section each of Math 115 and Math 125 – Enhanced, and I want to make sure it is available for students that actually need it.