2020

Strategies for Improving Remedial Mathematics Performance Among Community College Students

Lateria S. Joiner
Walden University

Walden University

College of Education

This is to certify that the doctoral study by

Lateria S. Joiner

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Robert Hogan, Committee Chairperson, Education Faculty
Dr. James Valadez, Committee Member, Education Faculty
Dr. Narjis Hyder, University Reviewer, Education Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2020

Abstract

Strategies for Improving Remedial Mathematics Performance Among Community College Students

by

Lateria S. Joiner

EDS, Mississippi State University, 2009

MA, Mississippi State University, 2007

BS, Mississippi State University, 2006

Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

January 2020

Abstract

Increasing numbers of underprepared students throughout the United States must enroll in college remedial math courses, which delays students' graduation and increases withdrawal rates. Two-thirds of first-year college students at a rural community college in the southeastern United States were required to enroll in remedial mathematics. Only 65% completed the course. Guided by Bandura's theory of self-efficacy, which maintains that belief in one's ability improves success, the purpose of this qualitative study was to examine the perceptions of instructors, administrators, and students to explain the gap in performance in remedial mathematics and to use the results of this study to identify strategies to improve student performance. The study incorporated semi structured interviews with purposeful sampling of 15 remedial math students, 4 remedial math instructors, and the head of the mathematics department. Perceptions of the students and instructors were coded to identify and analyze emerging themes. Findings revealed the following themes: effectiveness of the remedial class, teaching and learning preferences, obstacles to learning, and suggestions for improvement. These findings led to the development of a 3-day professional development project to develop instructional strategies to improve students' skills in task managing goals, tasks, and challenges; and to collaborate with local school districts to develop strategies to improve student performance in college mathematics. The study provides teachers and administrators with strategies that may lead to improved student preparation and success in remedial math, and opportunities to collaborate with local high schools to reduce the number of students requiring remedial mathematics.

Strategies for Improving Remedial Mathematics Performance Among Community College Students

by

Lateria S. Joiner

EDS, Mississippi State University, 2009

MA, Mississippi State University, 2007

BS, Mississippi State University, 2006

Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

January 2020

Dedication

I dedicate this project study to my late father, Gene Joiner, who instilled in me a constant drive toward becoming my best self. I also dedicate this study to my immediate family; Jaden, Aari, and Antoine, thanks for being my motivation to get through this very difficult journey. Finally, but definitely not least, I dedicate this study to my mom and two sisters; Marie, Angela and Dorthy, you all are my foundation. I would not have reached the academics success that I have if it was not for your constant efforts of encouragement and insistence. Thank you.

Acknowledgements

I would like to express my sincere gratitude to the members of my project committee: Dr. Bob Hogan, Dr. James Valadez, and Dr. Narjis Hyder. I would also like to thank my virtual mentor team and colleagues who provided me with valuable advice throughout most of my doctoral study: Dr. Jean Sorell and Dr. Lynne Orr.

Table of Contents

List of Tables

List of Figures

Section 1: The Problem

The Local Problem

According to the National Conference of State Legislatures (NCSL, 2016), more than 50% of first-time, first-year undergraduates must enroll in remedial math. Furthermore, the NCSL reported a mere 27% of students currently enrolled in remedial math earned a bachelor's degree; others found a link between student math abilities and their overall college and academic success (Cortes, Goodman, & Nomi, 2015; Parker, Marsh, Ciarrochi, Marshall, & Abduljabbar, 2013). College leaders must offer remedial math courses (Eddy & Hogan, 2014) and ensure these provide students with the best possible chances of succeeding (Cafarella, 2014; Fong, Melguizo, & Prather, 2015; Petty, 2014). Due to this requirement, enrollment in remedial math is high, which is a national challenge for college leaders (Belfield, Crosta, & Jenkins, 2014). The need for remedial math education negatively influences student success, with students needing to take additional courses to gain the necessary skills and knowledge to enroll in upper-level college courses (Fong et al., 2015). Remedial math courses for undergraduates must successfully develop student knowledge to support success as they matriculate.

While undergraduates requiring remedial math is a national problem, each state is unique in how the problem continues to impact undergrad students. The problem is similar in Mississippi, where 9,895 students enrolled in remedial courses (Mississippi LifeTracks, n.d.). This population is true at the study's local level as well; of the over 15,000 first-time students enrolled in community colleges, almost 10,000 (67%) have enrolled in remedial math education at John Morris Community College (JMCC); JMCC

is a pseudonym for the rural Mississippi community college in this study. Additionally, Twigg (2013) reported that approximately 50% of remedial math students complete college math, a requirement for graduation. Figure 1 shows the percentage of first-time Mississippi students enrolled in remedial math courses at in-state community colleges has continued to increase. This finding indicates Mississippi college leaders must increasingly provide remedial math courses to their students (e.g., Dasinger, 2013). The increase has also led to college leaders needing to adapt and improve the already-existing courses to manage increasing needs better (Skinner, 2014). Leaders must be prepared to be efficient and effective with resources to deliver a high-quality education to college and university students as higher education must play a larger role in the development of cursory skills needed for scholastic success.

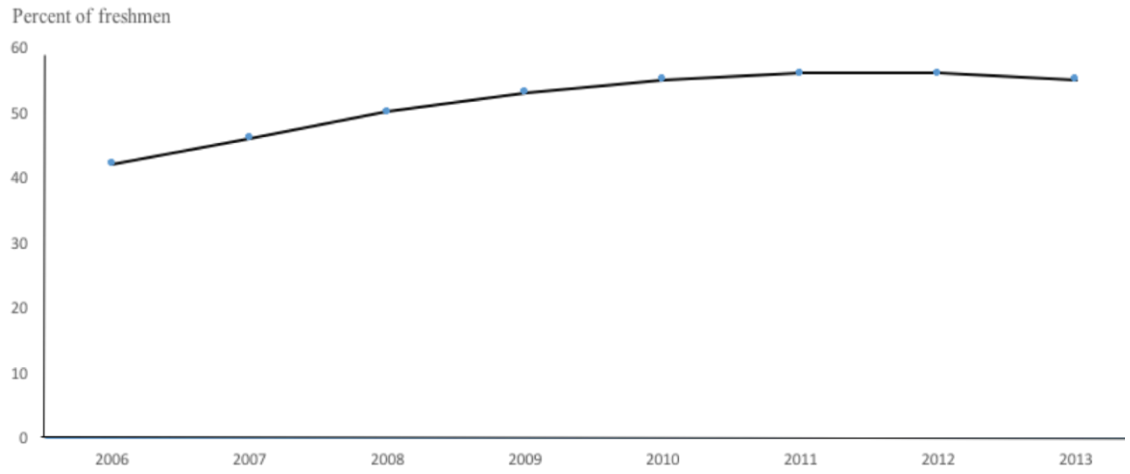


Figure 1. First-time community college

Students at JMCC have enrolled in remedial courses in record numbers, which has resulted in students needing to repeat the courses (J. Rosenburg, personal communication, May 20, 2016). In the 2014/2015 academic year, JMMC reported a total of 8,746 new (first year) remedial math enrollees across their campuses, and a total of 23,112 remedial math enrollees across all years and campuses. Consequently, JMCC's current remedial math courses are not entirely adequate to address the needs of remedial math students.

Rationale

There is a pressing need for college leaders to maintain and grow the effectiveness and efficiency of remedial math programs at the higher education level. The increased demand for remedial math courses at the college level has caused college leaders to focus on their current course offerings and find better ways of meeting student math needs (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). Acosta and College (2016), Cortes et al. (2015), Fong et al. (2015), Parker et al. (2013), Petty (2014),

and Price and Tovar (2014) all reported that leaders must meet the increased demand for remedial courses and find ways of improving current remedial course offerings. At JMCC, college leaders have implemented strategies to meet the increased demand for student success (J. Rosenburg, personal communication, May 20, 2016). They have aimed to improve student success in remedial math courses.

As of 2018, JMCC has a majority of African American students (49.6%) enrolled at the college; the remaining enrollees are Caucasian (47.1%), Hispanic (approximately 2%), and other (approximately 1.3%). Data from JMCC archives indicated that of the over 23,000 students enrolled in intermediate remedial math courses across campuses in 2014/2015, just over 10,500 (or 64.7%) successfully completed those courses. The student retention rate for that academic year was 59.4% across the JMCC campuses. Students partaking in college-level math remediation courses tended to fare better, averaging 75.7% completion between 2012 and 2015, while reporting a completion rate of 76.9% in 2015. JMCC's increased retention rates may be linked to such increased remedial course completion (J. Rosenburg, personal communication, May 20, 2016). The increased retention may also be from JMCC's various attempts to improve its current remedial offerings (J. Rosenburg, personal communication, May 20, 2016). However, more research is needed to determine the accuracy of this statement. Further research is also needed into improving current remedial course offerings even more.

Thus, the purpose of this qualitative intrinsic case study was to explore the perceptions of community college remedial math instructors, administrators, and remedial math students regarding the causes of low student performance in remedial

mathematics. The goal was to identify approaches to improve the math proficiency of students in remedial math courses. By highlighting perceptions of those directly involved in and affected by remedial mathematics courses, I gathered practical and implementable strategies for future remedial course improvements.

Definition of Terms

Developmental education: Developmental education courses are classes taken in college that are below college level (Bautsch, 2013).

Developmental math sequence: Developmental math sequence begins with the preliminary assessment and referral of a student to remediation; culminating in the student completing the highest required level for completion (i.e., the course that assists students with preparation for college-level studies (Bailey, Jeong, & Cho, 2010).

Remedial math: Remedial math is a subdivision of developmental education required to educate, instruct, and support students in the skills and assessment needed to complete gateway courses instruction successfully (Acosta & College, 2016).

Significance of the Study

Remedial education is frequently at the foundation of the undergraduate experience for students, and the frequency continues to increase. According to Bailey et al. (2010), nearly two-thirds of community college students must enroll in remedial education. Students taking remedial math courses are also less likely to achieve college-level math proficiency (Bahr, 2013). Researchers have also linked low completion rates to students' slow academic progress and instructors' expectations (Rubie-Davies, 2010; Twigg, 2013). Thus, remedial math course improvements are needed to limit course

repetitions and improve both students' math proficiency and instructors' assistance (Cortes et al., 2015; Holzberger, Philipp, & Kunter, 2013; Parker et al., 2013). Addressing such improvements from an administrator, instructor, and student perspective could ensure more holistic and effective remedial math intervention (Klassen & Tze, 2014; S. Rodríguez et al., 2014); however, limited research exists regarding college-level remedial math courses focusing on these stakeholders' perspectives. This intrinsic qualitative case study meets the need for research, as I have explored the perceptions of remedial math instructors, administrators, and students regarding the potential reasons for poor remedial math competency at a community college. I studied how the participants believe students could become better prepared to be successful in those courses.

By better understanding stakeholder perceptions, college leaders could use the findings and suggestions within this study to improve student success in remedial math, better meet the needs of students, and improve overall student success. Lowering student remediation rates would reduce time to graduate and tuition cost, as well as increase the college's completion rates. This study has contributed to the literature gap regarding student, administrator, and instructor perceptions of causes of the remedial math problem in this college. I have proposed ways to improve the pass rate in remedial math courses.

Research Questions

At the local study site, the number of students requiring remedial math courses and repeating the courses has increased over time, which has increased the time to graduation and increased dropout rates. Thus, I sought to understand why students have continued to fail remedial math courses and how to improve student success in those

remedial math courses. The guiding research question for this study focused on the perceptions of students, instructors, and administrators regarding the reasons for low student performance in remedial math. The goal of the study was to identify solutions to improve student success. Within this framework, I investigated the following research questions:

RQ1: What do students perceive as reasons for low performance among remedial math students?

RQ2: What do instructors perceive as reasons for low performance among remedial math students?

RQ3: What do administrators perceive as reasons for low performance among remedial math students?

RQ4: What approaches do students recommend for improving student performance in remedial math courses?

RQ5: What approaches do instructors recommend for improving student performance in remedial math courses?

RQ6: What approaches do administrators recommend for improving student performance in remedial math courses?

Review of the Literature

The literature review for this study includes research on aspects related to remedial math performance of community college students. I conducted the online search through the Walden University Library Website by accessing electronic databases such as Education Resource Information Center (ERIC), ProQuest, and EBSCO Host. Cited

sources included scholarly articles, research publications, and peer-reviewed articles. To gain the most relevant sources for this study, the word search included the interchangeable use of the following key terms: *community college, developmental education, remedial math, instructor, student attrition,* and *administrator perceptions.* A total of 85% of the sources included and reviewed in this section focused on primary research published within the past 5 years. The references published before 2013 were mostly seminal works relating to the topic and conceptual framework.

This literature review section is organized into two broad parts: (a) the conceptual framework of self-efficacy to be used in this study and (b) the review of the broader literature. The review of the literature is further broken down into subcategories regarding teacher and student self-efficacy in relation to student success and achievement, means of predicting self-efficacy, factors related to student completion rates, ways of improving students' college readiness, current remedial course effectiveness, what kinds of issues and problems students deal with in relation to math, best practices in remedial math, and obstacles that lead to student failure. I end the review with a brief overview of the main issues noted. This overview then leads to the final discussions for this first section regarding implications and the overall summary of the section. The following section presents the conceptual framework for this study.

Conceptual Framework

The conceptual framework for this study was developed from Bandura's (1997) theory of self-efficacy. The theory of self-efficacy is defined as individuals' beliefs that they can meet a given objective or goal (Bandura, 1997). Self-efficacy is related to

confidence in one's capability to achieve a goal (Wang, Shannon, & Ross, 2013). Researchers of the theory have asserted that a person's attitude may impact the likelihood they would take the necessary actions to achieve the said goal (Wang et al., 2013). Such actions could relate to how successfully individuals implement and use available resources or attempt and strategize to remain motivated throughout a task (Klassen & Tze, 2014; Komarraju & Nadler, 2013). Therefore, self-efficacy may help to understand how to improve student success of students in remedial courses at the higher education level.

Self-efficacy theory is important because of the role it can play in whether a student will perform well or not. For students, self-efficacy theory establishes their beliefs and attitudes may dictate behavior academic performance (Bandura, 1997). According to the self-efficacy theory, if a person can remain determined and diligent, he/she will likely perform well academically (Zimmerman, Bandura, & Martinez-Pons, 1992). This dissertation was focused on understanding how this process works through students in math courses. An individual's thought process and self-belief can influence his or her potential success or failure (Zimmerman et al., 1992). Furthermore, students' recognition of their own learning efficacy can determine levels of motivation and accomplishment (Jungert, Hesser, & Träff, 2014). Based on these findings there is support for the research performed in this dissertation where remedial success could, in part, be contingent on their own self-efficacy.

Further, research findings support there being different magnitudes of self-efficacy and each level having consequences. Based on these contributing factors, Jungert

et al. (2014) and Zimmerman and Kitsantas (2014) identified the following two types of efficacy beliefs: high efficacy and low efficacy. Enhanced self-efficacy encourages self-responsibility that leads to goal achievement (Zimmerman & Kitsantas, 2014). Conversely, low self-efficacy often related to the belief that failure to achieve goals is the fault of others (van der Westhuizen, de Beer, & Bekwa, 2011). Therefore, there are a form of social thought processes which are at play which are attached to self-efficacy.

Bandura (1997) linked social cognitive theory with self-efficacy. Social cognitive theory argues that actions are affected by such factors as knowledge, outcome expectation, goals, and facilitators. Social settings where individuals feel connected to others, in conjunction with such factors, can promote autonomous motivation and social success (Lechuga & Lechuga, 2012). This is in part because autonomy is linked to elements of self-efficacy theory where individuals attribute successes to themselves and failures to others. Thus, student achievement can be linked with a social context. An instructor's level of self-efficacy influences his/her students' learning environment (Holzberger et al., 2013; Klassen & Tze, 2014). Instructors' self-efficacy level can play a role in creating a positive social setting for students (Malinen et al., 2013; Peters, 2013). Therefore, it is essential to consider the social processes between the instructor and the student, where self-efficacy could be impacted by their social interactions. If instructors can model expected self-efficacy behaviors to their students, they will likely promote students' self-efficacy (Zimmerman & Bandura, 1994). This improvement can lead to higher levels of academic achievement (Pendergast, Garvis, & Keogh, 2011). The instructor as a role model in the classroom can play a pivotal role in student success.

By using the theory of self-efficacy to frame this study, I provided a context in which to understand and provide reasons for students' current academic achievement, or lack thereof, within their remedial math courses. I used the framework to ensure I asked pertinent questions during data collection to understand instructor and student perceptions better regarding the potential causes of and reasons for low student performance in remedial math courses. The self-efficacy framework assisted in determining the influence of the instructor-student relationship within such courses and provided a basis for seeing how instructors could further assist their students in achieving better results in math remediation. This particular theory provided a valuable lens through which to study this particular topic.

Review of the Broader Problem

The following section presents a review of the broad issue represented in the literature. First, there is a disconnect between what remedial courses offer students and what students require in order for them to be retained in their programs and to successfully matriculate towards graduation. Remedial efforts intended to move underprepared students closer to graduation may cause them to fall short of completion (Bettinger, Boatman, & Long, 2013; Ortiz & Dehon, 2013), which was partly due to students' lack of college readiness (Bremer et al., 2013; Camara, 2013).

Approximately 50 percent of students in open-door community colleges policy need remediation (Complete College America, 2011; Hodara, 2013). Nearly three-fourths of students enrolled in remediation are unsuccessful in completing college-level courses (Bahr, 2013). This finding was particularly true for math remediation (Hodara & Jaggars,

2016). Remediation requirements and student failure to complete courses indicate a likely discrepancy between the remedial course education that colleges offer, and what students require to complete their courses and attain a degree successfully. Remedial math course attrition can be due to how far behind students are in their math abilities (Cortes et al., 2015; Parker et al., 2013). In many cases, remedial courses fail to deliver on the development and preparation of students for a successful undergraduate experience.

Considering remedial math is intended to nurture students to succeed and graduate college, researchers should assess how remedial math can be improved and what factors are influencing the current attrition rates of remedial math students (see Pape & Prosser, 2018; Perin, 2018). The following subsection includes a discussion of self-efficacy of teachers and the role that this plays for student success.

Teacher self-efficacy and student success. This subsection provides a discussion of self-efficacy and student success**.** The self-efficacy of a teacher is important because of the role it plays in the classroom system vis-à-vis the teacher's involvement as a role model. Teacher/instructor self-efficacy refers to a teacher believing that he/she can stimulate students' learning (Zimmerman & Bandura, 1994). Teacher self-efficacy is a vital aspect of motivation for students that directly influences outcomes in the classroom (Pendergast et al., 2011). High levels may influence and foster group and individual student motivation that develops successful students (Siddique, Aslam, Khan, & Fatima, 2011). Therefore, students are dependent on a classroom experience led by a teacher who is capable of functioning as a leader that students can base their behaviors off of in the classroom.

Teacher self-efficacy and class practice. Self-efficacy has an impact in student success through their teachers. Self-efficacy also measures how able teachers are to teach in various class structures, within an inclusive educational environment, and across different cultures and demographics (Vieluf, Kunter, & van de Vijver, 2013). Because many U.S. community colleges are open door, U.S. remedial instructors must effectively teach a wide range of students (Cafarella, 2014; Douglas & Attewell, 2014). The level of teacher efficacy can be a good gauge for how effective teaching and learning can occur, regardless of what models and approaches are used (Malinen et al., 2013). Vieluf et al. (2013) established that strong faculty efficacy, translated into better student outcomes and higher levels of personal job satisfaction. High self-efficacy also often leads to instructors raising the bar of academic achievement motivation in their students (Malinen et al., 2013; Vieluf et al., 2013). Through self-efficacy, students are prepared to have stronger classroom performance because they take on positive behaviors.

In the scope of mathematics, previous research supports the role of self-efficacy among math students. In Holzberger et al.'s (2013) longitudinal panel study of 155 math teachers and 3,483 ninth grade learners in Germany, the researchers noted how self-efficacious teachers had a positive influence on overall learner math success. Riconscente (2014) further substantiated the relationship between teacher self-efficacy and student math success, noting that teachers' abilities to explain content well and promote student interest in the subject matter were the following: (a) directly linked to their personal levels of self-efficacy and (b) could work to improve student math results. The current

study would, in part, better establish how teacher efficacy could impact on an older, U.S.-based, student population group, which would further add to the literature.

Effects of teacher evaluation and teacher personality. Personal characteristics of a teacher can play a positive role in student success; however, teachers must understand the expectations that evaluators have of their performance. Klassen and Tze (2014) noted regular teacher efficacy evaluation, as well as teacher personality and general psychological make-up, could all play key roles in students' level of success. In a quantitative study of math in-service training in Appalachian schools, Barrett, Cowen, Toma, and Troske (2015) reported teacher participation had a positive influence on student success in math. However, S. Rodríguez et al. (2014) warned that teacher overconfidence could negatively influence students, as students would often become overly reliant on their teachers rather than actively participating in the learning process. Conversely, teachers who were not self-efficacious or had low confidence in their teaching abilities could create extra stress and demotivation in their students (Rodríguez et al., 2014). Personal teacher characteristics can influence student success; therefore, factors such as confidence should be a part of how teachers are evaluated and interventions to improve performance are pursued by administration and school leadership.

Based on this review of the literature in this subsection, teachers' levels of self-efficacy can influence student success. The more teachers have confidence in their teaching and knowledge, the more likely they will motivate students (Pendergast et al., 2011; Vieluf et al., 2013). Their confidence can lead their students toward meeting

academic goals (Siddique et al., 2011). Conversely, lower teacher-efficacy and confidence levels can lead to student demotivation and anxiety (Klassen & Tze, 2014; S. Rodríguez et al., 2014). Therefore, teachers require proper training and continuous development and assessment opportunities to ensure sufficient self-efficacy to promote student success (Barrett et al., 2015). Without a focus on continuous improvement, teacher knowledge, skill and ability could deteriorate.

Self-efficacy and student achievement. Several studies report links between student achievement and self-efficacy. Such beliefs can determine an individual's effort and endurance (Martin, Galentino, & Townsend, 2014; Venezia & Jaeger, 2013). Fenning and May (2013) supported the notion that self-efficacy influenced individuals' behavior, as individuals would present with differing behaviors and abilities according to how their low or high self-efficacy had influenced their perceptions. Therefore, while skill, knowledge and ability are important, efficacy may impact how it is utilized. These different perceptions can cause individuals to respond differently to their environments, with those with lower levels deterring achievement, while those with higher levels enhancing their learning and performances (Fenning & May, 2013; van der Westhuizen et al., 2011). Their behavior is based on both their capacity to perform and their self-efficacy.

Self-efficacy will therefore impact student's perceptions of internal capabilities. Students with low levels of self-efficacy may believe intelligence is innate, and academic success cannot be learned or changed (Komarraju & Nadler, 2013). Alternatively, students with high levels of self-efficacy may attempt to improve intelligence and

academic success by setting and attaining goals, while gaining knowledge in different areas (Zuffianò et al., 2013). Highly self-efficacious learners may demonstrate better motivation and course satisfaction (C.-H. Wang et al., 2013). The experience of the classroom is different where their success and goal achievement will impact further performance. This supposition supports the idea that emotions and beliefs can influence learning experiences (Mega, Ronconi, & de Beni, 2014). Moreover, there is an interplay between student emotions, self-regulation, motivation, and self-efficacy, where positive emotional connections and beliefs can positively influence academic results (Mega et al., 2014; C.-H. Wang et al., 2013; Zuffianò et al., 2013). These findings suggest that high self-efficacy can improve student outcomes.

Predictions of self-efficacy. Self-efficacy is important because of the role it has on outcomes. In the current study, the importance of self-efficacy for students is the focus. Evidence has indicated self-efficacy can predict academic achievement (van der Westhuizen et al., 2011). Education environments, courses, administration, and instructors should attempt to promote self-efficacy development (Parker et al., 2013; Peters, 2013). Student self-efficacy is essential for the successful performance of students in the classroom. Numerous factors can add to such development.

Self-efficacy, motivation and self-regulation, and course satisfaction. Self-efficacy will have a positive impact on factors of student success, as well as other outcomes related to the education experience. Joo, Lim, and Kim's (2013) structural equation modeling of 897 students showed self-efficacy played a significant role in student satisfaction and achievement and could influence and/or develop students'

understanding of the value of certain tasks. Self-efficacy could, thus, impact on how persistent and motivated students would be to reach academic goals (Martin et al., 2014). Conversely, procrastination and/or demotivation could negatively influence the success if students delay completing academic tasks (Hen & Goroshit, 2014). Thus, there is an interplay between self-efficacy and procrastination rates where students who procrastinate are more likely to develop low self-efficacy (Wäschle, Allgaier, Lachner, Fink, & Nückles, 2014). This finding is similar to how motivation, goal orientation, and task understanding can be used to predict higher levels of self-efficacy (Joo et al., 2013; van der Westhuizen et al., 2011). Through a hierarchical regression analysis of 507 high school students and teachers, Zimmerman and Kitsantas (2014) found self-regulated students often achieved better academic results; however, the converse finding could also be true. Thus, self-regulation and self-discipline, as well as students' skills and natural abilities, can be effective predictors of self-efficacy and ultimate academic achievement (Putwain, Sander, & Larkin, 2013). Self-efficacy can play an essential role in the success of students, because of its links to factors such as the students social, psychological and emotional well-being and intelligence.

Emotional, social, and psychological factors. Internal psychological and emotional, as well as social factors will impact the self-efficacy of an individual. Emotions and emotional intelligence (EQ) can be used to predict student self-efficacy (Putwain et al., 2013). Students' emotional responses to academic tasks, demands, or stress can influence their beliefs of goal achievement and ability (Zuffianò et al., 2013). Their emotional responses can also influence their motivation and academic success;

therefore, students need to learn skills for adequately handling and adjusting to stress to promote higher self-efficacy (Hen & Goroshit, 2014). Thus, student self-efficacy can be determined by emotions and/or an ability or inability to counter negative attitudes toward an academic area (Mega et al., 2014). Therefore, self-efficacy is a mechanism for coping with negative experiences.

Psychological and social factors can play a role in predicting self-efficacy. Morony, Kleitman, Lee, and Stankov (2013) and Kuo, Walker, Belland, and Schroder (2013) found student confidence levels and self-belief, along with general academic and course satisfaction, could predict self-efficacy and overall academic success levels. Therefore, student perceptions of experience can impact self-efficacy. Through a hierarchical regression analysis of 579 first-year students Krumrei-Mancuso, Newton, Kim, and Wilcox (2013) established stress, time management, college activity involvement, and general academic satisfaction could influence student success and self-efficacy levels. Students must learn proper skills, interventions, and strategies to assist in positively adapting to such factors (Wong, 2014). Based on these findings, self-efficacy can support student coping with experience in college.

Self-efficacy is related to several other factors where there is an inter-dependency on one another. Overall, there is an interplay between student self-regulation, self-discipline, confidence, and self-efficacy (Zimmerman & Kitsantas, 2014). Students' levels of motivation and satisfaction play a role in self-efficacy and general academic achievement (Putwain et al., 2013). Therefore, students should be provided with proper means for managing emotional and attitudinal responses to tasks and subjects (Kuo et al.,

2013). They should have numerous opportunities for improving their skills and knowledge in academic areas where they may have struggled (Morony et al., 2013). Self-efficacy is a powerful factor influencing the achievement of students.

Completion rate/attrition. Completion rates are important because of the link to whether students remain in programs or not. Leaders of most community colleges have reported high failure rates in remedial courses (Bahr, 2013). Such students are still likely to graduate (Burdman, 2013; Twigg, 2013). Generally, as many as 60% of students attending 4-year colleges complete their degrees within 6 years (Bettinger et al., 2013). Yet, Complete College America (2011) found remedial math students tended to report lower levels of graduation than non-remediation students. Such findings led to Obama's educational agenda, which requested higher education institution leaders would improve college completion rates (Ulmer, Means, Cawthon, & Kristensen, 2016). College leaders should improve their current remedial actions and included remedial approaches, such as mentorship programs, counseling, summer bridging programs, and financial aid.

Students' college readiness. College readiness is also an important factor because of its impact on whether a student believes that they are ready to achieve in the classroom. Students' college preparedness is important for improving degree completion (Bettinger et al., 2013). Much of colleges' current remedial actions are focused on preparing students for the demands of college, while providing students with accelerated remedial courses and means for degree completion (Hodara & Jaggars, 2016; Jaggars et al., 2014). Many community college students come from lower-income individuals and racial and/or ethnic minorities who demonstrate higher levels of college unpreparedness

(Arnold, Chewning, Castleman, & Page, 2015). Therefore, remedial education is important because of the role it plays in student development.

Socioeconomic and other demographic factors. There are several considerations which influence college choice; however, finance is perhaps the most important. More students have chosen community colleges for their degree completions as community college degrees are like bachelors offered by 4-year colleges (Monaghan & Attewell, 2015). This finding is particularly relevant for less affluent students (Price & Tovar, 2014), have chosen community colleges for their degree completions if they do not meet other colleges' or universities' readiness standards (Morest, 2013). Financial disadvantage can create difficulty with attending college and retention as a student.

The community college can be a benefit as the experience can be the foundation for further learning at a 4-year college. However, such students have reported higher levels of college attrition (Monaghan & Attewell, 2015; Morest, 2013). Part of the reason for this finding is how the two college systems are structured (Morest, 2013). Student engagement levels influence students' overall staying power (Stewart, Lin, & Kim, 2015). The more involved students are in their college environments, the more likely it they will be motivated to complete their degrees (Price & Tovar, 2014); however, Bremer et al. (2013) found older students came from White or Hispanic race groups; those students already working in a specific occupation were more likely to graduate. Ortiz and Dehon (2013) substantiated socioeconomic and other demographic factors as influencing college attendance and completion. Gay (2013) found demographics, access to resources, and abilities for success all played key roles in degree attainment. Considering most

students at JMCC (i.e., just under 50% as of 2018) are of African American ethnicity, and many are enrolled in math remediation courses, leaders of JMCC might need to consider the unique socioeconomic and ethnic realities of their students to improve retention and degree completion. The current study may aid in this regard.

Strategies for improving retention and degree completion. Retention is important for colleges, society, and students. To prevent dropouts, college leaders should promote student engagement activities, corroborative class learning opportunities, and general student support (Stewart et al., 2015). College leaders would do well to change their current policies and practices to assist students better in these areas in the future (Price & Tovar, 2014). Community college leaders should provide programs and opportunities that appeal to and address the needs of a wide range of differing marginalized student groupings (Gay, 2013). These programs should focus on the difference in education and preparedness between students.

College leaders can offer several strategies to students. College leaders can offer summer bridging programs to students before entering college, but these programs are currently underutilized and only incorporate a small minority of students (Douglas & Attewell, 2014). However, if these are used effectively and include all students who may benefit, such remedial action may translate into lower attrition levels (Fong et al., 2015). If students do not need to manage a normal college coursework in addition to remedial actions, they may experience less stress and higher levels of degree completion (Bettinger et al., 2013). The structure of the college experience for students who require remedial programs should be designed around the student's needs.

