Math Developmental Education Practices in the Alabama Community College System: Fall 2012 to Summer 2022

By

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Abstract

In the United States, students often graduate from high school unprepared to succeed in college. In Alabama, fewer than 25% of high school graduates are college ready. Frequently, unprepared students enroll in community colleges, which are tasked to help them transfer to a four-year institution or to enter the workforce. However, students who need math developmental coursework are less likely to take and complete college level coursework, to graduate or transfer, or to gain good employment. Many community colleges offer interventions to help unprepared students. They made placement decisions and structured developmental course sequences to maximize the likelihood that students would quickly complete the course of remediation. They also provided interventions such as tutoring, learning communities, and adaptive software. Previous research found that interventions had some positive effect on student success. The goal of this study was to determine what interventions have been tried at 21 Alabama community colleges and learn the impact on student success related to passage of the first developmental math course, the likelihood that a college level math course would be taken within two years, and passage of that subsequent college level course. Mostly, the results did not support previous research. The only intervention that was found to help students succeed at developmental math was mandatory tutoring. Using non-cognitive factors to aid in student placement had mixed effects with some students achieving higher pass rates in developmental courses and some students achieving lower pass rates. Streamlining students into shorter developmental sequences did not contribute to the likelihood that students would take a college level math course. No other intervention was linked to an increased likelihood that students would take a college level math course or pass a college level math course.

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Chapter 1 – Introduction

Problem Statement

United States' public two-year community colleges are critical for serving communities, providing flexible workforce training and general education instruction (Grubbs, 2020). Community colleges offer higher education to students who otherwise would not have such opportunities. Once these underserved students matriculate in community college, they face additional barriers that four-year college students rarely experience. Since many community colleges are "open access," students do not need to demonstrate that they are prepared for the rigors of college instruction. This helps to democratize higher education, but also means that less academically prepared students arrive on the community college doorstep. This is especially true in mathematics, which is coursework required in almost all postsecondary programs of study.

Remediation, or the need for students to take courses that are not college level to expose them to concepts they will need to know to succeed in college level courses, is recognized as being a significant reason that students fail to complete college. Community colleges have traditionally required underprepared students to take one to three developmental level non-credit bearing courses, thus adding expense and time that risks derailing progress. Efforts have been made across the U.S. to reduce the remediation barrier. Alabama Community Colleges similarly have undertaken different interventions to help students navigate the developmental education path. Unfortunately, the twenty-four institutions within the Alabama Community College System have not applied consistent treatments to reduce the developmental education burden on underprepared students, and extensive research has not been conducted to determine what treatments have been efficacious. Therefore, it would be of value to learn what efforts Alabama

Community Colleges have applied over the years and to compare that information with student outcome data to help craft a better understanding of interventions that have been most helpful.

Conceptual Framework

Pedagogy

As Alex Moore explains, Piaget understood that learners do not passively receive information, but that they participate actively in the teaching and learning process. Vygotsky's took this one step further, though, in positing that education occurs in a dynamic social environment. This moves the focus to how teaching and learning happens. This, essentially, is pedagogy (Moore, 2003). The word pedagogy is derived from the Greek words pais (child) and ago (to teach), and a strict interpretation means that pedagogy is the practice of teaching children (Mohring, 1989). Historically, the basic idea of pedagogy has been how knowledge is transmitted to the learner, and most teaching and learning research before the middle of the twentieth century was done using children (Holmes & Abbington-Cooper, 2000). As Holmes and Abbington-Cooper (2000) explained, pedagogy involves the teacher deciding the material to be taught, organizing it for logical transmittal in advance of the class, and determining how it can best be taught.

Andragogy

Edward Thorndike realized that transmission of information was more effective if what is being taught could be applicable to what students would experience in their real lives, emphasizing skills that would be needed in adulthood (Strom & Strom, 2014). Also, starting about in the 1950s, adult educators began to recognize that the behaviorist pedagogical approach to learning was not sufficient to characterize that process in adults (Merriam, 2001). When adults are the learners, a more constructivist approach to teaching may be warranted.

Andragogy, the theory of teaching adults, takes into consideration the vast body of experience that the learner brings into the educational environment and seeks engage through practical connections between new material and those experiences (Burduniuc, 2006). Malcom Knowles (Knowles et al., 2005) emphasized that the theory of andragogy does not address the outcomes of education, but instead focuses on the activity of adult learning. Therefore, it is centered on the learner and consists of principles that characterize all educational situations involving adult learners. According to Knowles et al. (2005). These principles include:

1) The need to know – adult learners need to know why they should learn about something. Adults become most aware that they need to know when they discover gaps in what they know based off of previous experiences and what they do not yet know.
2) The learner's self-concept – adults psychologically want to feel independent and that they are directing their own course. They do not thrive in environments when they are passive recipients in the teaching-learning process. In fact, it can be detrimental to the will to learn if they perceive that they are fully dependent on a teacher to learn new information.
3) The role of learners' experiences – adult learners have a much wider array of experiences that they bring into the learning environment than do youth learners. This means that they are more heterogeneous, thus needing individualized learning centered instruction. Individualization is also important because in that great body of experiences lies pre-conceived biases that need to be addressed on a personalized level. An additional benefit brought by adult learners' experiences is that they can share the knowledge that they gained as a resource for other adult learners. Last, adults often see their experiences as core to their identities; therefore, an acknowledgement of their experiences is an acknowledgement of their human value.

4) Readiness to learn – adult learners are often compelled to become better educated through the situations that they face. They do not have to have developmental milestones that prime them to be ready to learn. They come into the learning environment ready to gain new, valuable information.
5) Orientation to learning – adult learners are oriented to apply learning to real-life situations. Instead of being oriented to learning externally mandated subjects, they are prepared to learn new material that will help them better cope with things that they are facing in their daily life.
6) Motivation – adult learners are often intrinsically motivated. Although there are some external factors that drive an adult desire to learn (such as a salary increase, for example), there are many internal reasons why an adult may seek additional education. Some of these reasons include self-esteem, satisfaction with peak performance, and the natural inclination for continued growth.

