Program Characteristics of the Mathematics Corequisite Model in the State of Georgia

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ABSTRACT

Former President Barack Obama (2009) set a goal to make the United States the top producer of higher education graduates in the world again by 2020. Researchers from the Community College Research Center reported that nearly 68% of two-year college students and 40% of four-year college students nationwide take at least one remedial course. According to Complete College America researchers, only 30% of college students successfully complete the developmental math sequences in which they enrolled. To increase student completion of gateway courses, the University System of Georgia implemented the Corequisite model across all institutions in the fall of 2015. The problem of this study was that there is little literature on which characteristics of the Corequisite math model that yield the highest success rates.

The theoretical framework of this sequential, explanatory mixed methods study was rooted in organizational development. Organizational development is any process that has potential to enhance knowledge, expertise, productivity, and other outcomes whether for personal or group gain, or the benefit of an organization, community, nation, or the world. Research questions that guided this study focused on USG administrator and instructor perceptions of which institutional practices and instructional practices were most responsible for academic success of students in Corequisite math courses.

Analysis of the data revealed no significant quantitative results; however, from the qualitative data, six major themes were found: (1) recommendations from the Ad Hoc Committee, (2) passionate and dedicated faculty who care about learning-support students, (3) tutoring, (4) early alert systems, (5) study skills, and (6) a growth mindset.

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Chapter I

INTRODUCTION

According to the White House (2016) Administration, the United States had the highest number of higher education graduates in the world in 1990. In 2016, the country ranked 13th globally. Former President Barack Obama (2009) set a goal at the beginning of his presidential administration to address this issue. His goal was to have the United States produce the highest number of graduates in the world once again by 2020. He then challenged every American to commit to one year of post-secondary training or higher education. The former president's challenge, however, did not take into account the issue underlying the lack of graduates—many Americans are not prepared for higher education.

Current State of Remedial Education

The National Center for Education Statistics (2016) reported that nearly 68% of two-year college students and 40% of four-year college students nationwide take at least one remedial course. According to Long and Boatman (2013), a remedial course is a course that "provides academically underprepared students with the skills they need to succeed in college and the labor market" (p.1). Within this paper, the term "remedial course" was used interchangeably with "developmental course" and "learning support." The University System of Georgia (USG) (2015) reported that 37% of students in its two-year institutions and 18% of students in its four-year institutions are in learning support courses. The undergraduate student enrollment of USG students for fall of 2018 was 275,543 (USG, 2018).

USG's Mathematics Developmental System

For the past ten years, the USG has implemented a tiered model of learning support for the subjects of reading, writing, and mathematics. The USG Mathematics Task Force (2013) referred to it as the "Old Model" and that phrasing will be used to describe that system throughout this paper. With the Old Model, students were placed into one of three tiers depending on a combination of high school GPA, SAT/ACT scores, and college entry placement exams such as the COMPASS Exam. The USG left the decision up to the individual institutions with regards to how those items were used to sort students into the three tiers (USG Mathematics Task Force, 2013).

With the Old Model, students in need of profound remediation were placed in the bottom tier of foundations or beginning remediation. Those courses were typically labeled 0097 courses. The next tier of courses was for students who only needed refreshing, and who were placed in intermediate/support remediation. Those courses were typically labeled 0099 courses. The top-level courses were the beginning collegiate courses such as English Composition, College Algebra, Math Modeling, or Quantitative Reasoning. Those four courses are also known as "gateway courses," as they are the "gateway" into college, and have, in turn, "gated" so many students out of higher education (Bailey, 2009; Complete College America, 2016a; USG Mathematics Task Force, 2013).

America's Response to the Challenge

A non-profit organization named Complete College America (CCA) was founded in 2009. The CCA's mission (2016a) was to meet the former president's goal and challenge—to work with states to increase the number of Americans who have career training or college degrees, especially those from traditionally underrepresented populations. One of the main ways the CAA worked to achieve its mission was by implementing a new model for developmental education called the Corequisite Model. The Corequisite Model was developed from of a study done by Bailey, Jeong, and Cho (2010) who discovered that the Old Model created high attrition rates in a sample of 141,490 developmental math students. They found that less than one half of students completed learning support, and only 20 percent of those placed in developmental math completed a "gateway" course within three years of first enrolling under the Old Model. Bailey et al. (2010) reported, "twelve percent of those referred to developmental math completed the gatekeeper course in that subject without enrolling in a single developmental course in that same subject" (p. 30). Using the findings that over 16,000 remedial students placed in collegiate courses were able to succeed in the program along with other research findings, the authors founded the idea that remedial students would have lower attrition rates if they completed their developmental education more quickly.

Georgia's Response to the Challenge

The USG worked with Complete College America to create a task force with the mission of transforming remedial education in Georgia. The USG Mathematics Task Force (2013) published a report on transforming remedial mathematics in which the following eight recommendations were made:

1. Focus on supporting success in college credit-bearing, gateway mathematics courses for all students;
2. Align gateway mathematics course sequences with academic programs of study. In particular, College Algebra should not be the default class for non-STEM majors;
3. Implement a corequisite approach to support student success in gateway mathematics courses;
4. Develop year-long mathematics pathways for students with significant gaps in preparation;
5. Use multiple measures to place students in gateway courses and appropriate supports;
6. Terminate use of COMPASS as an exit examination;
7. Align the outcomes of gateway mathematics courses with the Common Core Georgia Performance Standards (CCGPS) for Mathematics; and
8. Develop advising systems and protocols for placing students in gateway mathematics courses and corequisite supports that align with their intended programs of study (p. 4).

All of these recommendations were implemented in the USG system-wide in the fall of 2015 (USG, 2015). The Corequisite Model was based on the premise that students should be completed with remedial education within one year. Students in need of more extensive remediation would take the same foundations course as with the Old Model. Students who needed less remediation would be enrolled in a support course as well as the needed gateway at the same time.

The USG Math Task Force (2014) released an implementation plan stating the general parameters of the support component of the Corequisite Model; those parameters are as follows: The support course would only count towards institutional credit, would only count 1-2 credits, and students would be enrolled in both the support and collegiate course at the same time (p. 7). If a developmental student fails the collegiate course, then he or she will have to take the collegiate and support class over again. The USG Mathematics Ad Hoc Committee (2014) released a best practices component in the implementation plan, advising that programs do the following:

- Preferably have the same instructor teach the support and collegiate course (p. 8);
- Focus the support on material closely linked to material being covered in the gateway course at the same time (p. 9);
- Have support students mixed with non-support students in the collegiate course;
- Keep the support class size under 15-22 students to allow for more one-on-one instruction (p. 9); and
- Require mandatory attendance as including attendance as part of the grade in the support course (p. 9).

Individual Institutions' Responses to the Challenge

The USG Mathematics Ad Hoc Committee provided primary best practices and allowed for individual institutions to implement their own best practices. The problem with this approach was that some institutions might remain unaware of best practices developed at other USG institutions, or how to implement them in their own programs. Cullinane and Treisman (2010) wrote, “even the campuses working most actively to improve student success are doing so in kind of solitary confinement, unaware of the progress and high-yield, detailed practices of others" (p. 16).

The Corequisite Model has been successful in helping remedial students pass gateway courses (Bailey, Jaggars, & Jenkins, 2015; CCA, 2016b; Edgecombe, 2011; USG Mathematics Ad Hoc, 2014). The USG (2015) reported that five years ago only 21% of USG developmental students passed the gateway courses under the Old Model. Under the Corequisite Model in 2014, 63% of developmental students concurrently enrolled in the support class passed the gateway courses. The USG (2015) also reported that only 42% of students placed in the lower foundation courses were successful in advancing to the support class. These data show that the model is successful but there is room for improving it, especially in helping foundation students successfully pass their gateway courses.

Bonham and Boylan (2012) stated that some of the best practices for developmental education were at the institutional and instructional levels. Institutional practices are institution-wide policies implemented to maintain academic rigor or improve academic success (Alcorta, 2009). Common best institutional practices found in the literature for developmental math education programs are as follows: academic momentum (CCA, 2016a), housing of all developmental courses in its own department (Alcorta, 2009; Carr, 2012), mandatory assessment of all entering students (Bailey et al., 2015), availability of early registration to all developmental students (Butler, 2014), implementation of a Statway or Quantway pathway (Cullinane & Treisman, 2010), and mandatory study skills course for all developmental education students (Reilly, 2014).

The Corequisite Model was an institutional practice implemented at all USG systems (USG, 2015).

Instructional practices are methods and techniques that are utilized to facilitate learning. These practices are implemented by individual instructors at an institution and will vary among faculty. Common best instructional practices found in the literature for developmental math programs are the implementation of technology in the classroom (Epper & Baker, 2009), collaborative teaching between two instructors (Butler, 2014; Campbell, 2015), mastery learning (Edgecombe, 2011), tutoring (Bailey et al., 2010), and math refresher programs (Bonham & Boylan, 2012). This study will investigate whether the listed instructional and institutional practices are significant predictors of academic success among Corequisite students.

Statement of the Problem

Numerous researchers have studied the effect of success of the Corequisite Model on developmental math students. The University System of Georgia implemented the Corequisite Model statewide after pilots showed 63% of remedial math students in the support class passed their collegiate course; whereas, only 23% of remedial students passed using the Old Model in 2010 (USG Mathematics Task Force, 2013). Developmental Corequisite students who enrolled in the foundations course only showed a 42% success rate compared to the similar Old Model success rate of 40% (USG Mathematics Task Force, 2013).

Despite all of our knowledge of the Corequisite Model, there is a gap in the literature on which characteristics of the model yield the highest rates of success. The USG Mathematics Ad Hoc Committee (2014) gave a baseline of best practices for the courses, but that information is not detailed enough to obtain the greatest success rates from the Corequisite Model. Researchers have urged the implementation of best institutional and instructional practices (Alcorta, 2009; Bailey et al., 2010; Butler, 2014; Campbell, 2015).

Theoretical Framework

The theoretical framework chosen for this study was based on the theory of organizational development (OD). The field of OD was developed in the 1940s by Kurt Lewin from his work with organizations to improve their productivity (Boyer & Crockett, 1973; Kegan, 1971), though the specific term organizational development was not used until the 1960s when it was coined by Richard Beckhard (McLean, 2005). The field of OD draws influence from many fields such as behavioral sciences, human resource development, the scientific method, and change theory. Because of this, some researchers (Asumeng & Osae-Larbi, 2015; Egan, 2002; Kegan, 1971) disagree on how best to define organization development. This study will use McLean's (2005) definition as follows:

> Organizational development is any process or activity that, either initially or over the long term, has the potential to develop in an organizational setting enhanced knowledge, expertise, productivity, satisfaction, income, interpersonal relationships, and other desired outcomes, whether for personal or group/team gain, or for the benefit of an organization, community, nation, region, or, ultimately, the whole of humanity. (p.9)

Egan (2002) found that there are ten variables in the theory of OD that address how organizations can grow successfully. These variables are as follows:

- Advance organizational renewal;

- Engage organization culture change;
- Enhance profitability and competitiveness;
- Ensure health and well-being of organizations and employees;
- Facilitate learning and development;
- Improve problem solving;
- Increase effectiveness;
- Initiate and/or manage change;
- Strengthen system and process improvement; and
- Support adaptation to change (p. 67).

Cullinane and Treisman (2010) stated, "although more effective preparation of students for college should reduce the need for developmental education, it is unlikely that developmental education will ever be rendered unnecessary" (p. 3). The need for developmental education will continue. The USG has many individuals from various departments working as an organization to provide students with an education and provide the country with quality graduates.

USG institutions placed a system-wide mandate that the Corequisite Model be implemented at all universities by fall of 2015. The Corequisite Model is a process that has the potential to develop knowledge and productivity in the field of education. Improving the Corequisite Model would result in a personal gain for the students, faculty, and administration. It would also benefit the USG, the state of Georgia, and the United States by increasing the number of college graduates. Implementing the Corequisite Model would be practicing organizational development. By using OD as the framework, this study was guided by the possible benefits of understanding the relationship between program characteristics of the Corequisite Model of developmental mathematics and collegiate courses and student success as perceived by the faculty and administration.

Purpose of the Study

The purpose of this sequential, explanatory mixed-methods study was to identify key institutional and instructional practices of the Corequisite Model that lead to success (defined as grades of A, B, or C in the collegiate course) of developmental math students enrolled at selected colleges and universities in the state of Georgia in 2017, as perceived by university administrators and faculty. Identification of these practices was achieved by collecting archival data, surveying faculty and administrators who work with the math Corequisite Model, and then following up with purposefully selected individuals to explore the results with interviews at the six schools with the highest percentages of success.

Research Questions

The following research questions guided the study:

1. What are the responses of USG administrators and instructors to questions about institutional practices and instructional practices for the Corequisite math courses?
2. Is the implementation of instructional practices (faculty instructional practices, Ad Hoc instructional recommendations, classroom instructional practices, department instructional practices, instructional delivery methods, instructional utilization) or the implementation of institutional practices (institutional adaptations, USG institutional implementations, institutional student requirements) significant predictors of academic success in Corequisite math courses in USG institutions?

3. What specific instructional strategies and institutional strategies were identified through interviews with administrators and instructors from institutions earning the highest success rates with Corequisite Math courses as having a direct effect on student success?

Definition of Terms

The following terms will be used throughout the study:

Ad hoc instructional recommendations. Instructional practices recommended by the USG's Ad Hoc Committee (USG Mathematics Ad Hoc Committee, 2014).

Academic momentum. The institutional practice of encouraging or incentivizing college students to take at least 15 credits during fall and spring semesters (CCA, 2016a).

Classroom instructional practices. Instructional practices implemented by the faculty during class time (Butler, 2014).

Complete College America (CCA). National nonprofit with a single mission to work with states to significantly increase the number of Americans with quality career certificates or college degrees and to close attainment gaps (Complete College America, 2016a).

Complete College Georgia (CCG). State implementation of CCA to increase the rate of Georgia higher education graduates from 42% to 60% by the year 2020. This can be accomplished by graduating an additional 250,000 graduates above current graduation rates (Complete College Georgia, 2016c).

Corequisite Model. A two-course model in which a developmental course is taken simultaneously with a college credit course; sometimes referred to as an example of acceleration, mainstreaming, or course pairing (Bailey, Jaggars, & Scott-Clayton, 2013; Cullinane & Treisman, 2010; Edgecombe, 2011).

Corequisite support course. A course that is paired with a Gateway course and is designed to support passing the Gateway course (Georgia State University Perimeter College, 2016, p. 5).

Department instructional practices. Instructional practices accepted and implemented by a whole department or division (Butler, 2014).

Faculty instructional practices. Instructional practices implemented by faculty members outside of class time (Butler, 2014).

Foundations course. A course that builds or refreshes a student in critical skill areas that applies to a Gateway Course (Georgia State University Perimeter College, 2016, p. 5).

Gateway course. A course that enrolls large numbers of students; a lack of success in these courses gate students from accessing other college courses (John C. Gardner Institute, 2016). In the USG system, those courses are considered to be English Composition, College Algebra, Quantitative Reasoning, and Mathematical Modeling. These courses will also be referred to as collegiate courses (USG Mathematics Task Force, 2013).

Growth mindset. To understand and believe that abilities and intelligence can be developed as opposed to believing abilities and intelligence are static (Dweck, 2015).

Institutional adaptations. Institutional practices adapted by a system that can be amended (Butler, 2014).

Institutional practices. Organizational policies or strategies mandated at an institution to improve academic success or maintain academic rigor (Alcorta, 2009). Accepted institutional practices are used by all faculty and staff at their institution. Common best institutional practices for developmental math education programs include academic momentum (CCA, 2016a), housing of all developmental courses in its own department (Alcorta, 2009; Carr, 2012), mandatory assessment of all entering students (Bailey et al., 2015), available early registration to all developmental students (Butler, 2014), and a mandatory study skills course for all developmental education students (Reilly, 2014). The Corequisite Model is an institutional practice (Bailey et al., 2010).

Institutional student requirements. Institutional practices that directly target and affect students (Butler, 2014).

Instructional delivery methods. The reorganization of instruction and curricula in ways that facilitate the completion of educational requirements (Edgecombe, 2011).

Instructional practices. Teaching methods and techniques that are utilized to facilitate learning by individual instructors at an institution. Common best instructional practices for developmental math programs include implementing technology in the classroom (Epper & Baker, 2009), collaborative teaching between two instructors (Butler, 2014; Campbell, 2015), mastery learning (Edgecombe, 2011), tutoring (Bailey et al., 2010), modules and math refresher programs (Bonham & Boylan, 2012).

Mainstreaming. Accelerating students' progress by placing students referred to developmental education directly into college-level courses. This delivery method can be accompanied by supplemental support, placing students into college-level courses and providing additional instruction through mandatory companion classes or other learning supports designed to promote success in the college course (Edgecombe, 2011, p. 2).

Instructional utilization. An instructional model utilized by a department or division to improve academic success (Butler, 2014).

Organizational Development Theory. "Organizational development is any process or activity that, either initially or over the long term, has the potential to develop in an organizational setting enhanced knowledge, expertise, productivity, satisfaction, income, interpersonal relationships, and other desired outcomes, whether for personal or group/team gain, or for the benefit of an organization, community, nation, region, or, ultimately, the whole of humanity" (McLean, 2005, p.9).

Remedial education. Courses that provide academically underprepared students with the skills they need to succeed in higher education (Long & Boatman, 2013). The term remedial education will be used interchangeably with learning support and developmental education in this study.

Retention rate. This is the percentage of students from the previous fall who either re-enrolled or successfully completed their program by the current fall semester. The percentage loss of students from one fall semester to the next (lack of retention) is called the attrition rate. (National Center for Education Statistics, 2015).

Statway. An institutional practice that combines remedial mathematics with introductory statistics intended for individuals pursuing degrees in non-STEM programs such as allied health, liberal arts, business, and social sciences (Cullinane & Treisman, 2010). Statway was sometimes referred to as Quantway, as the Statway courses are often labeled quantitative (Logue, Watanabe-Rose, & Douglas, 2016).

Student success course. A course providing foundational competencies in time management, note taking, study skills, goal setting, and career exploration with the intent of enhancing any given student's college and academic success; also termed college success, first year experience, and freshman seminar (Reilly, 2014, p. 10).

Student success rate. The percentage computed by dividing the number of students who earned an A, B, or C, in a class by the total number enrolled in the class on the census date (USG Mathematics Task Force, 2013).

USG institutional implementations. Institutional practices recommended by the USG's Task Force (USG Mathematics Task Force, 2013).

Procedures

A sequential, explanatory mixed-methods approach was used in this study. In Phase I (the quantitative phase), the Developmental Education Program Survey – Corequisite Mathematics Administration Specific (DEPS – CMAS) and Developmental Education Program Survey – Corequisite Mathematics Faculty Specific (DEPS – CMFS) were sent out to the target population. Data collected from the instruments was used as the nine independent variables. The independent variables were (1) institutional adaptations, (2) USG institutional implementations, (3) institutional student requirements, (4) faculty instructional practices, (5) Ad Hoc instructional recommendations, (6) classroom instructional practices, (7) department instructional practices, (8) instructional delivery methods, and (9) instructional utilization. In this phase, archival data was collected from a USG database and used as the dependent variable. The dependent variable was the average percentage of students earning a grade of A, B, or C in Corequisite math courses from Fall Semester 2016 and Spring Semester 2017 for each

USG institution. The average was weighted by the number of students enrolled in each semester. The population of interest in this study consisted of USG faculty and administrators who work with the Corequisite math model. Data were analyzed using SPSS through descriptive statistical analyses, standard multiple regression, forward stepwise regression, and backward stepwise regression. Then, results were used to answer the first two research questions.

In Phase II (the qualitative phase), 18 individuals (three from six USG institutions) were interviewed. These six institutions had the highest or the second highest Corequisite Model student success rates within their institutional category (comprehensive universities, state universities, and state colleges). The qualitative data were collected, coded, and analyzed. Themes that emerged provided a more comprehensive understanding of the success of Corequisite math courses at various institutions.

Significance of the Study

The USG is the fourth largest university system in the United States (USG, 2016). The system has undergone a profound change in developmental courses which affects all remedial students. The recommendations and best practice list from the USG Mathematics Task Force and the USG Mathematics Ad Hoc Committee are not specific enough for individual systems to have similar success rates for Corequisite math courses (see Table 3 in Chapter 3).

There may be USG institutions struggling with the Corequisite Model, and there may be institutions that have crafted better practices than those recommended. The significance of this study is that institutions within the USG still need to improve their student success rates in math. A list of best practices gathered from faculty and administrators who teach and manage Corequisite math courses at the most successful institutions in the USG would be most valuable. Using recommendations from faculty and administrators who have been most successful with the Corequisite Model would be especially helpful to the USG institutions who are struggling. This study may even have significance on a national scale to help systems in other states that have yet to implement the Corequisite Model. Even if a USG Best Practices for Corequisite Math list could yield a small increase in the student success rate, that percentage would mean hundreds of students could complete their collegiate math requirement. Those additional graduates could help Georgia reach the CCG's goal to produce an additional 250,000 higher education graduates by the year 2020 (Complete College Georgia, 2016).

Limitations of the Study

One limitation of this study was finding and surveying administrators who work directly with the corequisite math model. Math faculty can be identified by checking individual institution's directories or class schedules making math faculty easier to identify than administrators. Another limitation was the potential biases from the three institutions with the highest success rate. Those institutions might require higher ACT/SAT/GPA scores to enter their math courses, which could indicate that their students were better prepared for college-level coursework than other institutions in the study. This information was checked and taken into consideration when analyzing the data.

Each research approach has its own set of internal and external threats. An explanatory sequential mixed methods approach has threats during the quantitative and qualitative phases. Internal threats to validity are occurrences that threaten the researcher's ability to draw correct inferences from the data about a population in the experiment (Ary, Jacobs, Sorensen, & Walker, 2013). Internal threats can occur during the research procedures or treatments. According to Creswell (2014), there are ten common internal threats to the quantitative approach: history, maturation, regression, selection, mortality, diffusion of treatment, resentful demoralization, compensatory rivalry, testing, and instrumentation. None of these were a threat to this study.

There are potential biases due to the fact that the DEPS – CMAS and DEPS – CMFS are rating scale instruments. Johns (2010) reported three response biases for rating scale data. The first is central tendency bias, which is the avoidance of using extreme positive or negative response categories. Acquiescence bias occurs when participants agree with the statements as presented. The final response bias is social desirability bias where responders attempt to portray themselves or their organization in a more favorable light.

These biases are not to be confused with the internal threat of instrumentation. Instrumentation is a threat to validity that occurs when the instrument is changed during the experiment or that produces changes in the outcome not caused by the variables (Patten, 2007; Ary et al., 2013). This did not occur during this study.

External threats to quantitative validity occur when researchers draw incorrect inferences from the sample data to other persons, other settings, and past or future situations. This means the researcher cannot accurately assume that the treatment of the sample can be generalized to the population (Patten, 2007; Ary et al., 2013). According to Creswell (2014), there are three types of external threats with the quantitative approach. The first is the threat of interaction of selection and treatment. This is when the researcher cannot generalize the characteristics of his or her sample to the population. The next threat occurs during the interaction of setting and treatment. A researcher cannot generalize the results of his or her sample due to the setting of the experiment (Creswell, 2014). The last threat is when time becomes an external threat in the interaction of history and treatment. If a study's results are time-sensitive, the researcher may not be able to generalize his or her sample's results to a past or future population (Ary et al., 2013).

None of the external threats mentioned above occurred during this study. The threat of selection and treatment was avoided by surveying the entire population of USG administrators and faculty who work with Corequisite Model. The surveying took place during the participants' own time and setting which avoided the threat of interaction of setting and treatment. The final threat of history and treatment was not applicable because the results are not time-sensitive. Additionally, both quantitative and qualitative phases took place during the same year to avoid any threats related to time.

Qualitative research does not separate validity threats into internal and external. Maxwell (2013) stated that validity in qualitative research refers to "the correctness or credibility of a description, conclusion, explanation, interpretation, or other sort of account" (p. 122). Researchers are encouraged to use validity strategies (Creswell, 2014) or validity tests (Maxwell, 2013; Patton, 2002) while conducting qualitative research. Validity strategies recommended by Creswell were implemented in this study.

Organization of the Study

This dissertation thesis is comprised of five chapters. Chapter 1 presented an introduction, the theoretical framework, the problem statement and purpose of the study, a list of definitions and terms, and the limitations and significance of the study. Chapter 2 presents a review of the literature on developmental education in the United States of America, the history of developmental education in the USG, the history of the Corequisite Model, best practices for developmental mathematics, best practices for the Corequisite model, and more information on the theoretical framework of organizational development. Chapter 3 includes the research design, participants of the study, instrumentation, and a description of the qualitative and quantitative measures employed for collection and analyzing. Chapter 4 presents the results of the quantitative phase and quantitative phase. The last chapter, Chapter 5, presents the discussion of the findings, suggestions for future research, and summary.

Summary

Former President Barack Obama challenged the United States to produce the highest number of graduates in the world by 2020. However many Americans are not prepared for higher education. Over 68% of two-year college students and 40% of four-year college students nationwide take at least one remedial course (CCRC, 2014a). The Corequisite Model was developed to increase the number of students passing remedial courses and has been shown in the literature to be effective. The USG implemented the Corequisite Model statewide in fall of 2015. The purpose of this study was to identify key institutional and instructional practices of the Corequisite Model at selected colleges and universities in the state of Georgia. This study will use the theoretical framework of organizational development. The theory of organizational development will focus on how the Corequisite Model and its best practices have the potential to enhanced knowledge, expertise, productivity, satisfaction, and student success rate for the gain of the institutions of the USG and the United States.