Several options exist for students. Hodara (2013) found although short-term programs (e.g., bridging or boot-camp programs) tended to only have short-term gains, other instruction methods or solutions (e.g., compression models, collaboration for conceptual understanding, and/or computer-mediated or online instruction) might have more success. More research into the best programs and practices, as well as potential changes or new approaches, is needed; therefore, I answered this call for research (e.g., Methvin & Markham, 2015). Similarly, Bahr (2013) posed that noting students' use of open-access programs trends and how they interacted with college policies and practices could predict their levels of degree attainment or attrition. Bremer et al. (2013) established math and English language abilities could predict potential student attrition or degree attainment. However, traditional research methods into studying these trends did not provide clear insights. More research is needed into how a deconstructionist approach may assist degree completion. Although not overly part of this study, some participants' views or perceptions may highlight this finding.

Improving performance is essential. College leaders should also find ways of improving student math scores, as math ability is a key constituent for academic success (Parker et al., 2013). X. Wang (2013) established students' decisions to attempt to attain a degree in a STEM subject were related to their abilities, prior experiences, and high school achievements in math; therefore, college leaders should approach remediation in conjunction with local high schools. There is also the need for promoting opportunities and positive math experiences for minorities before they reach the college level, as early

interest may lead to higher levels of STEM degree attainment (Gayles & Ampaw, 2016). Through remedial programs, greater diversity in STEM fields could be possible.

The problem of math skills is one which is linked to the greater system of education, going back to K-12, with implications for students in higher education. Cortes et al. (2015) established how early math intervention for under-achieving ninth-grade math students could translate to higher achievement levels in high school and lower levels of college attrition. This early intervention could lead to more college enrolment rates (Conley, 2014). Researchers could assist community colleges in improving their current remedial math programs by advancing research and understanding of policy requirements, student and instructor needs, and how to manage challenges of meeting short- and long-term goals (Mesa, Wladis, & Watkins, 2014). However, math intervention is not the sole factor for lowering college attrition levels as class environment, academic climate, conceptual understanding and subject knowledge, and student self-efficacy also play roles (Geisinger & Raman, 2013). Therefore, college leaders should approach remediation and retention strategies from various angles (X. Wang, 2013). There must be a vibrant approach to the problem of retention for students who go through remedial programs.

College readiness. There is a shift happening in the K-12 system where there is more focus on preparation and development aimed at post high school success. New education reforms request high school students be college and career ready (Ulmer et al., 2016). High school students' academic achievements influence their remedial education enrollments in community colleges (Hodara, 2013). High school course rigor is the most

important predictor of college-level course achievement (Edmunds, 2012). High school leaders and policymakers have launched various initiatives to implement course rigor at the high school level (Conley, 2014). These initiatives will work to increase college readiness by providing students with increased access to college-level courses through dual enrollment, transition curricula, and the option of taking early college courses (An, 2013; Barnett, Fay, Bork, & Weiss, 2013). Therefore, students can be prepared in a more effective way.

Several factors go into student preparation for college. Students can develop their college readiness through a combination of knowledge, skills, behaviors, and attitudes (Methvin & Markham, 2015). These components are constructed through study skills, time management, and proper communication with instructors (Bailey, Jaggars, & Scott-Clayton, 2014). By utilizing and developing these aspects effectively, lecturers and college administration could specifically work to improve college readiness in math, as improving student proficiency in math can assist students in math-related courses, and lead to higher student outcomes and degree attainment (Acosta & College, 2016). Therefore, to address the issue of math remediation at the community college level, Burdman (2013) suggested taking a less “one-size-fits-all” and a more “tailored” approach. School leaders have offered different, STEM-specific subjects and courses for more intensive remediation, while others have considered alternative math remediation. Similarly, Barnett et al. (2013) highlighted how transition curricula could assist pre-college students to avoid remediation. By doing this, the system of math education improves and becomes more effective for students.

Skills, behavior, and readiness assessments. Development must go beyond the scope of simple skill development. Additional skills and requirements, such as psychosocial and behavioral support, organizational skills training, and student persistence training, could translate into general and math-specific college readiness (Venezia & Jaeger, 2013). Researchers have linked such skills and requirements to student abilities and self-efficacy levels (Gayles & Ampaw, 2016; Zuffianò et al., 2013). Although many college leaders already implement readiness assessments, faculty do not necessarily have the necessary skills, resources, or technical abilities to run such assessments or adhere to such assessment policies effectively (Melguizo, Kosiewicz, Prather, & Bos, 2016). Thus, students may be put into remedial programs unnecessarily, not receive the needed tools and remediation interventions they require, or fall through the cracks entirely (Scott-Clayton, Crosta, & Belfield, 2014). This, in turn, creates inefficiencies in the education system.

A robust approach should be taken to understanding the need for remediation among students. Jackson and Kurlaender (2013) believed school leaders could use high school results or grade-point averages, particularly in relation to math remediation at the college level, to place students correctly for college preparation. Utilizing both traditional, test-score-based assessments, as well as empirical and practical assessment criteria, could better assist in the accurate college-readiness determination (Camara, 2013). However, more needs to be done to ensure proper criteria, policy, and assessment implementation. This current study provided practical suggestions for such implementation.

Remedial education can have a positive impact where it fills gaps that were missed by other educators. Students' level of college preparedness can have either negative or positive consequences for both students and the colleges of their choosing; therefore, interventions should start as early as middle school and involve various spheres of support, such as familial and scholastic, to ensure positive outcomes (Gaertner & McClarty, 2015). College readiness assessments usually occurs at late high school or early college level; thus, potential opportunities for early intervention and remedial strategies are often missed (Jayaprakash, Moody, Lauría, Regan, & Baron, 2014). Extra time, effort, and money, on both the student and the colleges' behalf, is required to fix issues that may have been addressed far earlier, and likely at a far lesser expense earlier on in the students' schooling career (Conley, 2014). Therefore, gaps are filled through remediation.

The college experience goes beyond the scope of knowledge and is focused on the preparation and development of students into productive, knowledgeable citizens. College readiness does not only refer to students' academic abilities and knowledge but also relates to how well-adjusted students are in terms of meeting the stresses and general changes and requirements of college (Camara, 2013; Methvin & Markham, 2015; Venezia & Jaeger, 2013). Various assessments can be used to determine college readiness and potential remedial program placement (Burdman, 2013). These assessments can be done during both high school and college (Hodara, 2013). Earlier college readiness assessments (e.g., at the middle school level) and other possible indicators (e.g., high school grade-point averages) are generally underutilized (Jayaprakash et al., 2014). The

current study provided insights into how such underutilized strategies and math remediation and indicators could be used to improve college readiness.

Remedial course effectiveness. Remediation can have positive implications on student development. Remedial education and intervention are important (Melguizo et al., 2016). Yet, other aspects, particularly in determining student remedial placement, leaves much to be desired (Scott-Clayton et al., 2014). Bailey et al. (2014) highlighted how remedial education's effectiveness was being questioned due to poor student outcomes and low community college graduation rates, yet these programs still held value. Instead of removing remedial programs, such programs should be evaluated, adjusted, or replaced based on the effectiveness for meeting students' needs and course requirements (Belfield et al., 2014). Remedial programs require re-focus and do not need to be removed.

For many, remedial programs can be long and difficult. Remedial programs require underprepared students to enroll in a developmental sequence of up to three remedial math courses (Dunlosky et al., 2013). The initial assessment measures current skill levels. If candidates are underprepared, they will be referred to remediation to gain necessary skills and knowledge; they will continue with remediation until they have achieved the desired results (Bailey et al., 2014). Although this process may work in theory, more still needs to be done on the practical implementation of such an approach to remediation (Scott-Clayton et al., 2014). This study was designed to contribute knowledge to the role of instructors in remediation.

Not all researchers support remediation. Di Pietro (2014) found little data indicating remedial courses influence on pass rates and completion. This lack of improvement may be due to instructors and/or institutions not implementing courses correctly or because of current offerings being too homogenous for the diverse student population enrolled in them (Cafarella, 2016). Most students in need of remediation come from minority and diverse backgrounds and demographics (Douglas & Attewell, 2014; X. Wang, 2013). To a degree, this study might fill a research gap in creating more diverse and minority friendly remediation solutions.

Remedial course approaches and needs. Face-to-face and distance learning are both potential course delivery options. However, researchers have yet to establish the positive influence on student outcomes in both these options (Jaggars, Hodara, Cho, & Xu, 2014). There is also lack of information and knowledge for both students and lecturers regarding potentially beneficial course material (Halawa, Greene, & Mitchell, 2014). This finding is particularly true in relation to online offerings (Hew & Cheung, 2014), which means college leaders may be implementing courses that are inadequate in addressing the needs of students (Petty, 2014). Alternatively, lecturers and students may not be utilizing good courses to their full potential (Price & Tovar, 2014). There is also a concern regarding the link between remedial math courses and student repetitions or drop-out rates (Ortiz & Dehon, 2013). Further research is needed to establish the accuracy of such assertions and concerns.

Education requires different approaches for different students. Different students and demographics may require different things from a specific remedial math course (An,

2013; Malinen et al., 2013; Riconscente, 2014). Therefore, existing courses and material would need to be adapted (Dasinger, 2013). Course material would also need to cater to individuals within the said group (Skinner, 2014). New approaches and course implementations would need to be specifically designed and chosen to gain the best student results (Edmunds, 2012; Ulmer et al., 2016), hence the need for this study. This research focuses on understanding the role of self-efficacy in remediation.

Remedial programs are costly for colleges initially. Particularly if these fail in effectiveness and not implementing remedial strategies could prove even more costly, so college leaders should rather implement and continue improving new and current remedial programs (Belfield et al., 2014). A lack of remedial programs could lead to higher drop-out levels, which could negatively influence college reputation. However, as Hodara (2013) and Di Pietro (2014) noted, little research into how this outcome could be achieved has been conducted, especially regarding general and math-specific remedial course effectiveness (Melguizo et al., 2016). Little research has occurred in how current remediation strategies can be improved (Bailey et al., 2014). Furthermore, although course designers and college boards and/or administrations may believe their courses are beneficial, those who work with the courses and content first-hand (i.e., instructors and students) may provide additional solutions. This study addressed these issues.

Student issues with math. While math is an important subject, it is difficult for many students. As a subject, math builds from one concept to the next; thus, if students have not successfully grasped math concepts early in their studies, they will continue to struggle and record low results in these areas (Claessens & Mimi, 2013). Therefore,

remediation program leaders need to first establish where an individual student has an issue in math (Pruett & Absher, 2015; O. Rodríguez, 2014). Current program leaders often fail to do so (Burdman, 2013; Gayles & Ampaw, 2016; X. Wang, 2013). Thus, students rarely get the opportunity to learn and fix math problem areas that may be holding them back (Scott-Clayton et al., 2014). Students who struggle with math may suffer from negative psychological associations with the subject, which can block them from attempting to learn or improve upon math-related issues (Silva & White, 2013). Students who initially struggle with or fail at math tend to believe that they cannot do it and can continue in this cycle of negativity if not assisted (Beillock & Willingham, 2014). This becomes an issue of self-efficacy.

Math performance is impacted by more than skill. Social perceptions of math and math ability influence if and how students deal with math issues (Rice, Barth, Guadagno, Smith, & McCallum, 2013). For example, racial minority students may learn that math or STEM subjects, in general, are not "for them," or they will naturally struggle more compared to other students (Treisman, 1992). Minorities are also less inclined to receive the proper math education and support needed to get them college ready (Moakler & Kim, 2014). Girls are often socialized away from STEM subjects or do not receive the proper level of parental, scholastic, or community support required for their math success (Bond, 2016; Han, 2016). Meaning that often, social factors impact education.

Students can struggle with math fundamentals, such as the approximate number system, thereby making it difficult for them to calculate rough mathematic estimations effectively and efficiently, on which more complex math skills, such as calculus and

algebra, are based (Park & Brannon, 2013). Spatial reasoning is another problematic area that relates to how well students can visualize and calculate three-dimensional objects, from where students develop their geometry and trigonometry skills (Steiff & Uttal, 2015). If students struggle with such elementary aspects of math and if these problems are not addressed efficiently and effectively, students can record continuous low math results and may likely attrite from their courses (Claessens & Mimi, 2013). Students must have the opportunity to improve over time.

Best practices in remedial math. Remedial math requires the use of best practices. Employing best practices in remedial math is important (Methvin & Markham, 2015). Community college leaders should find ways of raising current student success rates (Complete College America, 2011; Ulmer et al., 2016). Developing and improving best practices can assist in this regard (Scott-Clayton et al., 2014). Cafarella (2014) identified the following as best practices in math remediation: (a) promoting effective communication between student and instructor, (b) having students develop organizational skills, (c) incorporating collaborative learning and accelerated instruction for higher ability remedial math students with strong work ethic, and (d) ensuring instructor comfort level. Other best practices involve providing students with interactive student response systems, where they can directly interact with instructors and/or get immediate feedback and allowing students to rework problems they missed on assessments is another strategy (Rodesiler & McGuire, 2015). Together, these practices can improve the student experience.

Achievement, as measured by college leaders may be different than it is for students. College leaders may base their success measures on retention and general student achievement; however, these measures are too broad (Eddy & Hogan, 2014). Stewart et al. (2015) suggested instructors and college leaders should employ various other measurement factors alongside these broad notions, such as (a) allowing for different student population needs, (b) employing 'moderate structure' intervention, and (c) noting the level of individual assignment completion. Students could develop a more independent and focused approach to remedial education, which could improve distributed and communal learning opportunities (Gay, 2013). This would improve the options available to students.

College administrators must consider the best practices for both students and schools. Datray, Saxon, and Martirosyan (2014) reported best practices existed for both students and colleges; therefore, college leaders should offer ongoing professional training opportunities and manuals to instructors, as well as orientation sessions to new faculty. Developing colleges that adhere to best practices is as important as requiring students to implement best practices. Fong et al. (2015) noted institutional structure, such as smaller classes and population-specific course designs, alongside individual and subject developmental factors, could better assist remedial math students.

More research into remedial practices, the variety of approaches available, and necessary additional implementations required for successful remedial action is needed (Rodesiler & McGuire, 2015). Means of adapting remedial courses to the specific needs of diverse student population groups are currently understudied (Douglas & Attewell,

2014). College leaders must develop best practices within remedial courses, and researchers should assist in finding and establishing such practices (Fong et al., 2015). Community college leaders should adjust their policies and general class structures to ensure remediation is both effective and promotes student success (Datray et al., 2014). This current study should assist college leaders in this regard by providing better understanding remedial students', administrators', and lecturers' perspectives of what they have believed constitutes best practice.

Obstacles that lead to student failure. Various obstacles have been indicated as (potentially) leading to student failures. Such obstacles have included insufficient college readiness, students' difficulty with math or fundamental math concepts, and the homogenous remedial program offerings for heterogeneous student groups varying remedial needs (Bremer et al., 2013; Cafarella, 2014, 2016; Claessens & Mimi, 2013; Martin et al., 2014; Park & Brannon, 2013; Steiff & Uttal, 2015). Another obstacle to effective course completion is current remedial offerings' inadequacy to meet individual and unique student needs or impreciseness incorrectly determining whether remediation is even necessary (Burdman, 2013; Gayles & Ampaw, 2016; Scott-Clayton et al., 2014; X. Wang, 2013). These obstacles can be the difference between success or failure in programs.

Education is just one part of a student's life. Students can experience an obstacle to their success when well-intentioned remedial actions add undue stress due to time constraints or extra workloads (Complete College America, 2011; Geisinger & Raman, 2013). Furthermore, financial, mental, and/or emotional difficulties can be obstacles

(Mega et al., 2014). If students must pay for extra remedial courses or cannot find a good course-life balance, remedial programs may obstruct student success (Ortiz & Dehon, 2013). Stress and anxiety are common factors in college attrition (Hen & Goroshit, 2014; S. Rodríguez et al., 2014). Leaders of colleges and remedial programs must find constructive ways of limiting these obstacles (Klassen & Tze, 2014; Putwain et al., 2013).

There are several other factors which can impact retention. Other obstacles, such as college unpreparedness, lack of math proficiency, and lack of access, can lead to student attrition (Monaghan & Attewell, 2015; Price & Tovar, 2014). Low self-efficacy and under-trained or under-supported instructors can play a role in student failure (Twigg, 2013; Venezia & Jaeger, 2013). Remedial program leaders must make provision for both student and teacher needs (Belfield et al., 2014; Cafarella, 2014; Dunlosky et al., 2013; Mesa et al., 2014). This current study might assist in this regard.

Some students are impacted more than others in their decisions related to education. Obstacles may influence students from minority groups and/or first-generation college goers most (Arnold et al., 2015; Petty, 2014). Those who also failed to initially attain college exemption or did not have adequate high school support would also need more college remediation and assistance (Barnett et al., 2013; Burdman, 2013). Thus, remediation should be designed to overcome such various obstacles and be geared toward assisting the most at risk students. However, current remedial actions can fall short on these counts (Jackson & Kurlaender, 2013; Melguizo et al., 2016). Therefore, there must be further research to understand how to improve the college experience.

Implications

At the local community college (e.g., the study site), students do not perform well in remedial math courses and often need to repeat the courses. The students do not do well in subsequent math courses and are less likely to graduate. Remedial math teachers have been unsuccessful in improving student performances. Information from this study may be used to assist students in improving their remedial math outcomes and train remedial math instructors about possible strategies to improve student success in remedial math programs at the community college level. Better student success in remedial math can lead to improved student retention rates, lower numbers of students needing to repeat such courses, and less time to graduate (Dunlosky et al., 2013). Student, administrator, and instructor perceptions of the causes of student failure and ways to help students be more successful in remedial math courses may provide useful strategies to improvement improve student success and retention. Based on the data analysis and findings, professional development training may benefit both remedial math students and instructors, as well as the mathematics department.

Summary

There was an increased need for research into college-level math remediation, focusing on ways of improving college remedial math courses due to open admissions policies (Acosta & College, 2016; Fong et al., 2015; Hodara & Jaggars, 2016; Petty, 2014; Price & Tovar, 2014). The review of the literature indicated support for the conceptual framework regarding the influence of teacher and student self-efficacy on student success rates (Mojavezi & Tamiz, 2012; Siddique et al., 2011; Vieluf et al.,

2013). However, more research is still needed to ascertain the kinds of remedial programs needed to ensure improved math proficiency that may positively influence overall college success (Halawa et al., 2014). Students must be able to develop their fundamental math knowledge to better build into more complex math skills, as without these skills, students are less likely to achieve positive academic outcomes, complete their degrees, or be able to contribute to larger society more effectively (Claessens & Mimi, 2013; Park & Brannon, 2013; Steiff & Uttal, 2015). This study added to the body of literature on instructors', administrators', and students' views of the causes of low student performance in remedial mathematics and what is required to rectify this issue. This study provided various strategies to improve remedial math achievement through collaboration and feedback from remedial math students, instructors, and administrators.

Section 2 includes the research design, the methodology, and the rationale for choosing it. The section includes participant selection, protection of participant's rights, data collection, and analysis. Section 3 outlines the project and contains a literature review. Then, Section 2 justifies how the project fits with the research findings. In Section 4, I discuss my reflections on the significance of the study and the potential to influence positive social change. Appendix A describes the project.

Section 2: The Methodology

This section includes a discussion of the methodology used to explore the problem, beginning with an explanation and justification for the qualitative research design. This section includes the steps taken to gain access to the participants and to protect their rights. Also included is a presentation of the data collection and data analysis techniques used in the study, as well as the research results.

The purpose of this qualitative intrinsic case study was to explore the perceptions of community college instructors, administrators, and students regarding the causes of low student performance in remedial mathematics. This exploration was guided by the overarching research question concerned with instructors', administrators', and students' perceived reasons for low performance in remedial math for first-time community college students. The goal of this study was to identify approaches to improve math proficiency and pass rates of students in remedial math courses at a community college (JMCC) in Mississippi.

Qualitative Research Design and Approach

Qualitative Methodology

The purpose of this study was to investigate the reasons for poor retention and pass rates in the remedial math courses. Qualitative studies are well suited to study unquantifiable phenomena, such as opinions or perceptions, and to place these in real-life contexts to provide explanation and clarity (Davies & Hughes, 2014; Henwood, 2014; Pole & Lampard, 2013). However, not all qualitative approaches were suitable for this study's purpose. Therefore, a qualitative case study approach was chosen specifically due

to its appropriateness for comprehensive and in depth research (Davies & Hughes, 2014; Henwood, 2014; Pole & Lampard, 2013). Researchers can use the case study approach to study a given phenomenon within a particular context, further asserting that its selection for this particular study; the case study design was a practical approach to study the remedial math problem within the given JMCC context (see Yin, 2013). I used this approach to study teacher, administrator, and student perceptions of remedial math issues; identify curriculum, teaching approaches, and student needs; and present practical suggestions to improve remedial math courses (e.g., Yazan, 2015; Yin, 2013). The reasoning for not choosing other qualitative approaches, as well as a decision against using a quantitative or mixed methods design, are presented in the following subsections.

Other qualitative approaches: Phenomenological. Other qualitative studies, such as phenomenological, grounded theory, and ethnography, were considered as potential methodological options. However, researchers have studied remedial math intervention and developmental education as a phenomenon, and the practice is already relatively well-established in colleges and schools (e.g. Acosta & College, 2016; Bailey et al., 2014; Bettinger et al., 2013; Cafarella, 2014). Phenomenological researchers focus on individuals' experiences of a given phenomenon and how they are affected by the phenomenon in a personal capacity (Marshall & Rossman, 2016). Thus, this methodology does not provide researchers with the opportunity to understand a phenomenon as it plays out in a practical setting, or how those influenced by the phenomenon perceive it both personally and about their broader contexts (Marshall & Rossman, 2016). Due to several phenomenological studies already existing, this approach would be repetitive. This

approach would also not suit the current study as it would not meet the purpose of studying remedial math within the given JMCC context; thus, this qualitative approach was decided against.

Other qualitative approaches: Grounded theory. Grounded theory was not selected because there was no concern for developing a new theory. Grounded theory researchers attempt to study (relatively) new phenomenon and present theories with the said phenomenon when no theories are yet present (Marshall & Rossman, 2016). Grounded theory researchers may attempt to dispute current theories concerning a studied phenomenon and suggest alternative theories or expand on current theories to make them more accurate (Marshall & Rossman, 2016). Although future researchers may wish to conduct grounded theory research regarding remedial math programs, this study did not intend the same goal. Due to grounded theory not meeting the study's purpose, it was discounted as a potential methodological approach.

Other qualitative approaches: Ethnographic. There was no interest in focusing on a specific ethnic demographic or attempting to understand how ethnicity might impact remedial math outcomes (see Pole & Lampard, 2013). Ethnographic researchers focus on how demographics, such as ethnicity, race, and culture, can play a role in ways that a phenomenon is experienced or its outworking within said demographics (Pole & Lampard, 2013). Although ethnicity was a key indicator regarding remedial math outcomes and program effectiveness, more concerns derived from understanding the broader perceptions of community college instructors, administrators, and students regarding various possible causes for inadequate outcomes, rather than focusing on only

one specific aspect, such as ethnicity. Thus, an ethnographic approach would not suit the purpose of the study; therefore, it was rejected in favor of a case study approach.

Future researchers may be interested in following up this and similar studies with research-related ethnography as it pertains to remedial math programs and student outcomes. For this study, filling the gap of a general lack of research regarding lecturer and student perception regarding remedial math courses was deemed more important, before attempting to understand smaller population groups or alternative theories related to this research area. Additionally, ethnicity naturally formed part of the broader case study approach, as demographic and ethnicity-specific questions were asked in the interviews. Thus, needed and important ethnographic data were gathered without neglecting other potential critical areas of information within the study.

Other qualitative approaches: Action and narrative research. Action and narrative methodological approaches were deemed inappropriate because there was no concern with implementing changes to remedial mathematics programs by testing a potential program, approach to teaching, or other such practical implementations, as required in an action research design (see Davies & Hughes, 2014). Additionally, there was no wish to gain deep personal insights or stories from participants regarding their experiences of teaching in, developing of, or participating in remedial mathematics programs over time (see Davies & Hughes, 2014). Neither action nor a narrative approach would provide the understanding of remedial mathematics programs and outcomes within a specific context or discover potential changes or suggestions for improvements from participants for future implementation (see Davies & Hughes, 2014).

Based on the findings, however, future researchers may practically implement participant suggestions to test their viability and practicality or gain elaborative stories related to remedial mathematics-related experiences, as presented in action and narrative studies. Thus, a case study approach was deemed best suited for this study.

Quantitative Methodology

A quantitative approach was not chosen because perceptions cannot be quantified. Furthermore, the interest involved gaining insight into the student, teacher, and administrator opinions of the problem and potential solutions regarding the remedial math program (see Henwood, 2014). Quantitative researchers also do not allow participants to elaborate on or explain why they answered questions the way they did, thus failing to provide the necessary depth of insight needed for this study. Therefore, a quantitative approach did not meet my study's requirements. Because quantitative data could not be used effectively for this study, a mix methods approach would also be redundant, as only the qualitative data would be relevant (e.g., Davies & Hughes, 2014).

Participants

Selection Criteria

I used purposeful sampling to select remedial instructors, students who took/were taking remedial math courses, and remedial-math administrators to ensure the most relevant and representative sample was selected from the large potential pool (e.g., Henwood, 2014; Noble & Smith, 2015; Palinkas et al., 2015). The selection criteria for each sample follow is discussed in the following subsections.

Remedial students. Remedial students were selected based on the following criteria:

- Students were registered at JMCC.
- Students were in their final semesters of a beginning algebra or intermediate algebra remedial math course at JMCC, as these students were the most knowledgeable about the overall course, structure, instruction, processes, and so forth.

Remedial teachers. Remedial teachers were selected based on the following criteria:

- Teachers were full-time, registered employees at JMCC.
- Teachers had instructed in any or all of the following JMCC remedial math courses: beginning algebra course or intermediate algebra course.
    - Teachers could have presented instruction at any of the course levels, but
    - teachers' requirements were to have taught remedial instruction in any or all of the courses for a minimum of two years to ensure sufficient subject and course knowledge.

Remedial administrators. Remedial administrators were selected based on the following criteria:

- Administrators were full-time, registered employees at JMCC.

- Administrators were currently involved with the administration of any or all of the following JMCC remedial math courses: beginning algebra course or intermediate algebra course.
- Administrators had working knowledge (i.e., have been actively involved in the decisions and designs) of the chosen remedial curricula, course designs, processes, and the department's choice at the time of adoption and implementation.

Selected students were verified for enrollment in their last semesters of one of the chosen courses by requesting access to their class schedules. Similarly, remedial math teachers and administrative staff were verified for employment in the respective capacities at JMCC for 2 or more years by requesting access to their files through the college administration center. All student and staff information were readily available, and I ensured only those candidates meeting the criteria were contacted and accepted for the study.

Number of Participants

One-on-one, semistructured interviews were conducted with 15 students, four remedial math teachers, and one administrator who met the purposive sampling criteria. The interview approach (Appendices B and C) was beneficial for understanding the how's and why's behind a study topic; in this case the perceived reasons of instructors, administrators, and students regarding students' low performance rates in remedial math courses, and their recommendations as to how such performance rates could be improved (e.g., Yin, 2013).

Gaining Access to Participants

Instructors' email contact information was available on the college website. Remedial instructors who fit the selection criteria were emailed directly, requesting them to be involved in the study. The course head was contacted directly as well. Other administrative and course design staff's contact information was on file; therefore, an email to the criteria-meeting candidates was sent directly as well. To recruit the necessary student sample, the institutional research director provided remedial math students' email addresses. Students who met the selection criteria were emailed to request their participation in the study.

The emails to instructors, administrators, and students included a brief description of the study and its purpose, along with my contact details. The first five lecturers, administrative staff (which was the head of the department), and 15 students (as per data saturation and established study requirements) who met the criteria and responded to the email were sent follow-up emails with informed consent forms. Subsequent responses were kept on file to be used in case the initial respondents pulled out of the study or did not return the informed consent form.

The consent forms included further information about the study, sample questions from the interview protocols (Appendices B and C), and how the interviews would be structured. More information regarding the informed consent form is presented later in this section. Once the participants responded through email their consents, they could partake in the study. The 22 interview participants scheduled a time to meet with me face-to-face on the JMCC campus.

Establishing Researcher/Participant Relationships

All participants were offered open lines of communication to establish a positive working relationship, which was achieved through providing my contact information. The goal was to create an initial rapport with participants and create the foundation for a good participant-researcher working relationship (see Davies & Hughes, 2014; Henwood, 2014). Participants were contacted before they took part in the interviews to establish rapport and explain, in person, a bit about the study and general requirements for the interviews. Any preconceived notions were addressed before they commenced with participation.

Rapport was strengthened through further interactions with those participants partaking in the interview section. I conducted subsequent telephonic and email exchanges regarding the study and set up meeting times and places. Before the interviews, I reminded participants of their rights and explained how I would ensure their privacy. I selected an interview location that was private and comfortable yet convenient.

Protection of Participant Rights

Ethical considerations. Before commencing the study and participant recruitment, I obtained the necessary institutional review board (IRB) approval (12-11-18-0395369) for conducting a human-related study. This approval was confirmation that the study was legitimate and ethical. All participants were informed of their rights in writing in the informed consent form and verbally before each interview. Such rights included the voluntary nature of their participation, their confidentiality, and that they may feel free to leave the study at any point with no negative consequences (e.g., Davies

& Hughes, 2014; Henwood, 2014). Participants could peruse the information they provided, and notes were taken during the interview, through member checking, to ensure the final interpretation of what they meant was correct. Participants were informed they had little to no risk of harm—physically, emotionally, or mentally—during their participation in this study.

Every attempt was made to guarantee participants' privacy and confidentiality by using coding for identification purposes and the use of the pseudonym of JMCC for the study site (e.g., Holloway & Galvin, 2017). Additionally, all hard and soft copies of information gathered will remain stored for 5 years; after which, all data will be destroyed and deleted (e.g., Hey & Trefethen, 2003; Richards, 2015). All physical documentation and recordings are stored in a safe my office to which I alone can access. All electronic data will be stored on a private computer and are password protected.

Data Collection

Data were collected through semistructured interviews with remedial math students, remedial math instructors, and administrators involved in remedial math education. Interviewing three independent groups enabled investigation of the problem more exhaustively and increased the quality of the data. The interviews for the three participant groups (Appendices B and C) were conducted on campus. Access to participants was gained through email and arranged face-to-face interviews.

Remedial Math Student Interviews

Semistructured, in depth interviews were conducted with 15 students. Interviews lasted between 15 and 30 minutes each and occurred in a classroom in the math and

science building on campus. It took one week to complete all the interviews. A list of additional questions based on the research questions of the study (Appendix B) was created. A panel of experts, consisting of two remedial math instructors, one course designer, and two remedial math graduates reviewed these questions before the interviews commenced. Using semi-structured questions ensured all participants answered the same questions, thereby confirming consistency across the data collection (see Davies & Hughes, 2014). However, these questions allowed for follow-up questions that sometimes opened further discussion and led to greater clarity and insight into participant perspectives (see Pole & Lampard, 2013). All interviews were recorded using an audio-recorder.