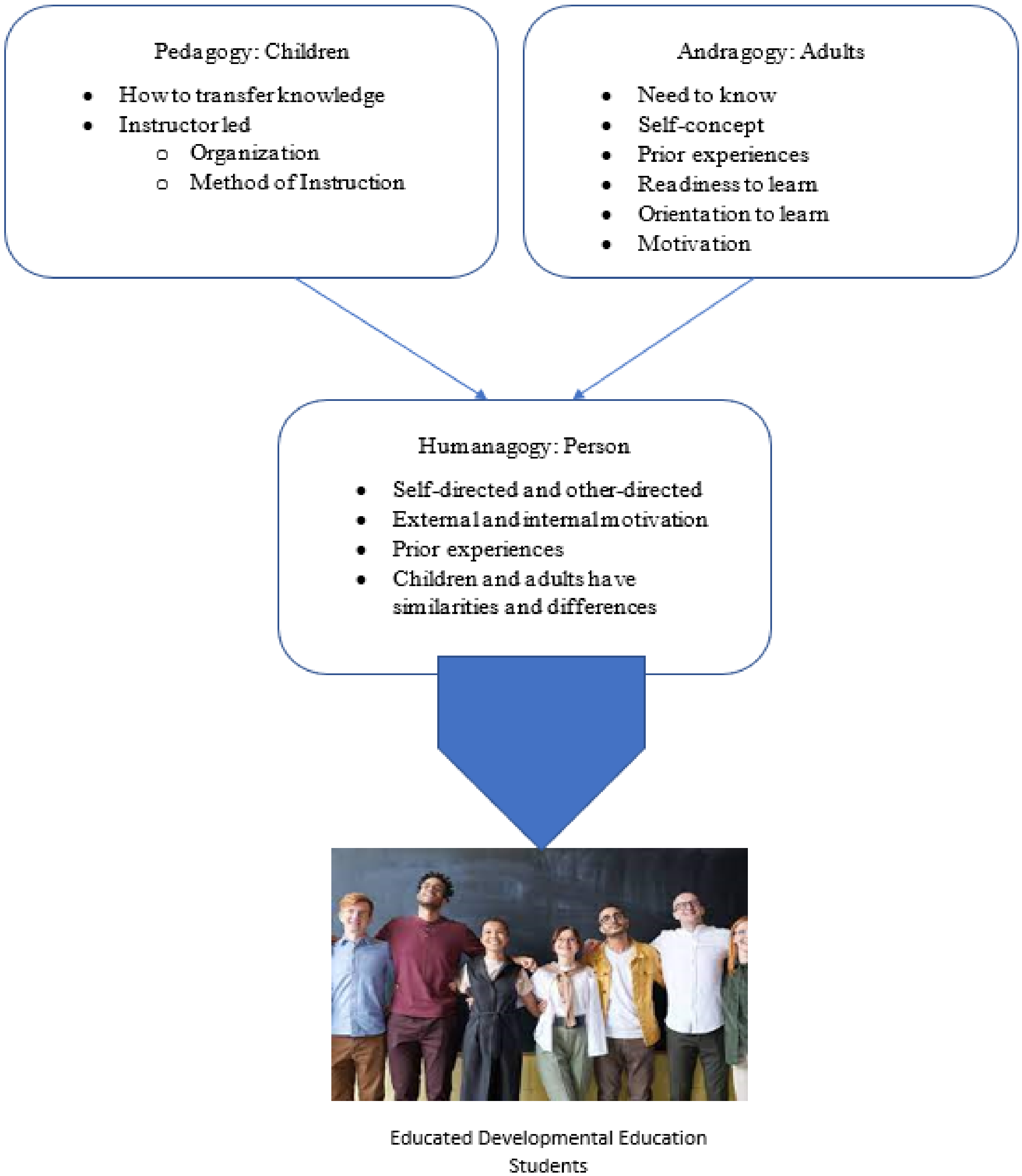
Humanagogy

Merriam (2001) explained that a criticism of androgogy is that it does not explain all adult learning or characterize all adult learners. Also, some of the tenets of andragogy describe child learning. For example, some adult learners are less self-directed and, instead, rely more on the input of the teacher similar to the way children learn. On the other hand, children are not always or completely extrinsically motivated. McKeachie (2002) explained that college students may be either extrinsically or intrinsically motivated. Some students experience pleasure from learning and are motivated to continue through their college matriculation. College students are also extrinsically motived to get good grades or simply pass a class. They also may be seeking the approval of parents, teachers, and friends and family. Thus, the education of developmental education students might best rely on concepts related to both andragogy and pedagogy. In some ways, there is little intrinsic motivation for these students to succeed at remedial math. As Strowbridge noted (1987), developmental education students often do not value learning to do math personally or for their working lives. Their marked underperformance on math tasks may indicate that they have prior bad math experiences. Still, Jaggers and Bickerstaff (2018) explain that developmental students need contextualized instruction; for instance, the developmental class could be paired with another course that is more relevant to the student's goals. The faculty of both classes could work together to provide an experience that contextualizes the math material, a more andragogical approach.

An approach to learning that takes into account the impetus for why learning occurs, previous learner experiences, and the learner's need for more or less directed instruction has been termed "humanagogy," explain Peterson and Ray (2013). Knudson (1979) argued that humanagogy does not deal with factions of individuals (such as children, adults, the elderly), but instead incorporates the consideration of differences and similarities of people of different ages. He explains that what adherents of andragogy consider adults used to be children and what pedagogical educators consider children will become adults, and so a theory that pertains to the entirety of the species might be a useful way to think about learning. Thus, the body of experience that the student brings to the learning environment is a crucial component. Components of pedagogical theory are important even when adults are the learners, since, as Knudson (1979) explains, the adult brings memories and emotions about the experiences that they had with education from when they were a child. Therefore, they may retain ways of behaving that were operational when they were children. Adults still have different motivations and experiences than child learners, though. That is why educators should also consider elements of andragogy. Humanagogy, theoretically, brings together andragogy and pedagogy to address the whole human as they were when they were a child and how they are as an adult. Figure 1 illustrates how principles of pedagogy and andragogy contribute to addressing the needs of educating people no matter their age or where they are in their educational development.

Figure 1

Principles of Pedagogy and Andragogy and Education of The Whole Person



Educating Developmental Education Students

It is important to consider the characteristics of developmental education students when determining best ways to educate them. First, at two-year institutions, these students are not "typical" college students. An expansive study by the National Center for Educational Statistics examined characteristics of students who started at a two-year college in the 2003-2004 academic year (Chen, 2016). First many of the developmental students were adults. Findings showed that almost $3/4^{ths}$ of beginning 20- to 23-year-olds took remedial courses in any field. So, maturationally, they are adults. The coursework that they are being required to take, though, is coursework usually encountered by younger individuals, such as adolescents in the k-12 system. Also, the coursework may not be directly relevant to what they will need to master to achieve their goal of transferring to a four-year college or graduating to enter a career. Instructors would do well to think about what motivates their students and how they can apply principles of andragogy and pedagogy to inspire successful performance. Students may need additional extrinsic motivators to keep them moving forward since, intrinsically, they are probably not primed to learn new material because of how it applies to their lives or experiences. Educators need to adopt innovative pedagogical practices to help students find meaning in their experiences.

Also, many developmental education students come from challenging backgrounds. Chen (2016) presented data that showed that almost 70% of beginning developmental education students had parents who had attained a high school degree or less as their highest educational attainment and over 3/4ths had incomes in the lowest quartile. These students may need extracurricular support, such as intense advising to help them navigate the college an developmental education landscape. Because they are adults, they may be inclined to be self-directed learners. They may not have the skill set needed to do this, though, and it might be beneficial if an infrastructure was in place to provide them assistance. There are special challenges that developmental educations face related to the cost of their education. Typically, developmental education courses are not credit bearing, so students have to pay for something in which they perceive little value. This, in addition to previous bad experiences with the subject matter (after all, they were unsuccessful in mastering high school level material) could be demotivating factors that educators will need to overcome. Perhaps the methods that they use to transfer the knowledge to students need to be adapted to this special population.

Research Questions

This research is designed to answer four broad questions.

1) What are the most common interventions (i.e., course structuring and academic supports) that have been used at Alabama Community Colleges any time from the Fall 2012 term to the Summer 2022 term related to developmental math education?

2a) How are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2022 related to student success (as defined by passing with an A, B, or C) in the first developmental math course taken within one year from high school graduation?

2b) How do these outcomes differ among students of different gender, race, or socio-economic status?

3a) How are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2022 related to student persistence to a college level math course within two years of attempting a developmental math course?

3b) How do these outcomes differ among students of different gender, race, or socio-economic status?

4a) How are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2023 related to student success (as defined by passing with an A, B, or C) in the first college level math course taken after successful completion (as defined by passing with an A, B, or C) of the first developmental math course?

4b) How do these outcomes differ among students of different gender, race, or socio-economic status?

Significance of the Study

This study should reveal the myriad of procedures and interventions that Alabama Community Colleges have implemented to help students succeed in math classes. Being able to survey personnel at all colleges will provide the opportunity to recognize how services are layered and work in tandem. Also, this study is important to offer guidance to State leaders who are charged with making decisions about what policies and procedures need to be mandated. The results will add to the body of knowledge shared by educational organizations, such as the Community College Research Center, who work with educators and governmental offices to drive change around developmental education. And, as such change happens, students will benefit and society will benefit, since more students will complete college and have a bigger impact in the workforce.

Definition of Terms

Developmental/Remedial Education

While many researchers, teachers, and postsecondary educators use the terms "remediation" and "developmental education" interchangeably, they have different meanings (Boylan et al., 2017). Remedial courses are only one component of developmental education; developmental education is more holistic, and includes consideration of environmental factors, issues of inequity, and attitudes about and value of education. This is an important distinction, because attention to factors involved in remedial instruction in an effort to move the needle on retention or completion might meet with less success than anticipated. Attention to variables that contribute to a student needing developmental education might be a more meaningful way to improve student outcomes. In a recognition that colleges usually try different, non-isolated interventions to help students over the duration of their matriculation, this paper will focus on approaches designed to move students through remedial courses into college level courses, and the terminology remediation and developmental education will be considered synonymous.

Gateway Courses

Gateway courses are those that are introductory at the college level. They are the first credit-bearing courses that many students will face during their college matriculation. Often these courses are required for degree programs, and so all students seeking a degree in that discipline will likely have to take the course (Kwak, 2020). An analysis by Clery (2011) investigated gateway course attempts by college students within their first three years of enrollment. Only 28% of students attempted a gateway math course at least once. Black Non-Hispanic students and those older than 30 were less likely to attempt a college gateway math course (24% and 15%, respectively). Also, only 25% of students placed in a developmental math course attempted at least one gateway math course. Since so few students attempt gateway coursework, it is considered to be an important milestone for student progression and completion (Clery, 2011). According to Kwak (2020), students who struggle to pass gateway coursework may pass crucial knowledge to succeed in their course of study.

Gender

The U. S. government refers the terms “men” and “women” to describe gender of college students (National Center for Educational Statistics [NCES], 2022a; NCES, 2022b; NCES 2022c; NCES 2022d; NCES 2022e) or the terms “male” and “female” are used (NCES Integrated Postsecondary Data System [IPEDS] Technical Review Panel [TRP], n. d.). While there is significant attention being paid to the topic of defining gender at the federal level (for example, see IPEDS Technical Review Panel #51, 2016; Mitchell, 2022; and Morgan et al., 2020) the extensive public commentary collected by the Office of Information and Regulatory Affairs related to proposed changes to IPEDS survey components (n. d.), the IPEDS TPR (n. d.) considered factors such as privacy needs, concerns about using data for issues surrounding equity, and the administrative burden on reporting institutions depending on how sex and gender is described and defined. The group decided that institutions should continue to report gender using the terms “male” and “female” (and “men” and “women”). Those terms will be used to connote gender in this narrative.