Chapter II

REVIEW OF RELATED LITERATURE

This chapter is a summary of the most current literature and research associated with the purpose of this study; that is, to discover the key institutional and instructional practices within the Corequisite Model that lead to the success of developmental math students. The literature review was from a historical perspective of best practices for developmental education and how these strategies and techniques apply to the mathematics Corequisite Model. This chapter identifies the history of developmental education in the University System of Georgia, the origins of the Corequisite Model, the historical best practices for developmental mathematics education, and the best practices for the Corequisite Model. This literature review was conducted by using a comprehensive search of *Galileo Education Resources Information Center* (ERIC) database, JSTOR, SAGE Publications, Valdosta State University (VSU) library search engines (Vtext), ProQuest Research Database, Achieving the Dream Database, Complete College America (CCA), Complete College Georgia (CCG), Community College Research Center (CCRC), the University System of Georgia (USG), and peer-reviewed journals and articles, dissertations.

Developmental Education in the University System of Georgia

The USG initiated a system-wide developmental studies program in the fall of 1974 (USG, 1997a). The Developmental Studies program was used to meet the reading, English, and mathematical needs of underprepared USG students. The Developmental Studies program not only brought the skills of marginally prepared students up to standard, but it was also a key part in the state's desegregation plan. The 1983 USG Board of Regents' System Vice-Chancellor, H. Dean Propst, stated that the Developmental Studies program represented "significant strides made in enrollment of minorities" (Hansen, 1983, p. 12).

All entering freshman with low Scholastic Aptitude Test (SAT) scores had to complete the College Guidance and Placement or the Basic Skills Examination before registering for classes (Presley & Dodd, 2008). Both were competency placement tests used to assess mathematics, English, and reading skills. If a student received a low score in any of the areas, they were required to enroll in learning support courses for that area. Presley and Dodd (2008) reported, "Students with weaknesses in mathematics could not enroll in freshman courses involving mathematics until they successfully completed all developmental mathematics courses" (p. 3).

On February 9, 1983, the Atlanta Constitution ran an article stating that the USG would possibly eliminating the Developmental Studies program. Hansen (1983) wrote, "The recommendation to phase out remedial courses is reflective of the move toward higher quality. According to the 1982 fall enrollment report compiled by the Board of Regents, "23% of all new students at the undergraduate level are now enrolled in developmental studies, costing close to $7 million annually" (p. 12). By 1988, 5,521 out of 16,471 entering freshman (32%) were in Developmental studies (USG, 1997b). The percentage of entering freshman who needed remedial courses rose to 34% the next year in 1989 (USG, 1997c). In 1994, the developmental studies enrollment was around 38%

and cost the USG $24 million annually (Presley & Dodd, 2008). While the current percentage of USG students enrolled in developmental classes remains similar to that from two decades ago, the actual number of students has grown. The USG (2015) reported that 37% of its two-year institutions' and 18% of its four-year institutions' students were in developmental courses.

The Shaping of Developmental Studies in the USG

Kemp v. Ervin (1986)

There are three instances of major change in the history of Developmental Studies programs in the USG. The first was the 1986 case of Kemp v. Ervin. In 1982, Dr. Jan Kemp was the English coordinator for the Developmental Studies program at the University of Georgia (UGA). She reported the preferential treatment of UGA student athletes in the Developmental Studies program. Kemp alleged that one player was promoted from remedial studies for scoring a winning touchdown at the Georgia-Georgia Tech football game (Fulford, 2008). Another nine students had exited Developmental Studies even though they received Ds in the classroom on their fourth attempt to take the class. This was a violation of the university's policy that required students in the program to receive a C or better or be expelled. Six of those nine athletes were football players whose grades were changed to keep them eligible to play in the Sugar Bowl (Presley & Dodd, 2008).

Kemp drafted a letter to Dr. Virginia Trotter who was the then Vice President for Academic Affairs for the University of Georgia at that time. The letter questioned the exiting of the nine athletes from Developmental Studies who had not earned a passing grade. Kemp also voiced her concerns to an ad hoc committee created to investigate the matter. Shortly after the ad hoc committee was created, Kemp was notified by Assistant Vice President of Developmental Studies, Dr. Leroy Ervin, that she would be removed from her position as coordinator of English for the Developmental Studies program. Later in the summer of 1982, Ervin notified Kemp that her employment contract would not be renewed for the following academic year. Kemp filed a lawsuit against Ervin and Trotter in federal court. The evidence against UGA's athletic program was overwhelming, and UGA officials were forced to concede that athletes were granted special treatment (Fulford, 2008). The jury awarded Kemp $2.3 million, with $1.5 million being against defendant Trotter and $800,000 against defendant Ervin. The judge later reduced the amount the defendants had to pay to $200,000 from Virginia Trotter and $200,000 from Leroy Ervin. Kemp also received $79,681.65 as lost wages, $1 for loss to professional reputation, and $200,000 for mental distress (Kemp v. Ervin, 1986).

The case of Kemp v. Ervin prompted several changes for the USG: the president of UGA retired shortly after the court decision was released, every institution was investigated for potential links between the Developmental Studies program and corruption in athletic programs, and every institution had its student records audited (Presley & Dodd, 2008). A few institutions were found in violation. The Board of Regents implemented 13 new policies to regulate the Developmental Studies Program, and the institutions were given a quarter semester to implement them (Jensen, 1988).

When writing about the 13 new policies, Jensen (1988) expressed his concern that three of these would have disastrous effects on remedial students. The first policy was the “30-hour rule,” which states that all students needing Developmental Studies courses are required to exit those courses before acquiring 30 credit hours. The second policy requires remedial students to register for their Developmental Studies requirements before they register for core curriculum courses. The third policy states that students enrolled in both Developmental Studies and credit courses may not withdraw from Developmental Studies classes unless they also withdraw from all other courses. All three of these policies are still implemented in the USG (2015).

Learning Support Revisal (1993)

The second historical change of the Developmental Studies program was a statewide revisal and title change in 1993. The Developmental Studies programs were revised and adopted under a larger and broader banner of Learning Support (USG, 1997b). Learning Support (LS) programs served students who needed preparation in reading, mathematics, English, and/or other areas for success in college. Students who did not meet standards for regular admission based on a combination of high school GPA and SAT/ACT scores were required to take the COMPASS exam. The COMPASS exam was used to determine whether those students were to be placed in LS courses in the areas of reading, English, or mathematics. Individual institutions were allowed to create their own admissions, placement, and exit requirements for remedial students as long as those standards were higher standards than those required by the USG. It was decided that no LS classes would count towards graduation credits, but institutional credit would still be awarded. Since 1993 LS programs have historically served three groups of students:

1. Students required to take LS courses because their scores are below USG minimum requirements for placement;

2. Students who have scores above the USG minimum requirements but who are required by the individual institution to take LS courses by not meeting the individual institution's requirements; and
3. Students who volunteer to take LS courses to prepare for regular college courses (USG, 2015).

During the Learning Support revision period from 1993 to 2015, the Old Model of developmental mathematics was used (USG, 1997c). In the Old Model, students in need of profound remediation were placed in the bottom tier of foundational or beginning remediation. Those courses were typically labeled 0097-courses. The next tier of courses was for students who only needed refreshing, and who were placed in intermediate/support remediation. Those courses were typically labeled 0099-courses. The top-level courses were the beginning collegiate classes such as English Composition, College Algebra, Math Modeling, or Quantitative Reasoning. Those four courses are also known as "gateway courses," as they are the gateway into college and have gated so many students out of higher education (Bailey, 2009; Complete College America, 2016a; Presley & Dodd, 2008; USG Mathematics Task Force, 2013).

CCA called the Old Model of remedial education "The Bridge to Nowhere" (CCA, 2016b). The Old Model was a system that did not lead to the success of remedial students. An example of this system's lack of success would be to imagine that a USG institution had 100 students start in the bottom tier (beginner algebra) of the Old Model. Records show that only 40% of those students would pass onto the next level (USG Mathematics Task Force, 2013). That means in the second semester only 40 students would take intermediate algebra. Since this course had a 50% pass rate (USG

Mathematics Task Force, 2013), only 20 of the original students (after a year of remediation who would technically be in their sophomore year) could start the gateway course of College Algebra. Given that the USG has an average pass rate of 60% for this course, only 12 of the original 100 would complete the gateway course (see Figure 1). This imaginary scenario does not take into account the students who enrolled at an institution but never attended classes. Some students become disheartened at the thought of being placed in a remedial track that takes over a year to complete and never attend the colleges in which they enroll (Bailey et al., 2010).

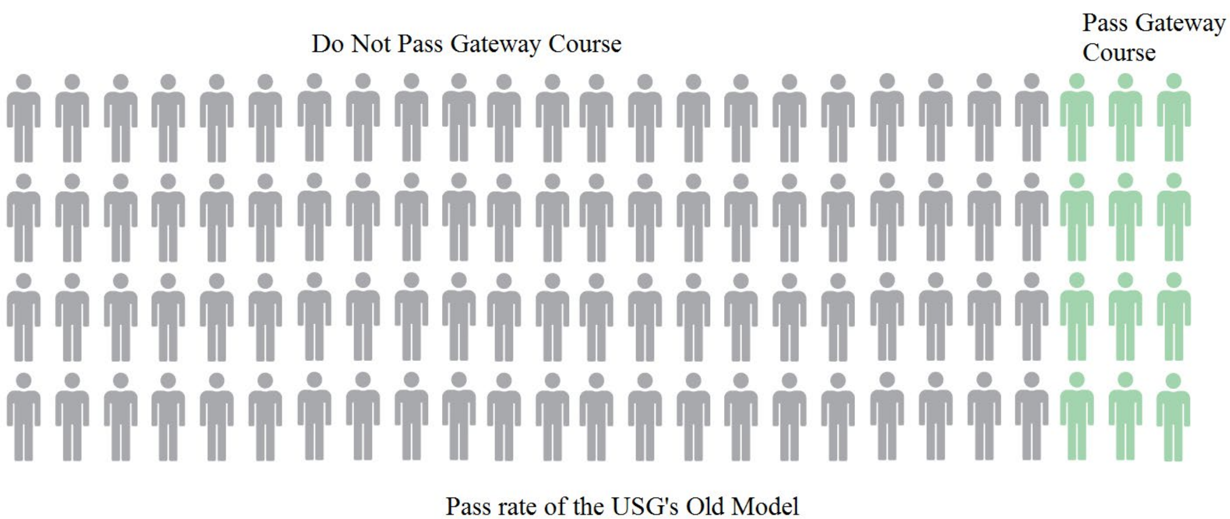

Figure 1. This model depicts the pass rate of 100 students who entered the USG's three-tiered model of developmental mathematics.

Corequisite Model (2015)

The third major change to developmental education in the USG was the implementation of the Corequisite Model in the fall of 2015. The plan to implement the Corequisite Model was devised in 2012 when Complete College Georgia was created (CCG, 2018). The Corequisite Model provides remediation to the majority of LS students in the form of Corequisite support courses, designed to provide support to students at the same time as they complete their gateway collegiate courses in mathematics or English (USG, 2015). Students who have significant gaps in preparation for collegiate courses may start in a foundations course. The main focus on the Corequisite Model was to have students exit LS in one semester or two at most (CCA, 2016a). The history of the Corequisite Model will be discussed further on in the review of literature.

Changes in USG's Mathematics Placement Practices

At the same time of the implementation of the Corequisite Model, the USG updated its institutional policies and practices. Based on the recommendations of the Ad Hoc Committee (2014), it was deemed that College Algebra should not be the default class for non-STEM majors. All institutions were required to offer a non-STEM pathway for mathematics. This pathway is also called Statway or Quantway (CCA, 2016c). The USG alternative courses are Quantitative Reasoning and Math Modeling (USG Mathematics Ad Hoc Committee, 2014). Another adapted institutional policy was to use a combination of measures to place students in gateway courses and appropriate supports. A Mathematics Placement Index (MPI) is calculated based on a student's High School Grade Point Average (HSGPA), SAT or ACT and, when necessary, placement test scores (USG, 2018). Students meeting the institution's requirements enroll in the gateway course. Students not meeting the standards can be placed in the foundations course or the gateway and Corequisite course combined (see Figure 2). Student placement varies from each institution as faculty and staff decide their institution's MPI. The final policy change was USG institutions terminating the use of the Compass exam as an exit examination for learning support. Remedial students now exit LS when they pass their gateway courses (USG Mathematics Ad Hoc, 2014).

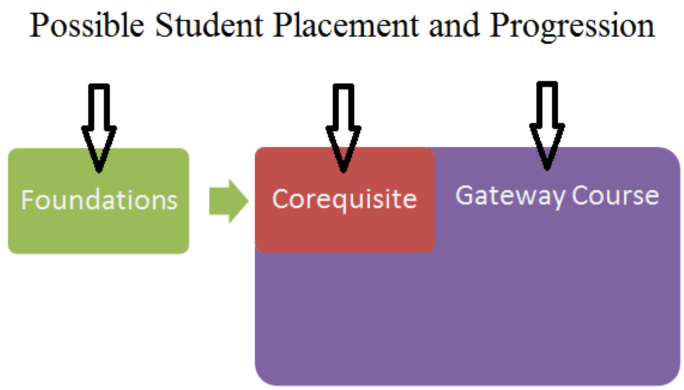

Figure 2. This model depicts how students are placed within the Corequisite Model and how they progress through the model.

The History of the Corequisite Model

Acceleration Model

Researchers discovered that there was a negative correlation between the amount of time spent in remediation and degree completion (Bailey et al., 2010; Epper & Baker, 2009). Acceleration is a type of strategy designed to decrease the amount of time students spend in developmental courses and allow them to enroll more quickly or immediately into collegiate courses (Nodine, Dadgar, Venezia, & Bracco, 2013). Acceleration has been identified as a best practice of developmental education (CCRC, 2014; Edgecombe, Jaggars, Baker, & Bailey, 2013). There are various models of acceleration.

Compressed courses. The first type is a compressed course. Compressed courses allow students to complete multiple sequences of developmental education in one semester (Edgecombe, 2011). One of the better known and researched compressed course models started in 2005 at the Community College of Denver (Edgecombe et al., 2013). This institution's developmental education program was called FastStart@CCD. FastStart@CCD allowed students to complete two levels of remedial mathematics in one semester. By combining two levels of LS into one semester, the FastStart@CCD increased remedial students' collegiate success rate from 12.5% to 43% (Edgecombe et al., 2013). The success of the FastStart@CCD may also be attributed to other practices.

FastStart@CCD was a holistic program that drew from a blend of accelerated instruction, student support, cohorts, interactive teaching, and career exploration. The program also used the mastery approach via technology, supported by Pearson's MyMathLab software (Epper & Baker, 2009). FastStart@CCD updated the program in 2008 by pairing the highest level developmental math with the collegiate-level math course (Epper & Baker, 2009). This was a different model of acceleration called paired courses. Paired courses linked developmental courses with a collegiate-level course (Edgecombe, 2011). This type of acceleration allowed students to gain college credit faster than going through the Old Model of developmental education.

Mainstreaming. Another variation on acceleration was called mainstreaming. Mainstreaming is the process of accelerating students' progress by placing students referred to developmental education directly into collegiate-level courses. Mainstreaming with supplemental support places remedial students directly into collegiate courses while those students are paired with additional instruction, either through mandatory companion classes or through other learning supports designed to promote success in the college course (Edgecombe, 2011). The Community College of Baltimore County used a mainstreaming with supplemental support model called the Accelerated Learning Program (ALP). A group of the college's developmental students were enrolled in collegiate courses and attended a companion course right after the collegiate course. Both courses were taught by the same instructor (Nodine et al., 2013). Developmental students enrolled in the ALP passed the collegiate course at a rate of 63%. Only 39% of non-ALP developmental students passed their collegiate courses at the Community College of Baltimore County (Edgecombe et al., 2013). Jenkins, Speroni, Belfield, Jaggars, and Edgecombe (2010) found that compared to non-ALP students, ALP students completed the developmental courses at a higher and faster rate, enrolled and completed the subsequent college requirements at a higher rate, and attempted more college courses. The ALP program was also more cost-effective for developmental students to complete the gateway courses. It cost ALP students $2,680; whereas non-ALP developmental students paid an average of $3,122 before finishing their gateway course (Jenkins et al., 2010).

Corequisite Model. The Corequisite Model is an adapted model of acceleration. It was a combination of paired courses and mainstreaming with supplemental support. It differed from those two models by offering a foundations course for students with significant gaps in preparation. The CCA (2016c) credited the research of Bailey et al. with the high attrition rates of developmental students as the beginning of the Corequisite Model. Bailey et al. (2010) discovered that the Old Model created high attrition rates in a sample of 141,490 developmental math students. They found less than one half of students completed LS, and a fifth of those referred to developmental math completed a gatekeeper course within three years of first enrolling in the Old Model. Bailey et al. (2010) reported, "Twelve percent of those referred to developmental math completed the gatekeeper course in that subject without enrolling in a single developmental course in that same subject" (p. 30).

Using the sample numbers, over 16,000 students deemed remedial passed college-level courses without ever taking a learning support course. Bailey et al. (2010) indicated that many students are academically capable of college-level work but could not endure multiple semesters of courses that did not count toward a degree. Scott-Clayton (2012) found that 24% to 33% of students placed into remedial education could have passed gateway courses if given the opportunity. While this study was conducted some years after the Corequisite Model was created, it provided more evidence towards the fundamental idea of the Corequisite Model: remedial students would have lower attrition rates and higher success rates if they completed their developmental education more quickly.

Colorado was the first state to implement the Corequisite Model within the Colorado Community College System in 2013. After implementing the Corequisite Model for one year, their developmental mathematics pass rates jumped from 31% to 64% (CCA, 2016a). Shortly after Colorado, West Virginia implemented the Corequisite Model in fall of 2014. Under the West Virginia's traditional remedial model, the entire community college system had an average of 13% of their remedial mathematics students passing gateway courses. After one semester under the Corequisite Model, that success rate increased to 62% (CCA, 2016a). Tennessee implemented the Corequisite Model around the same time but only as a pilot model at Austin Peay State University (CCA, 2016a). The Corequisite Model changed Austin Peay State University's previous success rate ─ having fewer than 10% of LS students completing a gateway math class in two years ─ to more than 70% completing a gateway math class in a single semester (Tennessee Board of Regents, 2015).

Georgia also implemented the Corequisite Model as a pilot the same year as West Virginia and Tennessee. Within the USG, the model was piloted at Albany State

University, Bainbridge State College, College of Coastal Georgia, Dalton State College, Georgia Highlands College, Gordon State College, and Middle Georgia State College (USG Mathematics Ad Hoc Committee, 2014). Of the remedial students who entered those institutions in the fall of 2010, only 21% completed gateway courses within two years. With one semester of using the Corequisite Model, the number of remedial students at those institutions who passed mathematical gateway courses increased to 63% (CCA, 2016a).

To put these gains into perspective, readers should recall the scenario presented earlier with the 100 USG students model. The foundations course has a similar pass rate as the Old Model's bottom tier--42% (USG Mathematics Task Force, 2013). That means in the second semester, 42 students would take the Corequisite course and the gateway course together. The Corequisite and gateway course have a 60% pass rate (USG Ad Hoc Committee, 2014). By the end of their freshman year, 25 students of the original 100 completed the gateway course (see Figure 3), which is double the number of successful students of the Old Model. The prospect of this large increase of successful students is the reason why the USG decided to implement the Corequisite Model statewide.

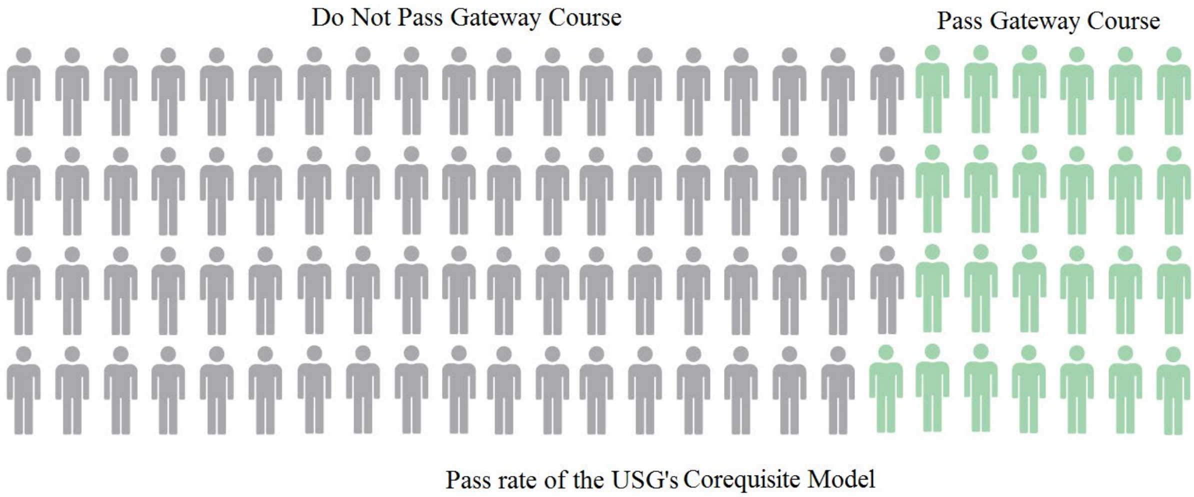

Figure 3. This model depicts the pass rate of 100 students who entered the USG's Corequisite Model of developmental mathematics.

Best Institutional Practices of the Developmental Mathematics Education

Boylan (2002) defined best practices of developmental education as the "organizational, administrative, instructional, counseling, advising, and tutoring activities engaged in by highly successful developmental programs" (p. 3). Organizational and administrative practices focus on the location, placement, assessment, and evaluation of developmental students as well as prioritizing developmental education and funding. Student support services focus on tutoring, academic support, advising and counseling for students, tutor training, and career advisement (Carr, 2012). Instructional practices are defined as teaching methods and techniques that are utilized to facilitate learning by individual instructors at an institution (Epper & Baker, 2009).

An institutional practice is an organizational policy or strategy mandated at an institution to improve academic success or maintain academic rigor (Alcorta, 2009). Accepted institutional practices are used by all faculty and staff at their institution. This study will combine organizational structures, administrative practices, and student support services under institutional practices and reorganize the practices into three areas. The three areas are: (a) program structure, assessment, placement, and momentum; (b) counseling, early warning systems, and study skills courses; and (c) regular program evaluation.

Program Structure, Assessment, Placement, and Momentum

Program structure. Developmental education programs in higher education can be structured as centralized or decentralized programs (Schwartz & Jenkins, 2007). A centralized structure places the delivery of all learning support courses, programs, and services in a separate department. This department is supervised by a dedicated department administrator or head, and the department has its own budget and resources (Boylan, Bliss, & Bonham, 1997). A decentralized program has learning support courses and programs offered through individual academic departments while remedial services are offered elsewhere on campuses (Gabriner, 2007).

Centralized programs have been shown in the literature to be the more effective practice in the literature. Carr (2012) conducted case studies on two USG colleges with the highest completion rates to discover what institutional and instructional practices they employed. Both institutions had centralized developmental programs. Boylan et al. in their 1997 research discovered that two-year institutions participating in centralized programs had higher rates of retention. They also discovered that four-year institutions with centralized programs had higher first-term and cumulative GPA scores than those institutions with decentralized programs.

Despite the literature showing centralized programs are more effective, decentralized programs dominate the majority of colleges (Boylan & Saxon, 2009). This does not indicate the majority of colleges are at a disadvantage using decentralized programs. Sheldon (2002) found in her research that decentralized programs can be just as effective as centralized ones if those programs are coordinated by someone capable of merging teaching philosophy with institutional expectations. Carr recommended a centralized program structure in his 2012 dissertation on best practices for student success in Georgia. Carr (2012) also recommended developmental programs be led by an individual passionate about developmental education and student success, and developmental education faculty must have the ability to be creative in methodology and pedagogy and be able to communicate openly with students and faculty across disciplines (p. 125). Boylan and Saxon (2009) stated that successful developmental programs are characterized as having the following:

- a clear statement of the campus philosophy for developmental education (p. 5);
- a clear statement of goals and objectives for developmental education (p. 5);
- regular meetings (at least twice a semester) between those teaching developmental courses and those providing support services to discuss problems and issues in developmental education (p. 5); and
- evaluation information provided to appropriate faculty and staff to enable them to continually enhance the quality of their services (p. 5).

Decentralized developmental programs that incorporate these practices and characteristics as mentioned by Carr (2012), Boylan and Saxon (2009), and Sheldon (2002) could be as effective as centralized programs. It could be that there was no relationship between the type of structure and effective practice. In 2014, Butler surveyed

Florida institutions and found that centralized and decentralized departments had little correlation to student success.