The interviews were audio-recorded, and interview notes were taken during each interview to substantiate the data collected. The audio recordings ensured all information and participant statements were collected, verbatim, ensuring data collection accuracy. Interview notes were used to elucidate on what I saw, heard, and experienced during data collection (e.g., Henwood, 2014). In this way, the finer nuances of participant perceptions, along with any practical demonstrations that occurred during the interview, was accurately documented (e.g., Davies & Hughes, 2014). These notes, although not forming part of the final data collected, substantiated the data and recalled events and experiences during the interviews that in case the audio recordings, were unclear. The notes also provided reminders and information regarding important visual cues not collected through the audio recordings. A panel of experts reviewed the protocols and

questions. The interviews were recorded and transcribed with software to produce accurate records. The notes assisted with keeping track of the emerging data.

After each interview, the audio-recording data were transcribed using Transcribe, a software program designed to turn audio into text format, with editing and playback capabilities (see Gupta, 2016; Transcribe, n.d.). Important observations and reminders from the interview notes in the transcripts were also included. The transcripts were shared with the participants for member checking. Member checking entailed interviewees reading their transcripts and confirming its accuracy (see Cope, 2014). After the participants verified the data, these data were uploaded for analysis. More information is provided regarding the analysis process in the next section.

Remedial Math Teacher Interviews

After student interviews were completed, interviews were conducted with four instructor participants and one administrator involved in remedial math education. This subsection will relate to the remedial math instructor interviews. The next subsection will elaborate on the administrator interviews. Together, these interviews will form the third and final phase of data collection.

Questions were asked similar to those posed to the students during their interviews, but these questions were honed toward the instructor's (Appendix C) and administrator's (Appendix D) perspectives. The same collection strategy was followed like the student interviews; meaning, each of the instructor interviews consisted of in depth, semi-structured questions. The interviews were audio-recorded, and additional interview notes were taken as a supplement. The notes assisted in keeping track of the

emerging data, and then ensuring the chosen instrumentation was as sufficient for data collection as it was for the student data collection. After their interviews, each participant was requested to take part in member checking their interview transcripts to ensure accuracy (Noble & Smith, 2015). The interviews were transcribed using Transcribe (n.d.). The participant transcripts consisted of both their audio-recorded interviews and the notes made during the interview, which was important for better understanding the data collected. Once member checking was complete, the interview data were analyzed.

Administrative Interviews

The head of remedial math at JMCC was interviewed. The interview followed the same in depth, semistructured structure as the student and instructor interviews. The questions for the interview was designed to gain the unique perspectives of the administrators. Each interview was audio-recorded, with supplementary interview notes taken for further validity (see Noble & Smith, 2015). The participant was asked to evaluate the interview transcript before it was analyzed.

Interview Protocol

A unique interview protocol for each interview phase was designed based on the research questions posed for this study (Appendices B and C). The protocols consisted of related questions but were designed to elicit the unique perspectives of students and instructors and administrators concerning remedial education. The protocols ensured the same questions were asked of the relevant participant groups. In this way, no questions were missed, data collected during these phases were consistent, and the participant/s

stayed on topic. This process provided the study with increased validity and reliability (see Noble & Smith, 2015).

Role of the Researcher

I do not currently work at JMCC, so I had no contact with current students. However, I did work at the college in the past, which means that I did interview some teachers and administrators with whom I previously have worked. Therefore, my role as a researcher did not negatively influence the findings; no participant felt hindered talking openly about the issues during the interviews. To ensure student participants were comfortable opening up during the interviews I made it clear their involvement would in no way influence their grades or their work, and all their information and statements would remain kept strictly confidential.

Another possible source of bias was my area of expertise, which might have influenced views on the topic, and caused me to ask leading questions or unintentionally manipulate the data collected through biased interpretation; however, none of those issues occurred. As part of my role as a researcher, every effort was made to mitigate bias. A panel of experts was used to evaluate the interview protocols.

Triangulation and member checking were used to improve data credibility, which refers to how accurately the data collected represents participants' responses (see Cope, 2014; Gupta, 2016; Noble & Smith, 2015; Transcribe, n.d.). The reliability of the data was checked using triangulation; additionally, the accuracy of the data was improved through member checking. Triangulation broadens the scope of potential answers to

research questions (Davies & Hughes, 2014; Henwood, 2014; Pole & Lampard, 2013; Yin, 2013).

Data Analysis

After the data collection procedure, namely the interviews, the data were analyzed for recurring words, phrases, and ideas using NVivo 11 software (see Rossman & Rallis, 2003). This process is known as thematic data analysis, where recurrences in the collected data are coded to formulate themes surrounding the studied phenomenon (Rossman & Rallis, 2003). The analyzed and codified data were collated and presented as the results of the final study.

This analysis occurred through a comprehensive process. Firstly, after each interview, the audio-recordings were transcribed to substantiate interview notes using Transcribe (n.d.), a downloadable program designed to turn audio into text easily and allows for text-based editing (Gupta, 2016). The notes were sent to the individual participants for member checking. Member checking is the process where participants read their transcribed answers and the researcher's interpretations and observational notes to validate the information pertained therein is correct and what they meant to say (Davies & Hughes, 2014; Henwood, 2014; Pole & Lampard, 2013). Once the interview data from each interview were verified, these were uploaded into NVivo 11. The interview data were then subjected to a process of coding and ultimate thematic analysis where NVivo 11 categorized/coded the interview data into different recurring themes.

Lastly, a comparative analysis of the data from both sections was conducted (Davies & Hughes, 2014; Henwood, 2014; Pole & Lampard, 2013). This process was

achieved by using NVivo 11 to categorize the recurring themes and perceptions that occurred across all the interviews. The software allowed for viewing and comparing perceptions per participant group, which ensured comprehensive data analysis had occurred, and all of the research questions had been thoroughly answered.

Evidence of Quality and Procedures

Reflective Journal

A reflective journal was used during all interviews. The information from the journal assisted in clarifying the audio recordings of the interviews as these acted as reminders/clarifiers to the information presented in the recordings. The notes allowed for keeping track of the emerging data between interviews, which aided data analysis. Using the notes as a "back-up" to the audio-recordings ensured accurate data collection, thereby improving the trustworthiness of my study (see Henwood, 2014). The notes were used to clarify any uncertainties with relevant participants either during the interview or at any subsequent stage (i.e., during member checking or analysis), which further ensured data accuracy and study credibility (see Davies & Hughes, 2014).

Member Checking

Member checking was used to ensure all transcribed interview data remained accurate; here, each participant was allowed to review their transcripts and check for accuracy regarding transcription, interpretation, and their intended meaning (see Cope, 2014). This process allowed participants the opportunity to clarify any statements, address any other issues they felt necessary, and sign off on the overall accuracy of the

data presented. Doing this process ensured only the most accurate data were included for analysis, which further provided the validity of the study (see Noble & Smith, 2015).

Expert Panel

Before commencing with data collection, a panel of experts reviewed all interview questions for the three participant samples. This panel comprised two remedial math instructors, one remedial math administrator, and two remedial math graduates. This panel was selected based on their knowledge of remedial math courses, their design, intentions, and experiences of participating therein—either as a student or as an instructor. Therefore, they could highlight any areas not covered in the initial questions. They could point out biases and ambiguity within the questions and suggest ways of mitigating such instances. The panel signed off on the accuracy and comprehensiveness of the questions to ensure accurate and relevant data that met the purpose of this study were collected (see Pole & Lampard, 2013). By ensuring a high-quality data collection instrument, it was better assured as to the credibility of the data and final results of this study (see Gupta, 2016).

Purposive Sampling

Participants were chosen based on purposive sampling. Purposive sampling uses a set of criteria to ensure that only the most relevant and representative sample is included in a study (Eiken, Musa, & Alkassim, 2016). Due to the large potential pool of participants for this study, purposive sampling was deemed useful in ensuring that only students and staff with comprehensive knowledge on the different remedial course options forming part of this study were included. The criteria for each have already been

presented in the section entitled Se*lection Criteria* that appeared earlier in this chapter. By only including the most knowledgeable participants, more detailed and valuable information was gathered, which meant this study would have a higher degree of credibility (see Marshall & Rossman, 2016).

Triangulation

Although I only used one main data collection instrument (namely interviews), the data still came from various sources. Firstly, data were collected from participants representing different spheres of the remedial math programs (i.e., students, instructors, and administrators). This process meant an array of perspectives, suggestions, and experiences were included for a more holistic understanding of the topic. These data were then cross-analyzed and used for better substantiation of the findings. Secondly, data were collected about different remedial math course offerings. This process meant remedial math programs were not studied in isolation but were representative of varying program options, thereby providing this study with more complex and substantiated data. Data were further substantiated through field note-taking, audio-recordings, and member checking, thereby ensuring higher levels of trustworthiness and overall data collection and analysis quality (see Marshall & Rossman, 2016).

Limitations

One limitation of this study was that it included only one Mississippi community college and its remedial math course offering. Thus, findings for this study do not apply to other community colleges. The findings cannot be assumed to represent the perceptions of those students, administrators, or instructors in other community colleges

in other parts of Mississippi and the United States. Although this study adds to the literature regarding the student, administrator, and lecturer perceptions regarding remedial programs, more research into different areas, programs, and college demographics will be needed.

The study was also limited by its qualitative methodological approach. Future researchers may wish to conduct research using ethnographic or other qualitative, quantitative, or mixed methods approaches to provide a broader understanding of issues related to remedial math. Furthermore, this study was concerned solely with remedial math intervention, which limited the study because it did not address other remedial programs that might also play a role in improving student outcomes. More research, including other population groups and other remedial subject courses, should be conducted in the future.

Data Analysis Results

This section includes data analysis of the information I collected through interviews. Included in this data set were 15 interviews with students, four interviews with instructors, and one interview with an administrator. There were three sets of questions for each participant group, and each participant answered all questions. The interviews were structured to include information about the participant, the remedial class, and their experience with it and suggestions for improvements. The section includes data analysis for each participant group, the discussion, and reflection on the overlapping opinions and suggestions, and some project ideas that came out of the interviews.

The interview transcripts with all participants were coded in NVivo to track and analyze particular themes that emerge in each conversation. While there were somewhat different themes that emerged out of the discussions, all three groups addressed the same questions, and themes that overlapped across all three groups of the participants were evident. Tables 1, 2, and 3 include all codes used for analyzing data in NVivo.

Table 1

Administrative Themes

Theme	Files	Refs
Improve teaching and learning	1	4
Partner with high schools to improve math	1	1
Add prerequisite classes to improve student success	1	1
Instill pride in the pedagogy and teaching skills	1	2
Improve student success by reducing fear of the material	3	4

Table 2

Administration Perspectives

Administration perspectives	Themes from administration	Files	Refs
Improvement, teaching, and pedagogy		1	4
Partnerships with high schools to improve math		1	1
Prerequisite class and teaching method for success		1	1
Teacher training and pedagogy		1	2
Reasons for defeat by the course – fear of the material		3	4

Table 3

Instructor Perspectives

Instructor perspectives	Themes from instructors	Files	Refs
Benefits of remedial math		4	5
Opinion towards low-performance levels		4	7
Purpose of the class		1	1
Lack of math foundations		3	4
Reasons for low performance		0	0
Students do not work hard		3	4
Suggestions for improvements		4	10
Incentives		2	2
Make math more fun		1	1
More time		3	5
Technology		2	2
Not a math person		6	7

Table 4

Student Perspectives

Student perspectives	Themes from students	Files	Refs
Class setup		11	14
Previous high school and remedial math experience		14	36
Lack of teacher engagement		6	7
Race and education		13	13
Student perspective on assistance needed		10	10
Refresher		1	1
Student discipline issue (not caring)		4	4
Student perspectives about low performance		15	18
Low scores not surprising		7	7
Students don’t try		13	15
Low scores surprising		7	7
Student perspectives on purpose of the class		15	15
Refresher		1	1
College-level preparedness		11	11
Student perspectives on effectiveness of the class		14	16
Not effective		3	3
Effective, good teaching		4	4
Student perspective on value of the class		14	18
More time to learn		1	1
Refresher		1	1
Skills and habits		1	1
Teacher		10	11
Tutoring		2	2
Student suggestions for improvements		15	26
Improve individual assistance		4	4
Need for innovative techniques		1	1
More group work		3	3
More time (or different time)		2	2
No suggestions		2	2
Smaller classes		1	1
Student engagement		9	10

Based on the research question, the final discussion focused on the overlapping responses from all three groups of respondents relating to the three major themes which frame this study. Through data analysis of all the answers collected from the participants, the following three themes emerged:

1. Purpose, value, and effectiveness of the remedial class.
2. Opinions about performance levels and significant obstacles to learning.
3. Suggestions for improvements in remedial math.

Table 5 represents all main themes and subthemes, as discussed in this section, related to each separate group of participants:

Table 5

Themes and Subthemes by Participants

Students	Instructors	Administrators
High school experience college preparedness.	Purpose and value of remedial class.	Purpose and value of remedial class.
Purpose and value of remedial class.	Performance levels and major obstacles to learning	Performance levels and major obstacles to learning
Opinions about performance levels and obstacles to learning	Suggestions for improvements	Suggestions for improvements
Suggestions for improvements		

Student Experiences and Reflections

I conducted structured interviews with 15 student participants. All student participants attended JMCC and took math classes. Eleven students took intermediate algebra courses, while the rest took either beginner algebra courses or were not taking math classes at the time. The average grade of the respondents in high school math was A, and the highest class taken was Algebra 3. Only four students worked part-time, one

full-time, while others did not work at all. Most (*n*= 14) student participants in the study were African American, and the schools and communities were predominantly Black. Most (*n* = 9) of the parents' highest level of education was a high school diploma (only four students' parents graduated from college). Most respondents received financial aid (*n* = 10), with only four receiving scholarships for either football or band, which was also their main reason for attending the EEMC. Students chose to attend JMCC for three predominant reasons: to learn basics they did not learn before (*n* = 5), because they were either in a band or a football team (*n* = 4), or because the school was community and family-oriented and offered a supportive learning environment (*n* = 3).

High school experience and preparation for college-level classes. All students were asked about their high school experiences and whether they thought it prepared them well for college. Out of 15 student participants, 14 responded to this question, and all but four believed their ethnic backgrounds affected their high school experiences. As Tigers1 noted, most believed, "It would have been better if they went to another school." Students mentioned at least one of the following three reasons their school did not prepare them well:

1. Lack of discipline and respect for the teachers;
2. Teachers focused on low performing students; and
3. There was no interest in teaching, and the instructors focused on disciplining instead.

Lack of discipline and respect for the teachers was an underlying issue in all responses; therefore, the three abovementioned themes were interconnected. Tigers6 summarized this experience in a way that described a larger trend:

> When I was in high school, we learnt stuff, but there was so much going on in the classroom you really couldn't learn anything. So, if I'd have went to another school, I figure that stuff would be more under control.

The general perception was the teacher spent too much time disciplining students or working with those who were not doing well, which limited learning opportunities for the students who did better in classes. This process made students feel alone in the learning process, which was reflected in such statements as the one given by Tigers16: "We had to just do it on our own, figure it out on our own." Students who wanted to learn more or had an interest in math in high school also added the teachers generally seemed uninterested in teaching the class. Tigers9 was a student who wanted to learn more but who did not receive enough support from the teacher: "I mean you would ask, and they would just go over it once, but they never really just practiced with you." Tigers9 summarized well the shared experience of the majority of student study participants:

> Most students didn't care. Half the students that did care, they couldn't learn because the other students was so loud in the class, and the teacher didn't care to tell the student not to be so loud or to leave or anything, so, basically, students missed out on a lot of learning.

The opinion about why such stark lack of interest and engagement existed, the opinions seem to be divided—some stated they believed the students simply have no interest in

working harder in school, and instead resort to behaving badly in classes, while others reported teachers did not care enough to help them improve, which demotivated the students and prevented them from trying to work harder and achieve better grades.

Purpose and value of the remedial class. Ten student participants responded to the question about assistance with math classes, and five stated they did not need any additional help. Out of five students who said they did not need additional help, three said that no additional help was needed because the teacher did a good job at explaining things in class, while one said they could use a little tutoring perhaps, but it was not necessary. The data indicated the students believed they did not need any additional assistance because they were already in the remedial math course.

Most students attended class 4 days a week (n = 5), three students stated they were in class every day, and one student was in class 2 days a week. The classes were anywhere between 1 and 2 hours long, but not all students gave this information, so it was difficult to determine if there were large disparities in the time spent in class. None of the students who responded to the questions about class setup knew about the math lab, and they did not attend it, but they all knew about the tutoring sessions available to them. All students responded to the question about the purpose of the remedial class, and 11 students stated the purpose was to learn basics and prepare for college-level classes, as Tigers18 noted: “I need this to get me prepared for college algebra and the things that I’m supposed to know that the high school didn’t teach us.” Only one student (Tigers11) said the purpose of the class was to refresh their memory about the things they learned before but did not use for a while.

The discussion related to the benefits of the remedial class were of great interest to the students. Students found remedial math class valuable for one of the following reasons:

1. Tutoring;
2. Good teaching;
3. Development of new skills and habits;
4. More time to learn; and
5. Refreshing knowledge and practicing.

The overwhelming majority of the students (n = 10) found most value of the remedial math class came from the teacher themselves. They credited their teacher's dedication and assistance for their success in math classes. All student respondents stated they valued the attention and the time that the teacher gives them. As Tigers12 stated, "I feel like the teacher takes his time, and he makes sure you know it before he moves on to the next thing." Because the student participants in this study did not receive individual attention in high-school classes, they found remedial math particularly valuable because the teacher provides them with individualized help. Tigers13 shared that "if he sees you not understanding, he'll help you. He'll actually help you one on one." Although not all students used tutoring assistance offered to them, two participants expressed they found it helpful because they could work with the teacher that taught them the concept first and that they liked to do so through direct application of their knowledge on problems. Students indicated tutoring was a way to overcome their obstacles to higher levels of performance, but their lack of interest or commitment to the subject prevented them from

taking advantage of it. Tigers11 stated, “It’s on us if we feel the need to open our mouth. But out of this whole experience, yeah, he gives them all the value. Tutoring would too, but I’ve never been to tutoring so.” One student noted that having more classes was beneficial:

> I felt better because of what I learnt that day, or I go on a Monday I go do that homework and even that Tuesday I come back. I probably don’t work that Monday, and then I add one more step extra to make sure that I’m getting it.

All but two student respondents (n = 12) stated the remedial class was effective in improving their math ability and math-related academic outcome. These students stated the class helped them to understand concepts they struggled with previously. Just as with the value of the class, the effectiveness was also credited to the teacher. Tigers12 stated, “I said before, obviously because he makes sure that we get it done and makes sure that we know what we doing before he moves on to the next line.” The two students who said this class was not effective in improving their math-related academic outcome said this was due to their own lack of application of the assistance and knowledge received. Tigers4 stated, “I just haven’t really pushed myself to do any math.” Six students noted this class helped them improve their academic outcomes outside of math classes as well because it taught them discipline and gave them the skills that they needed to overcome their own obstacles to learning and make progress.

In addition to paying more attention and making themselves available, the teachers who were particularly successful in motivating students and helping them learn better were innovative in their teaching approaches and used technology and more

interactive methods. These might include visual aids and videos to help students build stronger interest, understanding, and apply their skills and knowledge beyond the class. Based on the data, seeing the relevance of the class in the real world, outside of the classroom, and the need for it in their lives was one of the primary things that made the students motivated and making this class effective. The students who said that it had helped them improve academic outcomes outside of math made this connection particularly explicit. Tigers9 stated, "Because say, for instance, I have a sociology class. It deals with things going on in the world today like economics and all that. It helps me add, divide, all that, when I need to."

Opinions about performance levels and major obstacles to learning. The students who participated in this study believed the reason behind the lower performance was due to the low student engagement and low interest. This low interest was mentioned in almost all interviews and different contexts, but the students believed those in remedial classes did not work hard enough to achieve better grades. Seven students stated they did not agree with the research pointing at lower performance levels in students who were in remedial math classes because they did not see it reflected in their classes. The other half of the students agreed with this research finding and stated that they do not find it surprising because, as Tigers10 stated, "The class easy, so it's basically the students. They don't try." Tigers14 also added, "A lot of the students don't really do their homework or the practice tests because the practice tests are very long […] and they kind of just goof around."

Students who did not agree with the research pointing to lower performance levels in those who attended remedial math classes expressed the disparity in performance results might be because each student learned differently; moreover, there was a need for more personal assistance for students struggling with the material to develop full understanding of the concepts they were learning. Because they were in a remedial course, they said proof existed of their inabilities to engage with the concepts fully because they never developed a full understanding of math, which led them to believe some students were simply naturally more inclined to understand math than others. This opinion was usually stated alongside the belief that one was simply "not a math person," as Lion16 stated in the following:

> Because like some people it just take a little bit more. Like some people, it's like they just born naturally, you know, good at math, good at school. But, some people like they got to work a little harder just don't understand it.

Suggestions for improvements. All 15 students responded to the question about possible improvements to the remedial math class, and two did not have any suggestions. Regarding improving the effectiveness of the classes and increasing performance levels, two suggestions were predominant among the students:

1. Improve individual assistance for students.
2. Improve student engagement.

Individual and individualized attention was something that most student participants listed as the primary need. Tigers8 stated the following:

> I'd say just make sure they let the student know that they give their student the confidence that they need to let them know, "Okay, I'm not in this by myself. There is somebody that's on my side, somebody that's on my team. That wants to see me succeed in this course."

Some students believed they did not receive enough attention and assistance in a class tailored specifically for their own individual needs and a learning style, which was why they did not make progress. More time given to specific points of confusion was listed as a number one need and tool for improvement, as Tigers9 pointed out, "I think more explaining needs to be improved, and more problems like to be going over and worked out with the class."

Some respondents mentioned students often did not feel comfortable showing lack of understanding and seeking help in class, with other students present, which was why they felt the need for the teacher to approach students individually and gain a better understanding of their levels of understanding and needs. Tigers10 suggested, "Go to each student and personally help them instead of them raising their hand up. Because some students ain't just going to be like, 'I need help,' and all that. They ain't going to do that." To get more personalized help during class, students suggested those who were doing well in class could help others who were struggling to promote a more supportive environment and assist the teacher in addressing individual needs of students as well. Tigers17 proposed that the students could

> help each other out in ways, and then like instead of just the teacher helping us, we all come together and help each other and make sure everyone knows it

> instead of leaving someone out that don't understand or just don't get it at all or something like that.

To assist students who were struggling, one participant (Tigers19) suggested the teacher should introduce more innovative teaching techniques to help out students who were visual learners:

> So, I suggest teachers look up videos, more for visual learners, so that they can learn it and get it and replay it no matter how many times, 'cause as a teacher, you can't replay … you can't just replay their lesson for that day.

Even though the students expressed the need for more individual assistance, most stated they were aware of all the resources at their disposal and that they were aware of the tools they could use to improve, but that students need to take more initiative to learn. Nine participants suggested that students should take the initiative to engage more and pay attention in class. This finding indicated students felt responsible for their own success, and they were aware that if they did the work assigned by the teacher, they could gain the understanding of the subject and improve their grades.

Instructors

Four instructors were interviewed as part of this study. All but one received specialized training for remedial math courses. The instructors taught remedial math in addition to their regular courses offered at JMCC. All instructors reported they had proactively sought professional development opportunities and conferences that would allow them to improve their skills and become better instructors for remedial math. Three instructors received some form of training to teach remedial math, while one did not

receive any additional training. They believed there were a lot of resources and research available that could help them improve student engagement and performance.

Purpose and value of the remedial class. All respondents stated the primary reason students took the remedial class was they lacked the fundamental knowledge for them to understand the material offered in the college-level classes they were taking. Instructor Tigers21 stated, “Sometimes, you find yourself even doing the easiest thing up there, showing the multiplications.” The respondents stated students were unprepared in high school for advanced math level classes in college, and they needed the remedial classes to learn basic concepts to understand more complex problems. As Instructor Tigers2 said, “That’s a big issue. When it comes to factoring, it’s extremely difficult to get them to understand the concept behind factoring. They don’t understand, and they don’t know the multiplication facts.”

Although the instructors stated they were constantly working on increasing student knowledge and to increase engagement levels, the lack of interest and effort on the students’ part remained the main obstacle to progress. As instructor Tigers20 noted, “A lot of them are hardworking and go out and do what they need to do to be successful, so it’s just the ones that are not typically motivated that doesn’t do well and perform poorly.” This comment indicated additional classes and tutoring opportunities were not enough to ensure success. Instructors pointed out two main components needed for the remedial classes to be a success: innovative and engaging teaching technique and engaged and proactive students. The remedial classes were only beneficial if the teacher found a way/s to present it to the students so that they could understand the need for it

and the benefits of it. If the students did not understand why they needed the prerequisite classes, and if the material was not presented engagingly, it would not be helpful or effective. Finding a way to relate the material taught to the students' lives was the only way to engage them more, as suggested by the Instructor Tigers21: "It's kind of hard, being a math instructor, it's hard to make the math fun. But I'm pretty sure there are curriculums out there that can help you with that." Without active student engagement, all three instructors believed this class would not achieve its goal. Students have to put in the effort to do the homework, to find their own pain points, and to get help from teachers and tutors when they need it.

Opinions about performance levels and major obstacles to learning. All four instructors found the results of the research pointing at lower performance levels in students attending remedial math classes surprising. They believed their students were doing well and that there was not as much difference in their performance levels. Upon reflecting more on the possible reasons for such research results, the instructors stated they believed the primary reason for the low levels of performance in students taking remedial math classes was due to the lack of dedication to the class and efforts to engage actively with the material and do the work required to learn. Teachers stated they perceived student attitude as the main obstacle to learning as most believed they were "not a math person," or they simply "weren't good at math." Instructor Tigers20 stated the following:

> Some of my students perform poorly. A lot of them were hard-working and go out and do what they need to do to be successful, so it's just the ones that were not typically motivated that doesn't do well and perform poorly.

Teachers explained to remedy this issue, they were more available to build student confidence. Tigers 21 was available for tutoring and conversations about any obstacles the students might have faced:

> I guess when you deal with remedial students, they tend to... I guess some were fresh out of high school, so you tend to try to remind them of homework and try to have lab time where you can walk through, and kind of have a one-on-one with some of the students, especially if they low-end with the skills that they need to move on.

One instructor mentioned offering assistance on issues unrelated to math to help students become more engaged and focused learners.

Suggestions for improvements. Three out of four instructors had suggestions for improvements to the remedial math class. Most suggestions were related to allowing for more time to cover all the material that the students need. The instructors believed they did not have enough time to cover everything they needed to and that offering the course for longer than a semester would be beneficial for the students because; Tigers2 stated, "With that one semester, you're pretty much teaching and time limits it, as far as time to review and intervene, as far as going back and trying to reteach a topic." Instructor Tigers20 reported offering more tutoring sessions throughout the day was beneficial, so

students could go directly to a tutor as well rather just to a teacher and receive the assistance they would need.

Two instructors suggested incorporating more technology into the class as a way to increase effectiveness and benefits for students. Instructor Tigers21 suggested "showing them how to use the technology, use the calculator or use anything that's provided online" as a good way to assist students as teaching them how to use calculators would make the subject less intimidating. Finding a way to make math more fun and to provide more incentives for students was another suggested idea for improved student interest and performance. The incentives were proposed by Instructor Tigers21, who suggested that some form of "competition" would be good to motivate students: "Those who were improving, do some pre and post-tests, and get some incentives like Subway cards or $10 for the bookstore, stuff like that that they're interested in." However, all instructors agreed these suggestions were not enough if the student did not do the work required to learn and adopt the lessons shared with them truly. Finding the way to motivate students remained the primary concern of the teachers and the only way to ensure the success of the class.

Administration

Only one member of the administrative staff was interviewed as part of this study, but their observations much aligned with those of the students and teachers interviewed. This individual was a staff member in a position of high authority, actively involved in curriculum creation and remedial course structure; therefore, the participant was a credible and reliable source, who made up for lack of other respondents in this category.

Purpose and value of the remedial class. According to the respondent, the curriculum of the class was structured to allow students to have more time revisiting basic concepts, so they could approach more complex issues with confidence. The class structure and curriculum had been changed so that math fundamentals were no longer included; instead, beginning algebra, intermediate algebra, and college algebra courses were offered in addition to the remedial math course. This process was done to "take away one of those extra three hours or four hours of developmental, so we can allow our students to get to the gateway course a lot sooner than they used to." The supplemental lab was meant to give the student a second chance to learn math basics and "to allow that student the opportunity to work on skills that may have been covered in Intermediate or earlier courses. That instructor works with that student to build that familiarity with the topics that are being discussed."

Opinions about performance levels and major obstacles to learning. According to the administrator, the primary reason for low student performance in math was fear of the subject:

> I believe that students may have had problems with math before is because they were scared of the material. Math is always that subject that seems to fail you, "Well, I'm nervous about it," for whatever reason, lack of confidence, may not have a strong background.

The administrator was aware of the low-performance levels and that students had come to JMCC unprepared and lacking fundamental knowledge, which they believed caused lack of confidence and inability of the students to approach the subject with an open mind,

ready to learn. The respondent had been proactively involved in curriculum restructuring and working with other stakeholders to make the remedial math course more effective and beneficial to the students.

Suggestions for improvements. In addition to the curriculum restructuring, the administrator believed active engagement from teachers was one of the most effective ways to build student confidence. The participant believed math "is a difficult subject, but with the right instructor, you can't bypass that." For this reason, the administrator invested more in teacher training and development as the primary way for student performance improvement. It was believed investing time and energy into understanding and developing new and innovative pedagogical tools would improve remedial math experience for the students and increase performance levels.

Discussion of Data Analysis Results Across Different Participant Groups

Based on the responses from all three categories of respondents, there were significant overlaps in perceptions of obstacles to improved performance and suggestions or improvements of remedial math classes. Two main reasons for low math performance were identified by all participants:

1. Lack of high school level preparation.
2. Low student engagement and lack of interest.

Although student respondents noted the lack of interest and discipline was the major obstacle for learning in their high schools, teachers in JMCC noticed this reflected in their lack of organization and work habits.

After identifying these main reasons for low-performance levels, participants across all three groups agreed the remedial math course was crucial to equipping students with knowledge, tools, and self-confidence needed to succeed in college-level classes. Coming from high schools where they did not receive enough individual attention and where teachers seemed less interested in their knowledge and success, students in remedial classes highly valued all the assistance they had received from the teachers. Students were particularly inspired by the teachers who seemed "on their side" and helped them overcome any learning obstacles the students had faced. For this reason, students found remedial math classes highly beneficial—either because they learned, for the first time, things they missed in high school, or because they could revisit the knowledge they had obtained before and not used in a long time.

Although students valued teachers had made themselves highly available and offer tutoring sessions, not all student had used this extra help. This particular component of the course was something the teachers had been investing more time and energy into, while the administration even restructured the curriculum to allow for more tutoring time. Because students still desired individual attention and they and the teacher both brought up time shortage as an issue, engaging with students more during class might be a way to resolve the issues they had faced. This process could be done with the help of high performing students in the class, as suggested by both student and instructor respondents.

Even the students who did not take advantage of the tutoring believed this class was highly beneficial for them in math, as well as in other subjects. They reported the remedial math and teacher dedication allowed them to feel supported and build habits

that improved their learning abilities and helped them in other classes. Those who reported this class had no positive effect on their overall academic standing also stated the reason was their lack of implementation of the tools and knowledge made available to them by the teachers, as well as the program. The overall sense was the teachers were incredibly engaged and proactive, but the students lacked discipline and will to put in the work needed to make remedial math beneficial to them.