Race

Immediately upon ratification of the United States Constitution, the nation began a long struggle with how to accurately define race and ethnicity (Pratt et al., 2015). The responsibility for defining race lies with the Office of Management and Budget (OMB), an agency that formally adopted a directive titled “Race and Ethnic Standards for Federal Statistics and Administrative Reporting” in May of 1977 (Centers for Disease Control and Prevention, 2019). This directive set forth five basic racial/ethnic categories, including American Indian or Alaskan Native, Asian or Pacific Islander, Black, Hispanic, and White. Guidance recommended aggregation of data as most appropriate for the purpose of the analysis or the evaluation, including combining “Whites” in with all other races except a minority race if the minority race is the focus of the investigation. Concern had grown, especially following the 1990 Census data collection, that the definitions that were being used were not sufficiently comprehensive and descriptive to characterize the diversity of populations of people (The White House, 1997). In 1997, the OMB updated the race/ethnicity directive to distinguish the ethnic category of “Hispanic or Latino.” They also changed the name of the “Black” category to “Black or African American.” The agency retained their guidance on the aggregation of data if that is most appropriate for the analysis or presentation being done. For the purposes of this research, the population of “Black or African American” students will be distinguished from all other race/ethnicities. This is consistent with how educational data is report to the National Center for Educational Statistics

Socio-economic Need

Pell grant awards can indicate socio-economic need of college students. According to the U. S. Department of Education (n.d.), federal Pell grants are awarded to students who exhibit significant financial need, based on answers that they provide on the Free Application for Federal Student Financial Aid (FAFSA). In the decade between 2010-2011 to 2019-2020, a median percentage of 35.6 of public two-year college students in the United States received Pell funding (National Center for Education Statistics, n.d.). Pell grant eligibility is a good proxy for socio-economic status, because 89% go to students with family earnings of less than $50,000 per year with more than half of that (51%) going to families that earn less than $20,000 per year (Hanson, 2021).

Chapter 2 – Literature Review

Introduction

The purpose of this chapter is to provide a review of literature relevant to this study. First, a discussion will explore the importance of college and workforce training, followed by a narrative explaining the problem of mathematics under-preparedness overall and specifically in Alabama. The chapter will continue with details of research related to interventions that have been implemented at colleges to help remediate students and will end with an accounting of interventions that have been developed to help students at Alabama Community Colleges.

Importance of College and Workforce Training

In 2009, the federal government recognized the need of increased postsecondary education and advanced training to develop a globally competitive workforce (Pell, 2011). Evidence from the economic recovery that followed the 2008 great recession indicates that lingering unemployment and a slow recovery could be linked to having a populace that is not educated or trained to fill available jobs (Matthews, 2012). In 2009, to enhance the economic recovery, President Barack Obama urged all Americans to commit to attending college or career training for at least one year. He asserted that by 2020 the United States would have the largest proportion of citizens who graduated college in the world (Obama, 2009). To achieve the President's goal, Martha Kanter, the Under Secretary of Education in the Obama Administration explained, would require graduating an additional 12 million college students by 2020. Frank Chong, the Deputy Assistant Secretary, said that over 5 million of those students needed to graduate from community colleges (Kanter et al., 2011). There is an enormous segment of the population who have the potential to gain postsecondary education (USCB, 2019). According to the United States Census Bureau (USCB, 2019), approximately 36.11% of the U.S. population over age 25 had not completed any college education, although almost 44 million have attained either a high school diploma, a GED, or an alternative high school credential There is an enormous opportunity to make college accessible to the over 61 million people without postsecondary experience (USCB, 2019).

Not only is a better educated populace important nationally and internationally, but individuals also reap benefits from higher educational attainment (Snyder et al., 2019). Individuals with higher degrees comprise the bulk of the workforce. In the United States in 2017, about 52% of everyone over 25 who was employed had a postsecondary degree (associate's or higher), while fewer than one in ten (7%) had not graduated from high school (Snyder et al., 2019). In that same year, the unemployment rate of U.S. civilians aged 25 to 64 who had less than a college education was 11.3, compared to an unemployment rate of 8.5 for individuals with some college (but less than associate's degree) and a rate of 5.0 for people who earned an associate's degree (Snyder et al., 2019).

Data from 2014 showed that, across several states, women who earned an associate degree from a community college earned approximately $1,790.00 more each fiscal quarter than women who did not complete a degree (Belfield & Bailey, 2017). Men who received an associate degree earned about $1,160.00 more than men who did not (Belfield & Bailey, 2017). Further, associate degrees related to vocational fields resulted in higher earnings than associate degrees intended to facilitate transfer to four-year colleges. Completion of certificate programs also proved to be fiscally beneficial; females who earned a certificate earned about $740.00 more each quarter than female non completers, while men completers earned about $530.00 more per quarter (Belfield & Bailey, 2017).

Sub-associate level awards, which are typically certificate degrees conferred by community colleges, consist of anywhere from nine to fifty-nine credit hours of instruction. There is some evidence that certificates that require relatively more credit hours to complete provide a greater economic boost than those requiring fewer credit hours (Dadgar & Weiss, 2012; Jepsen et al., 2014). Jaggars and Xu (2016) agreed that, while that trend is generally true, earnings vary greatly depending on the field of study. For long certificate earners, fields such as construction, mechanics, and health care led to higher earnings over time while fields such as education led to flat earnings over time. For earners of shorter certificates, those in humanities and social science programs were more likely than others to earn more over time.

There is evidence that national efforts to increase rates of postsecondary education are working, according to the Organisation for Economic Co-operation and Development (OECD, 2020, OECD). In 2009, the U.S. was ranked 14th among OECD countries and partners in rates of 25- to 34- year-olds attaining postsecondary education. At that time, 41.06% had an education beyond the secondary level. In 2019, the U.S. ranking improved to number eleven and 50.38% of that age group attained higher education. There are some segments of the population that have not enjoyed improvement over time. For example, while both younger and older adults became better educated in the U.S., older U.S. citizens have lost some ground compared to national counterparts. In 2009, the U.S. had the second highest percent of adults aged 55 to 64 with an attained postsecondary education (40.84%), but by 2019, this U.S. age group was ranked fourth (43.37%). In the second decade of the twenty-first century, Canada and Japan joined Israel in boasting a higher educational attainment rate among older adults (OECD, 2021).

Mathematics Under Preparedness

There have been may variables identified among students who start a postsecondary education but who fail to complete college. The effects of having to take developmental math is deleterious (for example, see Bailey et al, 2015; Bohling et al, 2018; and Logue et al., 2016). Studies by the Community College Research Center have shown that at least 30% of students who had to enroll in at least one developmental math course did not complete their remedial courses within three years. More concerning, only about half of those students completed their first college level math course (Bailey et al., 2015). Only ten percent of students who enter needing remediation ever graduate within three years (Logue et al., 2016). Bohlig, et.al. (2018) found more positive, but still concerning, outcomes among students who took remedial math. Only 20.1% of the most underprepared students and 29.9% of the least underprepared students (who still needed remediation) graduated from college, compared to 42.7% of the those who did not need remediation.

Most U.S. high school graduates are not prepared to pass a gateway math course even though they will be required to take one if they enroll in college. Even some students who graduate from high school with high GPAs need remedial instruction. For example, in 2014, 40% of students with a reported high school GPA of 'A' had to take at least one developmental education course (Center for Community College Student Engagement, 2016). The extent of the problem of under preparedness is revealed by scores of twelfth graders on the National Assessment of Educational Progress (NAEP) test, which has content more advanced than what is typically taught in three standard high school math courses and which is foundational for college math, thereby providing predictive strength for how prepared students are for post-secondary math content (National Center for Education Statistics [NCES], 2016). For the 2019 administration, 63% of twelfth graders scored below the level indicative of college preparedness on the NAEP mathematics examination, while a 40% scored below the cut-off for basic performance (which is the lowest defined level of performance for the test) than in any years since 2005 (NCES, 2019a).

Non-white students are often less prepared to succeed academically in college math than white students (Bohlig et al, 2018; NCES, 2019a). In 2019, on the NAEP, black students scored, on average, 22 points below the mean of all students (150 on a scale from 0 to 300), while Hispanic students scored 12 points lower and American Indian/Alaska Native students scored 14 points lower. Conversely, white students scored 9 points above the mean and Asian/Pacific Islanders scored 23 points higher (NCES, 2019a). Since 2005, the mean scores of Hispanic and Black students have remained below the cut-off for basic performance, while the same can be said of the performance for American Indian/Alaska Natives for both 2015 and 2019. This trend has resulted in a higher proportion of non-white students in remedial classes. An examination of data related to remedial course taking by students across the U.S. revealed that 63.05% of Black students and 51.9% Latino/Hispanic students took remedial math, while only 43.17% of White students did so (Bohlig et al., 2018).