Mandatory assessment. The majority of higher education students are assessed before they are admitted into an institution. In a 2007 study of nationwide institutions, the NCDE found 92.4% of institutions required mandatory assessment (Gerlaugh, Thompson, Boylan, & Davis, 2007). Institutions use an array of assessment instruments to place students into collegiate courses, such as SAT or ACT scores, HSGPA, high school exit examination scores, or COMPASS or ACCUPLACER exams (USG Mathematics Task Force, 2013). The consensus in the literature was that a student should be assessed on at least two measures to provide a more accurate assessment of a student's ability to succeed in collegiate courses and where he or she should be placed (Bailey et al., 2010; Missouri, 2018; USG, 2015). Boylan et al. (1997) found that students participating in programs featuring mandatory assessment were significantly more likely to pass their developmental English or mathematics courses than students in programs where assessment was voluntary (p. 4).

Mandatory placement. Many state university systems (Georgia, Florida, Missouri, Texas, and West Virginia) have standardized assessments to place students in remedial or credit-bearing courses (Butler, 2014; Campbell, 2015; Missouri, 2018; USG, 2015). Mandatory assessment is used to place students into collegiate courses or somewhere in a sequence of developmental courses. In their survey of 6,000 developmental students, Boylan et al. (1997) found that mandatory placement in developmental education was positively correlated to retention at four-year institutions. They also found that mandatory placement was negatively related to retention at two-year institutions. Though mandatory placement was negatively related to retention, it was positively related to success in developmental courses (Boylan et al., 1997). Gabriner (2007) also found a positive relationship between mandatory placement and developmental student success in California.

Academic momentum. Most college students are advised to take 12 credit hours per semester, which is the minimum number to qualify for full federal financial aid. By only taking 12 hours per semester, a student cannot finish an associate's degree in two years or a bachelor's degree in four years unless they take summer classes. CCA (2016a) suggested increasing academic momentum by having every institution implement the practice of encouraging or incentivizing college students to take at least 15 credits during fall and spring semesters. Taking 15 credit hours per fall and spring semester ensures that students are more likely to finish their degree in the allotted time.

Belfield, Jenkins, and Lahr (2016) conducted a study on Tennessee college freshman students. Their sample had 28% of two-year institution students who were "momentum students" (those who took at least 15 credits to start) and 71% of four-year institution students who were momentum students. Only a fifth of the two-year institution students maintained their momentum towards graduating on time; whereas, exactly half of four-year college students maintained their momentum towards graduating (Belfield et al., 2016). By taking 15 credit hours per semester, the students at the four-year institution were more likely to graduate on time.

Counseling, Early Warning Systems, and Study Skills Courses

Counseling. There is a difference between counseling and advising. All college students undergo some type of advisement during their tenure in higher education.

Advisors are faculty or staff members trained to help students with placement, course selection, degree completion, graduation applications, transient forms, and to provide referrals to other departments on campus. Counselors are faculty and staff members who are trained to work with students on goal setting, math and test phobia, exploring majors and careers, personal issues, and concerns (South Seattle College, 2017). Counseling services have been shown to be an effective institutional practice for developmental students (Gabriner, 2007). Schwartz and Jenkins (2007) found the most promising counseling services had counselors trained to work with developmental students, and those students were mandated to have counseling.

Boylan et al. (1997) found that counseling services had no statistical relationship on developmental student retention and cumulative GPA. However, they did discover that counseling services were positively related to freshman first-term GPA and success in developmental courses at four-year institutions. Counseling services also helped students pass the mathematics developmental courses at two-year institutions (Boylan et al., 1997). Many developmental students have math or test phobia that has been shown to be eased by seeing a campus counselor (Nolting, 2002).

Early warning systems. An early warning system is when faculty or staff alert administrators or counselors about students in need of extra help. Staff can move quickly to provide those students with academic or personal support. The administrators or counselors then continue to monitor the students to ensure they are benefiting from the supports (Schwartz & Jenkins, 2007; USG Mathematics Task Force, 2013). In the state of Missouri, 44% of higher education institutions offered early alert programs (Missouri, 2018). The Missouri Department of Higher Education (2018) called for the adaption of early alert systems in all of their institutions. Carr (2012) insisted that early warning systems for at-risk students were paramount to student success.

Study skills course. A study skills course (sometimes called a success course) is a course that provides fundamental knowledge in areas such as time management, note-taking skills, study skills, goal setting, and career exploration (Reilly, 2014). Researchers recommended integrating study skills with developmental and collegiate math courses to accelerate student progress (Butler, 2014; Edgecombe, 2011). Many institutions offer study skills courses. Twenty-two higher education institutions (88%) in Missouri (2018) offer student success courses. In 2009 the Massachusetts Community Colleges Executive Office ordered a study of best developmental education policies and conducted an audit of their systems. During the audit, Cape Cod Community College was found to have a pre-algebra and study skills paired class. The class integrated budgeting, life skills, and study skills. Students in the paired course had a pass rate of 80%; whereas, non-paired pre-algebra students had a success rate of 60%. Butler (2014) found in her study of Florida institutions that requiring all entering developmental education students to participate in a study skills course was the only institutional practice to have an effect on student success rate. In Reilly's (2014) study of a Floridian institution, she found 61.4% of mathematics students exited LS without a paired study skills class; whereas, 84.3% of mathematics students passed with a study skills course.

Regular Program Evaluation

The purpose of program evaluation is to investigate which parts of an institutional program are working well and which are not. Boylan et al. (1997) found that 89.7% of developmental math courses were regularly evaluated. Gerlaugh et al. (2007) found a similar number for program evaluations of developmental mathematics programs (79.3%) in their nationwide study of institutions. Boylan et al. (1997) found that students participating in regularly evaluated developmental programs were more likely to be successful in developmental mathematics at two- and four-year institutions than those students participating in non-evaluated programs.

Best Instructional Practices of Developmental Mathematics Education

As previously mentioned, instructional practices are defined as teaching methods and techniques that are utilized to facilitate learning by individual instructors at an institution (Epper & Baker, 2009). Instructional practices focus on faculty status, instructional strategies, program alignment to college-level coursework, and communication (Carr, 2012). Common best instructional practices for developmental math programs include collaborative teaching between two instructors (Campbell, 2015), implementing technology in the classroom such as with the emporium classroom strategy (Epper & Baker, 2009), other classroom strategies such as mastery, contextualized, and collaborative learning (Schwartz & Jenkins, 2007), tutoring programs (Boylan, 2002), learning communities (Gabriner, 2007), frequent testing and homework opportunities (Massachusetts Community Colleges Executive Office, 2009), and academic assistance centers (Boylan, 2002).

Collaboration between Two Instructors

In Campbell's 2015 qualitative study on Texas institutions implementing an accelerated developmental mathematics model (similar to the Corequisite Model), she found there was a relationship between the presence of two faculty members in the classroom and student success rate as perceived by students. There were two faculty members present in the accelerated course five days a week. One faculty member was an academic mathematics instructor, while the other was a developmental mathematics instructor. The students interviewed indicated that they received more immediate feedback and support with two faculty members. Both faculty members were allowed to count both support and gateway classes in their individual teaching loads.

Technology and the Modularized Strategy

Use of technology. In 1995, the American Mathematical Association of Two-Year Colleges stated that use of technology should be one of the standards for college-level math preparation. One of the more common implementations of technology was the use of computer-assisted instruction software. Most are commercial products such as MyMathLab (MML), Hawkes, ALEKS, WEBASSIGN, and more than 40% of community colleges nationwide use computer-assisted instruction software (Epper & Baker, 2009). There are studies documenting improved results for developmental math students who use such software. Rivers (2017) studied two years of data from the University of New Haven. Rivers found the pass rates of developmental students, who took classes paired with MML, increased by an average of 16%; and withdrawal rates decreased by 17% from Fall 2014 to Fall 2016. In a 2009 audit of best policies and practices, several department chairs within Massachusetts Community Colleges reported *MyMathLab* and/or *MyWritingLab* as essential supplementary activities.

Modularized strategy. Some college courses work well with lecture as the main strategy of instruction. Typically, however, mathematics courses are taught by an instructor demonstrating a problem to students and then having the students repeat the process. Computer-assisted instruction (CAI) software is capable of providing with personalized, on-demand assistance (Rivers, 2017). Emporium Learning is CAI software that provides lectures that are divided into modules. Students use their computer to receive multimedia-based instruction. The software has many features that allow students to have individualized instruction and control the pace at which they learn. Emporium Learning has increased the success rate of developmental math students as well as decreased the cost of instruction (Twigg, 2011). This approach has become increasingly popular when redesigning developmental math courses (Rutschow & Schneider, 2011). Foothill College and Jackson State College achieved a 20% increase in developmental students' success rate when the colleges implemented the Emporium Model (Epper & Baker, 2009).

Classroom Strategies

Mastery learning. Mastery learning is the classroom strategy of dividing course material into manageable units and testing students on each unit to ensure they have mastered the material before moving on to the next section (Schwartz & Jenkins, 2007). Students are allowed to go at their own pace, monitor their growth, and correct their performance while developing a true knowledge of the subject. Boylan (2002) and Gabriner (2007) believed it to be a best practice for developmental mathematics students. A survey of faculty in the state of West Virginia found that 93% believed mastering content before moving on to be an effective practice, and 84% implemented the practice in their classrooms (Pierce, 2010). Butler (2014) found that Florida institutions that used the strategy of mastery learning observed a positive relationship to the success rate of developmental math students.

*Contextualized learning***.** Contextualized learning is built around the idea of giving context to a subject matter. Many math students have uttered the phrase, "Why do

I have to learn this?," and this type of learning provides an answer. Contextualized learning focuses on teaching basic skills in mathematics (or any subject) in conjunction with other course content such as personal, academic, or career goals. This type of learning can be focused two ways. Contextualized learning could be used to improve developmental students' basic skills, rather than knowledge of content from the field (Boylan, 2002). Alternately, it may be focused on developing students' knowledge of an academic discipline or vocational field, with instruction in basic skills as a secondary objective (Rutschow & Schneider, 2011).

Collaborative learning. The Executive Office of Massachusetts stated that there was a strong relationship between socializing and learning (2009). This strategy was implemented by instructors providing group work, collaborative activities, constant feedback, and projects. It was also critical that the students provide feedback to each other (Schwartz & Jenkins, 2007). A survey of West Virginia faculty found that 77% believed collaborative learning to be an effective practice of developmental mathematics, and 84% implemented the practice in their classrooms (Pierce, 2010). Butler (2014) found that Florida institutions that used the strategy of collaborative learning had a positive relationship to the success rate of developmental math students.

Tutor Programs

Tutoring is a common practice implemented by a number of colleges as a way to advance developmental education students' achievements. The availability of tutoring for developmental students has increased by 18% compared to a decade ago (Gerlaugh et al., 2007). Twenty-five state institutions (100 percent) in Missouri offer additional tutoring/mentoring services (Missouri, 2018). Tutoring can be offered by faculty, staff, student peers, or through computer-assisted instruction with tutorial software packages (Rivers, 2017). Tutoring services may be housed in a stand-alone or academic assistance centers. In those centers students may receive one-on-one assistance or work in small groups with a tutor.

Tutor programs with tutor training. Despite the increase in tutoring services, there may be no need for them. Butler (2014) found there was no correlation in an institution having tutoring and student success in her study of Florida institutions. However, researchers like Boylan and Saxon (2009) stated there was a difference in having a tutor program and having a program where the tutors are certified or trained. Boylan et al. (1997) found students participating in tutoring programs featuring a training component were more likely to have higher first-term GPAs at both two-year and four-year institutions, higher cumulative GPAs and retention in four-year institutions, and higher pass rates in developmental English courses at both institutions. Boylan and Saxon (2009) stated all institutions should have their tutoring programs and developmental education programs certified by agencies such as the National Association for Developmental Education (NADE) or College Reading and Learning Association (CRLA).

Learning Communities

A learning community is a broad term for the variety of approaches applied to a cohort of students enrolled in two or more courses together (Epper & Baker, 2009). If the USG Mathematics Ad Hoc Committee's (2014) recommendation of having the same instructor teach the support and gateway course was followed, those developmental students could be considered a learning community. Researchers have found that this practice leads to a positive impact on student engagement, college persistence, credits earned, and developmental course sequence completion (Bailey & Cho, 2010; Gabriner, 2007). However, Pierce (2010) found learning communities not to be effective (29%) nor used often (71%) in her survey of West Virginia higher education faculty.

Testing and Homework Opportunities

Frequent testing. Boylan (2002) found evidence that developmental students get better final exam scores when they are tested on a regular basis. Testing can be in the form of verbal questions or projects. Students benefited as long as relevant material was reviewed before the test, and they are given detailed feedback on their test performance (Schwartz & Jenkins, 2007).

Homework. The Executive Office of the Massachusetts Community College (2009) found that homework assignments that are carefully constructed, evaluated, and returned in a timely manner can reinforce classroom knowledge.

Academic Assistance Centers

These centers (also called laboratories) are separate structures outside of a department that provide academic services including tutoring (Schwartz & Jenkins, 2007). Since academic assistance centers are independent, they often create relationships with faculty and administrators from English or mathematics departments. Boylan (2002) and Gabriner (2007) found there to be a positive relationship between academic assistance centers and student success. Despite that literature, however, several colleges do not have centers. More than half of the department chairs in the system of Massachusetts Community Colleges (2009) indicated that they do not have laboratories. There was also discrepant research against academic assistance centers. Butler (2014) found there was no correlation in an institution having an academic assistance center and student success in her study of Florida institutions.

Best Practices for the Corequisite Model in the USG

There is little research that has been published on the best practices within the Corequisite Model. This can be attributed to the newness of the model. The model was only piloted in various states in 2012. It has since been fully implemented in the USG since fall of 2015. The USG Mathematics Ad Hoc Committee (2014) gave a list of five recommendations/best practices for the Corequisite Model. Those recommendations were having the same instructor for the support and gateway course, linking material taught in support classes to the material being covered in the gateway course, mixing support and non-support students in the gateway course, limiting support classroom size to 15-22 students, and making attendance mandatory in the support course. Edgecombe (2011) supported the practice of using the same instructor for the gateway and support course. She stated it was the best way to "maximize the potential of the model" (p. 12). No other information on best practices for the Corequisite Model has been found.

Another reason for the lack of research on best practices is that the Corequisite Model, itself, is seen as a best practice. It is a form of an acceleration model which is a known best practice (Edgecombe et al., 2013). Perhaps there is a mentality of "why fix what is not broke" or "why research the best practices of the best practice." There are researchers who believe developmental mathematics is not broken and does not need to be fixed by changing the delivery method (Reilly, 2014). However, there continues to be published data supporting institutions switching to the Corequisite Model. The system of Missouri found that Corequisite math pilots produced higher results than their other math learning support courses (2017). The system of Missouri has since recommended that all their institutions adopt an accelerated remedial education model as soon as possible.

There was some literature on best practices in the USG. Robert Carr (2012) analyzed the institutional average percentage for developmental education completion in USG two-year colleges during the cohort years of 2005, 2006, and 2007. At that time the USG had 16 two-year colleges. Many two-year colleges have been consolidated with larger universities since then (USG, 2016). In his study, the two colleges with the highest completion rates had rates of 65.5% and 61.3%. The two lowest college completion rates were 19% and 30%. The overall average completion rate of the 16 two-year colleges was 46.6%. During this time period the USG used the Old Model of developmental education.

In his study, Carr (2012) conducted case studies at the two USG colleges with the highest completion rates to discover what institutional and instructional practices they employed. He found seven best practices (some of which have been mentioned earlier) for developmental education in Georgia:

1. Institutions need an individual department that is assigned the function of developmental education at the institution.
2. The departments must have a strong leader who is passionate about developmental education and student success.
3. Developmental education faculty must have the ability to be creative in methodology, pedagogy, and the ability to communicate openly with students and faculty across disciplines.
4. Social and active learning skills are essential to reach the modern student. Mastery learning methods and curriculum that builds from a similar model are

highly effective. Social and active learning allows students to start at a similar point and interact with students in the same module. Active learning rather than formal lecture-style learning creates direct involvement in learning.

5. Early and intrusive interventions with at-risk students are paramount.
6. Student support services, tutoring, career services, and disability services are critical for student success and must be integrated into the developmental education curriculum.
7. Advising and instruction that identifies and enables early success promotes program completion. For optimum student success, instructors must find assignments that students can accomplish and receive higher grades while not lowering standards in the classroom (p. 125).

The first three recommendations are linked to a centralized system for developmental education. The fourth recommendation was a combination of classroom strategies such as mastery, contextualization, and collaborative learning. The remaining best practices have also been reviewed in the literature above. These best practices were all implemented at the two USG institutions with the highest success rates and were reported to produce results comparable to the Corequisite Model. Recall, the Corequisite Model has an USG average success/completion rate of 60% (USG, 2016). The two USG institutions in Carr's (2012) study were also producing similar results years before the idea of the Corequisite Model was implemented in Georgia.

Summary

This review of literature provided the history of developmental education in the USG, the history of the Corequisite Model, a summary of the best institutional and instructional practices for developmental education, and lack of research on best practices for the Corequisite Model. There was an abundance of literature on best practices for developmental education, especially in the setting of community colleges. There was also an abundance of literature on the effectiveness of the Corequisite Model in the setting of higher education. Little research has been conducted to identify best practices within the Corequisite Model to increase its effectiveness.

The goal of this research study was to determine which type of institutional or instructional practices will provide the most success for developmental students enrolled in the Corequisite Model. This study aimed to add to the research base of developmental education by examining the best institutional and instructional practices for the Corequisite Model. In Chapter 5, suggestions are offered for further research into best practices for Corequisite students.

Chapter III

METHODOLOGY

The research design, the study participants, and the survey instruments are described in the following pages of Chapter 3. Additionally, the data collection processes for the quantitative and qualitative phases of the study are outlined, followed by descriptions of data analysis techniques for each phase. The chapter concludes with a summary.

Research Design

This study utilized a sequential explanatory mixed-methods approach. This two-phase design required collecting quantitative data in the first phase, analyzing the results, and then using the results of the first phase to plan the second, qualitative phase. Creswell (2014) stated, "The overall intent of this design is to have the qualitative data help explain in more detail the initial quantitative results" (p. 224).

Quantitative Phase

For the quantitative phase of this study, the following nine independent variables were used: institutional adaptations, USG institutional implementations, institutional student requirements, faculty instructional practices, Ad Hoc instructional recommendations, classroom instructional practices, department instructional practices, instructional delivery methods, and instructional utilization. These variables consisted of items taken from the DEPS—CMAS and the DEPS—CMFS surveys and are measured on an ordinal rating scale. The individual items were combined into nine subscales and used as the nine independent variables at the interval measurement level. Three of the independent variables are forms of institutional practices: (1) institutional adaptations, (2) USG institutional implementations, and (3) institutional student requirements. The other six independent variables, (4) faculty instructional practices, (5) Ad Hoc instructional recommendations, (6) classroom instructional practices, (7) department instructional practices, (8) instructional delivery methods, and (9) instructional utilization, are forms of instructional practices.

Dependent variables were the percentages of students earning a grade of A, B, or C in Corequisite math courses from each of the 21 USG institutions. This archival data were measured at the interval level and were collected from the USG for Fall Semester 2019 and Spring Semester 2017.

Qualitative Phase

For the qualitative phase, interview questions were created from the quantitative results. Eighteen recorded interviews were conducted, organized, transcribed, and member checked. Data were the interviewees' transcripts that were coded and clustered into the following six themes: (1) recommendations from the Ad Hoc Committee, (2) passionate and dedicated faculty who care about learning support students, (3) tutoring, (4) an early alert system, (5) study skills, and (6) growth mindset.

Participants

Quantitative Phase

According to USG (2016), there were a fewer than 20,000 faculty and staff employed at the 28 colleges or universities within the USG during the Fall Semester of 2016. Permission to research was obtained for 21 institutions. The total number of faculty and staff at institutions that granted permission to research was 9,023. A list of each USG institution's administration and math faculty who potentially work with the Corequisite Math Model was obtained from each institution's website via campus directories. The list was comprised of 350 administrators and 777 faculty members.

A total of 53 administrators and 112 faculty responded to the surveys. There are three administrators on a college campus who would be expected to know of the institutional practices such as the Corequisite Model: the head of mathematics department, the dean over that department, and learning support coordinator. Of the estimated 60 administrators who work with the Corequisite model, 53 responded which represents approximately 88% of USG administrators considered related to the USG Corequisite Math Model.

In the fall semester of 2016, there were 3,735 students enrolled in learning support at the surveyed institutions. After reviewing archived schedules for those institutions and emailing math department heads, the original list of 777 faculty was narrowed to approximately 167 math faculty who would be associated with the Corequisite Model. These math faculty were emailed, invited to participate in the study, and given the link for the DEPS—CMFS instrument. Of the 167 math faculty, 112 responded which represents 67% response rate.

Qualitative Phase

The qualitative phase of the study consisted of recorded interviews with 18 participants. Participants in the qualitative phase of the study were purposefully selected from the quantitative population and included two USG institutions from each of the three institutional categories—comprehensive universities, state universities, and state colleges. Research universities were not included in the study, because these institutions do not offer remedial courses. The six institutions were chosen for the qualitative phase because their Corequisite Math scores were either the highest or the second highest within their category. Math department heads from the six chosen institutions were contacted to obtain a list of faculty and administrators who were perceived to be most knowledgeable about their institution's Corequisite practices. From the lists of faculty and administrators provided by department heads, participants were purposefully chosen as one administrator and two faculty members from each of the six institutions. An email explaining the study was sent to each of the 18 participants, and VSU IRB consent was requested and obtained from each participant before each interview began (Appendix A).

Instrumentation

Quantitative Methods

This study employed two modified versions of the Developmental Education Program Survey—Mathematics Specific (DEPS—MS) developed by Butler (2014). Butler (2014) modified an existing survey, the Developmental Education Program Survey (DEPS), to be mathematics-specific. The DEPS was itself a modification from the Community College Inventory (Alcorta, 2009). The DEPS—MS is a rating-scale survey used to collect college information on the level of implementation of instructional practices and institutional practices. Several items in the DEPS—MS referred to the Old Model of developmental education, which is no longer implemented in the USG. Those items were modified for this study so that they refer to the Corequisite Model. This modified version of the DEPS—MS, now called the Developmental Education Program

Survey—Corequisite Mathematics Administration Specific (DEPS—CMAS), can be found in Appendix B.

The DEPS—CMAS was sent to the administrators (department chairs, deans, and learning support coordinators) of the 21 USG institutions. It contains 19 ordered-response items about the level of implementation of institutional practices in the Corequisite Model and contains four items regarding demographics. The 19 items are grouped into three subscales. The first seven items are grouped into a subscale labeled Institutional Adaptations; the next six items are grouped into a subscale labeled USG Institutional Implementation; and the last six items are grouped into a subscale labeled Institutional Student Requirements. The responses for each item in the survey are coded as follows: 0 = No implementation, 1 = Under discussion, 2 = Marginal implementation, 3 = Partial implementation, and 4 = Full implementation. At the top of the survey, the following definitions of the ratings are provided so that participants could make decisions regarding the level to which Corequisite math practices are being implemented.

- **0 = No implementation** means there is no evidence that the practice being implemented at the institution.
- **1 = Under discussion** means the practice is being discussed or is in the planning stages.
- **2 = Marginal implementation** means there are isolated examples of the practice at the institution.
- **3 = Partial implementation** means the practice is being implemented in some areas of the institution in a visible and substantial way.

- **4 = Full implementation** means the practice has been fully implemented across the institution (Butler, 2014).

The last four items of the survey ask about demographic characteristics. The first characteristic is gender (GENDER). GENDER is a self-selected nominal dichotomous variable, coded as male = 0, female = 1, and other = 2. The second characteristic is years of experience (EXP) which is a self-selected ordinal variable representing the number of years the respondent has served in his or her respective field. The variable was coded as 0-4 years = 0, 5-9 years = 1, and 10+ years = 2. Job title (JT) is a self-selected ordinal variable representing respondents' positions at their employing institution. The variable was coded as department chair/dean = 0, administrator = 1, and other =2. The last demographic characteristic is the USG institution where the participant was employed (USG). This variable was a nominal variable coded as 1 to 21 based on the ascending alphabetical order of institutions provided with this question. This information was not utilized in the analysis but provided background information.

The second modified version of the DEPS—MS, called the Developmental Education Program Survey—Corequisite Mathematics Faculty Specific (DEPS—CMFS) was administered to adjunct faculty, full-time faculty, and departments heads. This survey can be viewed in Appendix C. The DEPS—CMFS contains 42 items that solicit data on the level of implementation of instructional practices. The 42 items are grouped into six subscales as follows:

1. Faculty Instructional Practices subscale contains nine items
2. Ad Hoc Instructional Recommendations subscale contains four items
3. Classroom Instructional Strategies subscale contains seven items

4. Department Instructional Practices’ subscale contains seven items
5. Instructional Delivery Methods subscale contains nine items
6. Instructional Utilization subscale contains six items

The final four items were coded similarly to the corresponding items in the DEPS—CMAS, except the variable, Job Title. It was coded as adjunct faculty = 0, full-time faculty = 1, department head = 2.

Content validation study. Validity is the extent to which an instrument measures what it claims to measure (Ary et al., 2014). To establish content validity of the DEPS—CMAS and DEPS—CMFS, the instruments were reviewed by an expert panel of five individuals with experience in Corequisite mathematics or institutional/instructional practices. The panel was asked to evaluate the surveys for clarity, appropriateness, and relevance of items to the Corequisite model. The five individuals were provided with copies of the DEPS—CMAS and DEPS—CMFS via email, and feedback was returned via email or gathered over the phone. Feedback from each of the experts was examined, and changes were made to the questionnaire after consulting with the dissertation committee.