This sentiment was visible in the responses to questions related to the research, indicating students in remedial math class had lower performance levels compared to other students across all levels. All three participant groups agreed the lower performance levels concerned engagement, while students argued that some was because different students had "different learning abilities." This finding showed the belief that "math is not for them" persisted among students, and six student respondents stated this openly as well.

The data showed the benefits of remedial math classes were not in question, but there remained a need for innovation. The burden remained on teachers to develop more engaging ways to make the subject more attractive and reliable for the students. For this reason, professional development opportunities and more research remained the key to making remedial math a beneficial course. Based on the data, the suggested improvements fell into one of the following three categories:

1. Allow more time for the class.
2. Improve individual student assistance and student engagement.

3. Include more technology and more exciting ways of making the subject interesting and relevant to the students' lives.

Project Ideas

After a thorough analysis of the data collected and all the themes that emerged, four possible project ideas emerged. These are discussed in the following subsection.

Collaboration with High Schools

This first idea is the one that came out of the conversation with an administrator, which is already in the process of implementation: collaboration with high schools to ensure the quality of the classes is improved and the fundamental knowledge in math gets across to the students before college. This project may address the first concern listed by most participants, which is the lack of fundamental knowledge needed for students to perform well in college-level classes.

Teacher Skills and Knowledge: Professional Development

Increasing professional development opportunities for teachers is a need shown in several interviews with the instructors as well as the students. The administration pointed to this need as the main issue and a potential way to innovate the course. Engaging more actively and learning from the latest research was offered as a way to arrive at ways to resolve some of the remaining obstacles to learning.

Engaging More Active Students Who Do Well in Math Classes

This idea came from the students themselves; they suggested engaging students who have done well in class might be a good way to improve overall performance. This engagement could be twofold: an individual can help other students during the class

itself, and a person can facilitate group work on projects and homework, which would allow students who perform well to help those who were struggling.

Introduce Technology and Innovate Presentation Styles

The final idea that came out of the data was from an instructor as well as a student respondent, and it was related to technology and innovative approaches to material presentation. There is a need to teach students more about how to use calculators, especially those who have not been exposed to them through their high school classes. A suggestion entailed exploring other alternative ways to reach visual learners and make the class more interesting, such as using more video material in teaching. This process might be a good way to break students' fear and resistance to the material. Additionally, students stated the teachers who connected the material to real-life issues had more success in making the students interested and engaged in the learning process.

Section 3: The Project

Introduction

The purpose of this qualitative intrinsic case study was to explore the perceptions of community college instructors, administrators, and students regarding the causes of low student performance in remedial mathematics. Findings from the data analysis revealed that students reported a lack of fundamental knowledge needed for college-level classes, as well as a lack of engagement/motivation. Administrators and teachers reported a need for more professional development as a way to innovate the course. Based on ideas expressed from participants, a 3-day professional development training was designed to address strategies to improve remedial math performance.

Rationale

Based on the data analysis results in Section 2, I chose the professional development (PD) as my project genre. The findings of this study indicated a need to address college readiness at the high school level, as well as a need to train administrators, instructors, and students on strategies to improve remedial math performance. The training focuses on areas of improvement within the curriculum, instructional strategies, and student engagement. This 3-day PD is intended to improve remedial math student performance by increasing the skills and knowledge of instructors and students and developing new contextualized instructional methods for real-world application practices. The data analysis in Section 2 indicated a strong student concern for improvements to high school math courses and student engagement/motivation, as well as course restructuring to address different learning styles through real-world

application practices. Instructors and administrators shared most of the same concerns and suggestions for improvements, student engagement, and development of new and innovative pedagogical tools. This training will provide the community college and local school district with better insight, strategies, and solutions for improving remedial math performance. The strategies and solutions developed form this training may lead to improving overall student performance at the community college and not just in remedial math.

Review of the Literature

Purpose of Remedial Math

Remediation a common response to areas where students have not received important preparation or development for success in an academic program. In the United States, 42% of students will enroll or be required to enroll in a remedial course (Perin, 2018; Whiton, Rethinam, & Preuss, 2018). Remedial math is offered at 4-year and community college institutions to serve students with low entry-level grades in mathematics (Whiton et al., 2018). Outside of remedial mathematics, entry-level college algebra is traditionally the lowest level of mathematics offered to students (Fleurizard & Young, 2018; Whiton et al., 2018). However, many students have found they were unprepared for algebra and lacked fundamental knowledge to succeed in foundational collegiate mathematics (Fleurizard & Young, 2018). Researchers have noted that taking enrolling in remedial math classes did not necessarilty improve success (see Fleurizard & Young, 2018). The average retention rate for remedial math classes sits at 40% in the United States (Fleurizard & Young, 2018; Whiton et al., 2018). Considering remedial

math is intended to nurture students to succeed and graduate college, it is essential to assess how remedial math could be improved and what factors were influencing the current attrition rates of remedial math students (see Pape & Prosser, 2018; Perin, 2018). The quantitative results from previous remediation and retention studies support the link between the two.

Search Strategy

The search strategy for the review of relevant literature included searching the following databases: MUSE, Journal of Counseling and Psychology, International Journal of Research in Education Methods, Community College Review, Community College Journal of Research, Science Direct, SpringerLink, Google Scholar, JSTOR, and EBSCOhost Online Research Databases. Using the following keywords results were found pertaining to this topic: *remedial math classes, remedial math at community college, remedial math at four-year university, tutoring in remedial math, technology usage in remedial math classes, innovative methods in remedial math classes, challenges in teaching remedial math in college, teaching methods in remedial math,* and *student performance in remedial math classes.*

These search terms yielded 49 total research articles related to the main topics of this study. Only one dissertation was cited to review relevant literature; however, all other articles were peer-reviewed. All literature used for this review was published from 2016 to 2019. Articles prior to the year of 2016 were not used to obtain the most current data.

The literature review is organized into several broad themes with more specified subsections. These themes are drawn from the findings of the literature and reflect the most current academic research in relation to the topics revealed during the data collection. The next section begins the literature review by discussing the preparedness of students for collegiate remedial math classes. The review is finalized by a brief summary of the reviewed sections as these relate to the purpose of the study.

Student Preparedness for Collegiate Math

Results from this study indicated that students and instructors expressed they did not feel their high-school prepared them adequately for entering college and taking math classes. Authors have focused on the standards students have faced when preparing to enter college (Perin, 2018). Many standards for preparedness were privately controlled by the state and the school (Perin, 2018). Ideally, all students leave high-school with basic mathematical skills (Perin, 2018). However, Perin (2018) argued that educational standards were not applied sufficiently in the classroom to ensure future academic success. Perin's argument was based upon the increased enrollment in remedial classes, which indicates that students are not leaving with the basic required knowledge that standards are designed to enforce prior to college. Perin’s concerns indicated a need existed to focus on how students were prepared for college while in high-school. Considering high remedial math enrollment, the current methods for instilling basic mathematical concepts may no longer be fully functional (Boatman & Long, 2018). Preparing students for success in college is vital, and authors have begun to focus their attention on how students are being prepared for college while in high-school (Boatman

& Long, 2018). Such an approach would improve the overall system of math skill development.

Researchers have found that students often leave high-school unprepared to take college level mathematics courses. Multiple researchers outside of Perin (2018) have noted that students have left high-school unprepared for college math. Atherton (2018) interviewed first-generational college students to obtain their perspectives toward college readiness and found that students believed high-school had failed to prepare them for college. Students had remarked that emphasis was placed upon standardized testing, which only placed them academically but did not help them understand how to navigate college or how to succeed within college courses. These remarks are concerning, as high-school classes are often designed to prepare students for college; however, the remarks within Atherton were only applicable to the study group interviewed and might not have represented all first-generation college students. These studies indicate that future research is needed to understand how standardized testing and other methods prepare students for entering college level mathematics.

Recent studies have found that there are flaws in the models used to prepare students for college courses. However, other authors have noted flaws in preparedness for college courses and college math specifically. Moore et al. (2010) conducted a state-wide survey for the 2006 and 2007 school year. Moore et al. examined the statistical preparedness for college readiness of students leaving high school and entering college. The authors found that students were mostly unprepared for mathematics and reading courses in Texas. This study was notable as it encompassed an entire school year and

state-wide data, indicating students in Texas were entering high-school disadvantaged and unprepared for college-level math and reading classes. Studies indicate that some models of preparing students are failing to be adequate when students enter college.

All college students should prepare for college level math before entering college. Researchers have noted that this preparation is vital during middle- and high-school periods. Boatman and Long (2018) argued that the ability for college students to succeed in remedial math was highly dependent upon how they were prepared for college in middle school and high school. To test their assumptions, the authors assessed students who only needed one remedial course versus students who needed multiple levels of remedial courses (Boatman & Long, 2018). The authors found a negative association with students who required only one remedial course (Boatman & Long, 2018). However, students requiring multiple levels of remedial courses were positively affected by taking a course (Boatman & Long, 2018). Boatman and Long's study indicated that students who were needing more than one remedial course would benefit significantly by taking the required remedial math course; however, those needing only one remedial course might find that the class was not significantly beneficial.

Future research is needed to understand if the findings of Boatman and Long were applicable to educational institutions across the United States; however, the author's findings did indicate students who would need multiple semesters of remedial math classes would benefit from prolonged exposure to foundational mathematical concepts (Boatman & Long, 2018). Some students (needing only one remedial course) had spent prolonged time in courses with no perceivable benefit to their overall career attainment

goals (Boatman & Long, 2018), which led some researchers to question both the requirements for placing students in remedial math and the designated number of semesters a student should be required to attend (Melguizo & Ngo, 2018). Overall, students who take multiple remedial math classes are more likely to benefit from required remedial courses in college.

Community colleges fill a vital role in higher education. Regarding community college, approximately a third of high-school students will choose to enter community college to earn an associate degree or gain prerequisite credits for later entering a 4-year college (Melguizo & Ngo, 2018). Melguizo and Ngo (2018) documented these students being required to enroll in remedial math classes at community college due to low entry scores in mathematics-specific sections. Melguizo and Ngo studied a series of students entering community college directly from high school, finding students with high placement scores in math were required to enter remedial math courses. They suggested that college leaders should use transcripts to determine readiness versus placement tests to evaluate students who might need to be in remedial courses. In conjunction with the findings of Boatman and Long (2018), these results were concerning. There must be a more vibrant response to math skill development in higher education.

To summarize, further research is needed to assess the placement criterion for developmental mathematics. In addition to assessing the criterion for placing students, researchers must assess how demographic and instructor-student interactions have influenced students' preparedness for college-level mathematics (Pape & Prosser, 2018). The studies reviewed in this section indicated that students had entered college

unprepared for mathematics. Boatman and Long (2018) and Melguizo and Ngo (2018) found that students left high-school and entered community college were typically placed in remedial classes due to their lack of college readiness. State-wide studies conducted by Moore et al. (2010) further indicated students had left high-school unprepared for college-level math and reading. Furthermore, phenomenological assessments by Perin (2018) and Atherton (2018) noted that students had remarked they believed high school did not prepare them adequately for college. These findings correlated with the student and instructor remarks about the inadequacy of high school preparation for college-level math. More research is needed to assess the link between high-school and college mathematic success; however, it appears that students' preparedness before entering college is crucial.

Next, the following subsections are designed to address the themes from participant interviews within this study. These themes include topics ranging from college preparedness and teacher support for college math preparedness in high school.

College preparedness and ethnicity. During my study, 11 student participants believed their ethnicity affected how they fared in high school, and thus might have influenced them at the collegiate level. These remarks were far from unfounded as recent research had shown ethnicity had influenced students in high school and often negatively affected their path to success in entering college (see Bal-Taştan et al., 2018; Davis & Martin, 2018; Hepworth, Littlepage, & Hancock, 2018; Hodara, 2019). Scott (2018) reported significant ethnic disparities for preparing students for college. In a modern assessment of Tennessee high-schools, Scott discovered minority students were not

receiving equitable educations to prepare them in key topics, such as mathematics. found minority students less likely to be enrolled in college prep classes. Thus, the variable connection between minority status and mathematic preparedness is a critical consideration.

Previous researchers have assessed possible connections gaps in equitable approaches to preparing students of color for college. Hodara (2019) conducted a review to understand the demographic makeup of remedial math students in the United States. Hodara found that White students were less likely to be required to take a remedial math class; however, a systematic analysis of the meaning of these findings in correlation with the experiences of minority students in high-school was not currently available. Ideally, future researchers will consider these factors (Davis & Martin, 2018). Similarly, analyses of possible ethnic disparities in remedial college classes were not currently present in academic literature (Bal-Taştan et al., 2018). Overall, there appears a significant gap between the equitable preparedness of students of color for entering college.

However, the preponderance of literature is focused upon discrimination in high-school preparation. Ideally, future researchers should examine these issues by examining studies of collegiate experiences (Davis & Martin, 2018; Hepworth et al., 2018; Hodara, 2019). These disconcerting findings corroborated the concerns of students in this study. These findings and the concerns of cited authors were used to study how pedagogical techniques were failing minority students and likely affecting their transitions into collegiate mathematics (Bal-Taştan et al., 2018; Davis & Martin, 2018; Scott, 2018). In all, the contemporary pedagogical techniques appear to be aimed towards white students,

which fail students of color in preparing to enter college. The following subsection focuses on teacher-to-student support and its effect on student confidence and success in college.

Teacher support and student success. In this study, participants remarked their high-school experience often included feeling overlooked due to teachers who focused on disciplining (or failed to discipline) other students. A general feeling of dissatisfaction for their teachers was noted by some student participants, which had led to them being unprepared for mathematics in college. Current literature indicated that student participants were not alone in these reflections of their high school experiences (Yu & Singh, 2016). Yu and Singh (2016) reviewed high school data in 2009 and found the support of teachers in topics, such as mathematics, was crucial to student engagement and success. Complex topics, such as math, required teachers to employ teaching strategies unique to specific students; however, they found distracted teachers did not provide support and did not instill confidence in their students; they were more likely to create students who struggled with math (Yu & Singh, 2016). In some cases, student dissatisfaction with education and teachers may lead to a decrease in preparedness for topics such as math.

However, the relationship between students and teachers is complex. Schenke, Ruzek, Lam, Karabenick, and Eccles (2018) argued that the ability for students to gauge the emotional support of a teacher could be problematic for the mutually ensured satisfaction of students and teachers. Schenke et al. defined a teacher's role as mediating arguments, controlling challenging students, and providing emotional support while

teaching complex topics. The authors noted that even if a teacher is emotionally supportive of a student, the student may not recognize the support, which can lead to overall unhappiness and lowered academic achievement. Schenke et al. (2018) therefore proposed that teachers should attempt to provide feedback clearly while considering if students recognize support. Feedback and sufficient emotional support can give students a better understanding of their current place in a program.

Teacher support may lead to the bettered retention of mathematical skills. These findings indicate a mixed understanding of the influence of teacher support on the ability of students to retain mathematical skills. Nevertheless, all students must feel supported to achieve some level of academic success (Yu & Singh, 2016). Based on participant responses, future researchers should focus on how participants experienced support or lack of before attending remedial classes (Yu & Singh, 2016). A more comprehensive rationale of the relationship between teacher support and student success could lead to a more thorough explanation of the factors affecting student college preparedness (Schenke et al., 2018; Yu & Singh, 2016). Support and instilling confidence in students appears to play a vital role in student preparedness for college. Thus, the next section explores methods currently employed by instructors and educational administration are reviewed in conjunction with the themes of this project.

Teaching Methods in Remedial Math Classes

There are apparent links between educators and student success in remedial math classes. Thus, this section presents the common teaching methods in remedial math classes. Some authors have noted that current teaching methodologies may affect the

retention rate and success of students in remedial math classes (see Stoneham, Moore, Slate, & Martinez-Garcia, 2017). Mathematical teaching methods can include teaching students using contextualized methods, such as connecting real-world scenarios to the concepts taught in class, or by using traditional formats that require students to work on material during and after the class (Stoneham et al., 2017). In this study, the application of math to real-world topics was considered a vital factor in the effectiveness of teachers. Thus, researchers should consider the methods teachers use in remedial classes and their influence on student retention.

Student success in remediation is essential. Researchers have addressed how students can succeed in remedial math classes and how these statistics may indicate areas needing improvement (Stoneham et al., 2017). Stoneham et al. (2017) reviewed students enrolled in computer-based and traditional lecture style remedial math classes at community college. Stoneham et al. reported that students in lecture-style classes performed had higher grades compared to students in classes with other methods of instruction. The finding indicated that students using computers were not fully benefiting from the technological format (Stoneham et al., 2017). Opportunity for distraction was one possible reason presented for lack of retention with online formats, but Stoneham et al. (2017) argued that students were only learning basic concepts to complete the modules and could not apply the concepts in more complex scenarios. Though the Stoneham et al. study did not apply to all colleges and students, the authors' results did indicate a need for furthered understanding of the interaction of technology with mathematical learning

success. Therefore, student success can depend on several factors and resources which are available.

The format that an educator uses in class can impact how a student retains information. Researchers have argued that teaching format is a key element of student performance in remedial classes (Skuratowicz et al., 2019). Skuratowicz et al. (2019) studied four students enrolled in two different algebra classes. One class was designed to teach algebra in a traditional educational format, while the other class contextualized algebra with applicable real-life scenarios (Skuratowicz et al., 2019). The authors found that at the end of the semester students in contextualized algebra classes had succeeded at higher rates and had higher pass grades in the course than students enrolled in traditional format classes (Skuratowicz et al., 2019). The authors' findings indicated a need to find ways to teach students how mathematics might be applicable in their lives and future careers (Skuratowicz et al., 2019). Connecting mathematics to real-life scenarios can lead to increased retention. Accomplishing this aspect might involve addressing the one-on-one needs of students in remedial classes. Previous studies of one-on-one teaching methodologies are reviewed briefly in the following subsection.

Individualized teaching. A few student participants in this study suggested one-on-one customization; students believed some individuals earned differently and might need special attention to find the best way to learn mathematical concepts. Individualized teaching methods show promise in pedagogical reviews. For example, Mills and Mills (2018) advocated for individualized teaching methods based on a renewed understanding of how students learn complex subjects. Researchers in Indonesia have tested student

groups using the traditional lecture-style versus a real-life approach slightly customized to the learning style of each student (Fauzan, Musdi, & Yani, 2018). The authors also found that students who used the contextualized approach fared better compared to students in traditional courses, and argued that mathematics education should be tailored to real-world applications specific to the learning style of the student (Fauzan et al., (2018). In Scandinavia, students were taught mathematics by allowing students to self-teach concepts (Eronen & Kärnä, 2018). Eronen and Kärnä (2018) studied 23 students using this method, finding students who could self-teach themselves through modules in the class were more likely to succeed in exams and assignments. In the United States, some researchers have called for technology and textbook specific modules based on the learning style of each student (Priscylio, Rochintaniawati, & Anwar, 2018). Overall, individualized learning, technological advancements and specialized visualization methods may lead to increased retention for students in mathematics classes.

However, it can be difficult to customize educational material to fit the needs of all students in classrooms. Hott et al. (2019) studied schools in rural regions of Texas and found that funding presents a significant barrier to customization based on a student by student basis. Hott et al. found that teachers in rural regions were largely uneducated on learning styles and ways to adapt the material to these techniques. The authors argued for the implementation of professional workshops for educators to assist them in the transition to assist students on a need-by-need basis (Hott et al., 2019). These researchers contextualized the current state of affairs of individualized learning (Eronen & Kärnä, 2018; Hott et al., 2019; Priscylio et al., 2018). The adaption of learning style techniques

is institution-specific and variable on the time, funding, and of each department (Hott et al., 2019). Further research is required to understand how one-on-one teaching techniques would fair in remedial math courses. One-on-one techniques in the classroom can increase retention, however, there is a need for specialized training to enable the success of this method in classrooms. The following subsection transitions into reviewing the current methods for teaching remedial math. Specific attention is paid to innovative and technological methods, as reviewed in the academic literature.

Pedagogical methods for remedial math. Technological advancements are one of the recent models for increasing retention of academic subjects. In the United States, the advent of technological advancement in teaching methods has allowed teachers to select a range of technologically diverse tools to help them communicate complex problems to students with a variety of educational backgrounds (Kellems, Cacciatore, & Osborne, 2019; Pape & Prosser, 2018). Ample attention has been paid to teaching methods for collegiate students in nonremedial class formats. However, academic researchers are now focused on how innovative methods were being used in remedial classes where students require more unique ways to help them understand problems that they have struggled with previously in middle-school and high-school (Kellems et al., 2019). Innovative methods, such as technological tools, are now a growing technique for reaching students and providing variety to normative pedagogical methods.

There is a need for more diverse perspectives regarding learning styles and disabilities in respect to remedial classes. Kellems et al. (2019) argued for incorporating more diverse perspectives into the remedial classroom. According to the U.S Department

of Education, out of all surveyed disabled high-school students, only 6% were capable of passing entrance exams and avoiding remedial classwork (as cited in Kellems et al., 2019). Kellems et al. (2019) addressed this concern by arguing that not only did the perspectives of college students with disabilities need to be pointedly addressed but augmented reality technology should also be used as an alternative to teaching students with disabilities. For this study, augmented reality translated into presented students with a video of a math problem. The math problem was translated into a video-guided, step-by-step process. Kellems et al. interviewed one teacher who had incorporated the technique in his remedial math class, and according to the educator, the process had helped his disability students to solve problems that they had previously expressed inability to solve. The author's study was one of the only studies addressing how disability students were overlooked in the remedial mathematics educational process in college (Kellems et al., 2019). The author's findings indicated a need to focus on how technology can be incorporated into remedial collegiate math classes, but also how to adapt to specific learning styles to fit the diverse needs of the student population (Kellems et al., 2019). Learning styles should be considered in remedial math classes, which in part can be addressed by technology to meet the diverse needs of students.

There are currently two predominant pedagogical models for teaching remedial mathematics. Kellems et al.'s (2019) findings presented promising methods for teaching remedial students in innovative ways. Out of the current academic literature, two main themes were prominent within innovative methods for instructing remedial students.

These two themes (technological methods, MOOCs, and nontechnological innovations) are presented in three separate sections.

***Technological methods*.** Within this study, participants and students suggested the incorporation of technology into remedial math courses to engage students and increase the methods for teaching in interactive ways. The technological theme was prominent in the findings of this study and also appeared as an issue of importance in academic literature. In 2018, a large scale dissertation was presented by the author concerning the possible effects of technology on remedial mathematics. Bradford (2018) studied 2,900 community college students studying remedial math in classrooms using technological methods for teaching purposes. Bradford included extensive exploration of variables of age, gender, and race in correlation with success in technologically aided classrooms. Bradford's findings indicated a positive correlation with technology-driven remedial math classes and student success. Technology in remedial classes, especially math classes, may lead to increased retention and student success.

Some specific age and ethnicity categories appear to be more strongly aligned with technology as a tool for remedial math. Regarding demographics, students under the age of 30 and identifying as Native American ethnicity fared better in classrooms with technology. Older students of African American and Latino ethnicity did not perform as successfully as other ethnic groups (Bradford, 2018). Bradford (2018) argued that the findings indicated a need to understand how technology was successful in remedial math classes, with particular interest toward ethnicity and age in future studies. Overall, technology can be a useful model, but may not be an appropriate for all students.

Scaffolding techniques are also another model that is used in remedial math courses. A recent review of tribal students indicated students who self-employed the scaffolding technique were more successful in preparing for mathematics in college (Lundberg, Conrad, Gasman, Nguyen, & Commodore, 2018). Lundberg et al. (2018) reviewed Native American students, educators, and administrators at a tribal community college (CDCK). Students at the college took remedial math classes based on computer systems. Each computer program was designed to ensure students would master a minimum of 80% of the material of one math topic before moving to the next topic (Lundberg et al., 2018). The system would allow students to learn and study at any location while accessing their math textbooks online and interacting with learning modules in the textbook. Thus, 70% of reviewed students believed the courses were useful and preparing them to enter college (Lundberg et al., 2018). The emphasis for CDCK tribal college was based on student's ability to learn the skills, and administration remarked more importance of students learning math to succeed in life than passing or failing the classes (Lundberg et al., 2018). In reviewing their findings, Lundberg et al. (2018) suggested that the hands-on method by the administration should be applied to other schools. Because the administration was concerned about students learning rather than attrition statistics, their students felt confident and safe. Additionally, the authors argued that all college leaders should strive to learn to recognize the successful innovative, technological, or nontechnological teaching methods for their students (Lundberg et al., 2018). Importantly, students who feel supported, both emotionally and technologically, are more likely to succeed throughout their classes.

Technological implementation is not always a successful approach. Though researchers have defined technology as useful in classrooms and remedial math courses, some have argued that educators and educational institutions have faced significant barriers when attempting to implement technology in the classroom (Bradford, 2018; Lundberg et al., 2018). Pape and Prosser (2018) reviewed schools in rural regions of the United States and found these schools lacked the funding and the technological facilities to implement technology into the classroom successfully. Considering that a few past studies have argued that technology is ideal for improving students' retention in remedial courses, these innovative methods are not accessible to all colleges; thus, not all students can access the same quality of education (Bradford, 2018; Lundberg et al., 2018; Pape & Prosser, 2018). Colleges are limited in providing technological advanced to students. Future researchers should attempt to understand innovative methods that can be accomplished within the means of schools with lower funding (Pape & Prosser, 2018). One possible solution to low funding institutions is the next method presented in the ensuing subsection.

Massive online open courses (MOOC). One model for improving remedial math is the use of specialized online software. Academic researchers have vouched for the use of MOOC as an innovative technique for teaching mathematical concepts (Lovell & Elakovich, 2018). MOOCs have previously been used to teach challenging courses such as physics, to nontraditional (e.g., older and online) students (Lovell & Elakovich, 2018). MOOCs were unique, as they typically require one access code for the semester and allow multiple students to access them (Lovell & Elakovich, 2018). Though the initial

cost may be a concern for administration, it does eliminate the cost of buying devices for each enrolled student (Lovell & Elakovich, 2018). Lovell and Elakovich (2018) used a mathematic MOOC to teach community college students in face-to-face classes. The authors assessed the perspectives of the students upon the conclusion of the class (Lovell & Elakovich, 2018). Students remarked at the end of the class that the MOOC conveniently linked mathematical concepts to real-world applications. All participants remarked that the MOOC made the mathematical class enjoyable and easy to understand (Lovell & Elakovich, 2018). Though the author's research was not applied to a remedial class, the findings were pertinent to the application of new technology to the teaching of remedial mathematics (Lovell & Elakovich, 2018). However, other authors have used the MOOC concept to remedial math with positive findings (Hernández, Rodriguez, Hilliger, & Pérez-Sanagustín, 2018).In all, MOOCs appear a successful model for teaching students through innovative data visualizations and real-world applications

MOOCS are shown as successful models for university students in remedial math classes. In 2018, Hernández et al. analyzed the usage of MOOCs in remedial math classes in a series of 700 students at 4-year universities. The authors found that students who spent more time working with MOOC modules and assignments online were more successful at the end of the class (Hernández et al., 2018). MOOCs proved to be useful for relearning concepts that might have been difficult to understand but also to prepare for future exams in the classroom (Hernández et al., 2018). The interactive nature of MOOCs allowed for the students to learn remedial math concepts in ways that had previously been unavailable for them (Hernández et al., 2018). Some students remarked

that MOOC essentially opened up their eyes to new possibilities of how to use math, which they had previously not realized was possible. In sum, the authors argued that MOOCs were useful for teaching math but were also invaluable assets for the remedial math students (Hernández et al., 2018).

To summarize, the findings of these authors should be further explored by more researchers in the future to understand how MOOCs were useful to remedial math classes on larger sample sizes (Bradford, 2018; Hernández et al., 2018; Lovell & Elakovich, 2018). Mainly there is room for concern when considering MOOC usage in schools that lack adequate funding. Still, the findings of these studies are promising methods for remedial classrooms (Bradford, 2018; Hernández et al., 2018; Lovell & Elakovich, 2018). The following sub-section will discuss nontechnological innovations for teaching students in remedial math classes. Considering not all schools have the funding for MOOC or other technological methods, the next section will address other alternative modalities for ensuring student support and course engagement.

***Innovative nontechnological methods*.** Other suggestions for improving remedial math outcomes includes nontechnological changes to class structure and pedagogy. Recent concerns over the lowered attrition rates for students in remedial math courses has led academic thought to the functionality of the teaching material and pedagogical methods (Perez, To, Fowler, & Larrivee, 2018). Perez et al. (2018) analyzed 794 students in embedded remedial math courses and traditional math courses. Embedded refers to "just-in-time" classes, which were classes that presented mathematical skills directly before the semester student takes a class that would require said mathematical skills

(Perez et al., 2018). Traditional courses were remedial math courses that could be taken at any point that the student had chosen, though usually in the first year or two years of college education (Perez et al., 2018). Perez et al. (2018) compared grades by each class type and found 87% of students in embedded courses gained a C or better, while 72.5% of students in traditional formats gained a C or better. The author's findings were not statistically significant, but the authors argued that minor increases in retention were related to the students' direct connections with the importance of the math class concerning the next class that they would need to take (Perez et al., 2018). Some techniques, such as embedding, are noted as successful for nontechnological innovations to the classroom.

Embedded learning appears as a technique that can ensure students are focused on specific tasks that are vital for their grades and course success. Understanding that the skills that they were learning depended on students' current success in the following class seemed to motivate embedded students to work harder to understand the concepts (Perez et al., 2018). Perez et al. (2018) argued that future students should continue to study this phenomenon to determine if the order in which a student took a remedial class (e.g., before or after classes that they need essential skills for) would influence their success rates, or grades in their mathematical courses (Perez et al., 2018). Overall, these findings indicated that students might benefit from taking a remedial course directly before they would need to use mathematical concepts for their significant courses (Perez et al., 2018). Some students in this study did remark that it was useful to have real-world applications of math; therefore, researchers should consider the timing of the remedial course during

the degree span of a student. Ideally, researchers should continue to consider this phenomenon. Overall, embedding is a useful technique for nontechnological innovations in remedial math classes.

Incentivized programs for students in developmental math programs has also shown some moderate success. Some authors have suggested incentivized programs for students in developmental math programs (Vandenbussche, Ritter, & Scherrer, 2018). Noting the high-rise of students enrolled in remedial math classes, Vandenbussche et al. (2018) argued that educators should work to incorporate new methods for motivating students to achieve higher grades in these classes, so they could be successful in more advanced math classes that they would need for their degrees. For the author's analysis, incentives were grade increased based on their participation in the class. To test their assumptions, the authors each taught separate Calculus I classes to undergraduate students at Kennesaw State University (Vandenbussche et al., 2018). For one semester, participation was incentivized by providing grade bumps based on their activities. For another semester, participation was not incentivized, and grades were based on traditional methods (e.g., tests and assignments; Vandenbussche et al., 2018). The authors found students who did participate (e.g., motivated by the incentive) were more successful in the class; however, the authors noted though there was a connection between these two factors, a higher sample set was needed to understand if statistical causality existed between the two factors (Vandenbussche et al., 2018). Some evidence has shown that incentivized classrooms are more likely to motivate, and lead to the success, of students.