Alabama Mathematics Under Preparedness

High School Student Proficiency

Twelfth grade participation in the NAEP is optional for states, and Alabama opts out of the testing. Instead, proficiency is determined by ACT test performance among public school eleventh graders. According to the Alabama State Department of Education (Alabama Achieves, 2023), student proficiency is divided into four “achievement levels.” Level 1 indicates that a student did not meet grade level standards, level 2 indicates that grade level standards were partially met, level 3 indicates that the student met the grade level standards, and level 4 indicates work that exceeds grade level standards. Only levels 3 and 4 are considered proficient. In 2022, only 23.55% of the student body of eleventh graders who were tested were deemed proficient in math. Table 1 shows the proficiency of sub-populations of students.

Table 1

Alabama Public School Student Proficiency Levels

Population	Proficient	Level 4
Males	24.53	8.95
Black	7.00	1.16
White	32.00	11.96
Other/Unknown (Median of the Mean)	17.15	5.53
Females	22.58	6.63
Black	8.23	1.19
White	29.55	8.90
Other/Unknown (Median of the Mean)	19.85	3.21
Hispanic/Latino	13.70	2.76
Total	23.55	7.79

High School Student College-Readiness

According to the Alabama State Department of Education (Alabama Achieves, 2023) students are considered to be college ready if they score a 22 on the Math portion of the ACT. The Public Affairs Research Council of Alabama (Spencer, 2022) compiles ACT trend data and provides comparisons with other states. The class of 2021 achieved an average score of 17.98 on the ACT math subtest. Table 2 provides scores of subpopulations of students.

Table 2

Average Alabama Public School Student ACT Math Scores

Population	Average Score
Gender	
Males	18.06
Females	17.90
Race	
Black	15.79
White	19.09
Other/Unknown (Median)	18.56
Hispanic/Latino	16.82
Economically Disadvantaged and Poverty	16.30
Total	17.98

Data made available from PARCA show that only 21.3% of all tested students were college ready in math and that only eight out of 362 (2.21%) schools had average scores indicating college-readiness (Spencer, 2022). Table 3 gives details about subpopulation college-readiness among all tested high school students, and Table 4 shows the number (and percent) of public schools that have average scores 22 or higher.

Table 3

Percent of Alabama Public School Students College Ready

Population	Average Score
Gender	
Males	22.1
Females	20.5
Race	
Black	5.9
White	29.2
Other/Unknown (Median)	26.2
Hispanic/Latino	12.6
Economically Disadvantaged and Poverty	8.9
Total	21.3

Table 4

Number (Percent) of Alabama Public High Schools with Average Scores at or Above College Ready

Population	Number (Percent)
Gender	
Males	8 (2.2%)
Females	5 (1.4%)
Race	
Black	1 (0.3%)
White	17 (4.7%)
Other/Unknown (Median)	5 (1.4%)
Hispanic/Latino	1 (0.3%)
Economically Disadvantaged and Poverty	2 (0.6%)
Total	8 (2.2%)

Interventions for Success

Pre-college

High School Remediation. Bailey et al. (2015) argue that too often secondary instruction is not aligned with post-secondary instruction. When the Common Core Standards were developed for high school instruction, there was little involvement by post-secondary instructors (Kamin, 2016). Kamin (2016) synthesizes study findings that reveal that students who progress through Common Core perceive math as unrelated rules that must be followed to correctly answer questions. This is remarkably different than college math faculty, who expect college students to think about math as a set of interrelated concepts and to comprehend how to do the work as well as why the work is being done. The lack of alignment between high school and college math instruction was sensed when longitudinal math course enrollments were investigated (Ngo & Velasquez, 2020). Among students who took Algebra 1 as their highest high school math class, only 7.07% placed into the equivalent of Algebra 2 or higher in college. Of students who took Algebra 1 as their last high school math course before entering college, only

8.51 started college math by taking Algebra 2 or higher. Almost half (48%) of students in college never took a college level math that was higher than the course they took in high school (Ngo & Velasquez, 2020).

The Southern Regional Education Board (SREB, 2015) states that community colleges have a large responsibility to coordinate with K-12 schools on working on barriers to student college readiness. The organization has advocated the implementation of 12th grade coursework to better prepare students to succeed in college classes. They also urge community colleges to share examples of work that will be required of students to demonstrate college success so high schools can incorporate that type of work into classes designed to close the knowledge gaps. In 2013, the SREB debuted a model math readiness course that includes instruction on competencies required in the Common Core and standards indicative of college readiness (Southern Regional Education Board, 2013). The course was developed with expert guidance from secondary educators, 2-year and 4-year postsecondary educators, system officials, and national experts. SREB readiness courses are "…built with rigor, innovative instructional strategies, and a concentration on contextual learning that departs from procedural memorization and focuses on engaging the students in a real-world context" (p. 3). As of 2019, among states that are a part of the SREB, nine require unprepared students to take high school courses to bring them up to readiness standards, six offer courses without requiring them, and only one does not offer such transitional courses (Southern Regional Education Board, 2020).

Some SREB states implemented initiatives to prepare high school students that did not rely on the model course. For example, Kentucky implemented a strategy called Targeted Interventions (TI) in 2010. Underprepared eleventh graders were identified by ACT test scores and were given additional educational supports and instruction to improve performance in areas of mathematics deficiency (Xu et al., 2021). The additional support was provided in school and extracurricular and often incorporated online educational resources designed to teach math content. Research showed that the intervention helped many students who were marginally underprepared (Xu et al., 2021). In fact, between 8% and 10% fewer marginal students who had experienced TI took developmental courses when they arrived at college. Students who went to a four-year college were 4% more likely to enroll in and pass a gateway math course in the first year. Similar positive outcomes were not observed with students who matriculated to two-year colleges (Xu et al., 2021).

Tennessee implemented an intervention (SAILS) where high school students in participating schools would be eligible to complete an online course in high school in a room staffed by teachers that was similar to the college developmental course. Kane et al., 2021 found that students who completed remediation during high school were more 29% more likely to take college math. Of those, though, only 13% passed the college math course. Enrollment in SAILS also changed the way math was perceived (Kane et al., 2018). Enrollment in the program led to a 16-point increase in how useful math was considered for a career, a 25-point increase in the perception of being prepared for college level math, and a 14-point increase in professed interest in math.

Bridge Programs. One way that colleges try to prepare students to enter college level instruction after graduation is to offer bridge programs that occur in the summer prior to college matriculation. The effects of such programs seem to be mixed. Lesik et al. (2015), studied a program called the Summer Institute, which was designed to help underprepared students with college level math by providing enhanced academic supports, such as instruction from proven teachers, work done in group settings, and extra content to be completed at home. They failed to find a significant difference in college math pass rates (defined as receiving a C- or higher) between program attendees and non-attendees, even when controlling for other variables, such as SAT scores. Kallison and Stader (2012) examined pre- and post- program math test scores at four community colleges. They found that there was no significant improvement because of program attendance.

Wathington et al. (2016) studied bridge programs hosted by Texas post-secondary institutions that offered accelerated intense remedial content instruction as well as some orientation to strategies to be a successful college student (such as accessing advising and peer academic counseling, understanding the financial implications of being in college, and being aware of college academic and support services). Students were given a stipend after they successfully completed the program so they would be less reliant on having to work while going to college. While bridge program completion did not have a significant effect on persistence or credit accumulation, it did significantly contribute to a higher percentage of students who passed gateway math courses (Wathington et al., 2016). Attendance in a bridge program may also help students start college coursework more quickly. Students at the Sumer Institute studied by Lesik et al. (2015) were more often placed directly into college classes upon enrollment, eliminating a lost semester taking developmental education.

Placement. Usually, when students enroll at a community college for the first time, they undergo assessments to determine if they must take a developmental level math course. Because outcomes are so much better for students who take fewer developmental level courses in a series, theorists and practitioners began looking for interventions to shorten the student path to get them enrolled in college level instruction more quickly (Edgecombe, 2011). As Bailey et al. (2015) explain, assessment designed to help students engage in the appropriate level of coursework might have the counter-intuitive effect of making student success less likely. In other words, the assessments are acting as a barrier for students to start their college education, thereby making it less probable that they will complete their college education. This is especially true when there are multiple levels of remedial education required of students. So, it is important that assessments are able to correctly predict what students can succeed at what level of class (whether developmental or college level). As Scott-Clayton (2012) explains, assessments that have a greater ability to discriminate which students can truly succeed reduce severe placement errors.