Many of the experts suggested removing survey items relating to the foundation courses of the Corequisite model. The USG announced in the Fall of 2017 that each institution would be phasing out foundation-level learning support within a year. The experts believed that these items would not be relevant to the model when the surveys were sent to the population. Removing these items resulted in deleting one item from the DEPS—CMAS and 10 items from the DEPS—CMFS. Other changes were made to wording to improve clarity. Two content experts recommended adding “other” as options for gender in the demographics section. All recommendations were made to the questionnaires before data collection. The final version of the DEPS—CMAS consists of 19 items, and the final version of the DEPS—CMFS consists of 42 items excluding demographics.

To improve internal validity of the instruments, a pilot test was conducted at a technical college located in the southeast region of Georgia that was currently using the Corequisite Model. The pilot study was used to identify any ambiguities or difficult items, the response time needed to complete the questionnaire, and any other issues in responding to the survey. Five participants (four faculty members and one administrator) were involved in the pilot test. The participants only had a few sentence structure recommendations which were implemented.

Reliability. A valid instrument must also be reliable. Reliability is an instrument's consistency to produce similar results on multiple occasions for the same sample (Ary et al., 2014). Information on the reliability of the DEPS—MS survey was found in the results of a Cronbach's alpha generated by Butler. Butler (2014) reported Cronbach's alphas for the 10 institutional practice items and 39 instructional practice items as .79 and .97, respectively. The overall DEPS—MS survey was found to be highly reliable (49 items; $\alpha = .98$).

The pilot study provided further information on the reliability of the modified DEPS – MS instruments (DEPS—CMAS and DEPS—CMFS). Once data were collected from the technical college pilot study, Cronbach's alphas were computed to determine the internal consistency reliability of the instruments. Cronbach's alpha was computed for the summated total score, the three summated subscales scores of the DEPS—CMAS, and the six summated subscales scores of the DEPS—CMFS.

The Cronbach's alpha for the pilot study DEPS—CMFS was found to be reliable (42 items; α = .85). Table 1 displays the Cronbach's alpha reliability coefficient score for each of the subscales. Only the subscales of faculty practices and department strategies were found to be reliable. The negative Cronbach's alpha for the Ad Hoc recommendations subscale could be attributed to the technical college not being a part of the USG. The Ad Hoc recommendations were made by a USG committee for USG institutions. The negative Cronbach's alpha for the delivery methods subscale could be attributed to the entire faculty delivering their lessons in a variety of formats.

The Cronbach's alpha for the pilot study DEPS—CMAS could not be computed, as the institution only had one administrator who could answer the survey. However, the total scale was found to be highly reliable (61 items; α = .93).

Table 1

Cronbach's Alpha Reliability Coefficient for DEPS Pilot Test Subscale

Subscale	Items	Cronbach's Alpha
Faculty Practices	9	.81
Ad Hoc Recommendations	4	-2.30
Classroom Practices	7	.47
Department Strategies	7	.90
Delivery Methods	9	-.18
Instructional Utilizations	6	.60

After data collection, the Cronbach's alphas were recalculated with all of the participants. The Cronbach's alphas for the 19 institutional practice items for the DEPS—CMAS and 42 instructional practice items for the DEPS—CMFS were .82 and .95, respectively. Table 2 displays the Cronbach's alpha's reliability coefficient score for each of the nine subscales. The Cronbach's alphas ranged from .59 to .91 which indicate medium to high reliability. The Cronbach's alphas for the seven institutional adaptations, six institutional recommendations, and four Ad Hoc recommendations items were below .70 which indicates questionable internal consistency. However, the overall total scale was found to be highly reliable (61 items; α = .93).

Table 2

Cronbach's Alpha Reliability Coefficient for Each DEPS Corequisite Subscale

Subscale	Items	Cronbach's Alpha
Institutional Adaptations	7	.64
USG Task Force	6	.70
Institutional Requirements	6	.59
Faculty Practices	9	.86
Ad Hoc Recommendations	4	.69
Classroom Practices	7	.85
Department Strategies	7	.91
Delivery Methods	9	.82
Instructional Utilizations	6	.80

Qualitative Methods

The ultimate goal of qualitative research is to gain a deeper understanding of a selected study. Merriam (2002) maintained, "the researcher is the primary instrument for data collection and data analysis" (p.5). The "human element" allows researchers the ability to "process information immediately, clarify and summarize material, check with respondents for accuracy of interpretation, and explore unusual or unanticipated responses" (Merriam, 2002, p.5). Kaplan and Maxwell (2005) also suggested that "researcher" impressions, observations thoughts and ideas also are data sources" (p.39). Therefore, the researcher must guard against personal biases that can affect the interpretation and conclusions of data gathered (Peskin, 1991).

Creswell (2014) said, "The overall intent of this design is to have the qualitative data help explain in more detail the initial quantitative results" (p. 224). Participants in the qualitative phase of the study were interviewed using a set of peer-reviewed questions which served as a guide. These questions were created after studying the findings of the quantitative phase and are listed below. Using a planned set of interview questions, this provided an outline, a framework, and a focus on ideas to guide the interview in a more systematic way (Patton, 2002).

1. Your school was found to have a high Corequisite success rate. What practices do you think have contributed to this success?
2. In the institutional area, what do you think are important factors towards your institution's success that were not mentioned in the survey? i.e., Demographics, admission requirements, grant funding, having the students take nine hours in their major in the first year, etc.
3. In the instructional area, what do you think are important factors towards your institution's success that were not mentioned in the survey? i.e., Using technology as a supplement, instructional strategies are regularly shared between developmental instructors, etc.
4. What are practices you do not think are predictors of Corequisite Success?
5. I think the practice of requiring students to participate in a study skills or success course (freshman seminar) might have an impact on Corequisite Math success in USG institutions. Do you think it has an impact? Does your institution use this practice? Would you consider implementing this practice into your mathematics courses if it is not already implemented?

6. I think the practice of implementing low- or no-cost educational resources in courses might have an impact on Corequisite Math success in USG institutions. Do you think it has an impact? Does your institution use this practice? Would you consider implementing this practice into your mathematics courses if it is not already implemented?
7. Follow-Up questions varied upon an on interviewee's responses to the above questions.

Maxwell (2013) stated that validity in qualitative research refers to "the correctness or credibility of a description, conclusion, explanation, interpretation, or other sort of account" (p. 122). By documenting the procedures and steps of the process, credibility and trustworthiness are given to the qualitative results. Before beginning the interview process, an expert panel of four individuals gave feedback on the draft of interview questions; these individuals had experience with the Corequisite mathematics program practices. Changes were suggested to eliminate speculation, biases, and leading questions; all changes were implemented.

Data Collection

Quantitative Data Collection

A list of each USG institution's administration and math faculty who potentially work with the Corequisite Model was compiled from each institution's website via campus directories throughout the fall of 2017. These data were required before the cover letter with linked surveys could be sent to each member. Once the Institutional Review Board (IRB) granted permission, the surveys were administered, and the archival data were compiled. The cover letter with linked surveys was emailed to 350 administrators and 777 faculty members on January 29, 2018. Every math faculty member from the USG was included to ensure that the entire population of Corequisite instructors was reached. Not all of the math faculty on the mailing list were expected to be working with the Corequisite math model.

The cover letter included the purpose of the study, a request for cooperation, assurance of confidentiality, a promise to share the results, an expression of appreciation, and a request for completion of a URL-linked Qualtrics survey. Creswell (2014) stated that follow-up requests are especially important for physically mailed surveys, emailed surveys, internet questionnaires, and phone surveys. The participants viewed a VSU statement at the beginning of the survey that informed the participant that his or her submission of a response indicated his or her consent. The first follow-up email was sent two weeks after the initial email had been sent out. It was a friendly request to complete the survey which also thanked respondents who had already completed the survey. In the two weeks that followed, 39 administrators and 99 faculty members responded that they were not involved with the Corequisite model and requested to be removed from the mailing list. This left a possible 311 possible staff and 678 possible faculty members.

The second follow-up was sent the fourth week after the original was sent. A third follow-up was done 6 weeks after the original. A fourth follow-up was sent out after 8 weeks to institutions with low response rates.

During the period in which data from the quantitative survey was collected, archival data were gathered on each institution's Corequisite Model success rate. The USG keeps records on all the Corequisite data for each institution. The USG was contacted, and permission to review archival data was granted. The USG had already compiled the data which was grouped by a year's cohort of fall and spring semesters. The success rate for each institution was calculated by dividing the number of remedial students who completed gateway math by the number of students in remedial math. These data are shown in Table 3; the 21 institutions were randomly coded from A to U for confidentiality.

Table 3

Corequisite Math Success Rate by Institution

Coded Institution	Success Rate for Fall 2016/Spring 2017
Institution A	81%
Institution B	80%
Institution C	78%
Institution D	80%
Institution E	71%
Institution F	83%
Institution G	75%
Institution H	76%
Institution I	74%
Institution J	90%
Institution K	76%
Institution L	61%
Institution M	83%
Institution N	77%
Institution O	76%
Institution P	76%
Institution Q	94%
Institution R	63%
Institution S	71%
Institution T	83%
Institution U	50%

Qualitative Data Collection

In qualitative phase of the study, six institutions were selected to conduct interviews with administration and faculty. USG institutions are divided into four types of institutions. In 2016, when the study began, there were four research universities, four comprehensive universities, 10 state universities, and 10 state colleges which totaled 28 institutions (USG, 2016). Most of the research universities (Augusta University, Georgia Institute of Technology, and University of Georgia), Georgia College & State University, and the University of West Georgia do not offer learning support courses; therefore, this excluded them from this study. Permission to do research was denied at two institutions, leaving 21 institutions to potentially interview.

Three people, one administrator and two faculty members, were purposely selected from the two institutions within each category (comprehensive universities, state universities, and state colleges) having the highest and second highest Corequisite Model success rate. Individuals from one comprehensive universities and one of the state universities did not respond to interview requests via phone calls or emails. The comprehensive university was replaced with the fourth highest state university, as the remaining comprehensive university had a low success rate and potential biases for the researcher. The state university was replaced with the next highest institution in the category. Invitation emails were sent; participants received a cover letter via email that stated the purpose of the study and asked if the participant would be willing to be interviewed. The email included, via attachment, the results of the quantitative phase, the IRB informed consent document (Appendix A), and a copy of the interview questions.

Eighteen interviews—six administrators and 12 faculty members, were conducted. The only demographic data reported in this study are the individual's institution, position, and pseudonym. Reporting demographics such as gender, job title, or years of experience would risk the participants' anonymity. For this reason, all pseudonyms were made gender neutral. Data collection for the 18 interviews began at the end of August 2018 and continued over the course of a month.

The first 12 interviews took place during the last week of August 2018; the second round of interviews started in December of 2018, and the final six interviews were completed by the first of January 2019. To maintain anonymity, the institutions were assigned alphabet letters; the final six interviewed institutions were randomly coded from A to F, while the remaining 15 institutions were randomly coded G to U (see Table 3).

The date, time, and name of the interviewee were recorded for each interview, and a consistent interview protocol was followed to validate the process. Interview sessions took place over the phone and were recorded via audio, with written notes taken as well. Interviewees were probed during the interview to follow-up, expand, elaborate, or explain details to responses. Interviewees were thanked for their time and participation at the end of each interview. Participants of the interviews later reviewed the transcribed data to ensure the data were reliable. The potential themes and quotes were constructed into a chart to guarantee efficient and accurate coding. Interview participants were then invited to review the final themes and concepts to ensure that they adequately reflected the participants' opinions of the Corequisite mathematics program and practices.

All data and audio files for this study were kept on two password-protected USB drives in the researcher's secure office. Two USB drives were used in case damage occurred to one of the drives.

Data Analysis

Quantitative Analysis

The quantitative data collected were entered into the Statistical Package for Social Sciences (SPSS) software for analysis (Cronk, 2012). Participants employed at the same institution had their item responses averaged together as a single item response. The DEPS—CMAS has 19 items, and the DEPS—CMFS has 42 items. Two multiple regressions were generated for this study. The first multiple regression used the DEPS—CMAS as one independent variable and the DEPS—CMFS as the second independent variable. For the second regression equation, the DEPS—CMAS's items were divided into three subscales and the DEPS—CMFS's items into six subscales. The nine subscales were used as independent variables by calculating a summated score for each subscale. The independent variables were institutional adaptations, USG institutional implementations, institutional student requirements, faculty instructional practices, Ad Hoc instructional recommendations, classroom instructional practices, department instructional practices, instructional delivery methods, and instructional utilization. The dependent variable was calculated by averaging each institution's Corequisite success rate from the previous fall and spring semester.

Descriptive statistics. Descriptive statistics were provided so that readers can ascertain the nature of the sample in the interpretation of the results. The descriptive statistical analyses consisted of the minimum, maximum, mean, standard deviation, skew, and kurtosis for each subscale. The number and percentage of responses by item on the surveys were reported, as well as other appropriate descriptive statistics. Frequency and percentage were computed on the participants' demographic characteristics. All this information is presented in Chapter IV.

Multiple regression analysis. Multiple linear regressions are used to make the prediction of a Y value corresponding to a set of X values (McDonald, 2014). In this study, the Y value was the academic success rate of the Corequisite Model at individual USG institutions. The X values were the nine independent variables: faculty instructional practices, Ad Hoc instructional recommendations, classroom instructional practices, department instructional practices, instructional delivery methods, instructional utilization, institutional adaptations, USG institutional implementations, and institutional student requirements. Brace, Kemp, and Snelgar (2012) stated that an acceptable ratio was 10 participants to 1 independent variable (predictor); whereas Mertler and Vannatta (2013) recommended a ratio of 15 to 1. A standard multiple regression will not work with nine independent variables and the study's sample size. The sample size was the number of USG institutions surveyed ($n = 21$). Multiple regression requires a larger sample size. Under those guidelines, the study could only acceptably have two independent variables for multiple regression.

A standard multiple regression was computed using two predictors: institutional practices and instructional practices. The summative score of the DEPS—CMAS was used as the variable of institutional practices. The summative score of the DEPS—CMFS was used as the variable of instructional practices. Two forms of multiple regression analysis, backward stepwise selection and forward stepwise selection, can be used as long as the sample size is larger than the number of independent variables (James, Whitten, Hastie, & Tibshirani, 2013). James et al. (2013) warned that forward stepwise selection may include variables early in the process that later become redundant. Furthermore, they recommend running both selections and comparing the two models. Backward and forward stepwise selections were used to predict the relationship between the dependent and independent variables to determine what causes variation in the Corequisite academic success rate.

Backward stepwise selection starts by including all the variables in the model (Brace et al., 2012). The variable with the largest p-value is removed, and the remaining variables are recalculated for statistical significance. Then, the variable with the next largest p-value is removed, and the model readjusted again; the procedure continues, removing one variable at a time until only variables with statistically significant p-values remain. Forward stepwise selection is the opposite of backward stepwise selection. The model begins with no predictors, then adds variables to the model, one at a time, until the model has the highest adjusted R-squared. In statistics, R is a measure of the correlation between the observed value and the predicted value of the dependent variable (Mertler & Vannatta, 2013). R Square (R^2) indicates the proportion of the variance of the dependent variable that is predictable from the combination of independent variables.

Statistical assumptions. A standard multiple regression, backward stepwise selection, and forward stepwise selection were used when the statistical assumptions were met. As previously mentioned, backward and forward stepwise selections are forms of multiple linear regressions. The assumptions of a multiple regression are normality, linearity, and homoscedasticity of variance (James et al., 2013). Normality is the assumption that the data are normally distributed (Fields, 2009). This assumption was checked by reviewing skewness and kurtosis and by running Kolmogorov-Smirnov (K-S) test. The assumption of linearity assumes that there is a straight-line relationship between two variables (James et al., 2013). Linearity was checked by reviewing residuals plots, running a Durbin-Watson test to check for autocorrelation, and running Casewise diagnostics, which determines which cases have residuals three or more standard deviations away from the mean (Mertler & Vannatta, 2013). Outliers were identified by calculating Mahalanobis distance in a preliminary regression procedure and determining which cases exceed the chi-square criteria. Cook's Distance was generated to determine if any cases should be excluded from the study. The leverage values were also generated to discover which cases had an effect on the regression model (Mertler & Vannatta, 2013). Mertler and Vannatta (2013) reported, "Homoscedasticity is the assumption that the variability in scores for one continuous variable is roughly the same at all values of another continuous variable" (p. 35). Homoscedasticity was examined by constructing scatter plots to determine if there were larger residuals at certain values. If larger residuals are present, it would indicate a lack of homoscedasticity and violate the assumption. The effect size was calculated by running Cohen's f_2 after the data had been collected.

A fourth issue was whether the produced regression equation was reliable. Cross-validation must be conducted to ensure the model is valid (Mertler & Vannatta, 2013). One consideration of cross-validation is the sample size (n) compared to the number of predictors (k). As previously mentioned, in this study n = 21 and k = 9, which is not the recommended ratio for a standard multiple regression. The nine predictors were divided into two predictors to run a multiple regression. Backward and forward stepwise selection can be conducted as long as n > k (James et al., 2013).

Another way to accomplish cross-validation is by splitting the sample into two subsamples (Mertler & Vannatta, 2013). One subsample (training set) can be used to develop the equation, while the other is used to cross-validate it (testing set). The regression model is developed with the training set online; then, this model is used to predict the output values for the data in the testing set. The errors discovered are averaged together for a mean test set error which is used to evaluate the model. However, there were not enough data in this study to allow half of it to be held back for testing. This study used leave-one-out cross-validation (LOOCV) (Schneider, 1997). This validation method works in a similar process as above. Instead of creating a training set with half of n, it is created with n-1. The one sample left out was used as the testing set. This is repeated 21 separate times to calculate the average error of each model and compare the errors.

Qualitative Analysis

The qualitative data were 18 recorded interviews that were transcribed and organized into different types depending on the sources of the information. Transcripts of interviews where sorted by their USG institution. The transcribed interviews were sent back to the participants for member checking. Creswell (2014) defined member checking as a method of improving accuracy and validity by having participants check the authenticity of the work. After reviewing all the transcripts, field notes, and member checking, the data were analyzed and coded. Coding is the process of organizing the data by bracketing chunks of text and choosing a word (or code) to represent the category (Creswell, 2014). The coding process was used to generate descriptions and categories. Using Microsoft Word software, selected sections of the interview transcripts were highlighted and labeled with a key word. Comments were made on the highlighted sections. Categories were then made by clustering together similar but distinct data sections together. A constant comparative method was used to ensure each category had its distinctive characteristics; then, each category was compared and grouped into similar categories to make themes. (Ary et al., 2014). Not all the information was used in the findings, and the final result was six themes.

In Chapter 4, a detailed description is given of the discovered themes using multiple perspectives from individuals and quotations. The interconnecting themes are also discussed later in Chapter 4. The themes are compared with information discovered in the review of the literature and the quantitative surveys. The findings are interpreted by bringing out the meaning and developing plausible explanations. The interpreted findings are then related back to the research questions.

Summary

This chapter contained a discussion of the research design and procedures used in the study. The independent variables were institutional adaptations, USG institutional implementations, institutional student requirements, faculty instructional practices, Ad Hoc instructional recommendations, classroom instructional practices, department instructional practices, instructional delivery methods, and instructional utilization. The dependent variable was the percentage of students earning a grade of A, B, or C in Corequisite math courses from the Fall 2016 and Spring 2017 semesters for each USG institution. The population of interest in this study consisted of USG administrators and faculty who work with the Corequisite math model.

In the quantitative phase of the study, archival data were collected from a USG database which was used as the dependent variable. At the same time, the DEPS—CMAS and DEPS—CMFS were sent out to the target population. The participants completed an informed consent statement and the surveys on Qualtrics. In the qualitative phase, three individuals were interviewed from each of six institutions–the comprehensive universities, state universities, and state colleges with the highest, second highest, or third highest Corequisite Model success rate—totaling 18 interviews. Quantitative data were analyzed using SPSS through descriptive statistical analyses, standard multiple regression, forward stepwise regression, and backward stepwise regression. The qualitative data were collected, transcribed, member checked, revised, coded, and grouped into six themes so that a more comprehensive understanding of the strategies and techniques that contribute to the success of Corequisite math courses could be achieved.

Chapter IV

RESULTS

The purpose of this sequential, explanatory mixed-methods study was to identify key institutional and instructional practices of the Corequisite Model that lead to success (defined as grades of A, B, or C in the collegiate courses) of developmental math students enrolled at selected colleges and universities in the state of Georgia in 2017, as perceived by university administrators and faculty. During the quantitative phase of the study, data were collected over a four-month period using two questionnaires. Participants completed the online questionnaires on Qualtrics™, and their responses were analyzed in SPSS. During the qualitative phase of the study, data were collected via interviews over the course of two months.

The following are the research questions chosen to guide this study:

1. What are the responses of USG administrators and instructors to questions about institutional practices and instructional practices for the Corequisite math courses?
2. Is the implementation of instructional practices (faculty instructional practices, Ad Hoc instructional recommendations, classroom instructional practices, department instructional practices, instructional delivery methods, instructional utilization) or the implementation of institutional practices (institutional adaptations, USG

institutional implementations, institutional student requirements) significant predictors of academic success in Corequisite math courses in USG institutions?

3. What specific instructional strategies and institutional strategies were identified through interviews with administrators and instructors from institutions earning the highest success rates with Corequisite Math courses as having a direct effect on study success?

This chapter presents the data analysis, the results of the questionnaires, and a detailed explanation of responses gathered during the interviews. The first section of this chapter is the quantitative results section which is comprised of the following subsections: Demographic Characteristics, Item-Level Descriptive Statistics, Scale Descriptive Statistics, and Multiple Regression Assumptions and Analysis. The second part of this chapter is the qualitative results section which will share information gathered from interviews with the participants and is organized by subsections labeled by individual interview questions. The third section of this chapter reveals the six themes or best practices that emerged from the study, and the chapter concludes with a summary.

Quantitative Results

The following are the results from statistical tests that were run using the data gathered from the DEPS—CMAS and DEPS—CMFS. Both surveys can be viewed in Appendix B and C. The data were analyzed using SPSS and Microsoft Excel. Information gleaned from this phase of the study provided answers to Research Question #1 and Research Question #2.

Demographic Characteristics

At the time of data collection, there were 28 USG institutions. Augusta University, Georgia Institute of Technology, Georgia College & State University, University of Georgia, and the University of West Georgia do not offer learning support courses, which eliminated them from this study. Permission to conduct research was not granted at two other USG institutions which also excluded them from this study.

Permission to research was obtained from the remaining 21 USG institutions. A total of 1,127 Qualtrics surveys were sent via email link, and 165 responses were received. Of the 165 that were received, 53 were from administrators, and 112 were from faculty. All surveys were usable for analysis. On the survey, participants were asked four demographic questions—gender, years of experience, job title, and their employing USG institution. Using the information gathered from the demographic questions on the DEPS—CMAS, individual characteristics of the sample of the administrators are presented in Table 4. Using the information gathered from the demographic questions on the DEPS—CMFS, characteristics of the sample of faculty are presented in Table 5.

Table 4

Number and Percentage of USG Administrators by Demographic Characteristic

Demographic Characteristics	Values	*n*	%
Gender	Male	21	39.6
	Female	32	60.4
	Other	0	0
Years of Experience	0-4 Years	11	20.8
	5-9 Years	11	20.8
	10+ Years	31	58.5
Job Title	Academic Support Counselor or Advisor	14	26.4
	Administrator	12	22.6
	School Head, Chair, or Dean	8	15.1
	Other	19	35.8

Table 5

Number and Percentage of USG Faculty by Demographic Characteristic

Demographic Characteristics	Values	*n*	%
Gender	Male	41	36.6
	Female	70	62.5
	Other	1	0.9
Years of Experience	0-4 Years	10	9.0
	5-9 Years	22	19.6
	10+ Years	80	71.4
Job Title	Adjunct Faculty	32	28.6
	Faculty	68	60.7
	Department Head	12	10.7

Item- Level Descriptive Statistics

To gather information related to USG administrator questions in Research Question #1 about institutional practices and instructional practices for the Corequisite math courses, the DEPS—CMAS was sent to department chairs, deans, and administration. The DEPS—CMAS contains 19 ordered-response items about the level of implementation of institutional practices in the Corequisite Model. The 19 items are separated into the following three subscales: Institutional Adaptations, USG Institutional Implementations, and Institutional Student Requirements.

The subscale of Institutional Adaptations consists of the first seven items comprised from the literature review of best practices. Table 6 presents the number and percentage of responses for each item as well as the median, mean, and standard deviation. Nine administrators (17%) and 33 administrators (63%) reported partial or full implementation, respectively, of an early alert system to alert staff of students who needed help. The majority of administrators (92%) reported full implementation of a tutoring center at their institutions. At the same time, only a third (35%) reported requiring the tutors to receive subject training or certification such as by the College Reading and Learning Association (CRLA).