However, incentivization has yet to be applied specifically to remedial math. The author's findings were not explicitly applied to remedial math classes, which may be due to strict grading criteria for remedial math classes under some state legislation (Barnett, Chavarín, & Griffin, 2018; Vandenbussche et al., 2018). There is still ample room to understand the impact of incentivizing student class engagement and success. Researchers should explore the use of incentives to motivate students to participate, which may lead to them engaging more thoroughly with the material and succeeding in the class. Next, the student performance in class is reviewed in relation to length (e.g., number of the semester) of remedial classes.

Length of Class and Student Performance

Another trend in the study of remedial math attrition is the effect of the classroom atmosphere and time for students to properly engage with the material. In this study, three out of four teachers believed the time provided in remedial math was a concern. Providing longer than one semester to cover remedial topics was one suggestion offered by the instructors interviewed. Previous researchers have focused on what is the best methods for remedial math classes (Ngo & Kosiewicz, 2017). Some authors have considered how frequently a student needs to attend class to be successful in a remedial course (e.g., several times per week or multiple semesters of remedial math; Ngo & Kosiewicz, 2017). Most frequently, students must take at least one remedial math course, but some students may find themselves required to enroll in multiple semesters of math courses; Ngo and Kosiewicz (2017) questioned whether this process was useful for the students' confidence and overall motivation. Ngo and Kosiewicz analyzed community

college students taking remedial algebra classes. Ngo and Kosiewicz suggested students required to take remedial algebra in two separate semesters, thus increasing their time to engage with the material, would be more likely to pass and obtain their degrees. To test this assumption, Ngo and Kosiewicz analyzed administrative data on students who had taken one versus two semesters of remedial algebra and compared these data with the success of the students academically following these courses from 2009 to 2012. The authors' findings indicated that students placed in intermediate algebra after taking the introduction to algebra did not fare as well as students who took combined introduction and intermediate algebra in one semester (Ngo & Kosiewicz, 2017). However, the authors did not provide a comparative study between students who were taking multiple semesters of math classes. For some students, the use of extended periods in math classes was more successful than taking multiple remedial math classes over periods of semesters.

For some students, extended time in math classes could lead to increased retention and success. Similar studies within academic literature have shown that college students can respond to math differently depending upon the amount of time that they are in class (Young, 2002). Young (2002) examined the preparedness of remedial math students in community colleges in Dayton, Ohio. The author examined students who were provided developmental courses in math prior to attending their first year of college. Notably, the classes were longer and more thorough during high-school and provided a significant amount of time for preparedness before college. Young found that students in developmental courses were more likely to pass remedial tests and enter into standard

collegiate mathematics classes. Young's (2002) and Ngo and Kosiewicz's (2017) studies similarly indicated that some students had responded to lengthier developmental classes versus spending multiple semesters within a collegiate remedial program. However, these studies were limited to the sample sets studied. Extended class time, combined with developmental math courses, may lead to more successful remedial math students.

Conversely, some academic research has indicated that multiple semesters of remedial math classes benefit students more than an extended period of one-semester of remedial math class. Santhanam, Shrivastava, and Toworfe (2019) investigated the perceptions of undergraduates enrolled in remedial math classes in Florida and found students desired more extended periods, stretched across multiple semesters, to learn remedial math skills. Some students within the study remarked in one class, over one semester, too-much-information was packed into the lecture, which made it challenging to retain the information for advanced classes by the next semester. Other studies have shown similar results to Santhanam et al. (2019). VanOra (2019) assessed the lived experiences of college students at community college enrolled in remedial classes. The students noted developmental classes helped them feel confident and refreshed the information they had failed to grasp in high-school and/or middle-school. Some students in the study would prefer to stretch out developmental classes over the periods of one academic year, versus only having all of their remedial classes in one semester. However, these responses were specific to these participants and could not be generalized to represent the general aptitude of all college students towards remedial math classes. In

sum, remedial classes over multiple semesters has been shown as successful for some students retention and mathematical confidence.

This section addressed the performance of students in remedial math. Ngo and Kosiewicz (2017) noted that students responded differently to the remedial math class depending upon the length of the class. Similarly, Young (2002) noted that some students fared better if they were in extensive and time-consuming developmental math classes in the year before entering college. Conversely, Santhanam et al. (2019) and VanOra (2019) found that students remarked they would prefer to be in classes stretched over multiple semesters versus extended one-semester classes. Yet, there remains a lack of consideration for students with disabilities in the remedial classroom. For example, Ngo and Kosiewicz (2017) and Young (2002) did not consider students with learning or physical disabilities who would be unable to sit in lengthy course room periods. Future studies should more carefully assess what specific variables contribute to some students faring better in extended classes versus some students achieving across multiple semesters. Additionally, more researchers should address the needs of students that are in collegiate remedial math but require remedial math to examine if these students are responding differently to remedial math than students without accommodations. The interaction between pedagogy and learning or intellectual disabilities has not been examined in academic literature.

These studies were limited to the sample sets examined and could not be overgeneralized to reflect all remedial math students. Furthermore, more research is needed to understand how extended class times further prepare students. Within this

study, three out of four teachers believed the time was limited to provide remedial math students with the proper education. Teachers within this study suggested multiple semesters to cover the material; however, academic literature was mixed regarding which mode was most beneficial to students. There was a general lack of available literature concerning how time was most effectively spent in remedial classes. Future researchers should elucidate if these findings are valid across other institutions (e.g., community college versus four-year college) in the United States. Next, the effect of tutoring and pedagogical techniques based on learning styles are reviewed.

Tutoring in Remedial Math

One model for increasing remedial math success is through tutoring. Tutoring is a method in which educators and educational administration have long argued that to be an invaluable resource to struggling students (Finlay, 2019). Leaders of many universities, both 4-year and community colleges, offer access to tutoring for free as per department funding permits (Finlay, 2019; X. Wang, Sun, & Wickersham, 2017). Private tutoring is funded primarily by the student, which is problematic for students who may be working and completing a degree simultaneously (Finlay, 2019). Tutoring is often suggested to improve student's difficulty in passing remedial math, but some researchers have argued that tutoring should be incorporated into the class structure itself, which leaves little room for procrastination and increases opportunities for students who have heavy/work-life commitments (X. Wang et al., 2017). Tutoring is considered an effective method for students but is highly dependent upon the students willingness to participate in tutoring programs.

In this study, student participants remarked that extra time in class was useful for tutoring, while other student participants remarked they had not personally been to tutoring before. Other researchers have focused on whether students in remedial classes were adequately taking advantage of resources in and outside of remedial classes, and if not, why they were not. Santhanam et al. (2019) argued that students in remedial classes should be required to meet with a mathematics faculty member for tutoring and to go over skills learned in remedial math. However, Santhanam et al. noted that their suggestion could be challenging to fulfill in schools lacking sufficient funds and the availability of math faculty. Despite the benefit of tutoring, for some schools, remedial math tutoring is not financially possible.

Real-life conceptualizations have been shown as techniques for improving the understanding of mathematical concepts. Wang et al. (2017) studied students at a Midwest community college where a majority of students were either first-generation or minorities. Wang et al. assessed the method of incorporating tutoring into the class. The authors stated that students enrolled in remedial math classes should be allowed the opportunity to contextualize their studies with real-life concepts that applied to their unique degrees. Mixed methods research was conducted, which combined classroom observations and interviewing students and educators in contextualized math classes (Wang et al., 2017). Demographic and pass and fail rates of students enrolled in these classes were subsequently analyzed over a series of several semesters to obtain a comprehensive analysis of the effectiveness of such methods (Wang et al., 2017). The authors found that students who could use a contextualized method for learning math

could approach their studies with confidence (Wang et al., 2017). Furthermore, tutoring the students in the class combined with teacher office hours served to engage students, encourage confidence, and to help them apply the material in ways they had not previously considered (Wang et al., 2017). For some students, tutoring is useful for increasing confidence and learning how to apply material. However, this outcome depends on the student and their commitment to tutoring outside of classroom time.

Other authors have explored the use of tutoring and resources to improve students' engagement and academic achievement in remedial math courses. Moore (2018) examined student academic success (course grade) in correlation with their usage of tutoring services for remedial math. Moore found that students exposed to scaffolding tutoring techniques (building one concept upon another concept) were more likely to receive higher grades and pass remedial math classes. These findings (Moore, 2018) were similar to the findings of Brower et al. (2018) and Herman (2019), who found students who engaged in professional or peer-to-peer tutoring fared better in the remedial math class. Herman (2019) investigated tutoring based upon a phenomenological exploration of how students felt tutoring and other resources had assisted them in remedial math classes. The students remarked tutoring had helped them achieve better class and course grades; however, these remarks were not statistically evaluated or correlated with tutoring as this was a qualitative assessment. Similarly, Brower et al. (2018) examined using scaffolding tutoring techniques to assist remedial math students. The authors examined institution-specific data to assess if students who use the services fared better in course grades in remedial classes. Brower et al. indicated that tutoring usage was correlated with

increased course grades. This study was useful, as Brower et al. did employ a statically correlation to assess the effectiveness of tutoring upon remedial college students. Overall, tutoring appears to be a useful model for improving class and course grades.

To summarize, tutoring is considered a useful opportunity for remedial math classes. The findings of this study indicated tutoring opportunities should not necessarily be considered the ultimate answer to ensuring students succeed in remedial math classes (e.g., Herman, 2019; Bower et al., 2019; Moore, 2018; Wang et al., 2017). Reviewing the study findings with the current literature available on remedial math tutoring indicated a need for in-class tutoring or mandatory meetings with students to provide tutoring to help the student succeed. Outside-class tutoring efficacy in remedial classes has not been addressed in academic literature. Further research is needed to understand if tutoring is useful to students, but the findings from this study and the reviewed literature indicate tutoring may be most useful when incorporated into the class structure during the semester (Santhanam et al., 2019; Wang et al., 2017). The next segment of this review provides a detailed review of desired remedial math course improvements that were noted by participants and by authors within current academic literature.

Improvements Needed for Remedial Math

All 15 students interviewed within this study referred to a need for improving the general structure and methodology of remedial math programs. All instructors believed significant improvements were needed to improve student success in the remedial math courses. The need to improve the structure and methods for remedial math class has not gone unnoticed in academic literature. For instance, Xu and Dadgar (2018) reviewed 23

community colleges and 24,664 first-time students who entered with the lowest bar of remedial math score on their Accuplacer or similar placement test. The authors questioned whether these students would be more successful if they had to take less remedial classes versus more considering their low math scores (Xu & Dadgar, 2018). The authors claimed that their results indicated that students with low math skills did not benefit from being required to take multiple semesters of remedial math (Xu & Dadgar, 2018). The authors noted this applied only to their study set, but their unusually large sample did reflect the statistical significance of their study (Xu & Dadgar, 2018). In all, there are multiple improvements needed to the structure of remedial math classes.

Developmental high-school programs may be one technique for improving contemporary remedial math course structures. Wendel and Hu (2018) investigated the use of remedial math classes to prepare students for college-level math. The authors studied a program in McHenry County College (MCC) designed to assist students in developmental math programs to succeed in their courses and prepare them for 4-year college math classes (Wendel & Hu, 2018). MCC implemented a summer math course designed for graduated high-school students to attend before attending their first semester at MCC (Wendel & Hu, 2018). Wendel and Hu (2018) analyzed their methods and procedures to determine the efficacy of summer bridge programs by following 71 students from 2012 to 2013. The authors found that in 2012, 48.5% of students proceeded directly to coursework and not remedial math after the summer program. These findings indicated the summer bridge initiative could be a fresh approach for community colleges to link the summer between high school and college while decreasing the expenditures

and enrollment costs of placing students in remedial courses (Wendel & Hu, 2018). Programs that bridge the gap (either semester or summer) between high-school and college may lead to decreased likelihood of entering remedial math courses, or increased success, in remedial classes in college.

Others have argued that it might be useful to completely shift away from the traditional educational structure of remedial math completely. For example, Logue, Watanabe-Rose, and Douglas (2017). The authors reviewed three community colleges in New York. A random selection of students, who were required to take remedial math due to their placement scores, were instead placed in statistical introduction classes (Logue et al., 2017). The authors found that students placed in the statistics class were more likely to pass than students in traditional remedial math classes (Logue et al., 2017). These findings indicated students might fare better in statistical math classes than traditional remedial math classes. However, this study did not address possible variables that might have contributed to the success of the statistical math class students. Future researchers should provide more analysis regarding how some students responded to introductory statistics versus traditional remedial math classes. Statistics is considered on alternative to remedial math courses, however, this change has yet to be implemented on a nation-wide scale.

Yet, statistical routed classes for remedial students show promise in engaging student interest. Logue et al. (2017) reported that students who were in the statistical route were on track to finish their degrees sooner compared to those in traditional remedial classes. This study was the first study of its kind in academic literature, finding

that some students might benefit from taking mathematical classes that incorporate statistics slowly in the educational material. However, these findings could only be applied to the sample set at hand. Future researchers should replicate Logue et al.'s study to analyze if and why statistics were more approachable and learnable for remedial students. Statistics are more approachable for many students and may be considered one alternative to traditional remedial math courses.

High-school and middle-school education may serve as one reason for struggles with mathematics on the collegiate level. Multiple researchers have attempted to understand how high-school and middle-school education has aided or impeded student success in mathematics (Barnett et al., 2018; Boatman & Long, 2018). Some have reviewed the current curriculum and argued for the need to implement a transition-based mathematical curriculum, which would assist in reviewing concepts needed for college (Barnett et al., 2018). Many programs were in place for high-achieving students to earn college credits while in high school, but collaborative programs designed to intervene and assist low-achieving math students do not currently exist as a standardized educational process (Barnett et al., 2018; Whiton et al., 2018). Collaborative programs with colleges are one possible solution to the difficult transition between high-school and college math.

Other models of preparing students is based upon connecting their degree interests with their required mathematics skills. Lane, Morgan, and Lopez (2017) investigated high-school students with low ACT scores. The authors found these students desired to be in degrees, such as engineering, despite their scores. Lane et al. (2017) posited that methods for engaging students' interests in STEM were designed to identify

skilled or interested students but not to show how students can prepare themselves for the academic skills necessary to succeed in STEM-based degrees. The authors' statements have been corroborated by Moran-Soto and Benson (2018), who found students were unprepared for STEM careers despite a growing marketing campaign for STEM careers. Lane et al. (2017) noted that school leaders could quickly correct for this by providing preparatory courses; however, suggestions such as these have yet to be tested for efficacy within the educational system. Prep programs, which include the interests of the students, are one possible alternative to the issues of decreased math retention.

However, many students who are interested in STEM related fields are unprepared for the math and science classes required for these degrees. The arguments of Lane et al. (2017) indicated students were unprepared for entering into STEM-related fields; Moran-Soto (2018) investigated the preparedness of engineering for advanced mathematics and found these to be problematically unprepared. The concerns noted by Moran-Soto (2018) and Lane et al. (2017) have led some researchers to investigate the methods for determining the need to place a student in remedial math class (Bahr et al., 2019). Bahr et al. (2018) argued that standardized placement tests, which were heavily used in high-school, were inaccurate indicators of mathematical ability or college readiness; instead, Bahr et al. argued for focusing on a student's entire record, transcripts, placement tests, and GPAs. Such procedures would decrease the number of students in remedial classes, decrease the educational burden, and decrease unnecessary expenditures by the state; however, these findings have yet to be tested for efficacy (Bahr et al., 2019).

As students present unprepared for specific degrees, a decrease in dependence on standardized testing may be one alternative to address this issue.

This section addressed the improvements needed for remedial math. In exploring the suggestions offered by scholarly researchers, several points were identified. Xu and Dadgar (2018) noted that not all students would benefit from remedial math classes. Similarly, Wendel and Hu (2018) noted that some students fared better within statistics classes than traditional remedial math classes. Xu and Dadgar (2018) and Wendel and Hu (2018) indicated that current methodologies for servicing students struggling with math might not be useful to all students. These findings were corroborated by Lane et al. (2017) and Logue et al. (2017), who found students interested in pursuing a science or engineering related degree were often unprepared for the advanced mathematics required for their careers. Moran-Soto (2018) similarly posited that current initiatives to motivate students to enter science fields had failed to consider how to prepare such students for complex mathematics. Bahr et al. (2019) argued that failure to prepare students mathematically might be related to a focus on standardized testing in high-school. Within this section, findings indicated that improvement was needed within the field of remedial math.

The Future of Remedial Math Courses

Students continue to be enrolled in remedial mathematics courses. The literature indicated several areas of concern for students, administration, and teachers (Perez et al., 2018; Wendel & Hu, 2018; Xu & Dadgar, 2018). These concerns were corroborated by reviewed academic researchers exploring similar themes across the United States. These

included broad themes of student preparedness for collegiate math, teacher support, pedagogical methods in remedial math, tutoring, and student engagement (Perez et al., 2018; X. Wang et al., 2017; Wendel & Hu, 2018; Xu & Dadgar, 2018). Issues such as remedial math, tutoring, student engagement, and educational support are a few of the variables considered when assessing the issue with increasing remedial math enrollment.

Communicating to students diverse needs is one method for improving the success of remedial math students. Current researchers have focused on the most effective way to communicate complex concepts to students in remedial courses (Santhanam et al., 2019; X. Wang et al., 2017). For some, this process includes using innovative technological formats, such as MOOCs (Vandenbussche et al., 2018). Others have suggested using interactive textbooks (Hernández et al., 2018; Lovell & Elakovich, 2018). Others have pushed for the implementation of methods that address the unique learning style of each student, but a full-scale analysis of this for remedial math students has yet to be attempted (Kellems et al., 2019; Lane et al., 2017; Logue et al., 2017; Melguizo & Ngo, 2018). Technologically based methods still remain a concern for institutions that lack funding, but some more affordable computer-based programs and nontechnological innovations, such as summer bridge programs, are promising to be useful for remedial math retention (Lundberg et al., 2018; Pape & Prosser, 2018). To reach the needs of students, nontechnological and technological methods, of varying innovation have been proposed.

Yet, there remains a disparity in the support provided to students of color in college. Multiple authors have noted that this support is not provided prior to college, and

more troubling appears to be a significant disparity between educational equality of minorities (Bal-Taştan et al., 2018; Davis & Martin, 2018; Hepworth et al., 2018; Hodara, 2019). Most importantly, mathematical retention rates were dependent upon the quality of education received at the middle-school and high-school levels (Bahr et al., 2019). In terms of defining the quality of education, Bahr et al. (2019) assessed quality education based on the resources available to students during their time at middle-school and high-school. Bahr et al. asserted that high-schools with students graduating and receiving passing placement rates on standardized tests were more prepared for college math compared to students who attended high-schools with lowered standardized test scores. Standardized testing and poor teacher support are a few of the variables that may contribute towards inequitable outcomes and preparedness for minority students.

However, there remains a gap in the understanding of how to best provide equitable teaching environments to prepare students for college level math. These themes required further analysis to understand how educational pedagogy and standards can be improved to ensure all individuals gain an equal and supportive education (Fauzan et al., 2018). The themes of MOOCs, one-on-one tutoring, and summer bridge programs all require further research to understand how these may aid the remedial student, but these remain promising methods for improving the confidence of the student and contextualizing complex concepts (Santhanam et al., 2019; Lovell et al., 2018; Vandenbussche et al., 2018). Techniques such as MOOCs, are one possible alternative to reach diverse student needs, but more research is required towards these techniques within remedial math courses.

Some students feel that the current remedial math courses will not prepare them to enter into their degree specific level math courses. Students in remedial math have remarked mixed-feelings regarding remedial math to prepare them for taking higher-level classes in college (Cox & Dougherty, 2019). Other researchers have noted that remedial math classes require updated techniques to advance student learning (Wilson, 2018). The current methodologies for teaching remedial math appear to be inadequate for students, teachers, and administrators (Lundberg et al., 2018; Pape & Prosser, 2018; Santhanam et al., 2019; Scherff, 2018). Future research should focus on technological and innovate modes for teaching remedial math (Lovell et al., 2018; Priscylio et al., 2018; Scherff, 2018). Considerations of student and educator perceptions are vital to assessing how remedial math courses can be reformed to meet the needs of students.

Continuous improvement is essential in education. Methods for improving teacher confidence, such as professional development workshops, should also be considered to cultivate the success of teachers and thus students (Scherff, 2018). Restructuring of the remedial math course model was also suggested by participants and by reviewed academic literature (Bahr et al., 2019; Lane et al., 2017). When considering the continued increased enrollment of remedial students, a fresh perspective is needed for the structure of the remedial math course model (Stoneham et al., 2017; Xu & Dadgar, 2018; Yu & Singh, 2016). The insights gained from the available literature and the responses of the participants of this study point toward clear avenues for new research, which may create new methods for teaching remedial math and increasing the retention rate of remedial students.

Project Description and Goals

A key element of an educator's preparedness to perform is professional development. Professional development is expected to improve the educator's knowledge and effectiveness (Barrett et al., 2015). The project developed for this study is a 3-day professional development (PD) based on the research findings to inform administrators, faculty, and students of the reasons for poor academic performance in remedial math classes. This professional development can be a crucial component in improving remedial math performance at JMCC. The purpose of this professional development is to provide remedial math instructors, students, and administrators with the necessary skills and strategies for improving student performance in remedial math classes.

To achieve the overall goal of the training and purpose of my study, I have developed a set of goals to ensure the project is aligned with the findings of my project. The goals include (a) collaborating between community college and local school districts to address lack of college readiness, (b) increasing faculty and student's skills and knowledge of math self-efficacy to improve student motivation/engagement, and (c) developing contextualized instructional methods (e.g., real-world application practices). These goals were all based on the results of my research findings.

The title of the PD training is "Strategies for Improving Remedial Math Performance." The training will occur over three days to provide an opportunity for community college administrators and local school district leaders, along with remedial math instructors and students to collaborate. This training will serve as a platform to present my research findings to individuals influenced by remedial math performance.

The training will be conducted by myself, along with other training facilitators knowledgeable and highly qualified in the field. The participants of this training include community college curriculum administrators, remedial math faculty and students (which includes both full-time and adjunct faculty), and local school district leaders. The design of the training is presentation and discussion of findings, development of strategies to address the problem, and skill training. After each session daily, participants will have the opportunity to reflect and take a survey to assess the success of the training.

Day 1

The goal of Day 1 is to provide an opportunity for community college and local school district leaders to collaborate and discuss the development of a transition-based curriculum for high school students. This curriculum should address the lack of fundamental knowledge in math before college. This session will consist of the daily training design, which is the presentation of research findings, and an opportunity to discuss findings. Next will be a session to brainstorm the development of a transition based curriculum. After lunch, there will be a session to create an implementation plan for the transition based curriculum. At the end of Day 1, participants will be asked to complete a survey for feedback.

Day 2

The goal of Day 2 is to increase faculty and student's skills and knowledge of math self-efficacy to improve student motivation/engagement. The target audience will be JMCC remedial math instructors and students. This session will consist of the daily training design, along with a presentation on math self-efficacy and a planning session to

develop strategies for remedial math improvement that includes addressing student motivation and engagement. Instructors and students will collaborate to discuss engagement concerns and develop strategies using the math self-efficacy methods presented. At the end of Day, 2 participants will be asked to complete a survey for feedback.

Day 3

The goal of Day 3 is to develop contextualized instructional methods such as real-world application practices and implementation strategies for the remedial math curriculum. The target audience will be JMCC administrators and remedial math instructors. This session will focus on best practices of contextualized methods of instruction along with the importance of a positive learning environment. Instructors will use the strategies developed from Day 2 to create new contextualized instructional methods. At the end of Day 3, participants will be asked to complete a survey for feedback.

Potential Resources and Existing Supports

Potential resources and existing supports include participation from the community college's administrators, remedial math instructors and students, and the local school district leaders. I will be the facilitator of the PD. I will need access to a meeting room with projector reserved for three days. Other materials to be used chart paper, pens, notebooks, sticky notes, snacks, and markers). The training will be free of cost, with all the materials being provided by myself. Appendix A includes the 3-day PD, PowerPoints, and surveys for my project.

Potential Barriers

Overall, there seem to be no significant potential barriers; all stakeholders were on board with the PD. Nevertheless, one potential barrier to this project being implemented involves conflicting schedules between the key stakeholders. Being that several key players were involved, everyone must be available at the same time. One potential solution to this barrier is sending correspondence through email with a calendar invite to all participants of the training. This process may allow everyone to plan around the PD. Along with the correspondence will be a registration form required for all participants of the training to be returned within three days. This process will ensure that I am well prepared with enough space and materials for the participants.

Proposal for Implementation and Timetable

The implementation of the project includes several steps. First, a review of the PD by JMCC. The training has already been developed and will be presented to the director of planning and research to ensure it aligns with JMCC's policies and procedures and to provide any recommendations. During that time, a meeting room with a projector will be secured for three days. Access to the meeting room will be needed 2 hours' prior on Day 1 for setup. Second, a registration form and calendar invite will be sent two weeks prior, along with a reminder two days before to plan appropriately. Third, materials and supplies will be picked up three days before the scheduled date of the training. Table 6 outlines the PD training implementation timeline.

Table 6

Timetable for Project Implementation

Time	Day 1	Day 2	Day 3
8:30-9:00 9:00-9:15 9:15-10:00	Sign-In Welcome: Norms/Expectations Remedial Math Talk: Discussion of Research Findings on Remedial Math Performance at Community Colleges.	Sign-In Ice Breaker Activity: Remedial Math Talk: Discussion of Research Findings on Teacher and Student Perceptions of Remedial Math.	Sign-In Ice Breaker Activity: Remedial Math Talk: Discussion of Research Findings on the importance of Real-World Application in Remedial Math (Contextualized Methods).
10:00-10:15 10:15-11:45	15 min. Break Session 1: Laying the Foundation Discussion of Transition Based Curriculum: Why is it needed?	15 min. Break Session 1: Laying the Foundation Self-Efficacy (SE)Presentation- effects on student success and methods to increase Self-Efficacy. Activity: Discussion of SE and student performance.	15 min. Break Session 1: Laying the Foundation How Students Learn: Best Practices of Contextualized Methods of instruction.
11:45-12:45 12:45-2:00	Lunch Session 2: Remedial Math that Works Develop an outline for the transition based curriculum. What will it look like? Review other program's key components and effectiveness.	Lunch Session 2: Remedial Math that Works Develop instructional SE strategies. 1:15-2:00 Discuss student engagement. How does SE affect student engagement?	Lunch Session 2: Remedial Math that Works Plan Contextualized Methods of instruction for Unit 1.
2:00-3:30	Session 3: Developing an Effective Plan of Action	Session 3: Developing an Effective Plan of Action Develop SE strategies for student engagement.	Session 3: Group Presentations: Develop implementation strategies for new Contextualized Methods developed.
3:30-4:30	Develop implementation strategies for both the community college and the local school district. Reflection, Wrap Up, Survey Day 1	Reflection, Wrap Up, Survey Day 2	Reflection, Wrap Up, Summative Evaluation

Roles and Responsibilities of the Researcher and Others

The overall purpose of this project study is to improve remedial math performance amongst community college students. The goal is to implement the strategies that have been discussed and devised throughout the 3-day PD. All stakeholders must be aware of their roles in improving remedial math student performance, along with their responsibilities to be in attendance all 3 days. I am responsible for conducting the PD and providing all the materials needed. Administrators and local school district leaders will be responsible for developing implementation strategies for the transition based curriculum. Remedial math instructors and students will be responsible for developing implementation strategies, student motivation, and engagement. Administrators, leaders, and instructors will be responsible for implementing the strategies developed.

Project Evaluation Plan

The goal of this project is to provide remedial math instructors, students, and administrators with the necessary skills and strategies for improving student performance in remedial math classes. The evaluation type for this project is goal-based. The goal of this project is to develop strategies to improve remedial math performance amongst community college students. The key stakeholders needed for successful implementation of this project include myself, JMCC math administrators, JMCC remedial math instructors, and students and local school district leaders.

Surveys will be given daily at the end of each session to assess the success of each training session, ensuring the goals and objectives were met, and allow participants to

provide feedback (Caffarella & Daffron, 2013). Feedback from the surveys will be used to determine if the PD was successful. All data from surveys will be collected, analyzed, and anonymously made available to stakeholders. The survey is listed in Appendix A.

Project Implications

Local Community

This project may improve remedial math student performance, as well as overall student performance at JMCC. By implementing the strategies and practices developed from the training, students from local school districts will benefit as well. This process could eventually lead to lowering student remediation rates, which will reduce the time for students to graduate and ultimately increase degree completion rates at JMCC. Thus, better student performance could generate industrial partnerships across the Golden Triangle Area.

Far-Reaching

The results of this study apply to JMCC; therefore, results cannot be generalized to other institutions. One of the limitations of this study was that it focused solely on one Mississippi community college and its remedial math courses. Thus, findings for this study might not be representative of other community colleges that follow different remedial math programs. Nevertheless, this study can provide insights into other institutions with strategies and methods to improve student performance.

Conclusion

Section 3 provides a detailed representation of the proposed PD project based on findings from my research. A review of the literature was presented to explain how the

project genre is appropriate to address both the research problem and the research findings that yielded the PD goals. The 3-day PD highlighted solutions and strategies for improving remedial math student performance grounded in scholarly research. Integrated throughout the PD was Bandura's (1997) theory of self-efficacy, which served as the study's conceptual framework. By implementing the strategies and practices devised in the PD, JMCC can make a significant impact on student performance in remedial math courses, potentially leading to higher degree completion rates in the near future. In Section 4, concluding reflections about the project are summarized, and my scholarly practice is discussed.

Section 4: Reflections and Conclusions

Introduction

The purpose of this qualitative intrinsic case study was to explore the perceptions of community college instructors, administrators, and students regarding the causes of low student performance in remedial mathematics. Based on the results of the case study, I developed a 3-day PD training to develop strategies to improve remedial math performance amongst community college students. This training was developed to provide an opportunity for collaboration amongst the community college administrators and the local school district, along with remedial math instructors and remedial math students. In this section, I address the project's strengths and limitations, recommendations for future research, and my personal reflections on the research process. This section focuses on doctoral study experiences emphasizing scholarship, leadership, and change. I address the potential for social change arising from my study, as well as implications for future research and my role as a practitioner.

Project Strengths and Limitations

The strengths of this PD were its design, its participants, and its benefits. I chose a professional development project deliverable because it was research based and provided an opportunity for collaboration amongst key stakeholders. The PD’s design was created to present and discuss the problem/findings, and then collaborate with key stakeholders to develop strategies and solutions to remedy the problem. The participants involved were significant in helping improve remedial math performance. This PD offered an opportunity for community college administrators and school district leaders to

collaborate and address the college readiness issues that remedial math students and instructors are faced with. It also afforded instructors and students the opportunity to address the needs of both. This PD offered many benefits for all stakeholders involved. Administrators and local school districts can establish rapport and build relationships to foster community growth. Instructors and students can collaborate and design a curriculum that addresses the needs of every learner. This PD provides strategies and solutions to improve remedial math success, which ties to attrition and graduation rates for the college.