Placement Tests. Standardized tests exist to allow assessments of preparedness to be efficiently administered and to provide a consistent method of evaluation. These assessments have some ability to predict which students will pass, but also have predictive power about which students will demonstrate good performance (Hughes & Scott Clayton, 2011). In 2011, most public 2-year colleges reported using one of two tests, ACCUPLACER or Compass, which were specifically developed for placement assessment (Fields & Parsad, 2012). These tests do a pretty good job predicting student success, explaining about 13% in the variation in college level math grades, according to Scott-Clayton (2012). ACT, the developer of Compass, calculated pass rates in math courses for students assessed with the Pre-Algebra instrument and discovered that approximately 36% of students placed in Elementary Algebra earned an A or a B in an Elementary Algebra (Westrick & Allen, 2014). The College Board, the developer of ACCUPLACER, presented evidence that their ACCUPLACER tests correctly place most students in the appropriate math class (Mattern & Packman, 2009). About two-thirds (66.5%) of students placed using the college level Math test and who were placed in a college level course earned a B or higher, while over three-fourths (75.1%) earned a C or higher.

High school Information. There is evidence that the use of standardized test scores, on their own, is not the best method of predicting college level course success, though. Scott-Clayton et al. (2014) studied standardized placement testing and determined that there was a severe under-placement rate (defined as students predicted to earn a grade of A or B in a college level math course who were placed in a developmental level course) of 28.4% when the Compass was used and 14.3% when the ACCUPLACER was used. When placement decisions were made using high school GPA with the standardized test, the severe under-placement rates dropped to 24.5% for Compass and 10.7% for ACCUPLACER (Scott Clayton et al., 2014). ACT (Westrick & Allen, 2014) acknowledged that placement being determined by high school GPA and the standardized placement test score increased the predictive value. While the probability of success in Elementary Algebra among students tested with the Compass Algebra test was .65, the probability of success when the both high school GPA and the standardized test scored were used in together increased to .69.

Researchers have conducted analyses to determine what else might be used to place students more appropriately into the level of coursework that they can successfully accomplish. Woods et al. (2018) investigated how high school coursework predicted success in college level math courses. If a student took Algebra 2, advanced math, science honors, or AP science coursework then they would be more likely to pass their gateway math course, they found. Also, students who took two or more years of foreign language courses in high school were more likely to succeed in college math. The researchers used high school course taking behavior to create profiles of students most likely to succeed in college level math and learned that almost half (47.69%) of the students who took two years of foreign language courses as well as Algebra 2 passed college math, while almost four-fifths (79.10%) of those who took a constellation of honors courses, foreign language studies, advanced math, and advanced placement English and science passed college math. Woods et al. (2018) concluded that students with more advanced credit were more prepared to succeed in college math.

Non-cognitive Indicators. Beyond grades and test scores, many educators are convinced that there is an array of non-cognitive factors that help students be appropriately placed to succeed in their college coursework. For example, Komarraju et al. (2013) investigated the mediating effect that academic discipline (such as turning in assignments on time) had on college success (measured by college GPA). They found that ACT predicted about 13% of the variance in college GPA, while the addition of high school GPA predicted about 11% more of the variance. Using the standardized test score, the college GPA, and adding academic discipline improved the explanatory power by about 2%. All three predictor variables explained 26% of the college GPA variance. Academic discipline was not a mediating variable between high school GPA and college GPA, though, suggesting that there was a direct effect on college GPA from the non-cognitive factor of academic discipline (Komarraju et al. 2013). Ngo et al. (2018) found that perceived importance of math by students allowed more students who would otherwise be deemed unprepared to be placed in college level math. These students performed as well in that course as students who were considered cognitively prepared (measured by placement test, high school GPA, high school course taking behavior, or a combination).

Cullinan et al. (2018) suggested that the opportunity for student success would be enhanced if colleges used multiple tools to determine appropriate court placement. They recommend that institutions combine assessment of non-cognitive factors with the assessment of academic preparedness (using GPA or standardized tests, for example) and call such a strategy Multiple Measures. Through exhaustive work assessing Multiple Measures strategies and helping colleges implement such assessment methods, the CCRC researchers recommended considerations that should be taken when non-cognitive factors are included in a comprehensive placement strategy. It is important for practitioners to incorporate assessments of factors with face validity, or those that naturally fit within the college culture and priorities. Also, the factors should be predictive of success. Colleges should take into account how much the assessment will cost to implement and to sustain and if the assessment can be done with extant systems, such as information technology, counseling services, and testing services. Last, the institution should think of any special consideration unique to the college, such as the population that is served and the history and mission of the college. Research that Cullinan et al. (2018) conducted at ten institutions in Wisconsin and Minnesota showed that the use of Multiple Measures allowed for many more students to be placed in college level math for their first class than using a placement test by itself (56% compared to 29%).

Assessment tools have been developed to help educators understand students' strengths related to non-cognitive factors that could be included in Multiple Measures placement schema. One test, SuccessNavigator, developed by ETS (the Education Testing Service), has as a stated goal to help accelerate students into higher courses by giving advisors and placement coordinators information about non-cognitive factors related to academic success (Markle et al., 2013). Academic skills are assessed by students self-reporting of behaviors, such as participating in classes and completing assignments on time. Students are also asked questions to evaluate their level of commitment, both to finishing their academic plans and to their institution. The degree to which students self-manage is determined by questions that ask about sensitivity to stress and anxiety as well as self-efficacy. Last, the reported ability of students to take advantage of college resources and to be connected to a social group are factors related to social support.

According to Markel et al. (2013) the SuccessNavigator test is not intended to stand alone but was designed to be used as a complement to high school GPA and standardized test scores. When SuccessNavigator scores were added to a model with standardized test scores and GPA, the assessment of the non-cognitive factors added a change in R^2 of .020. Also, adding SuccessNavigator scores to the formula used to place students, along with standardized test scores and high school GPA indicated that approximately 20% of students placed in developmental courses could succeed in a college level course (indicated by receiving an A or a B), thereby reducing under placement (Markel et al., 2013).

ACT developed an assessment, called Engage, that helps identify students deemed less likely to succeed by measurement of academic ability, behaviors, and alignment between program of study and student interest (ACT User Guide, 2015). Behaviors that are measured are grouped into three categories –Motivation, Social Engagement, and Self-regulation, with items comprising ten scales. Motivation includes such factors as being academically disciplined, being committed to completing college, having good communication skills, having the tendency to follow through, being determined to achieve goals, and having positive study skills (ACT User Guide, 2015). Social Engagement involves being comforTable in social situations as well as being engaged in the college community (ACT User Guide, 2015). Self-regulation is a measurement of a student's self-confidence and emotional steadiness (ACT User Guide, 2015). The ACT Engage User Guide (2015) recommends different student supports that might be indicated by scores on specific scales. In other words, students who lack academic discipline or self-confidence might need tutoring to succeed. Students who score high on Social Engagement scales might benefit from being involved in first year experience programs.

ACT (2016) explains how the Engage was developed and validated. Researchers found that random selection predicted that 20% of students will face academic difficulty in college. The Engage score, by itself, increased the prediction of academic difficulty to 44%. If the Engage score is taken into account with the ACT Composite score, then predictive power increased to 51%. In particular, the Academic Discipline scale was found to be correlated with first-year college GPA (r=0.23). Guy et al. (2015) analyzed the predictive effectiveness of Engage scale scores on the likelihood that students would continue in and pass (with a grade of C- or higher) a college level math class after developmental instruction. They found that higher scores on the Academic Discipline Scale were correlated with an increased likelihood of students succeeding in the subsequent college course, with an odds ratio of 1.10 (p = .011).

Guy et al. (2015) assessed the effectiveness of using the Attitudes Toward Math Inventory (ATMI) to determine if students were prepared to succeed in college level coursework. The ATMI was developed by Tapia and Marsh (2004), and included items related to self-confidence about math, the perception of the value of math, enjoyment of doing math, and motivation to undergo mathematical education. According to Guy et al. (2015), both the Confidence scale and the Motivation scale were significantly predictive of better scores on an end-of-semester developmental math course assessment (p = .005 and .032, respectively). Interestingly, students who reportedly held higher value of math education and enjoyed it more were not more likely to do better on the end-of-semester assessment. A higher score on the ATMI Enjoyment of Mathematics scale was correlated with increased likelihood that students would continue into and pass a college level math class with a grade higher than a D, though (OR = 1.10, p = .011), leading the authors to conclude that those factors were more related to longer term persistence and success.

Informed Self-placement. In the purest sense, informed self-placement occurs when students are given guidance counseling that helps them decide what courses would be best for them to take (Morton, 2022). One college had the opportunity to test the effects of self-determination theory on student placement and success (Kosiewicz & Ngo, 2020). Self-determination theory posits that students who are allowed play a role in deciding which courses to take will be more motivated to perform well. The college, one of a nine within a system of urban institutions, failed to renew the contract for the COMPASS math placement test. Therefore, students were directed to meet with a guidance counselor to discuss the course and review high school transcripts to decide on their own whether to register for a math course two levels below the college course, one level below, in the gateway course, or in one of two courses designed to prepare students for four-year college transfer.