Table 6

Number and Percentage of Responses and Descriptive Statistics by Item for Institutional Adaptations

	Item	1[a]	2	3	4	5	*Mdn*	*M*	*SD*
1	The institution... - Clearly defines REQUIRED student learning outcomes for each Corequisite Support math course.	1 (2%)	1 (2%)	3 (6%)	7 (14%)	38 (76%)	5.00	4.60	0.857
2	Clearly defines REQUIRED student learning outcomes for each collegiate-level math course.	1 (2%)	1 (2%)	2 (4%)	5 (10%)	41 (82%)	5.00	4.68	0.819
3	Elects to decentralize management and support services for Corequisite courses (developmental education is assigned to the English and mathematics departments).	8 (18%)	2 (5%)	1 (2%)	10 (23%)	23 (52%)	5.00	3.86	1.549
4	Allows late registration for students.	10 (19%)	1 (2%)	4 (8%)	5 (10%)	32 (61%)	5.00	3.92	1.595
5	Implements an "early warning" system to alert administrators or counselors about students who need extra help.	6 (12%)	2 (4%)	2 (4%)	9 (17%)	33 (63%)	5.00	4.17	1.368
6	Implements an academic assistance center where tutoring is offered.	2 (4%)	0 (0%)	0 (0%)	2 (4%)	49 (92%)	5.00	4.81	0.786
7	Requires peer tutors to receive subject training or certification such as by the College Reading and Learning Association.	17 (35%)	2 (4%)	2 (4%)	11 (22%)	17 (35%)	4.00	3.18	1.752

Note. [a] 1 (*No Implementation*), 2 (*Under discussion*), 3 (*Marginal Implementation*), 4 (*Partial Implementation*), and 5 (*Full Implementation*). Percentages above are rounded to the nearest whole number.

The subscale of USG Institutional Implementations is composed of six items. These items were taken from the USG Mathematics Task Force recommendations (2013).

The majority of administrators (56%) reported their institutions do not engage in the process of certifying with the National Association of Developmental Education. Forty-seven participants reported their institutions have fully implemented placement tests.

Table 7

Number and Percentage of Responses and Descriptive Statistics by Item for Institutional Implementations

	Item	1[a]	2	3	4	5	*Mdn*	*M*	*SD*
1	The institution...Aligns the outcomes of gateway mathematics courses with the Common Core Georgia Performance Standards (CCGPS) for Mathematics.	8 (20%)	3 (7%)	4 (10%)	5 (12%)	21 (51%)	5.00	3.68	1.619
2	Develops advising systems and protocols for placing students in gateway mathematics courses and Corequisite supports that align with their intended programs of study.	6 (12%)	0 (0%)	0 (0%)	10 (20%)	35 (69%)	5.00	4.33	1.291
3	Actively engages in the process for certification of its developmental education program and services with the National Association of Developmental Education.	23 (56%)	2 (5%)	2 (5%)	6 (15%)	8 (20%)	1.00	2.37	1.699
4	Integrates Corequisite support students and non-support students in gateway courses.	8 (16%)	1 (2%)	2 (4%)	7 (14%)	31 (63%)	5.00	4.06	1.506
5	Advises students to take 15-credit hours per fall and spring semester	4 (7%)	1 (2%)	5 (9%)	13 (24%)	28 (52%)	5.00	4.18	1.195
6	Implements placement exams such as ACCUPLACER for students who do not place with their high school GPA, SAT, or ACT scores.	1 (2%)	1 (2%)	1 (2%)	1 (2%)	47 (92%)	5.00	4.80	0.749

Note. [a] 1 (*No Implementation*), 2 (*Under discussion*), 3 (*Marginal Implementation*), 4 (*Partial Implementation*), and 5 (*Full Implementation*). Percentages above are rounded to the nearest whole number.

The subscale of Institutional Student Requirements is also composed of six items. These practices were a mixture of the original DEPS—MS and best practices identified in the literature review. A majority of participants (73%) reported that students are required to attend orientation; whereas, nearly half of the participants (49%) reported their students are required to participate in a study skills or success course (freshman seminar).

Table 8

Number and Percentage of Responses and Descriptive Statistics by Item for Institutional Student Requirements

	Item	1[a]	2	3	4	5	*Mdn*	*M*	*SD*
1	Students in the Corequisite Model are encouraged or required to... - Take fewer hours if they are employed full-time.	8 (16%)	3 (6%)	12 (24%)	12 (24%)	15 (30%)	4.00	3.46	1.403
2	Take a full-load.	6 (12%)	0 (0%)	7 (14%)	14 (27%)	24 (47%)	4.00	3.98	1.304
3	Participate in mandatory advising or counseling.	8 (16%)	0 (0%)	2 (4%)	7 (14%)	34 (67%)	5.00	4.16	1.461
4	Participate in a college orientation.	5 (10%)	0 (0%)	4 (8%)	5 (10%)	38 (73%)	5.00	4.37	1.253
5	Participate in a study skills or success course (freshman seminar).	12 (24%)	2 (4%)	8 (16%)	4 (8%)	25 (49%)	4.00	3.55	1.665
6	Be assessed on their technology skills if they are enrolled in an online course.	24 (48%)	3 (6%)	10 (20%)	4 (8%)	9 (18%)	2.00	2.42	1.579

Note. [a] 1 (*No Implementation*), 2 (*Under discussion*), 3 (*Marginal Implementation*), 4 (*Partial Implementation*), and 5 (*Full Implementation*). Percentages above are rounded to the nearest whole number.

In order to gather information related to the instructor questions in Research Questions #1, the DEPS—CMFS was sent to adjunct faculty, full-time faculty, and department heads. The survey contains 42 items that solicit data on the level of implementation of instructional practices. The 42 items are separated into the following six subscales: (1) Faculty Instructional Practices (nine items), (2) Ad Hoc Instructional Recommendations (four items), (3) Classroom Instructional Strategies (seven items), (4) Department Instructional Practices (seven items), (5) Instructional Delivery Methods (nine items), and (6) Instructional Utilization (six items). These practices were from the original DEPS—MS, USG Mathematics Ad Hoc Committee recommendations (2014), and from the literature review of best practices.

The majority (over 75%) of faculty members reported partially or fully implementing the practices in their Corequisite Models:

- Focusing support on material closely linked to matter being covered in the gateway course at the same time;
- Returning timely feedback to students so they can revise their knowledge before examinations;
- Testing collegiate mathematics courses at least four times a semester;
- Delivering the support Corequisite course instruction as in-class lectures;
- Providing frequent feedback on students' academic performance;
- Utilizing technology and media in the class and;
- Utilizing tutoring and a math learning center to support student learning.

Table 9

Percentage of Responses and Descriptive Statistics by Item for Instructional Practices

	Item	1[a]	2	3	4	5	*Mdn*	*M*	*SD*
1	Faculty members have... - Developed common criteria or rubrics that are used to assess and document each student's level of proficiency in required learning outcomes.	12 (11%)	15 (13%)	20 (18%)	21 (19%)	44 (39%)	4.00	3.63	1.396
2	Focused the support on material closely linked to material being covered in the gateway course at the same time.	7 (6%)	5 (5%)	11 (10%	29 (26%	59 (53%)	5.00	4.15	1.169

Table 9 (Cont'd)

Percentage of Responses and Descriptive Statistics by Item for Instructional Practices

	Item	1[a]	2	3	4	5	*Mdn*	*M*	*SD*
3	Created a team of faculty composed of academic math and developmental members who attend the support and collegiate courses.	28 (25%)	8 (7%)	14 (13%)	19 (17%)	41 (37%)	4.00	3.34	1.633
4	Implemented low- or no-cost educational resources in their courses.	12 (11%)	13 (12%)	25 (23%)	29 (26%)	32 (29%)	4.00	3.50	1.313
5	Been assessed on their technology skills if they are enrolled in an online course.	57 (54%)	7 (7%)	17 (16%)	8 (8%)	16 (15%)	1.00	2.23	1.533
6	Engaged in appropriately challenging and natural, authentic tasks that involve active problem solving.	13 (12%)	8 (7%)	34 (30%)	33 (29%)	24 (21%)	4.00	3.42	1.235
7	Connected new learning with students' prior knowledge in ways that address well-documented common misconceptions and that anchor new concepts in existing competencies.	12 (11%)	12 (11%)	26 (23%)	37 (33%)	24 (22%)	4.00	3.44	1.248
8	Received timely professional feedback from peers so they can revise their methods.	24 (22%)	12 (11%)	24 (22%)	28 (25%)	22 (20%)	3.00	3.11	1.429
9	Returned timely feedback to students so they can revise their knowledge before examinations.	3 (3%)	2 (2%)	12 (11%)	39 (35%)	55 (50%)	4.00	4.27	0.924
10	The institution has... - The same instructor teach the support and collegiate course.	8 (7%)	16 (14%)	17 (15%)	35 (31%)	36 (32%)	4.00	3.67	1.262
11	Kept linked support class sizes under 15-22 students to allow for more one-on-one instruction.	19 (17%)	7 (6%)	11 (10%)	23 (21%)	52 (46%)	4.00	3.73	1.513
12	Incorporated mandatory attendance as part of the grade in the support course.	20 (18%)	10 (9%)	11 (10%)	25 (22%)	46 (41%)	4.00	3.60	1.527

Table 9 (Cont'd)

Percentage of Responses and Descriptive Statistics by Item for Instructional Practices

	Item	1[a]	2	3	4	5	*Mdn*	*M*	*SD*
13	Incorporated critical thinking concepts and methods into the Corequisite mathematics curriculum.	12 (11%)	2 (2%)	33 (30%)	37 (33%)	27 (24%)	4.00	3.59	1.194
14	Students enrolled in ... - Collegiate mathematics courses are tested at least 4 times a semester.	7 (6%)	1 (1%)	11 (10%)	24 (21%)	67 (61%)	5.00	4.30	1.113
15	Support classes are frequently engaged in self-assessment and reflection on their learning processes and goals	14 (13%)	1 (1%)	41 (37%)	26 (24%)	28 (25%)	3.00	3.48	1.247
16	The Corequisite Model are provided with up-to-date and accessible information regarding academic support programs.	11 (10%)	1 (1%)	28 (26%)	23 (21%)	46 (42%)	4.00	3.84	1.271
17	Math support class are assigned homework in the support class.	19 (17%)	1 (1%)	21 (19%)	20 (18%)	48 (44%)	4.00	3.71	1.474
18	Math support class take unit exams in the support class.	50 (46%)	0 (0%)	11 (10%)	16 (15%)	32 (29%)	3.00	2.82	1.775
19	Math support class take a midterm in the support class.	65 (60%)	0 (0%)	13 (12%)	11 (10%)	20 (18%)	1.00	2.28	1.649
20	Math support class take a final exam in the support class.	54 (49%)	0 (0%)	7 (6%)	11 (10%)	38 (35%)	2.00	2.81	1.855
21	The mathematics division or department systematically utilizes... - Cooperative learning in its Corequisite Model.	20 (19%)	8 (8%)	26 (25%)	28 (27%)	23 (22%)	2.00	3.25	1.392
22	Collaborative learning in its Corequisite Model.	20 (19%)	8 (8%)	26 (25%)	27 (26%)	23 (22%)	2.00	3.24	1.397
23	Learning communities in its Corequisite Model.	41 (39%)	16 (15%)	18 (17%)	14 (13%)	17 (16%)	1.00	2.53	1.507

Table 9 (Cont'd)

Percentage of Responses and Descriptive Statistics by Item for Instructional Practices

	Item	1[a]	2	3	4	5	*Mdn*	*M*	*SD*
24	Contextual learning in its Corequisite Model.	25 (24%)	12 (12%)	26 (25%)	20 (19%)	20 (19%)	2.00	2.98	1.442
25	Mastery learning in its Corequisite Model.	22 (22%)	8 (8%)	28 (27%)	20 (20%)	24 (24%)	2.00	3.16	1.440
26	Problem based learning in its Corequisite Model.	18 (17%)	8 (8%)	28 (27%)	26 (25%)	25 (24%)	2.00	3.30	1.374
27	Curriculum and teaching strategies that align with required student learning outcomes.	7 (7%)	8 (8%)	20 (19%)	32 (31%)	37 (36%)	3.00	3.81	1.199
28	The institution delivers the support Corequisite course instruction as... - In-class lectures.	6 (6%)	0 (0%)	6 (6%)	31 (29%)	63 (59%)	5.00	4.37	1.017
29	Online methods.	27 (24%)	0 (0%)	12 (12%)	35 (34%)	30 (29%)	4.00	3.39	1.548
30	Hybrid (in-class and online).	41 (41%)	0 (0%)	16 (16%)	13 (13%)	31 (31%)	4.00	2.93	1.734
31	Emporium model.	57 (63%)	0 (0%)	14 (15%)	6 (7%)	14 (15%)	1.00	2.12	1.562
32	The institution delivers the support Corequisite course instruction as... - Non-course based instruction.	65 (71%)	0 (0%)	12 (13%)	6 (7%)	8 (9%)	1.00	1.81	1.374
33	Self-paced instruction.	47 (48%)	0 (0%)	20 (20%)	15 (15%)	16 (16%)	3.00	2.52	1.588
34	Individualized instruction.	37 (36%)	0 (0%)	31 (30%)	21 (20%)	15 (14%)	3.00	2.78	1.474
35	Modules.	37 (37%)	0 (0%)	16 (16%)	19 (19%)	29 (29%)	3.00	3.03	1.682
36	Immersion.	51 (55%)	0 (0%)	15 (16%)	15 (16%)	12 (13%)	1.00	2.32	1.562
37	The mathematics division or department utilizes... - Study skills workshops in its Corequisite Model.	28 (27%)	7 (7%)	0 (0%)	52 (50%)	18 (17%)	4.00	3.30	1.475
38	Frequent provision of feedback on students' academic performance in its Corequisite Model.	10 (10%)	2 (2%)	0 (0%)	51 (49%)	42 (40%)	4.00	4.08	1.131

Table 9 (Cont'd)

Percentage of Responses and Descriptive Statistics by Item for Instructional Practices

	Item	1[a]	2	3	4	5	*Mdn*	*M*	*SD*
39	Technology and media to support student learning in its Corequisite Model.	8 (8%)	1 (1%)	0 (0%)	43 (41%)	53 (50%)	4.50	4.25	1.070
40	Supplemental instruction in its Corequisite Model.	14 (13%)	6 (6%)	37 (36%)	46 (44%)	1 (1%)	3.00	4.00	1.329
41	Tutoring in its Corequisite Model.	8 (8%)	5 (5%)	0 (0%)	45 (43%)	47 (45%)	4.00	4.17	1.078
42	A math learning center in its Corequisite Model.	19 (18%)	1 (1%)	6 (6%)	27 (26%)	50 (49%)	4.00	3.85	1.498

Note. [a] 1 (*No Implementation*), 2 (*Under discussion*), 3 (*Marginal Implementation*), 4 (*Partial Implementation*), and 5 (*Full Implementation*). Percentages above are rounded to the nearest whole number.

Scale Descriptive Statistics

Items within each scale were added together for a total score. The nine variables used for the forward stepwise and backward stepwise regression had means that ranged from 14.6 to 31.3 (See Table 12). Descriptive statistics indicated the overall mean for the total administrators' practices scores was $M = 77.9$ ($SD = 8.55$). The overall mean for the total faculty practices was $M = 138.5$ ($SD = 23.1$). The success rate dependent variable ranged from 50% to 89% with a mean score of 73% ($SD = 11\%$).

A correlation matrix was generated to examine the correlations among the following three variables for the standard multiple regression model: Total Administrator Practices, Total Faculty Practices, and Success Rate. The relationships among the variables were assessed using the Pearson correlation coefficient (see Table 10). Correlations among the variables ranged from -.09 to -.15. The analysis revealed that no variables were significantly correlated.

Table 10

Correlations among Variables Total Scores for Multiple Regression

Variable	1	2	3
Total Administrator Practices	1.00		
Total Faculty Practices	-.15	1.00	
Success Rate	-.09	-.04	1.00

Another correlation matrix was generated to examine the relationships among the following 10 variables for the forward stepwise and backward stepwise regression models: Institutional Adaptions, USG Task Force Recommendations, Institutional Requirements, Faculty Practices, Ad Hoc Committee Recommendations, Classroom Practices, Department Strategies, Delivery Methods, Instructional Utilizations, and Success Rate. The relationships among the variables were assessed using the Pearson correlation coefficient (see Table 11).

Correlations among the variables ranged from .81 to -.27. A strong, positive correlation was found between Institutional Adaptations and USG Task Force Recommendations, r (21) = .74, $p < .001$, indicating that as the Institutional Adaptations total score increased, the USG Task Force Recommendations total score also increased. The Faculty Practices variable was significantly correlated with all other instructional variables, but not with the institutional variables. A moderate, positive correlation was found between Ad Hoc Recommendations and Department Strategies, r (21) = .45, p = .04, and Ad Hoc Recommendations and Instructional Utilizations, r (21) = .45, p = .04. This indicates that as the Ad Hoc Recommendations total score increased, Department Strategies total score and Instructional Utilizations total score also increased.

Table 11

Correlations among Variables Total Scores for Forward and Backward Stepwise Regression

Variable	1	2	3	4	5	6	7	8	9	10
Institutional Adaptations	1.00									
USG Task Force RECS***	.74**	1.00								
Institutional Requirements	-.07	.21	1.00							
Faculty Practices	-.09	-.17	-.12	1.00						
Ad Hoc REC	-.16	.08	.20	.46*	1.00					
Classroom Practices	-.25	-.22	-.02	.60**	.33	1.00				
Department Strategies	-.13	-.11	-.20	.68**	.45*	.81**	1.00			
Delivery Methods	-.06	.06	-.15	.59**	.18	.57**	.50*	1.00		
Instructional Utilization	-.05	-.13	-.15	.77**	.45*	.75**	.77**	.57**	1.00	
Success Rate	-.25	-.14	.22	.15	.17	-.08	-.03	-.27	-.05	1.00

Note. *p < .05, **p < .01, ***Recommendations is abbreviated as REC.

The strongest positive correlation was found between Classroom Practices and Department Strategies, r (21) = .81, p < .001, indicating that as Classroom Practices total score increased, Department Strategies total score increased. The Classroom Practices variables also had a strong, positive correlation with Instructional Utilizations, r (21) = .75, p < .001 and a moderate, positive correlation with Delivery Methods, r (21) = .57, p < .001. Additionally, Department Strategies had a moderate, positive correlation to Delivery Methods, r (21) = .50, p = .02, and a strong, positive correlation to Instructional Strategies, r (21) = .77, p < .001. Lastly, there was a moderate, positive correlation between Delivery Methods and Instructional Utilizations, r (21) = .57, p < .001.

Multiple Regression Assumptions and Analysis

Items within each scale were added together to derive a total score. The data were checked for missing values by examining the frequency distribution of each subscale. There were three institutions with incomplete data. Institution D was missing all the items from the USG Task Force Recommendations subscale. Institution T was missing two out of six items from the USG Task Force Recommendations subscale. Institution K was missing one item from the USG Task Force Recommendations and one item from the Institutional Requirements subscale.

Multiple imputation is a statistical strategy used to deal with data sets which are missing values. The multiple imputation procedure "replaces each missing value with a set of plausible values that represent with uncertainty about the right value to impute" (Yuan, 2016, p. 267). Multiple imputation can only be used if the data are missing at random. Little's Missing Completely At Random (MCAR) test resulted in $p = .986$. Because the significant is greater than .05, it can be concluded that the data are missing at random (Garson, 2015).

For Institutions K and T, five imputations were conducted. The four missing items were replaced with the median of the numbers generated from the imputations. The median of each item was 2. Institution D was imputed after the items were totaled together into subscales. This was done to reduce introducing error. The institution's total score for USG Task Force Recommendations was imputed 10 times. The missing subscale was replaced with the mean of the imputations which was 21.7.

Each variable was evaluated for outliers by inspecting z-scores and calculating Mahalanobis distance in a preliminary regression procedure and determining which cases exceed the chi-square criteria. Subscale scores were converted to z-scores to mathematically assess for outliers. The z-scores were analyzed for outliers using a cutoff z-score of 3.5 and -3.5, and there were no outliers. The closest score was -3.20 in the Total Administrator Practices subscale at Institution J. This data point was left in the data set. Calculating Mahalanobis distance based on a chi-square distribution resulted in p values $< .001$, which indicated there were no outliers in the data set.

After checking for missing data and outliers, the statistical assumptions were checked. The statistical assumptions for a multiple regression model are normality, linearity, and homoscedasticity of variance. Normality was evaluated by reviewing skewness and kurtosis and by running a Kolmogorov-Smirnov (K-S) test. Normal skewness and kurtosis values were within the range of -1 to 1. Significant, negative skewness values were found on two variables—Institutional Adaptions and the Total Administrator Practices. Significant kurtosis values were also found on Institutional Adaptions, Classroom Practices, and Total Administrator Practices (See Table 12).

Further analysis through the K-S test indicated normal distribution for USG Task Force Recommendations, D(21) = .07, p = .20, Institutional Requirements, D(21) = .011, p = .20, Faculty Practices, D(21) = .11, p = .20, Department Strategies, D(21) = .12, p = .20, Delivery Methods, D(21) = .15, p = .20, Instructional Utilization, D(21) = .12, p = .20, Total Administrator Practices, D(21) = .13, p = .20, and Total Faculty Practices, D(21) = .13, p = .20. However, the K-S test results for Institutional Adaptions, D(21)= .20, $p < .05$, and Ad Hoc Recommendations, D(21) = .20, $p < .05$ rejected the null hypothesis which indicates the variables are not normally distributed. The assumption of normality was not met.

Table 12

Descriptive Statistics of DEPS—CMAS and DEPS—CMFS Total Scores

Variable	*M*	*SD*	*Minimum*	*Maximum*	Skewness	Kurtosis
Institutional Adaptations	28.6	4.0	19.0	33.0	-1.05	.34
USG Task Force REC	22.9	4.1	12.5	30.0	-.51	.71
Institutional Requirements	26.4	3.5	18.4	31.2	-.83	0.43
Faculty Practices	31.3	5.8	18.2	41.5	-.23	.52
Ad Hoc Recommendations	14.6	2.8	7.5	18.8	-.82	.71
Classroom Practices	22.8	5.9	11.7	32.5	-.13	-1.10
Department Strategies	21.7	5.1	10.0	30.0	-.57	.00
Delivery Methods	25.1	5.1	14.5	33.0	-.69	-.18
Instructional Utilization	23.2	3.5	13.8	28.5	-.72	1.11
Total Admin. Practices	77.9	8.55	50.5	90.5	-1.57	4.29
Total Faculty Practices	138.5	23.1	84.8	183.5	-.38	.32

Note. $n = 21$

To achieve normality, the variables were transformed. The first step was to anchor each scale to 1.0. This was accomplished by taking the difference of the total score plus one and the total score. The Box-Cox power transformation was then used to transform the variables. The Box-Cox method is a way "to modify the distributional shape of a set of data to be more normally distributed so that tests and confidence limits that require normality can be appropriately used" (NCSS, 2018, p. 1).

By utilizing the Box-Cox method, the optimal transformation for each variable was determined by checking each lambda value from -2.5 to 2.5 by increasing at a rate of 0.1 until the values of skewness and kurtosis were at their lowest. Each variable had a lambda value for the data transformation process as follows: Faculty Instructional Practices $\lambda = 0.9$, Ad Hoc Instructional Recommendations $\lambda = 0.4$, Classroom Instructional Practices $\lambda = 0.7$, Department Instructional Practices $\lambda = 0.6$, Instructional Delivery Methods $\lambda = 0.5$, Instructional Utilization $\lambda = 0.6$, Institutional Adaptations $\lambda =$

0.1, USG Institutional Implementations λ = 0.7, Institutional Student Requirements λ = 0.4, and Success Rate λ = 0.4. The lambda values were also computed for the Total Administration Practices score and Total Faculty Practices score which were the variables to be used in the standard multiple regression. Those values were 0.4 and 0.8 respectively. Assumption of normality was reanalyzed with the transformed data, and the skewness and kurtosis levels were in normal range (see Table 13). The data values were then reflected back to the original order of the variable.

Table 13

Descriptive Statistics of DEPS—CMAS and DEPS—CMFS Total Scores Transformed

Variable	*M*	*SD*	*Minimum*	*Maximum*	Skewness	Kurtosis
Institutional Adaptations	2.6	0.9	1.0	4.1	0.02	-0.90
USG Task Force REC	6.0	2.2	1.0	10.6	-0.01	0.25
Institutional Requirements	3.3	1.2	1.0	5.6	0.01	-0.38
Faculty Practices	11.0	4.6	1.0	19.5	-0.04	0.43
Ad Hoc Recommendations	3.2	1.1	1.0	5.3	0.05	-0.08
Classroom Practices	6.1	3.0	1.0	11.9	0.16	-0.97
Department Strategies	5.2	2.1	1.0	9.7	-0.01	-0.23
Delivery Methods	4.1	1.8	1.0	7.8	-0.01	-0.25
Instructional Utilization	4.9	1.7	1.0	8.0	-0.05	0.00
Total Admin. Practices	5.3	1.8	1.0	9.5	0.06	1.36
Total Faculty Practices	24.5	11.0	1.0	49.4	0.02	0.45

Note. $n = 21$

Linearity was checked by reviewing residuals plots, running a Durbin-Watson test to check for autocorrelation, and running Casewise diagnostics. The residual plot between predicted values and standardized residuals values showed linearity. The Durbin-Watson test resulted in a value of 2.3 which indicated that there was little to no autocorrelation in the dataset. The Casewise diagnostics revealed no residuals more than three standard deviations away. Homoscedasticity was examined by constructing scatter plots. The residual scatter plots showed the variability in the data points were roughly the same.