One limitation of this PD was its timeframe. Because it was only a 3-day workshop, all concerns of the study participants would not have been addressed. Another limitation was that the PD focused on remedial math performance; therefore, it could not be generalized to address the top 10% of learners.

Recommendations for Alternative Approaches

I recommend that JMCC place more emphasis on instructors' skills and knowledge by implementing more training and collaborative planning sessions for full time and part-time staff. This process can provide staff the time to develop effective instructional methods consistently to reach all learners across the curriculum, not just remedial or math courses specifically. Another recommendation is to collaborate with other local school districts and colleges in the state to share strategies and solutions devised from this training. This process can provide better insight into the student performance issue across the state. Finally, implementing an academic success team to evaluate student performance throughout the semester provides an accountability system

for both instructors and students. All of these approaches can address student performance and provide alternatives to the solutions already presented.

Scholarship, Project Evaluation, and Leadership

My doctoral journey has been like no other I have experienced in my life; it has been long and very trying yet extremely rewarding in the end. While completing my doctoral project study, I learned about the many processes of research and project development. I spent hours gathering information about my topic as well as developing my analytical and research skills all to create a professional development training that addresses the needs of my local community. This rewarding journey was vital in helping me to know that my research could be used to promote positive change within the remedial math community.

Many facets throughout my life have helped me gain insight on student performance in math: personal experiences, being a math educator, as well as a special needs educator, and pursuing a doctoral degree with a focus on student performance in math. Over my career span, I have noticed a continuous need for improvements in math performance across all academic levels from secondary to postsecondary. Hence, the need to address this issue became the main focus of my project study. This doctoral process has afforded me the opportunities to grow in my educational career field and become more knowledgeable of current research on student performance in math. Social change has been a constant focus throughout my doctoral study journey; therefore, I am committed to staying a lifelong learner and problem solver in this community and career field.

The project was developed from the analysis of the research conducted from an administrator, instructor, and student interviews to gain insight on perceptions of administrators, instructors, and students on performance in remedial math at the community college level. From the data analysis, I used the themes cultivated to develop goals for the workshop. While developing this project, I became familiar with the processes of building a practical workshop that promotes engagement and produces outcomes. Through research, I was able to identify best practices for developing strategies to address the specific needs of the stakeholders. I created an ongoing evaluation process to make changes as needed. Survey takers were given daily to assess the success of the workshop, which allowed them to give feedback. The surveys were reviewed daily, and at the end of the workshop, these were analyzed, and the results were shared with the stakeholders.

Reflections on the Importance of the Work

The development of this project study has helped me to become a better practitioner through project development and leadership. As a practitioner, I am more aware of the many aspects of a problem and how to evaluate and develop effective strategies and solutions to resolve it. I have learned to respect the perceptions of others and remain unbiased in situations. I chose PD as my project genre, which gave me the opportunity to develop my skills in designing engaging lessons on a professional level. This project study afforded me the opportunity to provide a platform for key stakeholders to collaborate and be a part of social change in the community. The wisdom and

knowledge I have gained from my experience throughout this process have helped me enhance my leadership skills and build my confidence as a leader in education.

Implications, Applications, and Directions for Future Research

The expected benefit of this research is for the participants to improve remedial math performance through community collaboration, building instructor/student relationships, and developing effective instructional strategies to address the needs of all learners. Community college and local school district collaboration can foster partnerships that cultivate growth in the community. Instructor and student relationships can promote values of self-efficacy and lead to student motivation and engagement.

Possible future research direction includes collecting data across community colleges statewide. This future research may help to determine if location/rurality plays a part in student performance. Other college leaders may benefit from this project study and develop effective strategies and solutions to meet the needs of students more reflective of their population.

Conclusion

The average retention rate for remedial math classes sits at 40% in the United States (Fleurizard & Young, 2018; Whiton et al., 2018). The purpose of this project study was to improve remedial math performance amongst community college students. The study project was a 3-day PD based on the results of this research to provide strategies to improve students' remedial math performance, which would hopefully improve remedial math retention and graduation rates. Lastly, this study could provide a foundation for

other colleges in the state to develop strategies for improving remedial math student performance.

References

Acosta, D., & College, O. (2016). Impact of delivery modality, student GPA, and time-lapse since high school on successful completion of college-level math after taking developmental math. *Current Issues in Education 19*(1), 1-13. Retrieved from https://cie.asu.edu/ojs/index.php/cieatasu/article/view/1518

An, B. P. (2013). The influence of dual enrollment on academic performance and college readiness: Differences by socioeconomic status. *Research in Higher Education, 54*(4), 407-432. doi:10.1007/s11162-012-9278-z

Arnold, K. D., Chewning, A., Castleman, B., & Page, L. (2015). Advisor and student experiences of summer support for college-intending, low-income high school graduates. *Journal of College Access, 1*(1). Retrieved from http://scholarworks.wmich.edu/jca

Atherton, M. C. (2014). Academic preparedness of first-generation college students: Different perspectives. *Journal of College Student Development, 55*(8), 824-829. Retrieved from https://muse.jhu.edu/article/561674/summary

Bahr, P. R. (2013). The deconstructive approach to understanding community college students' pathways and outcomes. *Community College Review, 41*(2), 137-153. doi:10.1177/0091552113486341

Bahr, P. R., Fagioli, L. P., Hetts, J., Hayward, C., Willett, T., Lamoree, D., & Baker, R. B. (2019). Improving placement accuracy in California's community colleges using multiple measures of high school achievement. *Community College Review, 47*(2), 178-211. doi:10.1177/009915521984075

Bailey, T., Jaggars, S. S., & Scott-Clayton, J. (2014). Commentary: Characterizing the effectiveness of developmental education: A response to recent criticism. *Journal of Developmental Education, 36*(3), 18-22, 24-25. Retrieved from http://files.eric.ed.gov/fulltext/ED542142.pdf

Bailey, T., Jeong, D. W., & Cho, S.-W. (2010). Student progression through developmental sequences in community colleges. *CCRC Brief, 45*, 1-6. Retrieved from http://files.eric.ed.gov/fulltext/ED512395.pdf

Bal-Taştan, S. B., Davoudi, S. M. M., Masalimova, A. R., Bersanov, A. S., Kurbanov, R. A., Boiarchuk, A. V., & Pavlushin, A. A. (2018). The impacts of teacher's efficacy and motivation on student's academic achievement in science education among secondary and high school students. *EURASIA Journal of Mathematics Science and Technology Education, 14*(6), 2353-2366. Retrieved from http://www.ejmste.com

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.

Barnett, E. A., Chavarín, O., & Griffin, S. (2018). *Math transition courses in context: Preparing students for college success* (Community College Research Center research brief). New York, NY: Community College Research Center, Teachers College, Columbia University.

Barnett, E. A., Fay, M. P., Bork, R. H., & Weiss, M. J. (2013). *Reshaping the college transition: States that offer early college readiness assessments and transition curricula*. New York, NY: Columbia University.

Barrett, N., Cowen, J., Toma, E., & Troske, S. (2015). Working with what they have: Professional development as a reform strategy in rural schools. *Journal of Research in Rural Education, 30*(10), 1-18. Retrieved from https://jrre.psu.edu/

Bautsch, B. (2013). Reforming remedial education. *Proceedings of the National Conference of State Legislatures* (pp. 1-4). Retrieved from http://www.ncsl.org/documents/educ/remedialeducation_2013.pdf

Beillock, S. L., & Willingham, D. T. (2014). Math anxiety: Can teachers help students reduce it? As the cognitive scientist. *American Educator, 38*(2), 28-32. Retrieved from https://eric.ed.gov/?id=EJ1043398

Belfield, C., Crosta, P., & Jenkins, D. (2014). Can community colleges afford to improve completion? Measuring the cost and efficiency consequences of reform. *Educational Evaluation and Policy Analysis, 36*(3), 327-345. doi:10.3102/0162373713517293

Bettinger, E. P., Boatman, A., & Long, B. T. (2013). Student supports: Developmental education and other academic programs. *Future of Children, 23*(1), 93-115. doi:10.1353/foc.2013.0003

Boatman, A., & Long, B. T. (2018). Does remediation work for all students? How the effects of postsecondary remedial and developmental courses vary by level of academic preparation. *Educational Evaluation and Policy Analysis, 40*(1), 29-58. doi:10.3102/0162373717715708

Bond, B. J. (2016). Fairy godmothers > robots: The influence of televised gender stereotypes and counter stereotypes on girls' perceptions of STEM. *Bulletin of Science, Technology & Society, 36*(2), 91-97. doi:10.1177/0270467616655951

Bradford, M. L. (2018). *Effect of technology on community college developmental mathematics course completion rates* (Doctoral dissertation). Retrieved from https://scholarworks.waldenu.edu/dissertations/5680/

Bremer, C. D., Center, B. A., Opsal, C. L., Medhanie, M., Jang, Y. J., & Geise, A. C. (2013). Outcome trajectories of developmental students in community colleges. *Community College Review, 41*(2), 154-175. doi:10.1177/0091552113484963

Brower, R. L., Woods, C. S., Jones, T. B., Park, T. J., Hu, S., Tandberg, D. A., . . . Martindale, S. K. (2018). Scaffolding mathematics remediation for academically at-risk students following developmental education reform in Florida. *Community College Journal of Research and Practice, 42*(2), 112-128. doi:10.1080/10668926.2017.1279089

Burdman, P. (2013). *Changing equations: How community colleges are re-thinking college readiness in math*. Oakland, CA: LearningWorks.

Cafarella, B. V. (2014). Exploring best practices in developmental math. *Research & Training in Developmental Education, 30*(2), 35-64. Retrieved from https://ncde.appstate.edu/publications/research-developmental-education-ride

Cafarella, B. V. (2016). Developmental math: What's the answer? *Community College Enterprise, 22*(1), 55-67. Retrieved from https://www.schoolcraft.edu/cce

Caffarella, R., & Daffron, S. (2013). *Planning programs for adult learners.* San Francisco, CA: Jossey-Bass.

Camara, W. (2013). Defining and measuring college and career readiness: A validation framework. *Educational Measurement, 32*(4), 16-27. doi:10.1111/emip.12016

Claessens, A., & Mimi, E. (2013). How important is where you start? Early mathematics knowledge and later school success. *Teachers College Record, 115*(6). Retrieved from https://www.tcrecord.org/

Complete College America. (2011). *Remediation: Higher education's bridge to nowhere*. Indianapolis, IN: Author.

Conley, D. T. (2014). *Getting ready for college, careers, and the Common Core: What every educator needs to know*. San Francisco, CA: Jossey-Bass.

Cope, D. G. (2014). Methods and meaning: Credibility and trustworthiness of qualitative research. *Oncology Nursing Forum, 41*(1), 89-91. Retrieved from https://onf.ons.org/

Cortes, K. E., Goodman, J. S., & Nomi, T. (2015). Intensive math instruction and educational attainment. *Journal of Human Resources, 50*(1), 108-158. doi:10.3368/jhr.50.1.108

Cox, R. D., & Dougherty, M. (2019). (Mis) Measuring developmental math success: Classroom participants' perspectives on learning. *Community College Journal of Research and Practice, 43*(4), 245-261. doi:10.1080/10668926.2018.1456378#.XW9MzpNKjeQ

Dasinger, J. A. (2013). Causal attributions and student success in developmental mathematics. *Journal of Developmental Education, 36*(3), 2-12. Retrieved from https://ncde.appstate.edu/publications/journal-developmental-education-jde

Datray, J. L., Saxon, D. P., & Martirosyan, N. M. (2014). Adjunct faculty in developmental education: Best practices, challenges, and recommendations. *Community College Enterprise, 20*(1), 34-47. Retrieved from https://www.schoolcraft.edu/cce

Davies, M., & Hughes, N. (2014). *Doing a successful research project: Using qualitative or quantitative methods* (2nd ed.). London, England: Palgrave MacMillan.

Davis, J., & Martin, D. B. (2018). 2008–racism, assessment, and instructional practices: implications for mathematics teachers of African American students. *Journal of Urban Mathematics Education, 11*(1). Retrieved from http://ed-osprey.gsu.edu/ojs/index.php/JUME

Di Pietro, G. (2014). The short-term effectiveness of a remedial mathematics course: Evidence from a UK university. *Manchester School, 82*(3), 363-384. doi:10.1111/manc.12013

Douglas, D., & Attewell, P. (2014). The bridge and the troll underneath: Summer bridge programs and degree completion. *American Journal of Education, 121*(1), 87-109. doi:10.1086/677959

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest, 14*(1), 4-58. doi:10.1177/1529100612453266

Eddy, S. L., & Hogan, K. A. (2014). Getting under the hood: How and for whom does increasing course structure work? *CBE–Life Sciences Education, 13*(3), 453-468. doi:10.1187/cbe.14-03-0050

Edmunds, J. A. (2012). Early colleges: A new model of schooling focusing on college readiness. *New Directions for Higher Education, 2012*(158), 81-89. doi:10.1002/he.20017

Eiken, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1-4. doi:10.11648/j.ajtas.20160501.11

Eronen, L., & Kärnä, E. (2018). Students acquiring expertise through student-centered learning in mathematics lessons. *Scandinavian Journal of Educational Research, 62*(5), 682-700. doi:10.1080/00313831.2017.1306797

Fauzan, A., Musdi, E., & Yani, R. (2018, February). The influence of realistic mathematics education (RME) approach on students' mathematical representation ability. In *1st International Conference on Education Innovation (ICEI 2017)*. Paris, France: Atlantis Press.

Fenning, B. E., & May, L. N. (2013). “Where there is a will, there is an A”: Examining the roles of self-efficacy and self-concept in college students’ current educational attainment and career planning. *Social Psychology of Education, 16*(4), 635-650. doi:10.1007/s11218-013-9228-4

Finlay, S. (2019). Academic and personal impact of peer tutoring on the peer tutor. In *Handbook of research on curriculum reform initiatives in English education* (pp. 234-249). Hershey, PA: Idea Group Publishing Global.

Fleurizard, T. A., & Young, P. R. (2018). Finding the right equation for success: An exploratory study on the effects of a growth mindset intervention on college students in remedial math. *Journal of Counseling and Psychology, 2*(1), 3. Retrieved from https://digitalcommons.gardner-webb.edu/jcp/

Fong, K. E., Melguizo, T., & Prather, G. (2015). Increasing success rates in developmental math: The complementary role of individual and institutional characteristics. *Research in Higher Education, 56*(7), 719-749. doi:10.1007/s11162-015-9368-9

Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *The Qualitative Report, 20*(9), 1408-1416. Retrieved from http://nsuworks.nova.edu/tqr/

Gaertner, M. N., & McClarty, K. L. (2015). Performance, persistence, and the full price of college readiness. *Educational Measurement, 34*(2), 20-33. doi:10.1111/emip.12066

Gay, G. (2013). Teaching to and through cultural diversity. *Curriculum Inquiry, 43*(1), 48-70. doi:10.1111/curi.12002

Gayles, J. G., & Ampaw, F. (2016). The impact of college experiences on degree completion in STEM fields at four-year institutions: Does gender matter? *Journal of Higher Education, 85*(4), 439-468. doi:10.1080/00221546.2014.11777336

Geisinger, B. N., & Raman, D. R. (2013). Why they leave: Understanding student attrition from engineering majors. *Agricultural and Biosystems Engineering Publications, 29*(4), 914-925. Retrieved from http://lib.dr.iastate.edu/abe_eng_pubs

Gupta, P. (2016). 10 best transcription software for Windows (free + paid). *CrunchyTricks.* Retrieved from http://www.crunchytricks.com/2016/05/transcription-software-for-windows.html

Halawa, S., Greene, D., & Mitchell, J. (2014). Dropout prediction in MOOCs using learning activity features. *eLearning Papers, 37*(1), 1-10. Retrieved from https://www.openeducationeuropa.eu/sites/default/files/legacy_files/asset/In_depth_37_1.pdf

Han, S. W. (2016). National education systems and gender gaps in STEM occupational expectations. *International Journal of Educational Development, 49*, 175-187. doi:10.1016/j.ijedudev.2016.03.004

Hen, M., & Goroshit, M. (2014). Academic procrastination, emotional intelligence, academic self-efficacy, and GPA. *Journal of Learning Disabilities, 47*(2), 116-124. doi:10.1177/0022219412439325

Henwood, K. (2014). Qualitative research. In T. Teo (Ed.), *Encyclopedia of critical psychology*. New York, NY: Springer.

Hepworth, D., Littlepage, B., & Hancock, K. (2018). Factors influencing university student academic success. *Educational Research Quarterly, 42*(1), 45-61. Retrieved from http://erquarterly.org/

Herman, K. P. (2019). A Phenomenological Study of the Shared Experiences of Former Developmental-Math Students Who Have Successfully Completed a College-Level Math Course. Retrieved from https://digitalcommons.liberty.edu/doctoral/2122/

Hernández, J., Rodriguez, M. F., Hilliger, I., & Pérez-Sanagustín, M. (2018). *MOOCs as a remedial complement: Students' adoption and learning outcomes*. Piscataway, NJ: Institute of Electrical and Electronics Engineers Transactions on Learning Technologies. doi:10.1109/TLT.2018.2830373

Hew, K. F., & Cheung, W. S. (2014). Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges. *Educational Research Review, 12*(1), 45-58. doi:10.1016/j.edurev.2014.05.001

Hey, T., & Trefethen, A. (2003). *The data deluge: An e-science perspective* (Doctoral thesis, University of Southampton, UK). Retrieved from https://eprints.soton.ac.uk/257648/1/The_Data_Deluge.pdf

Hodara, M. (2013). *Improving students' college math readiness: A review of the evidence on postsecondary interventions and reforms* (CAPSEE working paper). New York, NY: Columbia University.

Hodara, M. (2019). *Understanding the developmental mathematics student population: Findings from a nationally representative sample of first-time college entrants.* Retrieved from https://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_191821.pdf

Hodara, M., & Jaggars, S. S. (2016). An examination of the impact of accelerating community college students' progression through developmental education. *Journal of Higher Education, 85*(2), 246-276. doi:10.1080/00221546.2014.11777326

Holloway, I., & Galvin, K. (2017). *Qualitative research in nursing and healthcare* (4th ed.). Aimes, IA: Wiley-Blackwell.

Holzberger, D., Philipp, A., & Kunter, M. (2013). How teachers' self-efficacy is related to instructional quality: A longitudinal analysis. *Journal of Educational Psychology, 105*(3), 774-786. doi:10.1037/a0032198

Hott, B. L., Dibbs, R. A., Naizer, G., Raymond, L., Reid, C. C., & Martin, A. (2019). Practitioner perceptions of algebra strategy and intervention use to support students with mathematics difficulty or disability in rural Texas. *Rural Special Education Quarterly, 38*(1), 3-14. doi:10.1177/8756870518795494

Jackson, J., & Kurlaender, M. (2013). College readiness and college completion at broad access four-year institutions. *American Behavioral Scientist, 58*(8), 947-971. doi:10.1177/0002764213515229

Jaggars, S. S., Hodara, M., Cho, S.-W., & Xu, D. (2014). Three accelerated developmental education programs: Features, student outcomes, and implications. *Community College Review, 43*(1), 3-26. doi:10.1177/0091552114551752

Jayaprakash, S. M., Moody, K. W., Lauría, E. J. M., Regan, J. R., & Baron, J. D. (2014). Early alert of academically at-risk students: An open source analytics initiative. *Journal of Learning Analytics, 1*(1), 6-47. doi:10.18608/jla.2014.11.3

Joo, Y. J., Lim, K. Y., & Kim, J. (2013). Locus of control, self-efficacy, and task value as predictors of learning outcome in an online university context. *Computers & Education, 62,* 149-158. doi:10.1016/j.compedu.2012.10.027

Jungert, T., Hesser, H., & Träff, U. (2014). Contrasting two models of academic self-efficacy—domain-specific versus cross domain—in children receiving and not receiving special instruction in mathematics. *Scandinavian Journal of Psychology, 55,* 440-447. doi:10.1111/sjop.12139

Kellems, R. O., Cacciatore, G., & Osborne, K. (2019). Using an augmented reality-based teaching strategy to teach mathematics to secondary students with disabilities. *Career Development and Transition for Exceptional Individuals*. doi:10.1178756870518795494

Klassen, R. M., & Tze, V. M. C. (2014). Teacher's self-efficacy, personality, and teaching effectiveness: A meta-analysis. *Educational Research Review, 12,* 59-76. doi:10.1016/j.edurev.2014.06.001

Komarraju, M., & Nadler, D. (2013). Self-efficacy and academic achievement: Why do implicit beliefs, goals, and effort regulation matter. *Learning and Individual Differences, 25*, 67-72. doi:10.1016/j.lindif.2013.01.005

Krumrei-Mancuso, E. J., Newton, F. B., Kim, E., & Wilcox, D. (2013). Psychosocial factors predicting first-year college student success. *Journal of College Student Development, 54*(3), 247-266. doi:10.1353/csd.2013.0034

Kuo, Y.-C., Walker, A. E., Belland, B. R., & Schroder, K. E. E. (2013). A predictive study of student satisfaction in online education programs. *International Review of Research in Open and Distributed Learning, 14*(1), e16. doi:10.19173/irrodl.v14i1.1338

Lane, T. B., Morgan, K., & Lopez, M. M. (2017). "A bridge between high school and college": A case study of a STEM intervention program enhancing college readiness among underserved students. *Journal of College Student Retention: Research, Theory & Practice*. doi:1521025117729824

Lechuga, V. M., & Lechuga, D. C. (2012). Faculty motivation and scholarly work: Self-determination and self-regulation perspectives. *Journal of the Professoriate, 6*(2), 59-97. Retrieved from https://caarpweb.org/publications/journal-of-the-professoriate

Logue, A. W., Watanabe-Rose, M., & Douglas, D. (2017). Reforming remediation: College students mainstreamed into statistics are more likely to succeed. *Education Next, 17*(2), 78-85. doi:10.3102/0162373717715708

Lovell, E. D. N., & Elakovich, D. (2018). Developmental math pilot: Massive open online course (MOOC), psychology concepts, and group work. *Community College Journal of Research and Practice*, *42*(2), 146-149. doi:10.1080/10668926.2016.1251353

Lundberg, T., Conrad, C., Gasman, M., Nguyen, T.-H., & Commodore, F. (2018). Practices of remedial mathematics students who succeed in college: A case study of developmental math education at chief dull knife college. *Review of Higher Education, 42*(1), 61-101. doi:10.1353/rhe.2018.0034

Malinen, O.-P., Savolainen, H., Engelbrecht, P., Xu, J., Nel, M., Nel, N., & Tlale, D. (2013). Exploring teacher self-efficacy for inclusive practices in three diverse countries. *Teaching and Teacher Education, 33*, 34-44. doi:10.1016/j.tate.2013.02.004

Marshall, C., & Rossman, G. B. (2016). *Designing qualitative research* (6th ed.). Thousand Oaks, CA: Sage.

Martin, K., Galentino, R., & Townsend, L. (2014). Community college student success: The role of motivation and self-empowerment. *Community College Review, 42*(3), 221-241. doi:10.1177/0091552114528972

Mega, C., Ronconi, L., & de Beni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. *Journal of Educational Psychology, 106*(1), 121-131. doi:10.1037/a0033546

Melguizo, T., & Ngo, F. (2018). *Why do I have to repeat algebra in college? The equity cost of college-readiness standards misalignment.* Retrieved from https://pullias.usc.edu/wp-content/uploads/2018/09/Equity-Costs-Misaligned-Math.pdf

Melguizo, T., Kosiewicz, H., Prather, G., & Bos, J. (2016). How are community college students assessed and placed in developmental math? Grounding our understanding in reality. *Journal of Higher Education, 85*(5), 691-722. doi:10.1080/00221546.2014.11777345

Mesa, V., Wladis, C., & Watkins, L. (2014). Research problems in community college mathematics education: Testing the boundaries of K-12 research. *Journal for Research in Mathematics Education, 45*(2), 173-192. Retrieved from https://www.nctm.org/publications/journal-for-research-in-mathematics-education/

Methvin, P., & Markham, P. N. (2015). Turning the page: Addressing the challenge of remediation. *Change: The Magazine of Higher Learning, 47*(4), 50-56. doi:10.1080/00091383.2015.1060100

Mills, I. M., & Mills, B. S. (2018). Insufficient evidence: mindset intervention in developmental college math. *Social Psychology of Education, 21*(5), 1045-1059. doi:10.1007/s11218-018-9453

Mississippi LifeTracks. (n.d.). *Community college: Remedial coursework and college readiness*. Retrieved from https://lifetracks.ms.gov/CommunityCollege/ViewReport.aspx?reportName=CCCollegeReadiness

Moakler, M. W., & Kim, M. M. (2014). College major choice in STEM: Revisiting confidence and demographic factors. *Career Development Quarterly, 62*(2), 128-142. doi:10.1002/j.2161-0045.2014.00075.x

Mojavezi, A., & Tamiz, M. P. (2012). The impact of teach self-efficacy on students' motivation and achievement. *Theory and Practice in Language Studies, 2*(3), 483-491. Retrieved from http://www.academypublication.com/issues/past/tpls/

Monaghan, D. B., & Attewell, P. (2015). The community college route to the bachelor's degree. *Education Evaluation and Policy Analysis, 37*(1), 70-91. doi:10.3102/0162373714521865

Moore, G. W., Slate, J. R., Edmonson, S. L., Combs, J. P., Bustamante, R., & Onwuegbuzie, A. J. (2010). High school students and their lack of preparedness for college: A statewide study. *Education and Urban Society*, *42*(7), 817-838. doi:10.1177/0013124510379619.

Moore, K. S. (2018). *The relationship between tutoring and academic success of students enrolled in remedial mathematics* (Doctoral dissertation, Nova Southeastern University). Retrieved from https://nsuworks.nova.edu/fse_etd/151/

Morán-Soto, G., & Benson, L. (2018). Relationship of mathematics self-efficacy and competence with behaviors and attitudes of engineering students with poor mathematics preparation. *International Journal of Education in Mathematics Science and Technology*, *6*(3), 200-220. Retrieved from https://dergipark.org.tr/download/article-file/479712

Morest, V. S. (2013). From access to opportunity: The evolving social roles of community colleges. *The American Sociologist, 44*(4), 319-328. doi:10.1007/s12108-013-9194-5

Morony, S., Kleitman, S., Lee, Y. P., & Stankov, L. (2013). Predicting achievement: Confidence vs. self-efficacy, anxiety, and self-concept in Confucian and European countries. *International Journal of Educational Research, 58,* 79-96. doi:10.1016/j.ijer.2012.11.00

National Conference of State Legislatures. (2016). *College and career readiness*. Retrieved from http://www.ncsl.org/research/education/college-and-career-readiness.aspx

Ngo, F., & Kosiewicz, H. (2017). How extending time in developmental math impacts student persistence and success: Evidence from a regression discontinuity in community colleges. *Review of Higher Education, 40*(2), 267-306. doi:10.1353/rhe.2017.0004

Noble, H., & Smith, J. (2015). Issues of validity and reliability in qualitative research. *Evidence-Based Nursing, 18*(2), 34-35. doi:10.1136/eb-2015-102054

Ortiz, E. A., & Dehon, C. (2013). Roads to success in the Belgian French community's higher education system: Predictors of dropout and degree completion at the Université Libre de Bruxelles. *Research in Higher Education, 54*(6), 693-723. doi:10.1007/s11162-013-9290-y

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research, 42*(5), 533-544. doi:10.1007/s10488-013-0528-y

Pape, S. J., & Prosser, S. K. (2018). Barriers to technology implementation in community college mathematics classrooms. *Journal of Computing in Higher Education, 30*(3), 620-636. doi:10.1007/s12528-018-9195-z

Park, J., & Brannon, E. M. (2013). Training the approximate number system improves math proficiency. *Psychological Science, 24*(10), 2013-2019. doi:10.1177/0956797613482944

Parker, P. D., Marsh, H. W., Ciarrochi, J., Marshall, S., & Abduljabbar, A. S. (2013). Juxtaposing math self-efficacy and self-concept as predictors of long-term achievement outcomes. *Educational Psychology, 34*(1), 29-48. doi:10.1080/01443410.2013.797339

Pendergast, D., Garvis, S., & Keogh, J. (2011). Pre-service student-teacher self-efficacy beliefs: An insight into the making of teachers. *Australian Journal of Teacher Education, 36*(12). doi:10.14221/ajte.2011v36n12.6

Perez, E. B., To, H., Fowler, M., & Larrivee, L. (2018). Math course for liberal arts majors: A pilot with embedded remediation. *Numeracy, 11*(1), 6. doi:10.5038/1936-4660.11.1.6

Perin, D. (2018). Teaching academically underprepared students in community colleges. In *Understanding community colleges* (pp. 87-90). New York, NY: Routledge.

Peters, M. L. (2013). Examining the relationship among classroom climate, self-efficacy, and achievement in undergraduate mathematics: A multi-level analysis. *International Journal of Science and Mathematics Education, 11*(2), 459-480. doi:10.1007/s10763-012-9347-y

Petty, T. (2014). Motivating first-generation students to academic success and college completion. *College Student Journal, 2*, 257-264. Retrieved from http://www.ingentaconnect.com/content/prin/csj

Pole, C., & Lampard, R. (2013). *Practical social investigation: Qualitative and quantitative methods in social research*. New York, NY: Routledge.

Price, D. V., & Tovar, E. (2014). Student engagement and institutional graduation rates: Identifying high-impact educational practices for community colleges. *Community College Journal of Research and Practice, 38*(9), 766-782. doi:10.1080/10668926.2012.719481

Priscylio, G., Rochintaniawati, D., & Anwar, S. (2018). Needs of integrated science textbooks for junior high school based on learning style. In *International Conference on Mathematics and Science Education of Universitas Pendidikan Indonesia* (pp. 396-401). Retrieved from http://science.conference.upi.edu/proceeding/index.php/ICMScE

Pruett, P. S., & Absher, B. (2015). Factors influencing retention of developmental education students in community college. *Delta Kappa Gamma Bulletin, 81*(4), 32-40. Retrieved from https://www.dkg.org/DKGMember/Publications/Journal

Putwain, D., Sander, P., & Larkin, D. (2013). Academic self-efficacy in study-related skills and behaviors: Relations with learning-related emotions and academic success. *British Journal of Educational Psychology, 83*(4), 633-650. doi:10.1111/j.2044-8279.2012.02084.x

Rice, L., Barth, J. M., Guadagno, R. E., Smith, G. P. A., & McCallum, D. M. (2013). The role of social support in students' perceived abilities and attitudes toward math and science. *Journal of Youth and Adolescence, 42*(7), 1028-1040. doi:10.1007/s10964-012-9801-8

Richards, L. (2015). *Handling qualitative data: A practical guide* (3rd ed.). Thousand Oaks, CA: Sage.