Kosiewicz & Ngo (2020) found that students who self-placed were more evenly dispersed across the five math courses that were available. This meant that a greater proportion of students enrolled in the highest level transfer course (14.55% under self-placement compared to <1% using the placement test) and enrolled in the lowest developmental course (10.39% under self-placement compared to 7.50% using the placement test). Women, Black, and Hispanic students were more likely to opt into the lowest level course that was available. Study findings showed that students were less likely to withdraw from courses they chose themselves and pass rates remained about the same as when students were placed by an examination. And, while students were no more likely to earn a degree if they determined their own math fate, but they were more likely to complete a transfer level math course.

In Florida, legislation was passed to allow students from public in-state high schools to opt out of placement testing and developmental education. Research done after the reform took place indicates that self-placement of underprepared students into college level math can increase the percentage of students who pass (Park et al. 2018). Twenty-three percent of the least prepared students passed college algebra while 54.3% of the slightly underprepared students passed. These successes might be attributed, in part, to the response to the legislation by Florida colleges. Some have done extensive training for advisors to help students choose their path and more tutoring resources have been dedicated to helping students succeed (Hu, 2015).

During College

Increased Support. Some strategies that community colleges use to help students succeed involve increased student support.

Learning Communities. It is often helpful for students to participate in a learning group with students who are taking the same courses. Some colleges have introduced learning groups specifically to help students taking developmental math. For example, Baier et al. (2019) described a learning group for developmental math students at midwestern university which incorporated student study meetings, peer tutoring, and increased faculty engagement. The students made a commitment to participate in these group activities for six hours each week outside of the classroom. Results showed that students in the learning communities achieved a higher grade point average after both their first year and second year of college. Weiss et al. (2015) studied learning communities at six community colleges. All of the learning communities had students that were enrolled in the same paired courses (at least one developmental course and one non-developmental course). They were interested in how participation in the learning communities affected credit hour accumulation. The researchers found that students in the learning communities earned about ½ more credit hour during the first semester than non-learning community students, and the increase was usually in the same subject as the remedial course. While ½ credit sounds small, it represented a 24% increase over the control group.

Tutoring. Tutoring is one way that colleges support student learning in developmental education, and research indicates that tutoring can help students succeed. Rheinheimer et al. (2010) found a significant positive correlation between tutoring and grade point average. These findings seem to extend to developmental math achievement, specifically. Jaafar et al. (2015) found that 75% students in a pre-algebra developmental course who received tutoring earned a C or higher, while 71% of students across all sections (regardless of tutoring) earned a C or higher. In an algebra developmental course, 53% of tutored students earned a C or higher, while only 42% of all students did the same. Tutoring also seems to help students complete their developmental sequence of courses. According to Howell and Walkington (2022), students who received tutoring were 4.39 times as likely to complete the sequence than other students. Interestingly, though, Bannier (2007) shared research findings that suggested that less confident students, younger students, and students who had taken fewer math courses were less likely to attend non-mandatory tutoring sessions.

Adaptive Software. Adaptive software (sometimes called an "intelligent tutorial system") is used by colleges to help support student learning while they are in developmental math education. The software includes a system that assesses students' beginning knowledge, then adapts content for students to fill gaps, leading to better preparation for what is expected in the classroom. Research has shown that the use of adaptive software is efficacious. Weltman et al. (2018) examined the difference in mathematic engineering exam scores between students who did or did not use the computer aided tutorial system. Students who completed using the tutorial scored statistically better on exam questions, and it was found that, of students who failed to correctly answer, 71% made no attempt to use the support.

One of the products that some colleges use to help students is the ALEKS (Assessment and Learning Knowledge Spaces) system, by McGraw Hill (2023). There is evidence that the use of ALEKS to support student learning outside of the classroom is effective in helping students succeed. Cung et al. (2019) found that students who used the adaptive software while attending a face-to-face course did better than students who took developmental math online. They did much better on the final exam and their course grade was a half letter grade higher. Melnikova et al. (2020) also found positive results related to the use of ALEKS software by students. They learned that for every increase of 100 minutes of use, a final course grade increased by 1% on average. The use of the software explained 41% of the variance in final course grades.

Another product that is available to provide adaptive computerized tutoring to students is from Pearson and is called MyMathLab (Pearson, 2023). There is evidence that adding the use of MyMathLab increased posttest scores in a developmental math course by 54.41 points (Cerkour, 2018). Students who did not use the adaptive software saw an increase of 26.15 points, which was significantly lower. Chekour (2018) also found that males and females benefited equally from the use of the program. Students expressed satisfaction with using MyMathLab. Serhan and Almeqdadi (2020) surveyed users who reported that they liked the immediate help and feedback embedded in the software and that they appreciated the flexibility of being able to use it anywhere and at any time.

Acceleration. Another strategy that is used aims to get underprepared students through the developmental sequence at a faster pace and/or with fewer courses. These interventions are designed to accelerate students through developmental education. There are three primary ways that developmental education can be accelerated: streamlining courses, course compression, and co-requisite instruction.

Streamlining. Bailey et al. (2015) suggest that developmental curricula with multiple courses in a sequence give students too many opportunities to step off their educational path. Streamlining courses to include directly relevant material that is more complimentary to college level instruction allows students to maintain their momentum toward college readiness. Ensuring that the developmental courses include material that is directly connected to college level content may help students become prepared with fewer instructional contact hours. For example, some CUNY institutions that Hodara and Jaggars (2014) studied had shorter sequences of developmental courses than other institutions (two instead of three). They found that in matched samples, students who progressed through the shorter sequence were more likely to register for and complete college level classes. Also, they were just as likely to pass the college level class if they took the shorter course sequence. Unfortunately, the positive findings did not extend to degree attainment. Matched samples indicated that students were equally as likely to complete their degree program regardless of whether they started by taking three developmental courses or two (Hodera & Jaggars, 2014).

Co-requisite Instruction. A third way that some postsecondary institutions accelerate developmental instruction is to encourage students to co-enroll in both a remedial level and college level course at the same time. Having corequisite courses introduces a couple of advantages; there are fewer leakage points where students can stop out or drop out, the content of the developmental course could be made more meaningful if it is linked to work done in the college level course, students can be affiliated with a cohort going through similar experiences and facing similar challenges, and students will start gaining college credit earlier than if they took remedial coursework alone (Edgecombe, 2011).

Anderson et al. (2020) reviewed data from nine Southeastern community colleges and discovered that students who co-enrolled in a remedial level and a college level course were over three and a half times more likely to pass the lower-level course than students who took the remedial level course without a co-requisite college level course. An extensive study in Louisiana (Campbell & Cintron, 2018) revealed that students who placed into remedial coursework and who took a corequisite college course with the developmental course were just as likely to pass a college level course as students who did not co-enroll. The advantage was that they were able to succeed within one term instead of two. Kashyap and Mathew (2017) compared students in a college level course with co-requisite support to students who were in college level course without co-requisite support. They found that the students who received supplemental instruction earned higher grades and cited instructional flexibility as an important contributor. When students were asked, they admitted to appreciating the “just-in-time” nature of the supplemental instruction, whereby they could ask questions about content encountered in the college level course or could have more time to practice and review homework in the co-requisite remedial course.

Modular Instruction. Other colleges allow students to proceed through developmental instruction using a modular approach (Edgecombe, 2011). Students can spend more time on modules that cover more challenging content while spending less time focusing on material that they have demonstrably mastered. The evidence of efficacy related to modular instruction is mixed. Weiss and Headlam (2019) studied modular developmental math instruction at a large Texas community college to determine the effect on students completing the full sequence of two developmental math courses. Students were randomly assigned to either the treatment (modular instruction) or to another more traditional type of instruction (such as an analog or computer-assisted lecture course). Both groups had access to computerized instructional materials (including the textbook, videos/presentations, and support resources) and attended instructor staffed classes; the difference was that modular courses were broken up into three five-week sessions, each of which could be repeated for mastery, if needed. The advantage was that students would not have to wait until a new term to try to master challenging material. If students did master the material in the three modules before the end of the semester, they could progress to the next three modules. Theoretically, this would increase the likelihood that students would complete their sequence of developmental classes and do so more quickly, according to Weiss & Headlam (2019). According to the researchers, this was not the case, though. Almost 1/4th (23%) of the treatment group completed the math sequence compared to only slightly fewer (22%) of the control group. One possible reason for these results might have been because only 1% of students completed more than three modules in a term compared to 24% who repeated modules (Weiss & Headlam, 2019).