To determine whether the utilization specific institutional and specific instructional strategies could be identified as significant predictors of academic success in Corequisite math courses in USG institutions, three types of regression models were run after the assumptions of the model were met to answer Research Question #2. A standard multiple regression was computed using two predictors—Total Administrator Practices score and Total Faculty Practices score. The multiple regression analysis was used to test whether or not the summative institutional practices and summative instructional practices were predictors of Corequisite students' success rate. The results of the regression indicated that the two predictors explained 01.1% of the variance ($R^2 = .01, F(2,18) = 0.10, p = .94$), which is not significant.

The two other types of regression used were a forward stepwise selection and a backward stepwise selection using all nine subscales as independent variables. Backward stepwise selection starts by including all the variables in the model (Brace et al., 2012). The variable with the largest p-value will be removed, and the remaining variables will be recalculated for statistical significance. Then the variable with the next largest p-value will be removed, and the model readjusted again; the procedure continues, removing one variable at a time until only variables with statistically significant p-values remain. Forward stepwise selection is the opposite of backward stepwise selection. The model begins with no predictors, and then adds variables to the model, one at a time, until the model has the highest adjusted R-squared.

The forward stepwise regression did not produce any results, as no variables could be added to the model to produce significance. The backward selection regression produced an equation with two subscales—Faculty Practices and Delivery Methods. The results of the regression indicated the two predictors explained 22.5% of the variance ($R^2 = .23, F(2,18) = 2.61, p = .10$). This is also not significant. The Cohen's f^2 indicated a small effect size ($f^2 = 0.30$). The analysis indicated there was no significant difference between implementing institutional or instructional practices and the institution's Corequisite success rate.

Qualitative Results

During the second phase of this study, the perceptions of faculty and administrators were sought regarding the Corequisite Math process at the most successful comprehensive universities, state universities, and state colleges within the USG system. The sequential explanatory design used in this study was chosen to provide more in-depth information on the quantitative findings. Since no significant findings were found, the qualitative portion became more crucial to this study in seeking to understand what specific practices yield student success for the Corequisite math model. Information gathered in this phase of the study was used to answer Research Question #3 and will be reported in the following sub-sections.

Interview participants were provided with a list of the six interview questions, a copy of the quantitative results, and an informed consent document before each phone interview. To ensure that interviewees understood the foundation behind each question in the qualitative phase, the results of portions of the quantitative phase were provided beside each interview question.

Interview recordings were transcribed, member checked, and then coded. The following is a compilation of the 18 participants' responses to interview questions organized by the six individual interview questions.

Interview Question 1

Your school was found to have one of the highest mathematics Corequisite success rate in the USG system: What practices do you think have contributed to this success?

Institution A. Alex and Bailey stated having their support course as three-credit hours, having the same instructor for the support and gateway course, requiring new students to attend orientation, having all learning support students meet together for advisement and registration rather than meet with their major department, devoting staff to handle specific interventions for struggling students, and a walk-in tutoring center as the practices that contributed to their institution's high success rate. Ashton, the third participant from Institution A, did not believe the Corequisite Model was working for the institution. The participant said,

> To me as an instructor on the front lines (so to speak), it is not clear that the model is doing anything positive for the student—especially the student with less than average mathematical skills or the non-traditional student attending college after many years away from the academic setting.

Institution B. Participants from Institution B (Cameron, Casey, and Dakota) listed the following as factors of their institution's success: late registration, an early-alert warning system, the walk-in tutoring center, an end-of-semester party with study guides, faculty involvement for finals, working with Pearson to set up coordinator courses on MyMathLab for Quantitative Reasoning and College Algebra to ensure consistency across the corequisite classes, and a common final exam. Casey added that the MyMathLab course helped show students underlying skills needed to pass a college-level math course such as numeracy and study skills. A unique feature of Institution B was when the students took their remedial courses. Dakota reported,

> We allow students with both LS math and LS English requirements to start their LS Math required class in the spring. We feel this helps by lessening their first-semester load and increases their likelihood for success in math with more maturity or study skills, etc.

Institution C. Participants from Institution C (Dallas, Hayden, and Jamie) all indicated dedicated faculty and staff as the reasons for the students' success rates. Dallas stated, "I think having the same instructors for both the class and the support component has been a big help." Hayden agreed,

> Having the credit level class and the support right after with the same instructor is the way to go. That way if the student has a question in support about something mentioned in the college-level course, then they have the same instructor there to answer any questions.

Jamie answered the interview question without hesitation: "I think it was the faculty's desire to do well and trying different things in their own classroom, together as a department but also individually, to change our success rates."

Institution D. Participants from Institution D (Jody, Kerry, and Lee) reported similar practices as the previous participants: same instructor for the support and gateway course, tutoring, and an early alert system. Uniquely mentioned at this institution was emphasis on embedded tutoring in classes with high DWF rates and tracking student attendance. Lee said, "The kids who stick with tutoring have higher pass rates at midterms and at the end. And we really stay on the kids, too. We track their attendance in class and on D2L."

Institution E. Morgan and Nico reported the importance of instructors to their institution's success. Nico, a faculty member, declared hands-on learning to be the most important practice. "I would lecture the first 30 to 40 minutes or so. We would then practice what we learned right after it was taught." Morgan stated,

> I think the dedication and mindset of the instructors is key. We recruited and hired staff (credentialed as faculty) who had an interest and experience teaching developmental education. They were told it was their primary purpose, and we selected staff who would hold the students to a high standard in the support courses but could also understand when a student needed a little more support.

Morgan added their institution also implemented embedded tutoring where tutors came to their classes and allowed for more one-on-one working time with the students as well as promoting the tutoring center. Nico and Morgan both indicated the faculty were dedicated to their students; that faculty members spent many hours outside of the class working one-on-one with students during the instructors' office hours.

Institution F. Participants from Institution F (Quinn, Riley, and Tory) listed many practices that contributed to their institution's success rate. Quinn and Riley, both faculty members, listed the following:

- small student-to-teacher ratio to provide each student with high-quality instruction;
- having the same instructor for the support and gateway course;
- incorporating foundation-level lessons into support;

- providing worksheets to establish a uniform level of instruction across campuses and;
- piloting new ideas in the support class.

An administrator from the institution (Tory) also stated similar points. "Students need the same instructor. I think having the most experienced faculty teach these classes has helped, too." Tory also pointed out the importance of tutoring as a center as well as embedded in the class. The participant also said the linked support and gateway course should only be filled with students in support.

Interview Question 2

In the <u>*institutional*</u> *area, what do you think are important factors towards your institution's success that were not mentioned in the survey? i.e, Demographics, admission requirements, grant funding, having the students take nine hours in their major in the first year, etc.*

Institutions A, C, E, and F. Six participants (Morgan, Jamie, Alex, Tory, Nico, Quinn, and Riley) felt that demographics played a part in the institutional area of their institution's success. Morgan believed demographics played a role but was uncertain how that would affect the success rate. Jamie and Alex were both surprised their institutions did so well as the success rate did not match up to their perceived current pass rates. Jamie said, "Honestly, it may have just been that group of students."

Institution F. Tory, Riley, and Quinn all reported demographics of their student population (learning support versus non-learning support) caused their success rates to be quite high. The participants stated the majority of their students were in learning support. Riley said,

> Our demographics are kind of diverse over the different campuses, so there is nothing consistent with that. Not necessarily a factor in that sense, or at least in how we looked at it. The students coming to us from this campus are not really the same demographic as coming to us from that campus, that are not the same demographic coming to us from yet another campus.

Quinn stated, "One of our primary goals is to assist students who might not be quite ready to handle a 4-year program. Due to our mission and our population, we tend to take our Corequisite Learning Support classes quite seriously." Riley also added, "I think the reality of this model is that students are going to be coming to their college-level courses lacking foundation knowledge, and so we are trying to do that as well."

Institution E. Nico shared the same idea and said,

> Having higher enrollment standards have helped. I think each student is just different. So, it will vary. Some students are in the class because they did not do well on the ACCUPLACER. Some are just lazy and never really tried that hard in math, but somehow did just enough to get by. Some students enroll in college because that is what they feel they are supposed to do, but they do not want to be really be here.

Institution D. Participants from Institution D did not believe demographics affected their success rate. Kerry, Jody, and Lee all pointed out that a large percentage of their students were minorities, and their institution had a high success rate. Lee said, "I do not think our students face any more difficulties than what socioeconomic status already dictates."

Institution C. Hayden from Institution C mentioned success rates could be admission standards, but pointed out it was more likely spreading out the number of remedial students in support. The participant felt having 20 or more students in a support lab was far too many for one instructor to handle, and no one should have a class full of only remedial students.

Institution B. Casey, administrator from Institution B, mentioned having a quality enhancement plan (QEP) that focused on quantitative and communication skills were the keys to success. The participant felt that the QEP had an impact on their success rate as well as redesigning student orientation and implementing a growth mindset into their classes. Cameron and Dakota (faculty members of Institution B) also mentioned, later in the interview, implementing growth mindset in their classrooms. Casey defined growth mindset as the idea that learning takes effort. Casey also stated,

> Students should believe that with effort they can learn something; then they do learn it. Students who have a fixed mindset believe that talent is what passes people: talent is what causes what some people can and that some people just can not do it. And as educators we know that is not true, that students can grow their brain with true education and hard work.

Casey, Cameron, and Dakota also all attributed an early alert system as one of the reasons for their institution's success. As defined in Chapter 2's review of literature, early warning system is a system whereby faculty or staff alert administrators or counselors about students who are in danger of failing. The student is then brought in, and a plan is made to get the student back on track (USG Mathematics Task Force, 2013). Other administrators (Bailey, Dallas, and Kerry) all mentioned early alert systems as a practice that works. This practice will be discussed again in Research Question 3.

Interview Question 3

In the instructional area, what do you think are important factors towards your institution's success that were not mentioned in the survey? i.e. Using technology as a supplement, instructional strategies are regularly shared between developmental instructors, etc.

Institution B. Cameron from Institution B reported,

> One factor that seems to be important to student success is, whenever possible, having the same instructor for the collegiate course and the support course. This seems to have a better overall outcome: attendance is higher. Since the instructor spends more time with the students, there is a better relationship between the students and the instructor.

Having the same instructor is a practice that almost every participant mentioned with the exception of Ashton, Jody, and Parker.

Institutions B, C, and F. Participants Casey, Cameron, Hayden, Jamie, Quinn, and Riley from State Colleges all mentioned difficulty in arranging the same instructor for support and college-level course. Casey said, "That is not always possible in math because of scheduling problems or scheduling difficulties. But where it is possible, we do it, because it is hard to align the movement of the course where they have different instructors." Hayden added that having different instructors at Institution C was a practice that simply did not work. "It is an issue because of differences in personalities. That's just what it boiled down to. Not that anybody was better than the other. It is just that it was a different person with different teaching styles." Cameron mentioned techniques to use when it is not possible to have the same instructor teaching both the collegiate and Corequisite courses. "It is beneficial to take a team teaching approach [to the Corequisite Model]. Good communication is key."

A few faculty members believed the scheduling of Corequisite classes mattered. Hayden and Cameron believed the classes should be back-to-back because it increased attendance. Cameron said, "Having the classes scheduled back-to-back seems to result in the best attendance. Other scheduling arrangements seem to be less effective." Hayden liked having the college course first and the support afterwards. "I know that one of the terms used in literature is called 'just-in-time' way of learning. Where the information is presented, and the students get a head start on the assignment. I think that having it fresh on their minds helps." When further probed on attendance in such a setup, especially on days where the students had an exam in the college course, Hayden said, "They have the option to stay, and they usually do. Several of them have assignments they need to continue working on, so they will come back during lab time to continue working."

A few administrators (Morgan, Kerry, and Dallas) were hesitant to comment at first due to not actually teaching courses. After additional probing, such as asking what the students may think were the best instructional practices, all three offered up technology as an influential practice. Dallas stated online homework was there to help students and provide them instant feedback even if the students did not view it as help. Morgan warned against overuse of technology via hybrid courses or only using online homework. "Technology is important, but should not be overused, as I think that can detract from the personal connection students need to feel to encourage them to ask for help or ask questions to clarify content." Cameron, faculty from Institution B, also believed technology was important. Cameron stated,

> I think the judicious use of technology can be very beneficial. I utilize some of my classroom time to teach students how to use technology, with good results. With regards to technology use, I have found the more detailed the instruction, the better the outcome.

Bailey, an administrator from Institution A, had a lot to say on the instructional matters. This participant also stated that Corequisite courses need "faculty who are interested in and committed to engaging pedagogies and who never demean students who struggle" and "the best faculty to teach the classes." Bailey warned, however, that those faculty need to teach the course "as an instructional class, not treating the time in the support course as study hall or homework center." Bailey also mentioned peer tutoring as a successful practice. Walk-in tutoring centers or embedded tutoring centers was mentioned by a member at each institution. This practice will be discussed in further detail later in Research Question 3.

Interview Question 4

What are practices you do <u>not</u> think are predictors of Corequisite Success?

Participants had a variety of answers for this interview question. Parker from Institution E and Jody from Institution D both stated it was impossible to indicate what was or was not working with all the changes implemented over the years. Quinn from Institution F laughed and said, "You want me to list *all* the things that do not work? I would rather not." Bailey from Institution A listed practices from the DEPS—CMAS and DEPS—CMFS survey: CRLA certification of all tutors, alignment of gateway math with CCGPS, NADE certification, blended credit-bearing courses, and enrolling in 15 hours, inclusive of the Support course hours. Enrolling in 15 hours per semester is part of the Momentum Year efforts. Complete College Georgia defines a momentum year as a starting point to aid students in completing a college degree by making a purposeful major choice, entering school with an academic mindset, and following a sequenced program that includes nine credits in the student's area of focus and 30 credits in their first year (2018). All USG institutions have implemented Momentum Year efforts (CCG, 2018). Tory (Institution F) did not believe the Momentum Year practice of having students take nine hours in their major in their first year helped the success rate of remedial students.

Jamie from Institution C pointed out that having homework required for the support course and not having a mandatory attendance policy were two non-helpful practices. Mandatory attendance is one of the USG Mathematics Ad Hoc Task Force's (2014) recommendations. However, some institutions still struggle with it. Riley from Institution F said attendance has been an ongoing challenge since the start of the Corequisite Model. Hayden (Institution D) and Cameron (Institution B) also mentioned attendance as one of the reasons the collegiate and support courses should be scheduled back-to-back.

Cameron and Dallas (Institution C) mentioned that GPA alone is not a good predictor of student placement in the Corequisite Model. Dallas stated that this is because GPA scores often seemed "a little bit inflated." Dallas also mentioned that the students are responsible for less successful pass rates, especially when they do not believe in the model. This participant said, “They do not want the support. They think they can do it themselves.”

Interview Question 5

I think the practice of requiring students to participate in a study skills or success course (freshman seminar) might have an impact on Corequisite Math success in USG institutions. Do you think it has an impact? Does your institution use this practice? Would you consider implementing this practice into your mathematics courses if it is not already implemented?

Interview question five was proposed after a visual review of the data which showed that almost all of the most successful institutions implemented this practice and almost all of the least success institutions did not. All of the participants at institutions who did not implement such a class (Institutions C and D) felt that a study skills or success course would have an impact on the institution’s Corequisite Math success rate. Dallas, Hayden, Jamie, Kerry, and Lee stated that students would benefit from learning the skills necessary to pass classes such as note-taking, studying, and following classroom procedures.

Institutions that implemented a freshman seminar were ambivalent on whether or not the practice worked. Nico from Institution E indicated that the course would not prepare students for gateway math courses. Alex and Bailey from Institution A stated that they had mixed results from the freshman-level course. Their freshman seminar course was recently retooled to be an “in-house intervention” for students who had failed any Corequisite learning support courses.

Institution B had implemented a freshman seminar at their institution as part of their Momentum Year efforts. While the freshman course was implemented in a different semester than the semester this data was gathered in this study (Fall 2018 versus Fall 2016 and Spring 2017), Casey stated that there was a large improvement in the Corequisite success rate in the fall semester of 2018 as a result of implementing the course.

Participants from Institution F did not believe a freshman studies course was an important route. All three participants indicated they had offered the course in the past but had since moved away from it. Quinn and Parker, however, mentioned incorporating study skills in their support classes.

Interview Question Six

I think the practice of implementing low- or no-cost educational resources in courses might have an impact on Corequisite Math success in USG institutions. Do you think it has an impact? Does your institution use this practice? Would you consider implementing this practice into your mathematics courses if it is not already implemented?

Question six, the last of the interview questions, was proposed after a visual review of the data which showed that almost all of the most successful institutions implemented low or no-cost educational resources that almost all of the least successful institutions did not. Most of the participants (with the exception of Ashton and Parker) indicated that low- or no-cost educational resources were being used at their institutions. However, there was discourse among the participants over whether or not it would have an impact on the Corequisite success rate. The participants were split into three categories—not believing, ambiguous, and believing in the practice.

Tory, Jamie, Bailey, and Nico did not believe low or no-cost education would have an effect. Jamie further reflected,

> It may have an impact on who can afford to come to college. I do not know that it has an impact on how well they do when they are there. Unless you wanted to say the kids who were really motivated to attend can now attend because it is low cost and so you do better in the class because those who really want to be there are financially able to be there.

Dakota, Lee, Riley, and Rainy were ambiguous over the practice. Dakota pointed out, "There is a clear trend toward saving students' money. For the Math 1001 and Math 1111 courses, we tend to require just the MyMathLab e-text access codes and no hard-copy text in either course." Many of the institutions had applied for the USG Affordable Learning Grant to adapt their gateway courses to using low or no-cost resources. They were hesitant to comment on the practice given the lack of data in their classes. Lee said,

> I do not have any data to prove it, but I think it might help. In theory, when a student is presented with free textbooks and cheaper software, students who are more economically disadvantaged will have the opportunity to use materials they could not have purchased before. I think it provides less of a financial strain on students as well. But again, this is just theory, nothing I can back up with data. Our school had a grant this past year. It will be nice to see the data.

Cameron, Quinn, Dallas, Kerry, Hayden, and Morgan believe that the practice of lowering the cost of educational resources did have an effect on the Corequisite success rate. They believed it benefited their students. Kerry said, “Our students appreciate having cheaper textbooks and not having as much financial worry.” Hayden believed it made a great difference for the students being able to use cheaper software that provided instant feedback and to be able to access a free e-book for examples if needed. Dallas wished the institutions could go further and provide resources to every student from the beginning of the semester. This participant stated,

> I would hope that eventually, we would be able to provide more resources in terms of every student getting a calculator or a laptop when they get here as part of the technology fees. I think that would be impacted positively. I do have students who say they just could not afford the MML or a calculator. They do not speak up until it is too late.

Six Themes or Best Practices Identified

Given that none of the variables yielded a statistical significance on the effect in the quantitative phase of this study, interviews became a vital part of the study through which an understanding could be gained of specific practices that affect success rates of Corequisite math courses. For Research Question #3, regarding instructional and institutional strategies highlighted by administrators and instructors as contributing to student success in Corequisite Math courses, data from the transcripts were coded, clustered, and six themes emerged. The themes were as follows: (1) recommendations from the Ad Hoc Committee, (2) passionate and dedicated faculty who care about learning-support students, (3) tutoring, (4) early alert systems, (5) study skills, and (6) a growth mindset. The following are detailed descriptions of these best practices that emerged after an in-depth study of the interview transcripts of participants.

USG Ad Hoc Steering Committee Recommendations

This first theme that emerged was the use of strategies recommended by USG Ad Hoc Steering Committee. In February of 2014, the USG Mathematics Ad Hoc Steering Committee released an implementation plan to execute the 2013 USG Mathematics Taskforce's recommendations. One of the Taskforce's recommendations was to implement the Corequisite Model as the new learning support system. Every USG institution that offered learning support was expected to implement the model by Fall Semester 2015 (USG Mathematics Ad Hoc Committee, 2014). The USG Mathematics Ad Hoc Committee recommended the following strategies:

- The same instructor teach the Lab or Support component as well as the collegiate-course;
- The focus of each session of the Corequisite support course be closely linked to the material covered in the gateway course at the time;
- Students participating in the Corequisite support component should be mixed with non Corequisite students in the gateway courses;
- Total class size be limited to 15-22 students participating in both the lab or support and the regular gateway course or a smaller group of around 10 students participating in the Lab sessions, mixed with a larger group of students participating only in the gateway course;
- Attendance be included as part of the grade for the corequisite support course (2014, p. 8-9).

The practices were recommendations, not requirements. However, all of the USG Mathematics Ad Hoc Committee recommendations were mentioned by participants of this study as practices that work. The only one that was debated was the recommendation of mixing support and non-support students in a collegiate course. This will be discussed in detail below. There is little to no research on these recommendations, as these were specifically recommended for USG institutions. In the following paragraphs, participants' ideas regarding each of the USG Mathematics Ad Hoc Committee's recommendations will be shared.

Same instructor. As previously mentioned, almost all participants with the exception of Ashton, Jody, and Parker stated that having the same instructor for the support and collegiate class as having a positive effect on the Corequisite success rate. Hayden from Institution D said that by having the same instructor, this person can "walk around, check on [the students], and make sure to answer any questions [that came up earlier in lecture]." Lee (Institution E) said,

> It is been really helpful having all the support students be my College Algebra students. I have one support student out of 60 who is not mine; they could not fix his schedule to make it happen. He does not regularly attend; his algebra class seems to be a few days off from mine, and his classwork is different. I think he suffers, because he is not my Algebra student.

When questioned on how that situation was handled, Lee responded,

> I just do my best. He skips so often it is difficult to plan. I allow time for the support class to do their homework. I give him the practice tests my own students have, because I often review the test the day before in support.

Alex and Bailey from Institution A and Casey, Cameron, and Dakota from Institution B agreed. Alex said,

> I think that having the same instructor for both the Coreq and the college-level course is a big plus. I can see where the people who have one teacher for the college course and a different instructor for the Coreq are struggling. The students do not like it as much, and it is harder for communication between the two faculty.

Cameron said, “Since the instructor spends more time with the students, there is a better relationship between the students and the instructor.” A few of the participants added to the sentiment. They felt having the same instructor created a connection between the instructor and remedial students. Kerry, an administrator from Institution C, observed that the students “seem to appreciate it more when the lab instructor and class instructor is the same person.” Lee, a faculty member from the same institution, reflected the thought from the faculty’s perspective and said, “I like when they are [the students] all mine.” Tory, an administrator from Institution F, put it best by simply stating, “Students need the same instructor.”

Linking or aligning support and gateway courses. “We struggled a lot in the beginning to figure out what was the right thing to do. It was hard to change from the old model,” Lee (Institution C) explained when asked about what practices did not work for the Corequisite Model. This participant continued by saying,

> I do not think we changed a lot. I think we kept it the same kind of intermediate class. We just went from three hours to two hours which really hurt the kids I think that first semester. Later, we realized not changing material was hurting everyone, and we fixed it. We made it a true corequisite instead of showing prerequisite material. We made everything line up. The students complained when

> it did not line up. They said it felt like having two different classes; and in fairness, it was. That and having different instructors were the students' biggest complaints.

Aligning the support and gateway courses seemed to be a common practice among the institutions. Quinn and Riley stated they worked as a department to align the material taught in the college-level math courses first, and then started to work on aligning what was taught in the Corequisite support classes. Alex from Institution A, Casey from Institution B, and Hayden and Jamie from Institution C also mentioned working as a department to align what was being taught in the collegiate classes. Alex stated that Institution A was trying to streamline and be more consistent across the board with their content in their Non-STEM pathway math (Quantitative Reasoning or Math Modeling courses). Alex worked with Pearson to create a MyMathLab course to introduce a uniform homework assignment with built-in study skills and mindset videos. This participant said, "We made assignments out of those and encouraged everybody to use those."

Mixing students. The practice of mixing non-support students in a collegiate course with support students is debated among participants. Some felt the linked gateway course should only contain support students; whereas, others felt it should be a mixture. Tory from Institution F said,

> One factor which I am not sure is good–different faculty have differing opinions–whether the college-level class should include only those students who are in support. Logistics require that we do this now, but I am not sure it is the best practice.

There were even different opinions found at the same institution. Jamie from Institution D believed the students should only be support. The participant stated that it was easier to schedule and, it allowed faculty to better connect with a group of identical students they saw every day. Conversely, Hayden believed there needed to be a true mixture and added,

> I have heard it both ways, and both ways are fine. However, I think you have less problems when it is more of a mixture. Even if it is just five fewer students, then that is an opportunity in lab time to be more one-on-one.

Limiting support class sizes. Quinn said,

> One of the things we focus on at Institution F is a small student-to-teacher ratio. Our class sizes in our corequisite classes are kept particularly low. This enables us to provide each student with high-quality instruction.

This idea is echoed in Hayden's quote in the previous section, where it was stated that fewer students in the support class means the instructor can provide more one-on-one time.

Attendance. A few participants said an issue with their institution's success rate is that students are not attending the support class. Dallas from Institution C implied that it is a part of the students' mindset. "They do not want the support. They think they can do it themselves." However, most students placed in remedial support cannot do it themselves. Nico from Institution E said, "You have to make the students get in there and do the work themselves is key. You have to practice working what you have learned to be successful in math." Jamie, a faculty member from Institution C, pointed out that if the students do not attend support, then they are more likely to fail and said, "You have to have mandatory attendance, or they will not attend." Jamie share that by mixing in a daily grade, one can increase attendance. Riley from Institution F agreed and stated,

> An ongoing challenge since the start is student attendance. We tried to integrate in-class work into the course. We tried to encourage instructors. You know the whole thing is how prescriptive we want to be. That is a balance we are trying to strike, but we do encourage instructors to have in-class work as part of the grade to encourage students to show.