Riconscente, M. M. (2014). Effects of perceived teacher practices on Latino high school students' interest, self-efficacy, and achievement in mathematics. *Journal of Experimental Education, 82*(1), 51-73. doi:10.1080/00220973.2013.813358

Rodesiler, C. A., & McGuire, J. M. (2015). Ideas in practice: Professional development to promote universal design for instruction. *Journal of Developmental Education, 38*(2), 28-31. Retrieved from https://ncde.appstate.edu/publications/journal-developmental-education-jde

Rodríguez, O. (2014). Increasing access to college-level math: Early outcomes using the Virginia Placement Test. *Columbia University Academic Common, 58*. doi:10.7916/D8HQ3X1P

Rodríguez, S., Regueiro, B., Blas, R., Valle, A., Piñeiro, I., & Cerezo, R. (2014). Teacher self-efficacy and its relationship with students' affective and motivational variables in higher education. *European Journal of Education and Psychology, 7*(2), 107-120. doi:10.1989/ejep.v7i2.183

Rossman, G., & Rallis, S. (2003). *Learning in the field: An introduction to qualitative research.* Thousand Oaks, CA: Sage.

Rubie-Davies, C. (2010). Teacher expectations and perceptions of student attributes: Is there a relationship? *British Journal of Educational Psychology, 80*, 121-135. doi:10.1348/000709909x466334

Santhanam, N. E., Shrivastava, R., & Toworfe, G. (2019). Students' attitude towards undergraduate foundation mathematics remediation in a HE institution in a Gulf Country. *International Journal of Research in Education Methodology, 10*, 3359-3367. doi:10.24297/ijrem.v10i0.7761

Schenke, K., Ruzek, E., Lam, A. C., Karabenick, S. A., & Eccles, J. S. (2018). To the means and beyond: Understanding variation in students' perceptions of teacher emotional support. *Learning and Instruction, 55*, 13-21. doi:10.1016/j.learninstruc.2018.02.003

Scherff, L. (2018). "Technology" in schools: Effective remedy or snake oil? *Voices from the Middle, 25*(4), 63-65. Retrieved from https://www.ncte.org/journals/vm

Scott, C. N. (2018). *Examining the Shelby County schools optional program: Barriers to black student enrollment in Shelby County schools.* Retrieved from http://dlynx.rhodes.edu/jspui/bitstream/10267/33990/1/201807_Christal_Scott_RIRS_paper.pdf

Scott-Clayton, J., Crosta, P. M., & Belfield, C. R. (2014). Improving the targeting of treatment: Evidence from college remediation. *Educational Evaluation and Policy Analysis, 36*(3), 371-393. Retrieved from https://journals.sagepub.com/home/epa

Siddique, A., Aslam, H. D., Khan, M., & Fatima, U. (2011). Impact of academic leadership on faculty's motivation, and organizational effectiveness in higher education systems. *International Journal of Business and Social Sciences, 2*(8), 184-191. Retrieved from http://www.ijbssnet.com/journals/

Silva, E., & White, T. (2013). *Pathways to improvement: Using psychological strategies to help college students master developmental math*. Stanford, CA: Carnegie Foundation for the Advancement of Teaching.

Skinner, K. (2014). Mississippi makes progress preparing students for college, but improvements still necessary. *Higher Education*. Retrieved from http://hechingerreport.org/mississippi-makes-progress-preparing-students-college/

Skuratowicz, E., Ota St. Clair, S., Pritzlaff, R., Anderson, C., Menefee, M., & Miller-Loessi, K. (2019). The effectiveness of a contextualized developmental course in intermediate algebra for community college students. *Community College Journal of Research and Practice,* 1-14. doi:10.1080/10668926.2019.1600607

Steiff, M., & Uttal, D. (2015). How much can spatial training improve STEM achievement? *Educational Psychology Review, 27*(4), 607-615. doi:10.1007/s10648-015-9304-8

Stewart, S., Lin, D. H., & Kim, J. H. (2015). Factors influencing college persistence for first-time students. *Journal of Developmental Education, 38*(3), 12-16. Retrieved from https://ncde.appstate.edu/publications/journal-developmental-education-jde

Stoneham, E. Z., Moore, G. W., Slate, J. R., & Martinez-Garcia, C. (2017). Instructional format and differences in remedial mathematics performance for community college students: A multiyear investigation. *Global Journal of Human-Social Science Research*. Retrieved from https://socialscienceresearch.org/index.php/GJHSS

Transcribe. (n.d.). *Transcribe*. Retrieved from https://transcribe.wreally.com/

Treisman, U. (1992). Studying students studying calculus: A look at the lives of minority mathematics students in college. *College Mathematics Journal, 23*(5), 362-372. Retrieved from https://www.maa.org/press/periodicals/college-mathematics-journal/the-college-mathematics-journal

Twigg, C. A. (2013). Improving learning and reducing costs: Outcomes from changing the equation. *Change, 45*(4), 6-14. doi:10.1080/00091383.2013.806169

Ulmer, W., Means, D. R., Cawthon, T. W., & Kristensen, S. A. (2016). Investigation of remedial education course scores as a predictor of introduction-level course performances: A case analysis at one for-profit institution. *Journal of College Student Retention: Research, Theory & Practice, 18*(1), 109-130. doi:10.1177/1521025115579675

van der Westhuizen, S., de Beer, M., & Bekwa, N. (2011). Psychological strengths as predictors of postgraduate students' academic achievement. *Journal of Psychology in Africa, 21*(3), 476-478. doi:10.1080/14330237.2011.1082048

Vandenbussche, J., Ritter, L., & Scherrer, C. (2018). An incentivized early remediation program in Calculus I. *International Journal of Mathematical Education in Science and Technology, 49*(8), 1235-1249. doi:10.1080/0020739X.2018.1458340

VanOra, J. (2019). "It's like one step for me to go forward": A longitudinal study of community college students' perceptions on the value of developmental education. *Community College Enterprise*, *25*(1), 59-77. Retrieved from https://go.gale.com/ps/anonymous?id=GALE%7CA594925405&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=15410935&p=AONE&sw=w

Venezia, A., & Jaeger, L. (2013). Transitions from high school to college. *The Future of Children, 23*(1), 117-136. doi:10.1353/foc.2013.0004

Vieluf, S., Kunter, M., & van de Vijver, F. J. R. (2013). Teacher self-efficacy in cross-national perspective. *Teacher and Teacher Education, 35*, 92-103. doi:10.1016/j.tate.2013.05.006

Wang, C.-H., Shannon, D. M., & Ross, M. E. (2013). Students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning. *Distance Learning, 34*(3), 302-323. doi:10.1080/01587919.2013.835779

Wang, X. (2013). Why students choose STEM majors: Motivation, high school learning, and postsecondary context of support. *American Educational Research Journal, 50*(5), 1081-1121. doi:10.3102/0002831213488622

Wang, X., Sun, N., & Wickersham, K. (2017). Turning math remediation into "homeroom": Contextualization as a motivational environment for community college students in remedial math. *Review of Higher Education, 40*(3), 427-464. doi:10.1353/rhe.2017.0014

Wäschle, K., Allgaier, A., Lachner, A., Fink, S., & Nückles, M. (2014). Procrastination and self-efficacy: Tracing vicious and virtuous circles in self-regulated learning. *Learning and Instruction, 29*, 103-114. doi:10.1016/j.learninstruc.2013.09.005

Wendel, D., & Hu, X. (2018). Breaking new ground: McHenry county college developmental mathematics approach. *Community College Journal of Research and Practice, 42*(9), 585-590. doi:10.1080/10668926.2018.1470044

Whiton, J. C., Rethinam, V., & Preuss, M. D. (2018). High school factors predicting enrollment in developmental courses. *Journal of Developmental Education, 42*(1), 8. Retrieved from https://ncde.appstate.edu/publications/journal-developmental-education-jde

Wilson, Y. S. (2018). *Impact of math study skills co-requisite courses on student success in pre-calculus at an urban community college*. Retrieved from https://repository.lib.ncsu.edu/bitstream/handle/1840.20/35612/etd.pdf?sequence=1

Wong, L. (2014). *Essential study skills* (8th ed.). Stamford, CT: Cengage Learning.

Xu, D., & Dadgar, M. (2018). How effective are community college remedial math courses for students with the lowest math skills? *Community College Review, 46*(1), 62-81. doi:10.1177/0091552117743789

Yazan, B. (2015). Three approaches to case study methods in education: Yin, Merriam, and Stake. *The Qualitative Report, 20*(2). Retrieved from http://nsuworks.nova.edu/tqr/

Yin, R. K. (2013). *Case study research: Design and methods* (5th ed.). Thousand Oaks, CA: Sage.

Young, K. M. (2002). *Retaining underprepared students enrolled in remedial courses at the community college*. Retrieved from https://eric.ed.gov/?id=ED467850

Yu, R., & Singh, K. (2016). Teacher support, instructional practices, student motivation, and mathematics achievement in high school. *Journal of Educational Research, 111*(1), 81-94. doi:10.1080/00220671.2016.1204260

Zimmerman, B. J., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal, 31*(4), 845-862. doi:10.2307/1163397

Zimmerman, B. J., & Kitsantas, A. (2014). Comparing students' self-discipline and self-regulation measures and their prediction of academic achievement. *Contemporary Educational Psychology, 39*(2), 145-155. doi:10.1016/j.cedpsych.2014.03.004

Zimmerman, B. J., Bandura, A., & Martinez-Pons, B. M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal, 29*(3), 663-676. doi:10.3102/00028312029003663

Zuffianò, A., Alessandri, G., Gerbino, M., Kanacri, B. P. L., di Guinta, L., Milioni, M., & Caprara, G. V. (2013). Academic achievement: The unique contribution of self-efficacy beliefs in self-regulated learning beyond intelligence, personality traits, and self-esteem. *Learning and Individual Differences, 23*, 158-162. doi:10.1016/j.lindif.2012.07.010

Appendix A: The Project

Title: Strategies for Improving Remedial Math Performance

P**urpose:** The purpose of this professional development training is to provide remedial math instructors, students, and administrators with the necessary skills and strategies for improving student performance in remedial math classes.

Goals

The goals of this professional development training are as follows:

1. Collaborate with local school district leaders to implement a high school to college transition plan for high school students to gain exposure to concepts needed in college math courses.
2. Demonstrate knowledge of self-efficacy strategies for implementing student motivation/engagement.
3. Improve student motivation/engagement in remedial math courses through self-efficacy and incentive programs. (develop strategies)
4. Increase the use of contextualized methods such as real-world application into their lesson planning.

Learning Outcomes

During this professional development training administrators, instructors, and students will:

- Develop a transition plan for high school students' exposure to the concepts needed in college math courses.
- Define self-efficacy and identify its components.
- Understand the factors that affect student engagement and motivation.

- Develop instructional strategies to increase instructor and student self-efficacy.
- Implement contextualized methods/real-world applications into the course structure.

Audience

The target audience for this professional development training is community college curriculum administrators, remedial math faculty and students (which includes both full-time and adjunct faculty), and local school district leaders.

Timeline

Professional Development Agenda: Day 1

Time	Activity	Presenter/facilitator
8:30- 9:00	Sign-In	
9:00- 9:15	Welcome: Norms/Expectations	President/ Presenter Presenter
9:15- 10:00	Remedial Math Talk: Discussion of Research Findings on Remedial Math Performance at Community Colleges.	Local School Superintendent and Dean of Students
10:00-10:15	15 min. Break	
10:15-11:45	Session 1: Laying the Foundation Discussion of High School Transition Plan: Why is it needed?	Presenter Group Leaders
11:45-12:45	Lunch	Presenter
12:45-2:00	Session 2: Remedial Math that Works Develop an outline for the high school transition plan. What will it look like? Review other program's key components and effectiveness.	
2:00-3:30	Session 3: Developing an Effective Plan of Action Develop implementation strategies for both the community college and the local school district.	
3:30-4:30	Reflection, Wrap Up, Survey Day 1	

Professional Development Agenda: Day 2

Time	Activity	Presenter/facilitator
8:30- 9:00	Sign-In	
		Presenter
9:00- 9:15	Ice Breaker Activity:	Presenter
9:15- 10:00	Remedial Math Talk: Discussion of Research Findings on Teacher and Student Perceptions of Remedial Math.	Presenter
10:00-10:15	15 min. Break	
10:15-11:45	Session 1: Laying the Foundation Self-Efficacy (SE)Presentation- effects on student success and methods to increase Self-Efficacy.	Group Leaders
	Activity: Discussion of SE and student performance.	Group Leaders
		Presenter
11:45-12:45	Lunch	
12:45-2:00	Session 2: Remedial Math that Works Develop instructional SE strategies. 1:15-2:00 Discuss student engagement. How does SE affect student engagement?	
2:00-3:30	Session 3: Developing an Effective Plan of Action Develop SE strategies for student engagement.	
3:30-4:30	Reflection, Wrap Up, Survey Day 2	

Professional Development Agenda: Day 3

Time	Activity	Presenter/facilitator
8:30- 9:00	Sign-In	Presenter
9:00- 9:15	Ice Breaker Activity:	Presenter
9:15- 10:00	Remedial Math Talk: Discussion of Research Findings on the importance of Real-World Application in Remedial Math (Contextualized Methods).	Dean of Students
10:00-10:15	15 min. Break	Group Leaders
10:15-11:45	Session 1: Laying the Foundation How Students Learn: Best Practices of Contextualized Methods of instruction.	Group Leaders Presenter
11:45-12:45	Lunch	
12:45-2:00	Session 2: Remedial Math that Works Plan Contextualized Methods of instruction for Unit 1.	
2:00-3:30	Session 3: Group Presentations: Develop implementation strategies for new Contextualized Methods developed.	
3:30-4:30	Reflection, Wrap Up, Summative Evaluation	

Training Activities and Presentations

Day 1: Bridging the Gap

Goal 1. Community college and local school district leaders will discuss findings presented from the research and identify their role in remedial math student performance.

Goal 2. Participants will have a better insight into student performance in remedial math and their role in student performance.

Goal 3. Participants will develop an outline for solutions to the issues discussed.

Ice breaker (Name that Tune). The participants for day 1 include JMCC administrators, JMCC remedial math instructors, and local school district leaders. Day 1 will begin with breakfast and check-in (participants will be asked to fill out name tags). After the check-in session, the college president will open with a welcome, and the facilitator will establish the norms and expectations of the professional development. Once the norms and expectations are explicated, there will be an icebreaker activity where the facilitator will ask each participant to guess the artist and song title of 5 songs played in a 3 second time interval. The facilitator will play five songs for 3 seconds with a 5 second transition time between playing the next song. After participants have had the opportunity to listen to all five songs and write their responses, the facilitator will ask the participants to put their writing utensils down. The five songs will be played back with the artist's name and song title on the screen. The participant will compare their answers to the screen, and the participant with the most answers correct (artist and song title) will win a door prize.

Guiding Question: Why are students performing poorly in remedial math? After the icebreaker activity, the goals and outcomes for day one will be presented. There will be daily guiding questions to drive the remedial math talk sessions. Participants will be provided a journal to record responses to the guiding questions presented in the sessions. The facilitator will present the guiding question for day one by asking participants, why do students perform poorly in remedial math, and to write their responses in the journals provided.

Remedial math talk. The remedial math talk session is a whole group session where research findings of the topic are presented. The session will start with a matching activity that allows participants to match reasons for poor remedial math student performance with the percentage pie chart. After the matching activity, each table will be given a handout with research findings and the opportunity to compare what they listed as reasons for poor remedial math performance and the findings from the research presented in the handout.

Participants will have a 15-minute break and then transition to the next session.

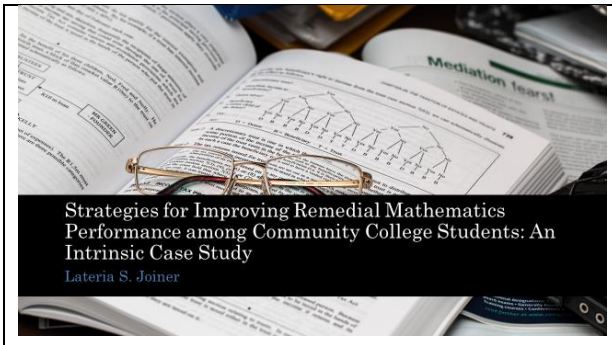
Session 1: Laying the foundation (community college administrators and local school district leaders). This session will be broken into two sections allowing the local school district leaders and community college administrators an opportunity to reflect on the findings presented amongst themselves. The superintendent of the local school district and the dean of instruction for the community college will lead their respective sessions. In their groups, they will be responsible for their group addressing the following:

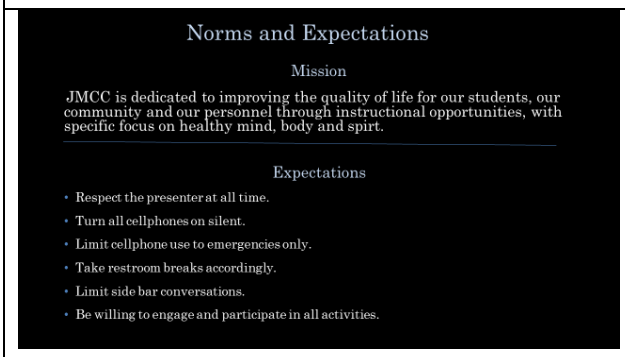
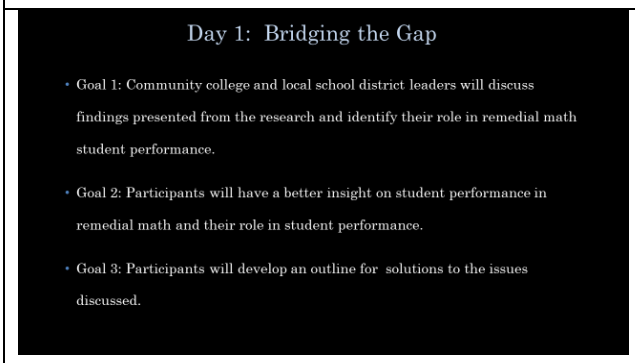
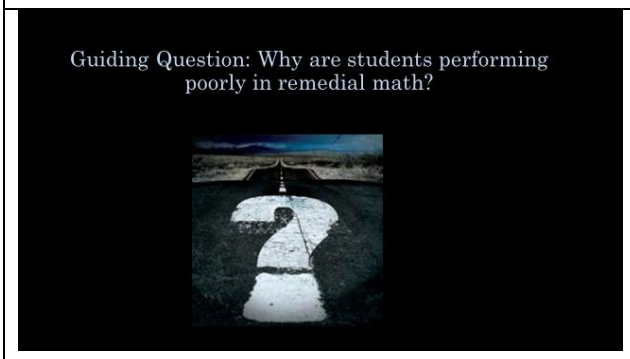
- Identify your role in remedial math student performance.
- How does your position affect student performance at the community college level?
- What can you do to address the problem?
- Brainstorm ideas for solutions to the challenges listed in the remedial math talk session.

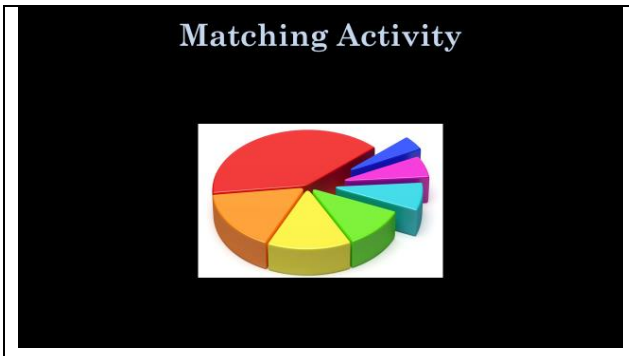
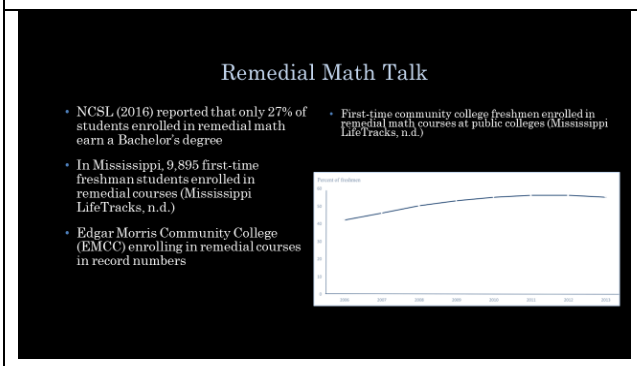
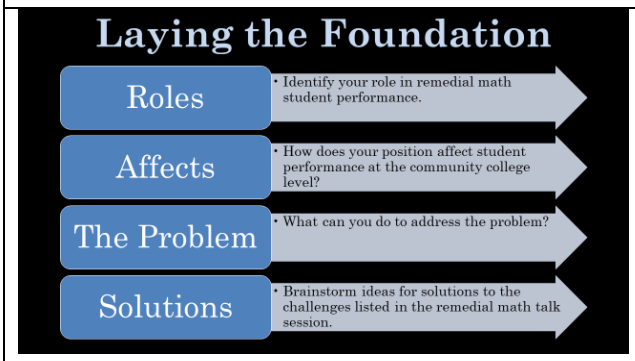
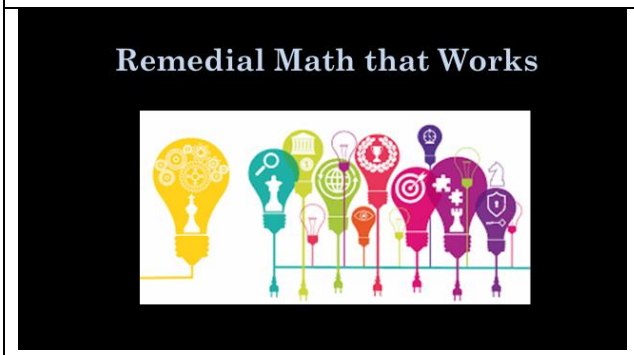
After Session 1, participants will go to lunch and move straight into session two once they return.

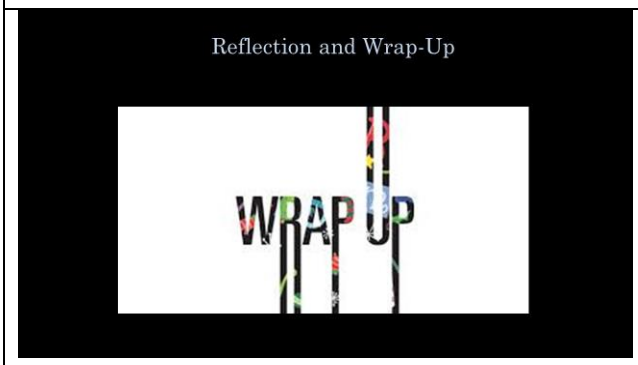
Session 2: Remedial math that works. This session will begin with reviewing exemplary remedial math programs across the United States to identify critical components and effectiveness of successful programs. After a review of exemplars, members will be instructed to develop an outline for the solutions drafted in session 1. At the end of session 2, each group is expected to present the outlines created in the whole group session.

Session 3: Developing an effective plan of action. This session is where both groups come together to share their outlines for the solutions they have outlined. After outlines have been presented, the groups will be merged randomly into subgroups to collaborate and develop implementation strategies for an effective remedial math program from two essential viewpoints. Each group will list the strategies developed on a poster. Day 1 will conclude with presentations of outlines, reflection/wrap up session, and the survey for Day 1. Participants will be allowed to share reflections on a post-it note and place them on the reflection wall. The day will wrap up with a drawing for a door prize, and the link for the evaluation will be posted on the projector screen. The survey allows participants to provide feedback about each session and share suggestions for improvement.

	Beforehand the Facilitator will: Be sure the sign-in sheet is at the registration table with name tags and markers. Make sure each table has all the supplies for the day. Make sure parking lots are posted in rooms for questions and topics to be discussed further. Make sure the Reflection wall is set up for participants to share reflections. Make sure raffle tickets are handed out after session 3 (transitioning into wrap-up session). Make sure the evaluation link is working. Make sure prizes/gift bags are accessible.

	After the check-in session and the President's welcome, the facilitator will establish norms and expectations.
	The facilitator will explicate goals for day 1.
	The facilitator will play five songs for 3 seconds with a 5 second transition time between playing the next song. After participants have had the opportunity to listen to all five songs and write their responses, the facilitator will ask the participants to put their writing utensils down. The five songs will be played back with the artist's name and song title on the screen. The participant will compare their answers to the screen, and the participant with the most answers correct (artist and song title) will win a door prize.
	The guiding questions are expected to drive the remedial math talk sessions. The facilitator will present the guiding question and ask participants to write their responses in the journals provided.

	The remedial math talk session is a whole group session where research findings of the topic are presented. The session will start with a matching activity that allows participants to match reasons for poor remedial math student performance with the percentage pie chart. Once the activity is complete, the reasons and percentages will be revealed.
	This slide shows the first time community college freshmen enrolled in remedial math courses at local public colleges. Participants will refer to the handout with detailed findings to compare the reasons and percentages they matched with the research.
	This session will be broken up into two sections allowing the local school district leaders and community college administrators an opportunity to reflect on the findings presented amongst themselves. The superintendent of the local school district and the dean of instruction for the community college will lead their respective sessions and address the targets listed above.
	Participants will review exemplar remedial math programs provided and identify critical components and effectiveness of successful programs. After a review of exemplars, members will be instructed to develop an outline for the solutions drafted in session 1. The outlines will be posted for presentation in the wrap-up session.

	In randomly merged subgroups, participants will collaboratively develop implementation strategies for an effective remedial math program. These strategies will be used on day 3 of the training.
	Each day will end with presentations, reflection/wrap up session, and a survey. Participants will be allowed to share reflections on a post-it note and place them on the reflection wall. The day will end with a door prize drawing and a link for the evaluation on the screen.

Day 2: Building Rapport

Goal 4: Instructors will collaborate with students on developing ideas to increase student motivation/engagement.

Ice breaker (building rapport). The participants for day 2 include JMCC remedial math instructors and JMCC remedial math students. During the check-in sessions, participants were given labels for the activity. The participants in this session will be randomly paired by numbers (1-2) across the room. Pairs will form and label their partner's back. Partner1 has to help Partner 2 guess the word on the label, and vice versa. Once the words are revealed, participants can share how they relate to the word. Once the activity is complete, participants will be allowed to transition back to their original seats.

Guiding questions: How can we get students engaged? The goals, outcomes, and guiding question for day two will be presented. Participants are encouraged to reflect on the question in their journal.

Remedial math talk. This session will start with a role-play activity where groups will be provided with scenarios to practice. Each group will discuss the appropriate way to respond and display those actions to the whole group. The purpose of this activity is to build a safe community, model appropriate behavior, and provide the opportunity to create a dialogue about student engagement and gain an understanding of instructors' and students' perspectives.

Scenario #1: Unprepared Students.

A group of your students do not complete homework assignments often and therefore contribute little to the class discussions. How would you handle this situation?

Scenario #2: Inattentive Students

A few students enjoy completing their homework assignments during class or frequently carry on their own conversation, which, at times, annoys others. How would you handle this situation?

Scenario #3: Reluctant Students

A student comes to class, sits in the back of the class near the door, rarely speaks to classmates, and has yet to ask or share information in class. How would you handle this situation?

Scenario #4: Oppositional Students

Student seems to have a chip on his/her shoulder. His/her comments in class often sound either angry or hostile. Even his/her nonverbal behavior seems contentious. How would you handle this situation?

After the role-play activity, each table will be given a handout with research findings on teacher and student perceptions of remedial math student performance at the community college level. The finding from the research will be presented to the whole group, and participants will be encouraged to reflect on the activity and findings in their journal. Participants will have a 15-minute break and then transition to the next session.

Session 1: Laying the foundation (instructors and students). Students and instructors will be given the opportunity to share thoughts about the findings from the research. In this session, a Self-Efficacy (SE) presentation will be delivered to explain SE effects on student success and methods to increase SE. After the presentation, the instructors and students will be asked to reflect on the presentation and how it relates to his/her perceptions.

After Session 1, participants will go to lunch and move straight into session two once they return.

Session 2: Remedial math that works. This will be an interactive session that allows instructors and students to collaborate and develop instructional SE strategies based on the research findings and SE presentation that can benefit both. Students and instructors will be randomly grouped to ensure that viewpoints from both groups are represented. Each group will be assigned a standard to deconstruct and develop SE instructional strategies to meet the needs of the remedial math students. Once the strategies are

developed, each group will share out, and the strategies will be rated. The top-rated strategies will be drafted on a poster for a later session.

Session 3: Developing an effective plan of action. This session focuses on developing SE strategies for student engagement. Students and Instructors will be asked to reflect on engagement in math class. The groups will be homogeneous, where students are grouped together, and instructors grouped together. Groups will be given poster paper to list responses to the following questions.

Students.

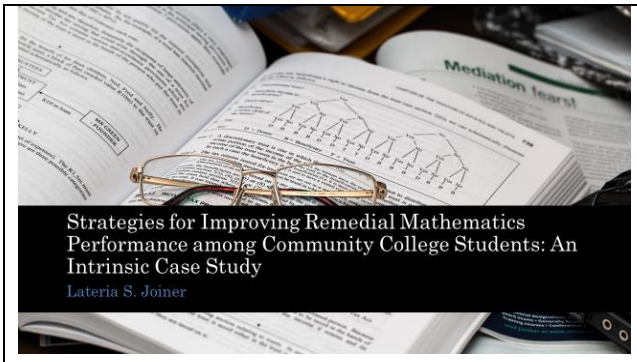
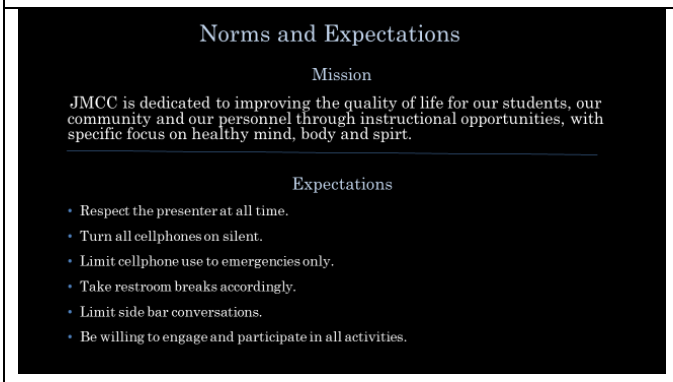
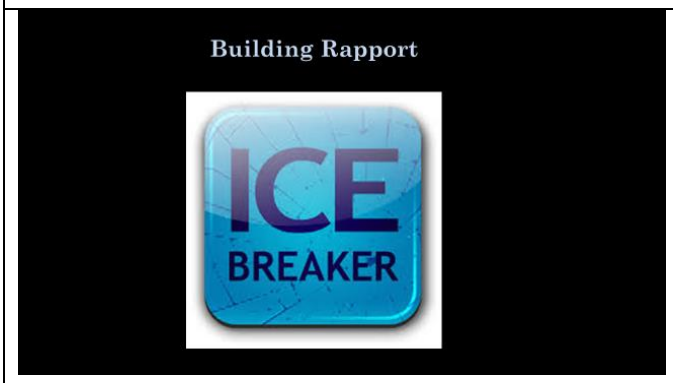
1. How can SE help students improve remedial math performance?
2. What kind of support is needed for students to activate SE?

Instructors.

1. How have you been using SE strategies throughout your teaching career?
2. What kind of supports can instructors provide to help students activate SE?
3. How can instructors implement SE strategies to engage/motivate students?

Students and instructors will share responses to gain insight on different perceptions. Groups will then be regrouped heterogeneously to collaborate and devise an effective plan of action for student engagement. The heterogeneous groups will implement what was learned to develop effective SE strategies that will get remedial math students motivated and engaged in the lessons. The strategies developed will be charted on a poster and placed on the wall for later use. Day 2 will wrap up with a reflection session and a raffle drawing for a door prize. The link for the evaluation will be posted on the

projector screen. The survey allows participants to provide feedback about each session and share suggestions for improvement.