Mainstreaming. Colleges sometimes choose to mainstream students directly into college instruction without requiring any co-requisite developmental coursework (Edgecombe, 2011). In 2013, Florida passed a law that allowed almost every student who graduated with a standard degree from a public State high school to enroll directly into gateway courses at community colleges if they did so within two years (An Act Relating to College Instruction, 2013). By most indications, the strategy met the goal of helping more students avoid developmental coursework (Park-Gaghan et al., 2020). In the first year after the change, an additional 3.20% of students initially enrolled in gateway math courses, but 1.31% fewer students passed the course. By 2016, the strategy was showing additional promise in that 8.82% more students enrolled in their first college level math course and the pass rate improved to only 0.28% fewer students passing than before the implementation.

The Alabama Community College System and Institutions

According to *Reclaiming the Dream: A 50-Year Retrospective of the Alabama Community College System* (Story, 2015), the Alabama legislature passed Act Nos. 92, 93, and 94 in 1963, which placed all two-year institutions in the state under one system, controlled by the Alabama State Board of Education, which also oversaw public secondary institutions. The System remained under this organizational structure until 1982, when the Legislature separated the Department of Postsecondary Education from the State Board of Education and mandated that it be led by a Chancellor appointed by the Board (Story, 2015). In 2017, the Alabama Constitution was amended to set up a distinct entity called The Alabama Community College System, removing it from the auspices of the Department of Postsecondary Education and giving the Board of Trustees ultimate authority over the System (Alabama State Constitution Act 2017-171, §1).

The Alabama Community College System currently consists of 24 postsecondary two-year institutions as well as entities that offer non-credit instruction, such as adult education, continuing education, and training to meet industry needs. Two of the 24 colleges offer technical training and twenty-two offer programs to prepare students to transfer to 4-year colleges and also provide career technical education programs, such as welding, robotics, mechatronics, construction trades, and nursing, among other programs. One college only serves incarcerated students and one primarily educates students expecting to enter a military academy. See Appendix 1 for a list of ACCS institutions by type and special mission. Students who intend to transfer are seeking to receive either an associate of arts (AA) degree or an associate of science (AS) degree. Students matriculating through career technical programs may pursue a technical associates degree (such as an associate in occupational technology (AOT), and associate in applied technology (AAT), or an applied associate of science (AAS) degree), a certificate (an award resulting from a program that takes between 30 and 60 credit hours to complete), or a short-term certificate (awards resulting from a program that takes less than 30 credit hours to complete). Students who seek any type of associate degree must take at least one three-credit hour course in the "Written Composition" area and two three-credit hour courses in the "Natural Science and Mathematics" area. Usually, one of the required "Natural Science and Mathematics" courses is a gateway math course.

Developmental Education Interventions at Alabama Community Colleges

Over the last couple of decades, Alabama Community Colleges have implemented interventions to help improve access to post-secondary education through improved developmental education. Some of these initiatives have been system-wide (at all Alabama public 2-year postsecondary institutions) and some have been implemented at the local college level.

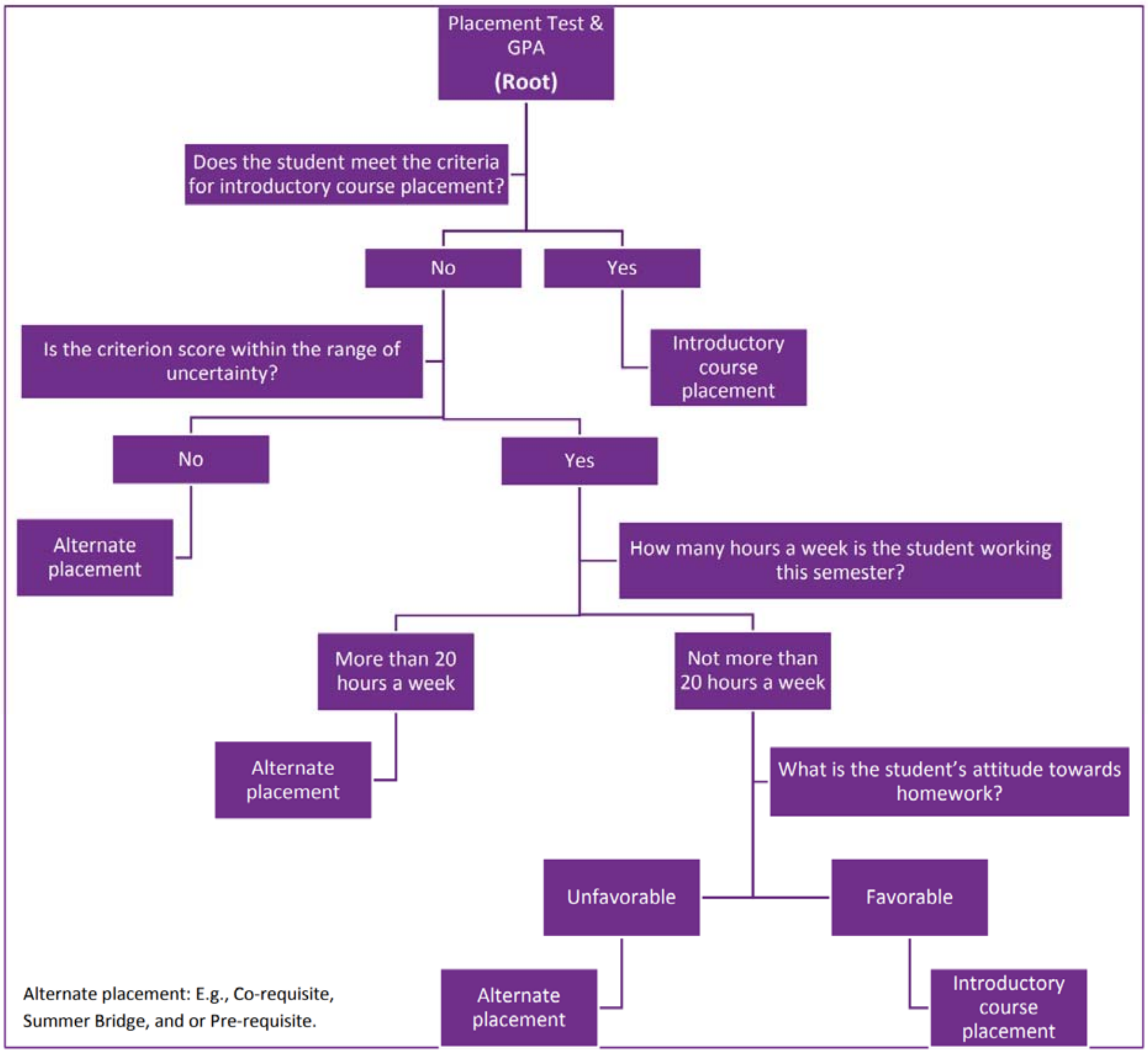
System-wide Interventions

In 2013, the Alabama Community College System Chancellor created a committee of developmental education faculty and administrators to review and revise the way the state colleges placed students into developmental education and conducted the instruction. The committee work culminated in a "Transitional Education Summit," which took place in 2013 (Chancellor's Memo 2013-ISS-071). The summit was intended to share best practices across the colleges. Speakers from Lurleen B. Wallace State Community College presented information about math boot camps and the math Emporium model, while a Shelton State Community College representative updated attendees on the progress being made through the “SOAR Institute” (SOAR stands for Student Opportunities for Achievement and Resources), where students receive intensive advising, can attend seminars about success strategies, and have the opportunity to practice for placement testing (Cook, 2016).

In 2016, an advisory committee recommended that placement be done with consideration to non-cognitive factors. The College Board incorporated questions into the ACCUPlacer test to allow those non-cognitive factors to influence placement based on a recommended decision tree (see figure 2), and all colleges were required to use the ACCUPlacer with those questions to place students.