Passionate and Dedicated Faculty

The second theme that emerged from the data gathered during the qualitative phase of this study was passionate and dedicated faculty who teach the Corequisite math course or lab. As reported in the literature review, Carr (2012) conducted a study on identifying best practices for Learning Support students in the USG. While Carr's study was conducted with the Old Model, one of his seven recommendations was to have faculty were who are "passionate about developmental education and student success" (2012, p. 125).

All the participants from Institution A accredited their dedicated faculty as being a positive influence on their success rate. Bailey said their faculty "devote most of their time and energy to teaching," and administrators "handle specific interventions for struggling students." Bailey also mentioned that their faculty "are interested in and committed to engaging pedagogies and who never demean students who struggle" and the institution "assign[s] some of our best faculty to teach LS." Alex agreed, "We had a handful of faculty teaching it, who really, truly put a lot into it." Even Ashton, who does not believe the Corequisite Model works, said it was the responsibility of "educators to help students."

Morgan and Nico from Institution E believed the faculty needed to be passionate and care about Learning Support students. Morgan stated that the institution especially "recruited and hired staff (credentialed as faculty) who had an interest and experience teaching developmental education." Nico, a faculty member, mentioned that working with the students hands-on every day and encouraging students to come by during office hours were evidence that their faculty were committed to the students. Tory and Quinn from Institution F believed in the practice as well. Quinn reported that their institution took Learning Support very seriously, and Tory believed in "having the most experienced faculty teach [LS] classes."

Tutoring

The third theme that emerged was the use of various forms of math tutoring. Many participants commented that having a tutoring center was a positive factor in their institution's Corequisite success rate. Researchers also agreed that having a tutor center, especially where the tutors are trained, is a best practice for developmental students (Boylan & Saxon, 2009; Boylan, 2002; Missouri, 2017). The emphasis from participants was that the tutoring centers were available for walk-in tutoring. "Our tutoring centers provide walk-in assistance for all levels and learners of math; no appointment is necessary," Bailey (Institution A) said.

Cameron, Casey, and Dakota from Institution B emphasized that their students had access to a free, walk-in, peer tutoring center. Morgan, Hayden, Kerry, and Tory all praised embedded tutors from the tutoring center. Morgan said, "The instructors consistently promoted the peer tutoring services run by our department. The instructors [also] had the support of additional tutors in their classes to allow for more one-on-one working time." Kerry said students who attended tutoring at Institution D showed higher pass rates at midterms and at finals.

Boylan and Saxon (2009) recommended that institutions should have their tutoring programs and developmental education programs certified by agencies such as the National Association for Developmental Education (NADE) or College Reading and Learning Association (CRLA). However, Bailey, Dallas, and Morgan, administrators from A, C, and E, believed that certification was not a predictor of Corequisite success.

Early warning systems

As shared in the review of literature, an early warning system is used by faculty or staff to alert administrators or counselors about students in need of extra help. Staff can move quickly to provide those students with academic or personal support (USG Mathematics Task Force, 2013). In Carr's (2012) study on best practices of the Old Model for Learning Support in the USG, he found that early warning systems for at-risk students were critical to student success. Others also found that having early warning or alert systems as being beneficial to remedial students (Schwartz & Jenkins, 2007; Missouri, 2017).

Bailey said the faculty at Institution A kept administrators apprised of concerns about students' failure from attending class, turning in assignments, and passing tests. "We follow up with every concern. We often develop an academic improvement plan that includes referrals to such resources as tutoring, career counseling, and personal counseling." Casey, Dallas, and Kerry (administrators from B, C, and D) along with

Cameron and Dakota (faculty from Institution B) all mentioned that their faculty used early alert systems.

Study Skills

"One reason students fail is that they do not come to class regularly or they quit coming to class altogether," Tory (Institution F) said. Tory continued by stating,

> Another reason they fail is they do not do homework assignments, including producing required drafts and doing required reading. Finally, students do not follow classroom procedures, i.e. they do not carefully read the syllabus or assignment descriptions, they never learn how to navigate Georgia View, they come to class with no pens, paper or books, they do not pay attention in class (I combat this, but some students seem to think just showing up to a class, even unprepared and disengaged, is enough for success). In short, these students do not know how to be students.

As reported in the literature review, a study skills course (or success course or freshman seminar) is defined as a course that provides knowledge in areas such as studying habits, time management, note-taking, goal setting, and career exploration (Reilly, 2014). Also, various authors reported that study skills were imperative to developmental students (Boylan, 2002; Butler, 2014; Edgecombe, 2011; Reilly, 2014). Carr (2012) believed that social and active learning skills are essential to remedial students in the USG. Several participants indicated that implementing study skills, whether as a course or embedded in support, was a key practice.

Alex and Bailey stated that the faculty at Institution A were weaving study success strategies and non-cognitive skills into the support class. Bailey said, "We require new students to attend student orientation and set the tone for academic success. Plus, we have been talking with our students about growth and fixed mindset for over a year." Institution B was also implementing a new orientation class that Dakota said "includes significant exposure to the growth mindset philosophy" and "some study skills material." Cameron said, "The success of a student in the mathematics classroom is based in part on study skills, not just previous mathematics background." Casey mentioned that Institution B had implemented the course in the Fall Semester of 2018, and it showed a great impact on the Corequisite success rate.

Jamie, Dallas, and Hayden from Institution C all believe that implementing a freshman seminar or study skills course or incorporating skills into their Corequisite support courses would increase their success rate further. Jamie said, "I think a freshman seminar course would help especially if we targeted those Co-req students. I do think it would help them, absolutely." Dallas added, "I definitely think that there is a need for a freshman seminar first-year experience for students. I know that is not something that we offer anymore. It used to be a graduation requirement." Hayden missed the course and explained, "It was a very basic class, and it did teach study skills. We used that for quite a while, and I thought it worked well." Dallas, an administrator, also mentioned the institution holding study skills seminars. "We got to promote students to go to non-credit events. They do not have to pay for the extra credit hours to attend these things."

Kerry and Lee from Institution D believed in having study skills for their students. Kerry said their courses were designed "to integrate the skills they need to complete college as well as the mathematics and reading." Lee added to how critical the skills were and stated,

> Students need to know that [study skills]; they need to know how to take notes; they need to know how to study. They come to college not knowing any of those skills. I feel like this group of students feels less prepared for college than previous years. But perhaps I say that every year.

Institution E participants, Nico and Morgan, stated that their school had a freshman course. Morgan believed it helped; whereas, Nico was unsure. Nico said, “Our school does have a class the freshmen have to take. I am pretty sure there is some math in the course, but I am not sure if it would prepare them for college algebra.” Quinn and Riley stated that Institution F had moved away from a freshman seminar, but some study skills were being implemented in the learning support courses.

Growth Mindset

The sixth and final theme that emerged centered around faculty’s commitment to the concept of improvement or growth. The USG has updated requirements for the Corequisite Model since it was first implemented across institutions during Fall Semester of 2015. The USG announced in the Fall of 2017 that each institution would be phasing out foundation-level learning support (MATH 0987 and MATH 0997) within a year and that institutions would only offer the support. Students who needed College Algebra, but scored in the foundation-level, would be required to first take a Non-Stem pathway math course (Math Modeling or Quantitative Reasoning) and it is support course or lab (USG, 2018). All institutions are required to have support classes linked to the same instructor by Fall Semester 2019 (USG, 2018). Some participants (Jody from Institution C and Parker from Institution E) felt these changes made it impossible to state best practices of the Corequisite model. Parker said,

> What we have done in the past has all changed due to the University System of Georgia mandate to create linked support classes for the [gateway math courses]. If it is considered that we were so successful before, it is to be determined whether or not we will be better or worse in the future. We are hoping better, but there are so many variable changes.

However, change might be the key to success. Part of the USG Momentum Year efforts is to have the students incorporate an academic mindset. The members of Institution B have implemented teaching their students a growth mindset. Dr. Carol Dweck (2015) defined the terms fixed mindset and growth mindset as "a person with a growth mindset has the understanding that abilities and intelligence can be developed; whereas, a person with a fixed mindset believes that intelligence and ability are static and cannot be changed" (Dweck, 2015).

Individuals from Institution B and F declared their institutions were always adapting and trying new things. They did not want to remain static. Riley pointed out that members of Institution F were trying and piloting new ideas over the time period in which the success rates were evaluated. This participant said,

> We were trying stuff out. And we are still trying stuff out. We definitely consider the Corequisite ongoing opposition in that way. Again, a lot of it is more focus on the challenges. At that point, we were just kind of trying stuff. Sounds terrible, does not it? Kind of sounds like we did not have a plan and in hindsight, it feels like we did. We were trying though.

"There is always room to improve," Casey (Institution B) pointed out and continued by saying,

> Part of any success always has to be continuously looking for ways to improve. I think if people start getting comfortable with the way they teach the model and if they are comfortable with 60 or 65% pass rates, then that is not something that is going to lead to being more successful. That is kind of a marginal result actually.

Faculty and administrators should adapt a growth mindset when it comes to the success rates of the Corequisite Model. There could be unchangeable factors that affect an institution's success rate such as admission standards and student demographics. However, individuals should always be willing to change and try new methods in the Corequisite model. The old proverb 'If it ain't broke, do not fix it' does not apply to learning support. Any opportunity to help one more student succeed out of learning support mathematics is worth review.

Summary

The results reported in this chapter were presented in a manner consistent with the sequential explanatory design where the quantitative results were reported, followed by the qualitative results. The data set consisted of 118 faculty and 53 administrators. The quantitative data failed to meet the assumption of normality and was transformed using the Box Cox Power Transformation. A standard regression, forward stepwise regression, and backward stepwise regression were generated using the transformed data. There were no significant results found with the regression analysis.

The major findings of this study were revealed in the qualitative section. Eighteen participants were interviewed, and their information was transcribed, coded, and categorized into six themes. The themes are best practices for the Corequisite Math Model as identified by the participants of this study. The first of the best practices was the use of the Ad Hoc Committee's recommendations: having the same instructor for the support and college-level course, linking or aligning the material in both courses, limiting class sizes, and requiring attendance. The Ad Hoc Committee's recommendation of mixing support and non-support students was argued among participants. The second best practice was making sure learning support classes are instructed by passionate and dedicated faculty who care about remediation. The third practice was the use of embedded tutors and encouraging students to attend available on-campus peer tutoring. The fourth practice was using early warning systems to provide at-risk students attention and resources to complete the course. The fifth practice was the institution having a study skills or freshman seminar, or implementing study skills into the learning support course. And, finally, the sixth best practice was administrators and faculty needing to adopt a growth mindset, along with the willingness to change and try new things in the Corequisite model.

Chapter V

SUMMARY AND DISCUSSION

Former President Obama challenged the nation to become the number one producer of higher education graduates by the year 2020. Complete College America was an initiative made to aid in reaching this goal. The state of Georgia implemented its own version called Complete College Georgia. The administrators of this program promised an additional 250,000 college graduates by the year 2020 (Deal Charges Campus, 2012). In an effort to increase graduation rates and reduce the number of time students spend in remediation, the USG mandated all institutions to implement the Corequisite Model for mathematics courses. Pilot studies conducted at five USG institutions showed 63% of remedial math students within the Corequisite Model passed their collegiate course; whereas, only 23% of remedial students passed within the old USG math model in 2010 (USG Mathematics Task Force, 2013).

The primary purpose of this study was to identify key institutional and instructional practices of the Corequisite Model that lead to success (defined as grades of A, B, or C in the collegiate course) of developmental math students enrolled at selected colleges and universities in the state of Georgia in 2018, as perceived by USG administrators and faculty. According to the Georgia Board of Regents (GBOR), the success rate of Corequisite students in math is 70% (GBOR, 2017). USG institutions range from 50% to 90% success rates. Each institution could possibly increase their success rate and the number of graduates if a list of best practices is identified.

The following are the research questions chosen to guide this study:

4. What are the responses of USG administrators and instructors to questions about institutional practices and instructional practices for the Corequisite math courses?
5. Is the implementation of instructional practices (faculty instructional practices, Ad Hoc instructional recommendations, classroom instructional practices, department instructional practices, instructional delivery methods, instructional utilization) or the implementation of institutional practices (institutional adaptations, USG institutional implementations, institutional student requirements) significant predictors of academic success in Corequisite math courses in USG institutions?
6. What specific instructional strategies and institutional strategies were identified through interviews with administrators and instructors from USG institutions earning the highest success rates with Corequisite Math courses as having a direct effect on study success?

This chapter provides brief summaries of the related literature, the methodology, and the findings of the study. After reporting the findings, there is a discussion of the quantitative and qualitative findings of study. The next section reports the limitations of the study, and implications for future research. At the end of the chapter, readers are provided with a conclusion.

Related Literature

The Corequisite Math model was created in 2009, was fully implemented in various states beginning in 2009, and was fully implemented at USG institutions in the Fall of 2015. Unlike the availability of literature on the Corequisite Math model, there is a good deal of research on developmental education and best practices. Boylan (2002) defined best practices of developmental education as the “organizational, administrative, instructional, counseling, advising, and tutoring activities engaged in by highly successful developmental programs” (p. 3). The following best practices were identified for developmental education:

- Having mandatory assessment or testing of remedial students (Bailey et al., 2010);
- Maintaining academic momentum by encouraging students to take at least 15 credits per semester (Belfield et al., 2016);
- Having early warning systems on campus (Schwartz & Jenkins, 2007);
- Offering a study skills course (Butler, 2014; Edgecombe, 2011);
- Having trained tutors (Boylan, Bliss, & Bonham, 1997); and
- Implementing the Corequisite Model (Edgecombe et al., 2013).

New literature was posted on the best practices of the Corequisite Model after this study had begun. The state of Illinois piloted the Corequisite Model in the 2016-2017 academic year (Becker, 2017). The piloted institutions’ success rates increased from 19% to 70%. Becker (2017) listed the observed best practices for the model; most of which are on the list of best practices the USG Mathematics Ad Hoc Committee suggested. The classes with the highest success rates had the same instructor for the support and gateway course, had material linked between the support and gateway, had the support class size limited to 15, and had mandatory attendance as part of the grade (Becker, 2017). Becker (2017) mentioned the learning support students were mixed with non-learning support students but was uncertain if it was a best practice. In addition to the Ad Hoc Committee's list of five recommendations, Becker (2017) also mentioned having peer tutoring available as a best practice.

Saxon and Martirosyan (2017) conducted a study on improving accelerated developmental mathematics courses, of which the Corequisite Model is a known form. The authors surveyed developmental mathematics faculty at National Association for Developmental Education (NADE) conferences and discovered the top three challenges cited by the instructors. The first and top ranking challenge noted by participants of that study was attendance. The faculty stated that poor attendance often ruined students' grades and that students with different instructors for the support and collegiate course were unlikely to attend the support class. The second most significant challenge was pace. Faculty reported that the pacing of material was too fast for some students, leaving them unable to keep up with daily assigned homework, while working at an individual pace caused some students to fall behind. The third challenge was a concern regarding the efficiency of student learning. The participants noted that students "do not have time to really digest material sufficiently for mastery," "have a difficult time juggling workload for two courses," retention of knowledge "can be very short," and students retaking the course "do not seem to remember anything from the first time" (Saxon & Martirosyan, 2017, p. 3).

In the same study, the authors provided the top three recommendations offered by the same participants for implementing an accelerated developmental model. The top recommendations were all instructional suggestions. Those suggestions were as follows:

- Teach less lecture and provide more problem-solving time (not limited to computer use).
- Ensure that the content is necessary. Some math concepts are de rigueur, but are not tied to next level courses. These can be eliminated to reduce the overwhelming content load.
- Rewrite lessons into one worksheet per day so students do not realize they are doing multiple lessons a day.
- Apply frequent formative assessment.
- Apply cooperative learning and make time for small group work.
- Set hard due dates, create well-structured classes, and make expectations clear.
- Do not "dumb down" the material for the sake of speed (Saxon & Martirosyan, 2017, p. 3).

The second highest noted recommendation affirmed the importance of advising. Instructors advised mentoring students in planning their schedule for classwork and also reminding students of the need to devote more time to an accelerated course. This recommendation is echoed in Robert Carr's dissertation on the best practices for developmental math in USG systems (2012). Carr (2012) recommended advising students on how to optimize their time in a developmental course. The third top-ranked recommendation was an institutional practice. It was to ensure the appropriate placement of students into accelerated courses (Saxon & Martirosyan, 2017).

Methodology

This study utilized a sequential explanatory mixed-methods approach. This two-phase design requires the researcher to collect quantitative data in the first phase, analyze the results, and then use the results of the first phase to plan the second, qualitative phase. Quantitative data were collected using two surveys: DEPS—CMAS and DEPS—CMFS. A standard multiple regression was computed with the variables of Total Administrator Score, Total Faculty Practices, and Success Rate. Additionally, a backward stepwise selection and forward stepwise selection regression model were also generated using the dependent variable of Success Rate as well as the following nine independent variables: Faculty Instructional Practices, Ad Hoc Instructional Recommendations, Classroom Instructional Practices, Department Instructional Practices, Instructional Delivery Methods, Instructional Utilization, Institutional Adaptations, USG Institutional Implementations, and Institutional Student Requirements.

In the qualitative phase, the perceptions of faculty and administrators were sought regarding the Corequisite Math process at the most successful comprehensive universities, state universities, and state colleges within the USG. The interview participants were provided a list of six interview questions, a copy of the quantitative results, and an informed consent document before each phone interview. Interview recordings were transcribed, member checked, and then coded.

Participants

The target population for the study was USG administrators and faculty who work with the Corequisite Math Model. There were 21 USG institutions that offered learning support during the time of this study. For the quantitative phase of the study, 165 responses were completed and submitted. All responses were found to be useable. Of those, 53 were from administrators, and 112 were from faculty. The majority of the participants identified as female (62%). The majority of participants also indicated they had 10 or more years of experience in academia (67%).

The qualitative phase of this study involved interviewing 18 participants from six of the 21 USG institutions with the highest Corequisite success rates. The participants were from each of the USG institutional categories—comprehensive universities, state universities, and state colleges. Research universities were not included in the study, because these institutions do not offer remedial courses. These participants were recommended by their math department head of each institution. The 18 participants were comprised of six administrators and 12 faculty members.

Instrumentation

The DEPS—CMAS and DEPS—CMFS were modified from a questionnaire called the DEPS—MS, which was created by Butler in 2014. To ensure content validity, an expert panel comprised of five individuals who were experienced with using the Corequisite Mathematics Model were consulted to validate the clarity and understandability of questions on both surveys. A pilot study was performed prior to conducting the research study at a technical college located in southeast Georgia. The panel of experts and pilot participants offered suggestions concerning the removal of questions regarding outdated practices and concerning grammatical changes to increase understandability of some of the items in the questionnaires. The final version of the DEPS—CMAS consists of 19 items and four demographic items (See Appendix B), and the final version of the DEPS—CMFS consists of 42 items and four demographic characteristic items (See Appendix C). Cronbach's alpha tests were run on these two instruments to ensure internal consistency; coefficients ranged from .82 to .95. These coefficients mirrored the Cronbach's alpha of the DEPS—MS (49 items; $\alpha = .98$).

Data Collection and Analysis

For the quantitative phase of the study, 165 participants completed the DEPS—CMAS or the DEPS—CMFS by using Qualtrics©. The results were entered into SPSS software program. Descriptive statistics, statistical assumptions, and regression models were computed and checked for all measures utilizing the SPSS package. Survey data from participants were converted to total-scale scores for variables. The standard multiple regression used Total Administrator Practices as a total score and Total Faculty Practices as a total score. These two variables represented institutional practices and instructional practices, respectively. The data were also converted into total scores for the nine individual variables (institutional adaptations, USG institutional implementations, institutional student requirements, faculty instructional practices, Ad Hoc instructional recommendations, classroom instructional practices, department instructional practices, instructional delivery methods, and instructional utilization) used for the forward stepwise and backwards stepwise regression models. Statistical considerations and assumptions were checked, and data transformations were performed in order to meet the assumptions.

For the qualitative phase of the study, 18 participants were interviewed in sessions that took place over the phone. These sessions were recorded via an audio recording device; written notes were also taken during these conversations. Interviewees were probed during the interview to follow-up, expand, elaborate, or explain details to responses. The qualitative data from the participants were transcribed and member checked. The data were then coded and categorized into six themes, which are summarized below.

Summary of Findings

For the quantitative phase of the study, three regression models were generated to examine the relationships among variables and to identify any variables that could predict success rates. A standard multiple regression was computed using two predictors—Total Administrator Practices score and Total Faculty Practices score. The results of the regression indicated that the two predictors explained 01.1% of the variance ($R^2 = .01, F(2,18) = 0.10, p = .94$). The model was nonsignificant. The forward stepwise regression model did not produce any results, as no variables could be entered into the equation. The backward selection regression model produced an equation with two independent variables—Faculty Practices and Delivery Methods. The results of the regression model indicated that these two subscales explained 22.5% of the variance ($F(2,18) = 2.61, p = .10$). This model was also nonsignificant.

Six themes emerged during the qualitative phase via coding and analyzing the 18 interviewed participants. The themes were as follows: (1) recommendations from the Ad Hoc Committee, (2) passionate and dedicated faculty who care about learning-support students, (3) tutoring, (4) early alert systems, (5) study skills, and (6) a growth mindset.

Discussion of Findings

The researcher sought to use the quantitative phase of this study to identify specific variables that could predict Corequisite math success rates at USG institutions. The regression models could not produce significant results. Each model explained little of the variance regarding the regression equations, which could be attributed to the small sample size of institutions (n = 21). There also appeared to be disagreement among some practices regarding which practices were and were not implemented within each school. Eight of the institutions had previously merged or were currently going through a merger (USG, 2016) during the time of this study. This could cause some disagreement in the practices. Administrators or faculty at institutions that merged may not have known all the practices that the other campuses offered. For example, one institution may only offer math courses as on-campus lectures, while the consolidated institution may offer hybrid or online classes.

Another factor to consider is adjunct faculty. Adjunct faculty made up 29% (32 out of 112) of the surveyed faculty. As part-time workers, adjuncts may not be expected or required to know the full range of practices their math department or their institution requires. There could also be institutional or instructional practices that are predictors of success that were not included in the surveys.

Having no significant results gleaned from the quantitative phase, the qualitative phase became the primary source for identifying the best institutional and instructional practices for USG institutions to use to ensure student success in the Corequisite math courses. As previously mentioned, there were six themes found after coding and analyzing the qualitative data: (1) recommendations from the Ad Hoc Committee, (2) passionate and dedicated faculty who care about learning-support students, (3) tutoring, (4) early alert systems, (5) study skills, and (6) a growth mindset.

Ad Hoc Recommendations

The Ad Hoc Recommendations is a list of practices the USG Ad Hoc Committee recommended in their implementation guide to the Corequisite Model for all USG institutions. Those recommendations were having the same instructor for the support and gateway course, linking material taught in support classes to the material being covered in the gateway course, mixing support and non-support students in the gateway course, limiting support classroom size to 15-22 students, and making attendance mandatory in the support course.

Same instructor. Edgecombe (2011) supported the practice of using the same instructor for the gateway and support course. She stated it was the best way to "maximize the potential of the model" (p. 12). In Saxon and Martirosyan's 2017 study, faculty cited a challenge related to the Ad Hoc Committee's recommendation Faculty stated it was difficult to keep students attending if different instructors taught the support and gateway courses. In the current study, Institution T (which had one of the highest success rates but did not agree to an interview) posted a presentation on CCG (2017b) about Institution T's best practices. Assigning the same instructor to the support lab and gateway course was a strategy recommended in Institution's T's presentation. This practice was being implemented at this institution well before the USG mandated it.

Linking material. Linking the material in the support and collegiate class appears to be a worthwhile instructional practice. Lee from institution D said that it hurt the students when instructors focused on teaching only beginner math in the support class instead of linking the material with higher courses. The participant mentioned that the students felt as if they were taking two separate math courses.

Mixing students. Mixing the support and non-support students in a collegiate course has positives and negatives. The participants were split over the decision, as seen in Chapter IV. However, the presentation by the math department head at Institution T reported their math courses were mixed with support and non-support students (CCG, 2017b). Becker (2017) was uncertain if mixing learning support and non-learning support students was a best practice of the Corequisite Model during the State of Illinois's implementation of the corequisite model.

It is possible the non-support students could provide guidance and aid to the support students, or vice versa if the support student feels more confident. However, the class might not build a sense of community and connectedness as opposed to a class of all support students who meet each day. The non-support students could feel bored at the pace of the class, as Saxon and Martirosyan (2017) found developmental students need to go at a slower pace.

Limiting class sizes. Limiting class sizes is a good practice, in theory, but may not be applicable to all institutions, as some institutions may have limited faculty and are unable to keep class sizes smaller than 23 students. Even the USG Mathematics Ad Hoc Committee (2014) acknowledged this in their implementation plan.

Mandatory attendance. Becker (2017) mentioned that mandatory attendance was a best practice from the implementation of the Corequisite Model in Illinois. Jamie, a faculty member from Institution C, said, "You have to have mandatory attendance, or they will not attend." In Saxon and Martirosyan's study (2017), the faculty recommended making attendance mandatory in some form, with a suggestion that mandatory attendance could be implemented as a daily quiz grade. However, to relieve some stress and tension from the students, the quiz could possibly be administered as a group quiz or open-note.