	Beforehand the Facilitator will: • Be sure the sign-in sheet is at the registration table with name tags and markers. • Make sure each table has all the supplies for the day. • Secure scenario cards for ice breaker activity • Make sure parking lots are posted in rooms for questions and topics to be discussed further. • Make sure the Reflection wall is set up for participants to share reflections. • Make sure raffle tickets are handed out after session 3 (transitioning into wrap-up session). • Make sure the evaluation link is working. • Make sure prizes/gift bags are accessible.
	After the check-in session, the facilitator will establish norms and expectations for the day.
	Facilitator will run Ice Breaker Activity.

<table>
<tr>
<td>Day 2: Building Rapport

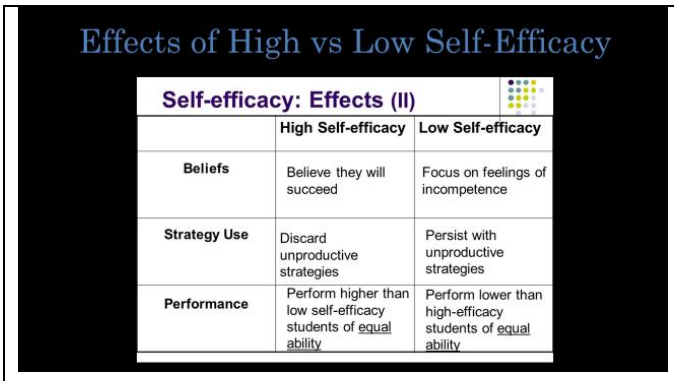
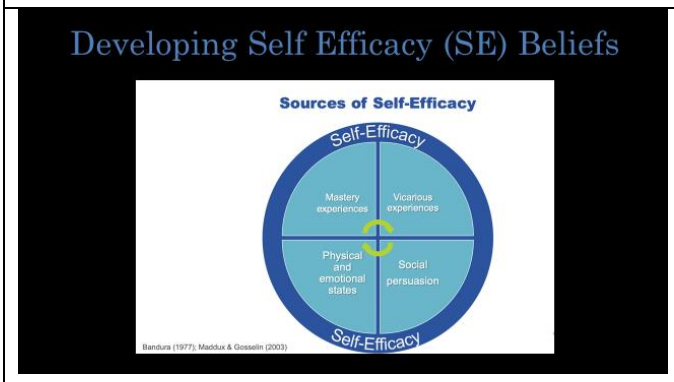
The participant/s will :
• Goal 4: Collaborate on developing ideas to increase student motivation/engagement.
• Goal 5: Define self-efficacy and identify its components.
• Goal 6: Understand factors that affect student engagement and motivation.
• Goal 7: Develop institutional strategies to increase instructor and student self efficacy.</td>
<td>The facilitator will explicate goals for day 2.</td>
</tr>
<tr>
<td>Guiding Question: How can we get students engaged?

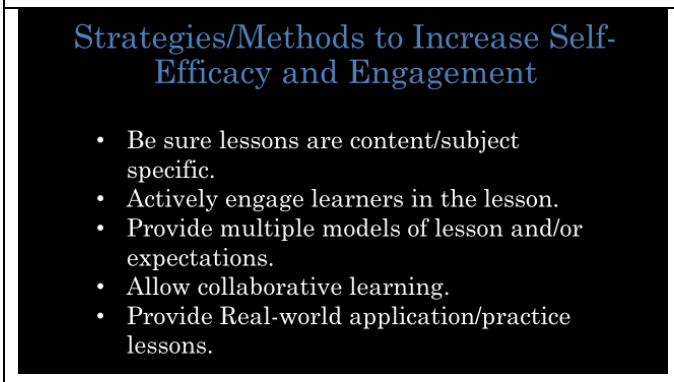
  </td>
<td>The guiding questions are expected to direct the discussion for the day.</td>
</tr>
<tr>
<td>Activity

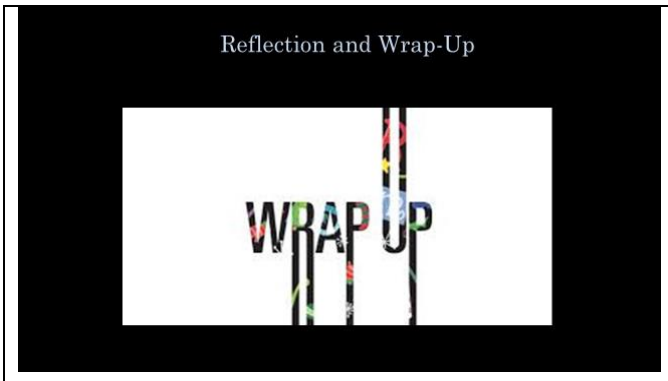
 
</td>
<td>We will break into four groups. Each group will be provided with a scenario to discuss and practice their response. After discussion and practice, the groups will present their scenarios to the entire group.</td>
</tr>
<tr>
<td>Remedial Math Talk

Themes and Subthemes by Participants
<table><tr><th>Students</th><th>Instructors</th><th>Administrators</th></tr><tr><td>High school experience college preparedness.
Purpose and value of remedial class.
Opinions about performance levels and obstacles to learning
Suggestions for improvements</td><td>Purpose and value of remedial class.
Performance levels and major obstacles to learning
Suggestions for improvements</td><td>Purpose and value of remedial class.
Performance levels and major obstacles to learning
Suggestions for improvements</td></tr></table></td>
<td>This will be an interactive session that allows instructors and students to collaborate and develop instructional SE strategies based on the research findings and SE presentation that can benefit both.</td>
</tr>
</table>

Remedial Math Talk Based on the data, the suggested improvements fell into one of the following three categories: 1. Allow more time for the class. 2. Improve individual student assistance and student engagement. 3. Include more technology and more exciting ways of making the subject interesting and relevant to the students' lives.	Students and instructors will be randomly grouped to ensure that viewpoints from both groups are represented. Each group will be assigned a standard to deconstruct and develop SE instructional strategies to meet the needs of the remedial math students. Once the strategies are developed, each group will share out, and the strategies will be rated. The top-rated strategies will be drafted on a poster for a later session.
Bandura's Self-Efficacy Theory 	The presenter will introduce Bandura's Self-Efficacy Theory and provide a rundown of the day's sessions. The Self-Efficacy (SE) presentation will be delivered to explain SE effects on student success and methods to increase SE. After the presentation, the instructors and students will be asked to reflect on the presentation and how it relates to his/her perceptions.
What is Self-Efficacy Self-efficacy is the belief in one's ability to succeed in achieving an outcome or reaching a goal.	The presenter will explain what SE is. Self-efficacy is internal; it is when a person believes he/she can succeed at a task. SE is built on mindset. Gaging participants' SE in the training can predict the success of the proposed practices.
High Self-Efficacy -vs- Low Self-Efficacy **High self efficacy** reflects individuals with confidence in his/her ability to exert control over self motivation, behavior, and environment. It also allows individuals to become advocates of his/her own needs and supports. **Low Self-Efficacy** reflects individuals with little to no confidence in his/her ability to exert control over self motivation, behavior, and environment.	This slide describes two different types of SE, High vs. Low. In general, individuals with **high SE** are more likely to make efforts to complete a task, and/or endure in the process. Individuals with **low SE** have negative emotions and vulnerability to poor performance, which leads to self-defeat.

<table>
<tr>
<td> 
</td>
<td>The presenter will expound on this particular slide and provide scenarios of individuals with high and low self-efficacy.</td>
</tr>
<tr>
<td> 
</td>
<td>The four sources of SE will be discussed.

There are four sources of self-efficacy:
Mastery experience of mastery influences the individual’s perspective on his/her abilities.
Vicarious observing someone else perform the same task or handle a situation increases the individual’s belief that he/she can master a similar activity.
Social Persuasion is the support or nonsupport from others on the individual's ability to do or not to do; when others encourage and/or convince you to perform a task, and you believe that you are capable.
Physical and Emotional Sates are feelings of the individual when engaged in a particular activity.</td>
</tr>
<tr>
<td> 
</td>
<td>Suggested strategies and methods are shared on this slide to provide the basis for strategy development.</td>
</tr>
<tr>
<td> 
</td>
<td>This session focuses on developing SE strategies for student engagement. Students and Instructors will be asked to reflect on engagement in math class. The groups will be homogeneous, where students are grouped together, and instructors grouped together. Groups will be given poster paper to list responses to questions provided to them.</td>
</tr>
</table>

	Each day will end with presentations, reflection/wrap up session, and a survey. Participants will be allowed to share reflections on a post-it note and place them on the reflection wall. The day will end with the link for the evaluation on the screen and a drawing for a door prize.

Day 3: Implementing the Plan

Goal 4: Instructors will incorporate contextualized methods such as real-world application into their lesson planning.

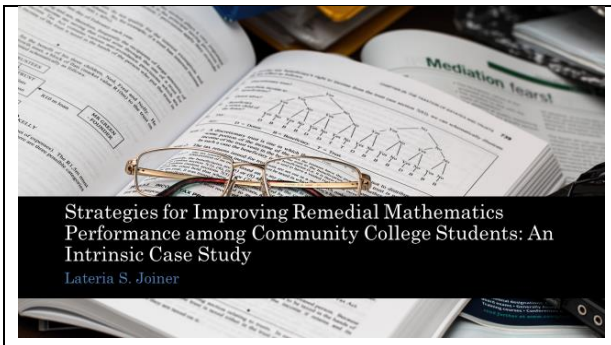
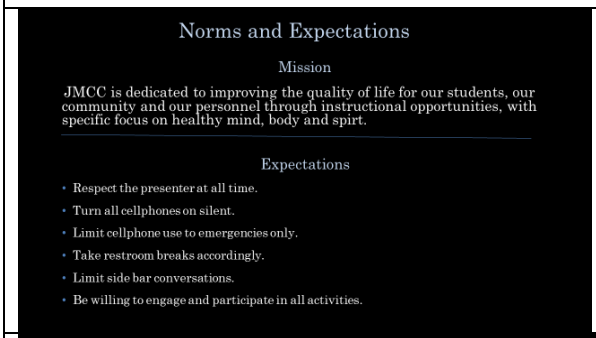
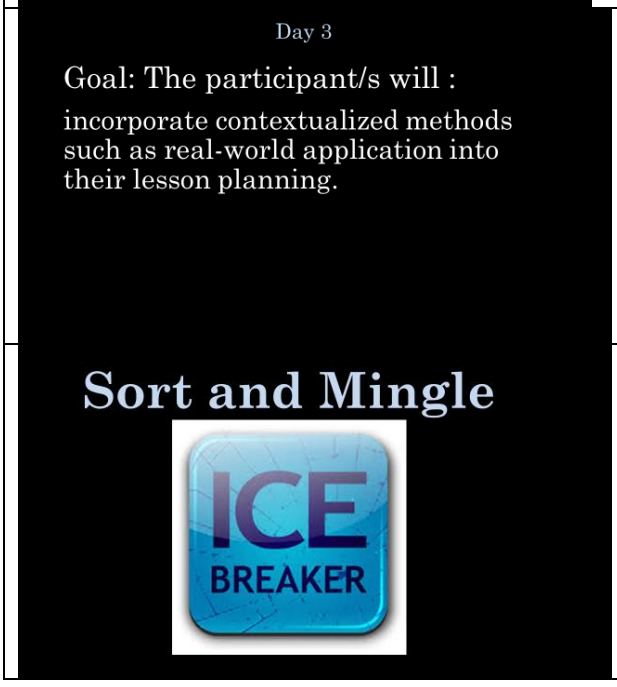
Day 3 will begin with the sign-in session. After sign-in, the ice breaker activity begins. Students, instructors, and administrators will be asked to stand at his/her seats. Questions will appear on the screen for participants to choose what they prefer. The choices will be color coated to match colored posters on the wall. Once the question is read, and a response has been chosen, participants are asked to transition to the colored poster that matches the response. After ten questions, the activity will be concluded. Participants will have a 15-minute break and then transition to Session 1.

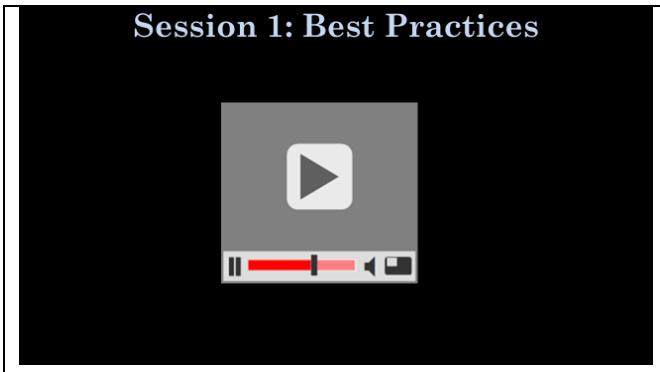
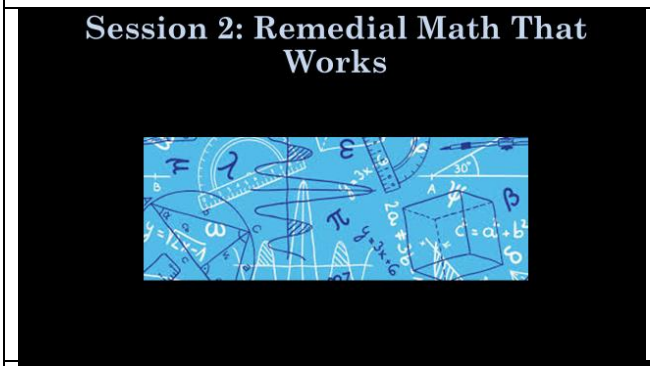
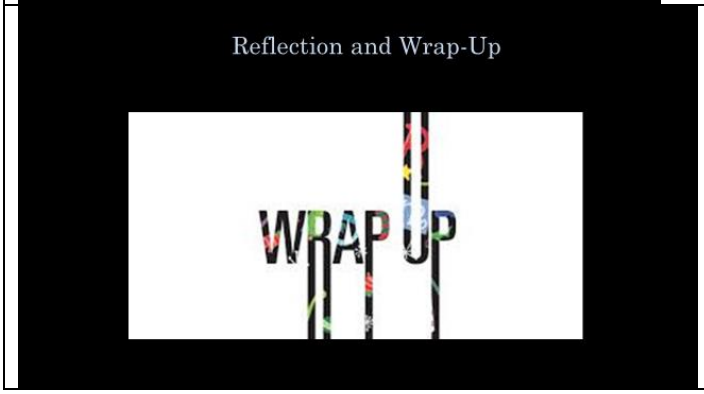
Session 1: Laying the foundation. This session will focus on how students learn: Best Practices of technology use and contextualized methods of instruction. The facilitator will show a video demonstrating best practices of technology use and contextualized methods of instruction. Instructors will be asked to focus on the instructor, students on the students, and administrators on both the students and instructors. After watching the video, groups will discuss what they saw that worked in the video, and list on chart paper

specific practices to incorporate into the plan of action that will be developed after lunch. Before lunch, the groups will be given two exemplar programs to review over lunch. From the review, instructors will consider methods to be implemented into the remedial math curriculum. After session 1, participants will go to lunch. After lunch, participants will go into Session 2.

Session 2: Remedial math that works. This will be an interactive session where admins and local school district leaders work together to develop a plan to improve student performance. Instructors and students will work together to plan contextualized methods of instruction for unit 1 of the remedial math curriculum. Admins and local school district leaders will develop a plan to ensure all students are being prepared to meet college requirements and will make plans to meet quarterly for an ongoing progress check. Instructors and students will work together to develop contextualized methods for Unit 1.

Session 3: Presentations. will consist of group presentations of implementation strategies for new contextualized methods developed. Admins and local school district leaders will present their plan for an effective transition from high school to college. Instructors will present a lesson using contextualized instructional methods. Day 3 will wrap up with a reflection session to discuss the next steps on continued PD, then the raffle drawing for a door prize. The evaluation on Day 3 will be summative to get feedback on overall PD. The evaluation link will be posted on the projector screen, allowing participants to provide feedback about each session and share suggestions for improvement.

		Beforehand the Facilitator will: • Be sure the sign-in sheet is at the registration table with name tags and markers. • Make sure each table has all the supplies for the day. • Make sure parking lots are posted in rooms for questions and topics to be discussed further. • Make sure the Reflection wall is set up for participants to share reflections. • Make sure raffle tickets are handed out after session 3 (transitioning into wrap-up session). • Make sure the evaluation link is working. • Make sure prizes/gift bags are accessible.
		After the check-in session, the facilitator will establish norms and expectations.
		The facilitator will explicate goals for day 3.
		The facilitator will project questions on screen for this activity. This activity is expected to let participants see how much they are alike and different.

	The facilitator will show a video demonstrating best practices of technology use and contextualized methods of instruction. Participants will focus on practices that work and fit in their respective settings.
	Participants will work together to plan contextualized methods of instruction for unit 1, and transition plans from high school to college. The facilitator will provide materials and guidance throughout the session.
	Groups will share out their plan of action.
	Each day will end with presentations, reflection/wrap up session, and a survey. Participants will be allowed to share reflections on a post-it note and place them on the reflection wall. The day will end with the link for the evaluation on the screen and a drawing for a door prize.

Survey

Day 1 and Day 2

Strategies for improving remedial math performance.

Circle your answer based on the following:
1= strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree.

1. The facilitator(s) had expert knowledge of the content presented.

   1 2 3 4 5

2. The facilitator(s) provided adequate opportunities for questions and discussion.

   1 2 3 4 5

3. Activities were relevant to my needs.

   1 2 3 4 5

4. The information presented was useful.

   1 2 3 4 5

5. Time allotted was adequate.

   1 2 3 4 5

6. The strengths of this workshop session were:
   _____
   _____
   _____

7. Suggestions for improvement:
   _____
   _____

Day 3: Professional Development Evaluation

Strategies for Improving Remedial Math Performance Please check the box that best corresponds to your answer.

1. Information from this professional development enables me to increase my knowledge of Self-Efficacy.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. "Strategies for Improving Remedial Math Performance" will assist in increasing my effectiveness as a remedial math teacher.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. I feel supported in my role as a professional.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. I have deepened my knowledge of current research, best practices, and utilization of contextualized methods to improve remedial math student performance.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. The Professional Development workshop aided in building collaborative relationships with key stakeholders in the community and school.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6. What did you take away from this workshop?
7. Final Comments/Thoughts.

Scenario cards.

Scenario Cards

Scenario #1: Unprepared Students

A group of your students do not complete homework assignments often and therefore contribute little to the class discussions. How would you handle this situation?

Scenario Cards

Scenario #2: Inattentive Students

A few students enjoy completing their homework assignments during class or frequently carry on their own conversation, which, at times annoys others. How would you handle this situation?

Scenario Cards

Scenario #3: Reluctant Students

Student comes to class, sits in the back of the class near the door, rarely speaks to classmates, and has yet to ask or share information in class. How would you handle this situation?

Scenario Cards

Scenario #4: Oppositional Students

Student seems to have a chip on his/her shoulder. His/her comments in class often sound either angry or hostile. Even his/her nonverbal behavior seems contentious. How would you handle this situation?

Math talk document.

Strategies for Improving Remedial Mathematics Performance Among Community College Students: An Intrinsic Case Study

Data Analysis Results

Administrative Themes

Theme	Files	Refs
Improve teaching and learning	1	4
Partner with high schools to improve math	1	1
Add prerequisite classes to improve student success	1	1
Instill pride in the pedagogy and teaching skills	1	2
Improve student success by reducing fear of the material	3	4

Administration Perspectives

Administration perspectives	Themes from administration	Files	Refs
Improvement, teaching, and pedagogy		1	4
Partnerships with high schools to improve math		1	1
Prerequisite class and teaching method for success		1	1
Teacher training and pedagogy		1	2
Reasons for defeat by the course – fear of the material		3	4

Instructor Perspectives

Instructor perspectives	Themes from instructors	Files	Refs
Benefits of remedial math		4	5
Opinion towards low-performance levels		4	7
Purpose of the class		1	1
Lack of math foundations		3	4
Reasons for low performance		0	0
Students do not work hard		3	4
Suggestions for improvements		4	10
Incentives		2	2
Make math more fun		1	1
More time		3	5
Technology		2	2
Not a math person		6	7

Student Perspectives

Student perspectives	Themes from students	Files	Refs
Class setup		11	14
Previous high school and remedial math experience		14	36
Lack of teacher engagement		6	7
Race and education		13	13
Student perspective on assistance needed		10	10
Refresher		1	1
Student discipline issue (not caring)		4	4
Student perspectives about low performance		15	18
Low scores not surprising		7	7
Students don’t try		13	15
Low scores surprising		7	7
Student perspectives on the purpose of the class		15	15
Refresher		1	1
College-level preparedness		11	11
Student perspectives on the effectiveness of the class		14	16
Not effective		3	3
Effective, good teaching		4	4
Student perspective on the value of the class		14	18
More time to learn		1	1
Refresher		1	1
Skills and habits		1	1
Teacher		10	11
Tutoring		2	2
Student suggestions for improvements		15	26
Improve individual assistance		4	4
Need for innovative techniques		1	1
More group work		3	3
More time (or different time)		2	2
No suggestions		2	2
Smaller classes		1	1
Student engagement		9	10

Based on the research question, the final discussion focused on the overlapping responses from all three groups of respondents relating to the three major themes which frame this study. Through data analysis of all the answers collected from the participants, the following three themes emerged:

4. Purpose, value, and effectiveness of the remedial class.
5. Opinions about performance levels and significant obstacles to learning.
6. Suggestions for improvements in remedial math.

Table 5 represents all main themes and subthemes, as discussed in this section, related to each separate group of participants:

Themes and Subthemes by Participants

Students	Instructors	Administrators
High school experience college preparedness.	Purpose and value of remedial class.	Purpose and value of remedial class.
Purpose and value of remedial class.	Performance levels and major obstacles to learning	Performance levels and major obstacles to learning
Opinions about performance levels and obstacles to learning	Suggestions for improvements	Suggestions for improvements
Suggestions for improvements		

Appendix B: Student Interview Protocol

Preliminary Matters

Good day, my name is [redacted], and I am the researcher for this study. Thank you for taking the time to participate in this interview.

[Participant response]

I am now going to turn on the audio-recorder.

[Participant response and recorder is switched on]

Thank you. Please state your name, for what remedial math course you are registered, and confirmation that you are in your last semester of this course.

[Participant response]

Thank you. Please provide confirmation that you have read, understood, signed, and returned the informed consent form I mailed to you previously.

[Participant response]

Thank you. Do you have any questions or concerns before we begin the interview?

[Participant response and issues addressed]

Please remember that your participation is voluntary and that you can ask to pause, postpone, or discontinue the interview and your participation in the study as a whole at any time.

[Participant response]

I will now commence with the interview.

Interview Begins

1. Please supply the following demographic details:
   a. Which high school did you attend?
   b. What grade did you achieve for math in high school?
   c. What was the highest math course you took in high school?
   d. Do you receive financial aid—either through scholarships or through financial assistance from family or some other form of support?
   e. Do you work full-time?

   f. What is your parent(s) educational background? (i.e., what was the highest education level that your parent(s) attained?)
   g. Why did you choose to go to JMCC?
   h. How would you describe your ethnic background?
   i. How, do you believe, your ethnic and/or socioeconomic standing might have influenced your need for remedial math assistance?

2. Why do you need remedial math assistance?

3. What is the purpose of the particular remedial course for which you are registered?
   a. Why do you need the specific offerings found within this course, rather than other remedial course offerings presented at JMCC?

4. What aspects of the course do you perceive as having provided you with the most value over the time you have studied?
   a. Why?
5. What aspects of the course do you feel did not really benefit you, or that you think need improvement?
   a. Why?

6. Overall, how has your experience been in relation to your remedial course? You can talk about anything you experienced – course material, instruction, assignment timeframes, anything.

7. Based on what you just said, have you found your remedial math course effective in improving your math ability and math-related academic outcomes? Why or why not?
   a. What about your general academic outcomes? Has the course helped you with these? Why or why not?

8. Research indicates that students registered and participating in remedial math courses tend to report lower performance levels in these courses than other students.
   a. Do these findings surprise you? Why or why not?
   b. Based on your experience, do you think such low-performance levels are reflected in the offered JMCC courses? Why or why not?

c. Why do you think students report such low levels of performance in remedial math courses?

9. Do you have any suggestions as to how JMCC and its remedial math course designers and instructors might assist in improving remedial math students' low-performance levels? Please be specific.

10. Do you have any recommendations on how you and your fellow remedial math peers might work to improve performance levels? Perhaps through better course engagement, better motivation, and self-regulation, or any other aspects? Please be specific.

11. Do you have any additional suggestions for ways of improving remedial math students' performance in such courses? Please be specific.

12. Are there any other aspects, suggestions, or issues you would like to address or highlight regarding your specific remedial math course and your experience thereof, which have not yet been covered?

13. Are there any additional things related to remedial math courses in general that you would like to discuss, which have not already been addressed?

Interview Ends

Thank you again for your time. I will transcribe this interview and send it back to you for review in the next two or three days. You have my contact details, should you have any queries or concerns. You can also contact me in the event that you decide to withdraw from the study. Please confirm that you understand and accept what I have just said.

[Participant response]

I will now turn off the audio-recorder.

[Recorder is switched off]

Appendix C: Instructor Interview Protocol

Preliminary Matters

Good day, my name is [redacted], and I am the researcher for this study. Thank you for taking the time to participate in this interview.

[Participant response]

I am now going to turn on the audio-recorder.

[Participant response and recorder is switched on]

Thank you. Please state your name, how many years you have held your current position, and the remedial course/courses for which you are responsible.

[Participant response]

Thank you. Please elaborate on the kinds of teacher training (if any) you have received in relation to your work as a remedial math instructor.

[Participant response]

Thank you. Please provide confirmation that you have read, understood, signed, and returned the informed consent form I mailed to you previously.

[Participant response]

Thank you. Do you have any questions or concerns before we begin the interview?

[Participant response and issues addressed]

Please remember that your participation is voluntary and that you can ask to pause, postpone, or discontinue the interview and your participation in the study as a whole at any time.

[Participant response]

I will now commence with the interview.

Interview Begins

1. What are your specific responsibilities related to the remedial math course(s) you mentioned previously?

2. Since you have worked in the remedial math department at JMCC, what has your experience been of your specific course(s)? You can talk about anything—how the course has developed over the years, the kinds of students who need intervention, the kinds of problems students face, anything.

3. What has your experience been regarding remedial math intervention in general at the college? Again, feel free to elaborate on any desired areas/concerns.

4. Based on what you have just said, overall, do you think that remedial math programs, both generally and in terms of your own course(s), are beneficial to students? Why or why not?

5. Have there been any changes regarding math remediation course curricula over the years? [Depending on participant's response, ask either questions a) and b) OR i) and ii)]
    a. If so, what were they?
    b. Do you think these changes have benefited students, teachers, and the program(s)? Why or why not?
        i. If not, why do you think nothing has changed regarding the curricula?
        ii. Do you think keeping the curricula the same has benefited students, teachers, and the program(s)? Why or why not?

6. Research indicates that students registered and participating in remedial math courses tend to report lower performance levels in these courses than other students.
    a. Do these findings surprise you? Why or why not?
    b. Based on your experience, do you think such low-performance levels are reflected in the offered JMCC courses? Why or why not?
    c. Why do you think students report such low levels of performance in remedial math courses?

7. Do you have any suggestions for ways in which you and other instructors and administrators could assist in improving these low remedial math performance levels? Please be specific.

8. Do you have any recommendations for how students themselves might better engage with remedial math course offerings, or in some other way improve their own performance levels?

9. Do you have any additional suggestions for ways of improving remedial math students' performance in such courses that have not yet been covered? Please be specific.

10. Are there any other aspects, suggestions, or issues you would like to address or highlight regarding your specific remedial math course(s) and your experience thereof, which have not yet been addressed?

11. Are there any additional things related to remedial math courses in general, or the roles of instructors and administrators, that you would like to discuss and with which we have not yet dealt?

Interview Ends

Thank you again for your time. I will transcribe this interview and send it back to you for review in the next two or three days. You have my contact details, should you have any queries or concerns. You can also contact me in the event that you decide to withdraw from the study. Please confirm that you understand and accept what I have just said.

[Participant response]

I will now turn off the audio-recorder.

[Recorder is switched off]

Appendix D: Administrator Interview Protocol

Preliminary Matters

Good day, my name is [redacted], and I am the researcher for this study. Thank you for taking the time to participate in this interview.

[Participant response]

I am now going to turn on the audio-recorder.

[Participant response and recorder is switched on]

Thank you. Please state your name, how many years you have held your current position at JMCC.

[Participant response]

Thank you. Please provide confirmation that you have read, understood, signed, and returned the informed consent form I mailed to you previously.

[Participant response]

Thank you. Do you have any questions or concerns before we begin the interview?

[Participant response and issues addressed]

Please remember that your participation is voluntary and that you can ask to pause, postpone, or discontinue the interview and your participation in the study as a whole at any time.

[Participant response]

I will now commence with the interview.

Questions

1. What are your specific responsibilities related to the remedial math course(s) offered at JMCC?
2. Since you have worked in administering the remedial math department at JMCC, what has your experience been of the programs offered? You can talk about anything—how the course has developed over the years, the kinds of students who need intervention, the kinds of problems students face, anything.
3. Please could you describe why and how you believe students have or have not benefited from the remedial math course offerings at JMCC.

   a. How might the course designs, scheduling, costs, or so forth impact such benefit or lack thereof?
4. Have there been any changes in the course offerings and/or structures over the years, particularly in terms of how the courses are managed and costs are structured? [Depending on participant's response, ask either questions a) and b) OR i) and ii)]
   a. If so, what were they?
   b. Do you think these changes have benefited students, teachers, and the program(s)? Why or why not?
      i. If not, why do you think nothing has changed regarding the remedial math courses?
5. Do you have any suggestions for ways in which you and other administrators could assist in improving low remedial math performance levels? Please be specific.
6. Do you have any additional suggestions for ways of improving remedial math programs that have not yet been covered? Please be specific.
7. Are there any other aspects, suggestions, or issues you would like to address or highlight regarding your specific remedial math course(s) and your experience thereof, which have not yet been addressed?

Interview Ends

Thank you again for your time. I will transcribe this interview and send it back to you for review in the next two or three days. You have my contact details, should you have any queries or concerns. You can also contact me in the event that you decide to withdraw from the study. Please confirm that you understand and accept what I have just said.

[Participant response]

I will now turn off the audio-recorder.

[Recorder is switched off]

Appendix E: Participation Email

To whom it may concern

My name is [redacted]. I am a doctoral student, currently working toward attaining my Doctorate in Education at Walden University. As part of my degree-attainment requirements, I am conducting a qualitative case study to explore the perceptions of community college instructors, administrators, and students regarding the causes of low student performance in remedial mathematics.

I am, therefore, seeking your participation in my study. Should you be interested in participating, or require further information regarding my study, please feel free to email me by replying to this email. Your assistance in this regard would be much appreciated.

Yours sincerely

[redacted]