Passionate and Dedicated Faculty

The theme of having passionate and dedicated faculty who care about learning-support students may be difficult for many institutions to implement. For instance, how does one evaluate the passion and dedication of faculty towards developmental students? Regardless of the measurement of passion and dedication, USG institutions may lose or have recently lost a group of individuals who are dedicated to teaching developmental math. With the USG policy mandating Corequisite support classes having the same instructor in the collegiate course, there may be a loss of adjunct faculty. Individuals with a bachelor's degree in mathematics are currently allowed to teach learning support math courses in the USG. This mandate of linking the courses will require adjunct faculty to have a master's degree with 18 graduate hours in the field they are instructing. Faculty who have never taught remedial courses may be called upon to teach learning support courses when they have no desire to do so.

During the course of this study, 1,127 surveys were sent out to every individual who could potentially work with the Corequisite Model. Over a tenth of those individuals (138) responded that they were not involved with learning support and asked to be removed from the mailing list. Several of those individuals (of which all were considered faculty) appeared to be offended that they were being associated with teaching learning support courses. This is the researcher's perception; however, it can be assumed there are individuals who are not interested in teaching learning support courses or care to work with learning support students. Alex from Institution A stated that the institution had greatly increased their number of Corequisite Non-Stem pathway courses from three to 14 sections. Alex said, “Some have an interest in teaching that kind of stuff, and some do not. You know where I am going with that?”

In essence, there may be math faculty members who are teaching learning support courses who dislike doing so but have no choice given their institution’s enrollment. This researcher recommends that when a new hire position becomes available at an institution, the administration considers hiring someone with experience and desire to help learning support students. This position does not have to be a tenure-track professor for an individual with a doctorate degree; it could be a lecturer position for someone with a master’s degree.

Tutoring

Tutor centers. Tutor centers are an invaluable resource across campuses. Students can receive help with many, if not all, of the subjects offered on campus during most hours of the school day. All of the participants in the qualitative phase emphasized that their students had access to a walk-in peer tutoring center across their campuses. Kerry from Institution D said “Students who attended tutoring at our school showed higher pass rates throughout the semester than the students who did not attend.” Of the participants surveyed in this study, the majority (92%) reported full implementation of a tutoring center at their institutions. Consequently, only a third (35%) reported requiring the tutors to receive subject training or certification provided by organizations such as the CRLA. However, some interviewees (Bailey, Dallas, and Morgan, administrators from Institutions A, C, and E) did not think tutor training was a predictor of their institution’s Corequisite math success rate.

Embedded tutors. Embedded tutors also appeared to be a trend noted by participants from the institutions with the highest success rates. Embedded tutors are individuals who sit in on a class and work with students in the classroom (Mission College, 2019). The tutor may help facilitate small group exercises or programs, work with individual students on class activities, or provide feedback. The tutor may attend all sessions of a class or only attend certain days (Mission College, 2019).

A presentation at the 2017 USG Learning Support Academy Conference recommended having tutors in the classrooms (CCG, 2017a). It can be speculated that institutions could begin embedding a tutor in each support class on a certain day of the week to help with bookwork or online homework. Hayden from institution C believed embedded tutoring has affected Institution C's success rate. Hayden said, "We would have tutors from our tutoring center coming to the lab portion. They would help me walk around and answer students' questions. That gave two bodies walking around helping."

Early Warning Systems

Early warning systems are an essential part of university systems. Carr (2012) insisted that early warning systems for at-risk students were paramount to student success in USG institutions. Many of the interviewed participants (Bailey, Cameron, Casey, Dallas, Dakota, and Kerry) acknowledged their institution's early warning system as one of the reasons for their success rate. An early warning system allows administrators and faculty to report students who are at danger of failing. Academic counselors can be alerted about a student due to absences, grades, or any other cause of worry. Bailey from Institution A said, "We follow up with every concern. We often develop an academic improvement plan that includes referrals to such resources as tutoring, career counseling, and personal counseling." Administrators can reach out and potentially help resolve those problems.

A student could have a variety of problems going on at home that faculty may not know about, but with the warning system, they will become aware that something is wrong. At the very least, it can be recommended for the student to withdraw from the class. While this does not help an institution's success rate, it does help the student from lowering his or her GPA.

Study Skills

A study skills course (sometimes called a success course) is a course that provides fundamental knowledge in areas such as time management, note-taking skills, study skills, goal setting, and career exploration (Reilly, 2014). Students require proper study skills to be successful in college, such as good note-taking habits, study habits, reading comprehension skills, scheduling abilities, and test-taking skills. As explained in Chapter IV, several of the participants incorporated study skills into their class or wanted to incorporate them. In the University System of Massachusetts (2009), students in a paired course for study skills had a pass rate of 80%; whereas, non-paired pre-algebra students had a success rate of 60%. In Reilly's (2014) study of a Floridian institution, she found 61.4% of mathematics students exited learning support without a paired study skills class; whereas, 84.3% of mathematics students passed with a study skills course.

Growth Mindset

Dr. Carol Dweck (2015) defined the terms fixed mindset and growth mindset as follows: "A person with a growth mindset has the understanding that abilities and intelligence can be developed; whereas, a person with a fixed mindset believes that intelligence and ability are static and cannot be changed." Part of the USG Momentum Year efforts is to have the students incorporate an academic growth mindset.

There are growth mindset supportive activities for students listed on the CCG's website (2019b). One activity is a form students fill out to request to retake a test or to submit revised coursework. In this activity, students must reflect on "their performance on a test or assignment, articulate the strategies they used to learn the material originally, and propose a plan for relearning the material" (CCG, 2019b, p. 1). Another activity to increase a student's growth mindset is to create and practice growth mindset phrases, so the student understands that "learning takes sustained effort" and requires "using effective learning strategies and switching between strategies when needed, and seeking help when needed" (CCG, 2019b, p.1).

Carr (2012) said developmental students need learning skills and social skills to succeed in a developmental model. The activities also included increasing the mindset of social belonging. CCG (2019b) encouraged faculty to reach out and establish electronic communication with students. This creates a connection between the instructor and student. Faculty are also encouraged to give wise and thoughtful feedback and to carefully frame comments so that it becomes clear "the instructor has a high standard for student work, but also that the instructor believes all students are capable of succeeding" (CCG, 2019b, p. 1).

Arguably, faculty and administrators should be adopting a growth mindset along with USG students, especially when it comes to the Corequisite Model. Faculty, especially those who have taught the same material repeatedly over the years, may fall into a pattern of behavior with their teaching methods. They may not want to change.

After all, the source material for College Algebra has not changed in hundreds of years; only the methods have changed. However, individuals should always be willing to change and try new methods. Every class of students is different, as is each student. Different techniques may be required to reach different students.

Limitations of the Study

A major limitation of this study was the researcher was employed as a math instructor at one of the surveyed USG institutions and was a doctoral student at another surveyed USG institution during the time of this study. The researcher can acknowledge that her employment institution and her school institutions both had 100% response rates, because she personally knew all the individuals to survey. The researcher acknowledges a certain amount of bias could exist.

Another limitation was the method used to collect quantitative data. Access to an accurate list of faculty and administrators' email-addresses was dependent on each institution's website. The directories of the 21 institution's website may have been outdated and reduced the response rate for the study.

There may be limitations as to whether results of this study can be applicable to other states and institutions. This study only included colleges and universities within the University System of Georgia.

Suggestions for Future Research

USG institution mergers could be a reason the regression models did not produce significant results. Eight institutions within the USG have merged since 2014: Georgia State University and Perimeter State College, Albany State University and Darton State College, Georgia Southern and Armstrong University, and Abraham Baldwin

Agricultural College and Bainbridge State College. It is plausible that there could be some disconnect between campuses of the same institution, because there had previously been two separate math departments. These faculty members could have reported different practices or implementation levels at the same institution. A suggested follow-up study could be conducted in the USG again in a few years when these eight departments are more consolidated.

This study could also be repeated with a larger sample size. This can be done by surveying additional states' university systems that implement the Corequisite Model such as Colorado, Florida, Minnesota, Missouri, Oklahoma, Tennessee, Texas, and West Virginia (CCA, 2016a). Feedback from the USG participants could be gathered to make the DEPS—CMAS and DEPS—CMFS more concise and relevant to be used across the entire United States.

A study of best practices for the Corequisite Model at technical schools should also be considered. The Technical College System of Georgia (TCSG) has 22 technical colleges. In 2017, TCSG had 134,630 students enrolled. They also had a retention rate of 69.6% (TCSG, 2017). That estimates to be 58,800 students who did not complete their diploma program. How many of those students were lost because they could not complete their remedial math requirement?

A similar study could be replicated for Corequisite English in USG institutions. A survey could be adjusted to be English specific, and individuals with the highest Corequisite English success rate could be interviewed. The success rate for remedial English students is 79% which is higher than remedial math students in the USG (70%).

However, success rates range from 60% to 98%. Further research could provide the best practices to improve all Corequisite English success rates.

Conclusion and Recommendations

Having the highest number of college graduates in the world is a goal of this nation. There are 20 million Americans currently enrolled in college; statistically only 5% will complete an associate's degree in two years; only 19% will finish a bachelor's degree in four years (CCA, 2019). Complete College Georgia (2019a) estimates 60% of jobs in Georgia will require a college education, and only 48% of the state's young adults qualify. Task Forces were created in Georgia to identify strategies for the state's public and private institutions to add an additional 250,000 college graduates by the year 2020 (Deal Charges Campus, 2012). Updating the state's learning support model to the Corequisite Model was one of those strategies. However, the desire to add an additional 250,000 college graduates by the year 2020 has since been pushed back to 2025 (CCG, 2019a), as we are not meeting our state's or nation's goal for graduates. The need for remediation is still the leading reason.

There is still a significant gap in the literature identifying which characteristics of the Corequisite Model yield the highest rates of success. The USG Mathematics Ad Hoc Committee (2014) and Saxon and Martirosyan (2017) gave a baseline of best practices, but that information is not detailed enough to obtain the greatest success rates from the Corequisite Model. The committee and authors merely recommended best practices but could not offer quantitative data to show those practices are, in fact, the best. Even this study was unable to offer quantitative evidence on best practices.

Students who pass their gateway courses (math and English) are more likely to graduate with a degree (Bailey et al., 2013; Edgecombe, 2011; CCG, 2016). We in academia must continue to discover ways to help our students succeed in their gateway courses, including continuously working to improve the Corequisite Model. More research should be done on the Corequisite Model to discover what combined practices create the best success rates.

In Fall of 2017, the USG had 5,538 students enrolled in Corequisite English and math remediation. The majority of those students (4,505 students, or 81%) were enrolled in Corequisite math. Seventy percent of those remedial math students successfully exited their gateway math course. Nineteen percent or 1,300 USG students did not pass their gateway math courses. As educators, we owe it to those failing students to continue investigating the best practices of the Corequisite Model. There could be factors affecting institutions' success rate that are beyond the control of the instructors, such as admission standards, student demographics, or student aspirations (Khattab, 2015). There are some students who are truly not prepared for the rigor of college coursework (Bailey et al., 2010; Jansen & Meer, 2011). President David Bridges of Abraham Baldwin Agricultural College gave an introductory speech at the USG 2019 Corequisite Academy. He said, "I want you to remember two words: meet and take. We have to meet the students where they are and take them where they need to be. Not all of them will survive the journey, but we will get the others where they need to be." While we may not be able to help all students, perhaps through further research and implementation of best practices, we can find ways to help more students and attain the goal set by our nation.

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APPENDIX A:

Institutional Review Board Protocol Exemption Report

VALDOSTA STATE UNIVERSITY

Institutional Review Board (IRB)

for the Protection of Human Research

PROTOCOL NUMBER:	**03517-2017**	**INVESTIGATOR:**	**Ms. April Abbott**
		SUPERVISING FACULTY:	**Dr. Iris Ellis**
PROJECT TITLE:	***Program Characteristics of the Mathematics Corequisite Model in the State of Georgia.***		

INSTITUTIONAL REVIEW BOARD DETERMINATION:

This research protocol is **Exempt** from Institutional Review Board (IRB) oversight under **Category 2**. You may begin your research study immediately. If the nature of the research study changes such that exemption criteria may no longer apply, please consult with the IRB Administrator (irb@valdosta.edu) before instituting any changes.

ADDITIONAL COMMENTS:

☒ ***If this box is checked, please submit any documents you revise to the IRB Administrator at irb@valdosta.edu to ensure an updated record of your exemption.***

Elizabeth W. Olphie 09/26/2017 ***Thank you for submitting an IRB application.***

Elizabeth W. Olphie, IRB Administrator Date ***Please direct questions to irb@valdosta.edu or 229-259-5045.***

Revised: 06.02.16

APPENDIX B:

Developmental Education Program Survey–

Corequisite Mathematics Administration Specific

Appendix B
Developmental Education Program Survey – Corequisite Mathematics Administration Specific

Purpose: This research explores administrators' perceptions on student success in connection with institutional practices about (a) institutional adaptations, (b) USG Task Force institutional implementations, and (c) institutional requirements for students.
Consent: Your submission of this survey indicates your consent for participation. All responses will be kept strictly confidential, and only group-level results will be reported.

Directions: Please darken the numeral in each column that best represents your degree of agreement with each statement.

On a scale of 0 to 4:
0 = No Implementation (no evidence that the practice has been implemented at the institution);
1 = Under Discussion (the practice is being discussed or is in the planning stages);
2 = Marginal Implementation) there are isolated examples of the practice at the institution);
3 = Partial Implementation (the practice is being implemented in some areas of the institution in a visible and substantial way);
4 = Full Implementation (the practice has been fully implemented across the institution)

A.	**The institution has...**	**No Implementation**	**Under Discussion**	**Marginal Implementation**	**Partial Implementation**	**Full Implementation**
1.	Clearly defined REQUIRED student learning outcomes for each Corequisite Model math course.	(0)	(1)	(2)	(3)	(4)
2.	Clearly defined REQUIRED student learning outcomes for each collegiate-level math course.	(0)	(1)	(2)	(3)	(4)
3.	The organizational arrangement of Corequisite courses and services are housed in a decentralized program (developmental education is assigned to the English and mathematics departments).	(0)	(1)	(2)	(3)	(4)
4.	The organizational arrangement of Corequisite courses and services are housed in a centralized program (developmental education has its own department).	(0)	(1)	(2)	(3)	(4)
5.	Late registration made available to developmental students.	(0)	(1)	(2)	(3)	(4)
6.	Implemented an "early warning" system to alert administrators or counselors about students who need extra help.	(0)	(1)	(2)	(3)	(4)
7.	Implemented an academic assistance center where tutoring is offered.	(0)	(1)	(2)	(3)	(4)
8.	Required tutoring training or certification such as by the College Reading and Learning Association (CRLA).	(0)	(1)	(2)	(3)	(4)

B.	**The institution has...**	**No Implementation**	**Under Discussion**	**Marginal Implementation**	**Partial Implementation**	**Full Implementation**
9.	Aligned the outcomes of gateway mathematics courses with the Common Core Georgia Performance Standards (CCGPS) for Mathematics.	(0)	(1)	(2)	(3)	(4)
10.	Developed advising systems and protocols for placing students in gateway mathematics courses and Corequisite supports that align with their intended programs of study.	(0)	(1)	(2)	(3)	(4)
11.	Actively engaged in the process for certification of its developmental education program and services with the National Association of Developmental Education (NADE).	(0)	(1)	(2)	(3)	(4)
12.	Corequisite support students mixed with non-support students in the gateway courses.	(0)	(1)	(2)	(3)	(4)
13.	Students being advised to take 15-credit hours per fall and spring semester.	(0)	(1)	(2)	(3)	(4)
14.	Terminated the use of an exit examination such as the COMPASS exam.	(0)	(1)	(2)	(3)	(4)

C.	**Corequisite developmental students are required to...**	**No Implementation**	**Under Discussion**	**Marginal Implementation**	**Partial Implementation**	**Full Implementation**
15.	Take fewer hours if they are employed full-time.	(0)	(1)	(2)	(3)	(4)
16.	Take a full-load.	(0)	(1)	(2)	(3)	(4)
17.	Under mandatory advising/counseling.	(0)	(1)	(2)	(3)	(4)
18.	Participate in a college orientation.	(0)	(1)	(2)	(3)	(4)
19.	Participate in a study skills or success course.	(0)	(1)	(2)	(3)	(4)
20.	Be assessed on their technology skills if they are enrolled in an online course.	(0)	(1)	(2)	(3)	(4)

Developmental Education Program Survey –
Corequisite Mathematics Administration Specific

Directions: Check or fill in each column that best reflects you as an USG administrator.	
D.	**Demographic Characteristics**
21.	Please select your gender.
	( ) Male
	( ) Female
22.	Please select your years of experience.
	( ) 0-4 years
	( ) 5-10 years
	( ) 10+ years
23.	Please select your job title
	( ) Department Chair/Dean
	( ) Administrator
24.	Please select the USG institution you are currently employed at.
	( ) Abraham Baldwin Agricultural College
	( ) Albany State University
	( ) Armstrong State University
	( ) Atlanta Metropolitan State College
	( ) Bainbridge State College
	( ) Clayton State University
	( ) College of Coastal Georgia
	( ) Columbus State University
	( ) Dalton State College
	( ) East Georgia State College
	( ) Fort Valley State University
	( ) Georgia College & State University
	( ) Georgia Gwinnett College
	( ) Georgia Highlands College
	( ) Georgia Southern University
	( ) Georgia Southwestern State University
	( ) Gordon State College
	( ) Kennesaw State University
	( ) Middle Georgia State University
	( ) Savannah State University
	( ) South Georgia State College
	( ) University of North Georgia
	( ) University of West Georgia
	( ) Valdosta State University

APPENDIX C:

Developmental Education Program Survey–

Corequisite Mathematics Faculty Specific

Appendix C
Developmental Education Program Survey – Corequisite Mathematics Faculty Specific

Purpose: This research explores administrators' perceptions on student success in connection with institutional practices about (a) institutional adaptations, (b) USG Task Force institutional implementations, and (c) institutional requirements for students.
Consent: Your submission of this survey indicates your consent for participation. All responses will be kept strictly confidential, and only group-level results will be reported.

Directions: Please darken the numeral in each column that best represents your degree of agreement with each statement.
On a scale of 0 to 4:
0 = No Implementation (no evidence that the practice has been implemented at the institution);
1 = Under Discussion (the practice is being discussed or is in the planning stages);
2 = Marginal Implementation) there are isolated examples of the practice at the institution);
3 = Partial Implementation (the practice is being implemented in some areas of the institution in a visible and substantial way);
4 = Full Implementation (the practice has been fully implemented across the institution)

A.	**Faculty members have...**	**No Implementation**	**Under Discussion**	**Marginal Implementation**	**Partial Implementation**	**Full Implementation**
1.	Developed common criteria or rubrics that are used in ascertaining and documenting each student's level of attainment of required learning outcomes.	(0)	(1)	(2)	(3)	(4)
2.	Clearly articulated learning outcomes at different levels of the developmental curriculum; consequently, prerequisites are clear and rational, and sequential levels are aligned with one another.	(0)	(1)	(2)	(3)	(4)
3.	Focused the support on material closely linked to material being covered in the gateway course at the same time.	(0)	(1)	(2)	(3)	(4)
4.	Created a team composed of one academic math faculty member and one developmental math faculty member who attend both support and collegiate courses.	(0)	(1)	(2)	(3)	(4)
5.	Implemented low-no cost classrooms that use open resource textbooks and software.	(0)	(1)	(2)	(3)	(4)

Developmental Education Program Survey –
Corequisite Mathematics Faculty Specific

A.	Faculty members have...	No Implementation	Under Discussion	Marginal Implementation	Partial Implementation	Full Implementation
6.	Be assessed on their technology skills if they are enrolled in an online course.	(0)	(1)	(2)	(3)	(4)
7.	Engaged in appropriately challenging and natural, authentic tasks that involve active problem solving.	(0)	(1)	(2)	(3)	(4)
8.	Connected new learning with their prior knowledge in ways that address well-documented common misconceptions and that anchor new concepts in existing competencies.	(0)	(1)	(2)	(3)	(4)
9.	Developed adequate conceptual understanding to support knowledge transfer and the productive use of newly acquired skills to solve problems.	(0)	(1)	(2)	(3)	(4)
10.	Received timely professional feedback from peers so they can revise their methods.	(0)	(1)	(2)	(3)	(4)
11.	Returned timely feedback to students so they can revise their knowledge before examinations.	(0)	(1)	(2)	(3)	(4)
12.	Developed conceptual and procedural fluency by practicing important skills, concepts, and principles in a variety of contexts increasingly distant from the context in which they learned them.	(0)	(1)	(2)	(3)	(4)
13.	Developed metacognitive awareness of their performance – for example, by developing strategies that allow them to self-monitor when solving a problem.	(0)	(1)	(2)	(3)	(4)

B.	The institution has...	No Implementation	Under Discussion	Marginal Implementation	Partial Implementation	Full Implementation
14.	The same instructor teach the support and collegiate course.	(0)	(1)	(2)	(3)	(4)
15.	Kept support class sizes under 15-22 students to allow for more one-on-one instruction.	(0)	(1)	(2)	(3)	(4)
16.	Incorporated mandatory attendance as part of the grade in the support course.	(0)	(1)	(2)	(3)	(4)
17.	Incorporated critical thinking concepts and methods into the Corequisite mathematics curriculum.	(0)	(1)	(2)	(3)	(4)

C.	Students enrolled in ...	No Implementation	Under Discussion	Marginal Implementation	Partial Implementation	Full Implementation
18.	Collegiate mathematics courses are tested at least 4 times a semester.	(0)	(1)	(2)	(3)	(4)
19.	Support classes are frequently engage in self-assessment and reflection on their learning processes and goals	(0)	(1)	(2)	(3)	(4)
20.	Foundations courses are provided intensive academic support.	(0)	(1)	(2)	(3)	(4)
21.	The Corequisite Model are provided with up-to-date and accessible information regarding state, district, and college policies that will impact their college experience such as placement exam score changes or changes in course offerings.	(0)	(1)	(2)	(3)	(4)
22.	The Corequisite Model are provided with up-to-date and accessible information regarding academic support programs.	(0)	(1)	(2)	(3)	(4)
23.	Math foundations courses are assigned homework.	(0)	(1)	(2)	(3)	(4)

C.	Students enrolled in ...	No Implementation	Under Discussion	Marginal Implementation	Partial Implementation	Full Implementation
24.	Math foundations courses take unit exams.	(0)	(1)	(2)	(3)	(4)
25.	Math foundations courses take a midterm.	(0)	(1)	(2)	(3)	(4)
26.	Math foundations courses take a final exam.	(0)	(1)	(2)	(3)	(4)
27.	Math support class are assigned homework in the support class.	(0)	(1)	(2)	(3)	(4)
28.	Math support class take unit exams in the support class.	(0)	(1)	(2)	(3)	(4)
29.	Math support class take a midterm in the support class.	(0)	(1)	(2)	(3)	(4)
30.	Math support class take a final exam in the support class.	(0)	(1)	(2)	(3)	(4)

D.	The mathematics division/department systematically utilizes...	No Implementation	Under Discussion	Marginal Implementation	Partial Implementation	Full Implementation
31.	Cooperative learning in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
32.	Collaborative learning in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
33.	Learning communities in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
34.	Contextual learning in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
35.	Mastery learning in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
36.	Problem based learning in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
37.	Curriculum and teaching strategies that align with required student learning outcomes.	(0)	(1)	(2)	(3)	(4)

E.	The institution delivers the support Corequisite course instruction as...	No Implementation	Under Discussion	Marginal Implementation	Partial Implementation	Full Implementation
38.	In-class lectures.	(0)	(1)	(2)	(3)	(4)
39.	Online methods.	(0)	(1)	(2)	(3)	(4)
40.	Hybrid (in-class and online).	(0)	(1)	(2)	(3)	(4)
41.	Emporium model.	(0)	(1)	(2)	(3)	(4)
42.	Non-course based instruction.	(0)	(1)	(2)	(3)	(4)
43.	Self-paced instruction.	(0)	(1)	(2)	(3)	(4)
44.	Individualized instruction.	(0)	(1)	(2)	(3)	(4)
45.	Modules.	(0)	(1)	(2)	(3)	(4)
46.	Immersion.	(0)	(1)	(2)	(3)	(4)

F.	The mathematics division/department utilizes...	No Implementation	Under Discussion	Marginal Implementation	Partial Implementation	Full Implementation
47.	Study skills workshops in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
48.	Frequent provision of feedback on students' academic performance in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
49.	Technology and media to support student learning in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
50.	Supplemental instruction in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
51.	Tutoring in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)
52.	A math learning center in its Corequisite Model.	(0)	(1)	(2)	(3)	(4)

Developmental Education Program Survey – Corequisite Mathematics Faculty Specific

Directions: Check or fill in each column that best reflects you as an USG faculty member.	
D.	**Demographic Characteristics**
53.	Please select your gender.
	( ) Male
	( ) Female
54.	Please select your years of experience.
	( ) 0-4 years
	( ) 5-10 years
	( ) 10+ years
55.	Please select your job title
	( ) Department Chair/Dean
	( ) Administrator
56.	Please select the USG institution you are currently employed at.
	( ) Abraham Baldwin Agricultural College
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