Figure 2

Placement Decision Tree Using Non-Cognitive Factors

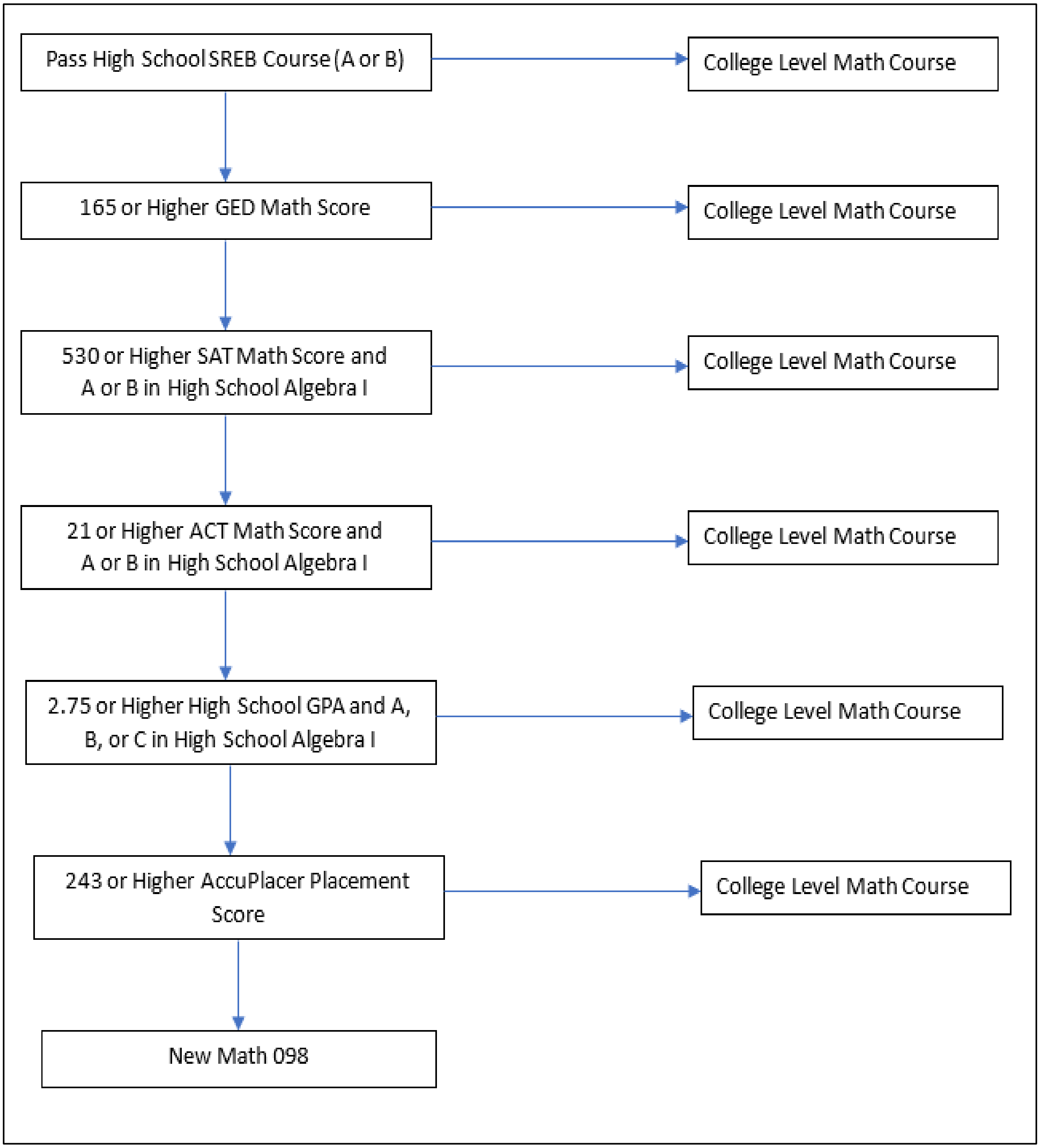


A "College Readiness Task Force" was convened by the ACCS Chancellor in September 2017 (Alabama Community College System, 2018). One of the charges of the committee was to enhance developmental education programs to help more students become college ready. There were four subcommittees that met. One reviewed the developmental education curriculum in an effort to accelerate the pace that students would become college ready, in part by offering more student support; one reviewed the placement guidelines that colleges were required to follow;

one considered professional development for faculty and staff; and, last, a data analysis/reporting subcommittee that would track and analyze outcomes. For math, the committee ultimately recommended that the number of developmental math courses in the sequence be reduced from two to one (Elementary Algebra) and that a support course be developed to help marginally prepared students for college math, which would be offered as a mandatory co-requisite. It was also suggested that students be placed following a stepwise decision tree reliant on various types of data (see figure 3). All of these recommendations, collectively called the "Developmental Education Redesign" were ultimately adopted by the system and implemented by colleges over 2018-2019. Appendix 2 includes a description of these courses.

Figure 3

Developmental Education Redesign Placement Decision Tree



Local College Interventions

Summer Boot Camp. Calhoun Community College offers students several different ways to become college ready. Among these is a summer boot camp experience which is hosted by the adult education division (Calhoun Community College, 2023). The camp has classes that students take to qualify to directly enroll in the gateway math course (as long as they successfully complete the bridge program coursework). Although these courses are similar to regular developmental education courses, they may provide opportunities to more students because they are free and offered on flexible schedules, such as at night, at one of two locations (Calhoun Community College, 2023).

Learning Communities. One intervention that colleges may incorporate to get developmental students prepared for college level courses are learning communities. Learning communities involve students with a common need proceeding through developmental material as a cohort. These students have additional support intended to scaffold their learning. One example of a learning community is that at Southern Union State Community College (Southern Union State Community College, 2023). The learning community program is called PATHS (Providing Access to Higher Education for Transitional Students) and consists of approximately two dozen students taking common courses organized by instructors to make the material relevant and useful. There are subject specific tutors assigned to help students in the community and counselors are dedicated to support students' needs and to provide mentorship.

Northeast Alabama Community College launched a learning community in 2006 (Buttram, 2016). The Mustang Learning Community (MLC) involved students who were underprepared for both math and English. Students in the community took a couple of surveys to assess their study styles and their learning styles. Results showed that students struggled with anxiety, motivation, organization and time maintenance. Also, it was discovered that almost all students needed instructions to be given both verbally and in written form. Advisors and tutors provided guidance, and students were able to access supplemental technology to bring them up to speed. Surveys administered at the end of the program showed that students appreciated the sense of community and togetherness and would recommend the MLC to other students (Buttram, 2016).

Supplemental Materials. There are several types of supplemental resources that allow students to prepare to take the placement test. Many of these resources are offered from third party companies and are entirely free of charge or can be accessed for a limited period at no cost to the student. Online resources typically fall into one of four categories: pedagogical aids such as flash cards, tutorial and instructional material, sample questions that students can answer for receive immediate feedback, and practice tests that simulate the testing environment. Most colleges offer one or more of these resources. For example, Lawson State Community College (n.d.) offers students a boot camp to help them become better prepared to succeed at placement testing. The camp, hosted by Mometrix, a commercial test preparation company, is online and allows students to spend up to 7 days reviewing tutorial materials without charge (Mometrix, 2023). Northeast Alabama Community College (2023) also offers students free online support offered from the U.S. Army, called March 2 Success. Students can create a free account and take interactive courses to improve their high school math skills and become ready for college math (March 2 Success, n.d.). Northeast Alabama Community College (2023) students are also provided links to learn about the ACCUPLACER placement test from the College Board's (2023) website and to work on practice questions that provide immediate feedback about student performance. Enterprise State Community College (2023) guides students to a web site hosted by

“Varsity Tutors,” which has freely available online material such as practice tests, sample daily questions, and flash cards. Tests are scored and students are given in-the-moment feedback about concepts that present challenges based on their performance. The company offers other services, such as tutoring, for a fee.

Summary

This chapter provided a review of literature about community college remediation. First, a discussion occurred about the importance of college and workforce training. Next, a narrative was presented that explained the problem of mathematics under-preparedness overall and specifically in Alabama. Details of research related to interventions that have been implemented at colleges to help remediate students were provided. Finally, the chapter ended with a discussion of interventions that have been developed to help students at Alabama Community Colleges.

Chapter 3 – Methodology

Introduction

The purpose of this chapter is to explain the methodology that was used to answer the research questions related to student success in math courses depending on supports offered and student characteristics. The research questions will be reviewed, participants and variables will be described, and procedures will be discussed. There will be an explanation of the population and sample, how the data was collected, and procedures for statistical analysis of the data. Issues of reliability and validity will be addressed, as well. Last, ethical considerations will be discussed.

Research Questions

This research is designed to answer four broad questions:

1) What are the most common interventions (i.e., course structuring and academic supports) that have been used at Alabama Community Colleges any time from the Fall 2012 term to the Summer 2022 term related to developmental math education?

2a) How are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2022 related to student success (as defined by passing with an A, B, or C) in the first developmental math course taken within one year from high school graduation?

2b) How do these outcomes differ among students of different gender, race, or socio-economic status?

3a) How are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2022 related to student persistence to a college level math course within two years of attempting a developmental math course?

3b) How do these outcomes differ among students of different gender, race, or socio-economic status?

4a) How are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2023 related to student success (as defined by passing with an A, B, or C) in the first college level math course taken after successful completion (as defined by passing with an A, B, or C) of the first developmental math course?

4b) How do these outcomes differ among students of different gender, race, or socio-economic status?

Methods

A qualitative analysis (using a survey) was conducted to determine what interventions Alabama community colleges have used over the last decade to support students underprepared to succeed in postsecondary math. Quantitative analyses of grades were conducted to determine what interventions identified from the survey responses are most closely linked to student success. Differences in outcomes related to gender, race, and socio-economic status were investigated.

Participants

The participants for the survey component of this study included all Alabama community college full-time math instructors and administrators, such as department or division heads/chars and instructional deans. A census was conducted, so the survey was sent to everyone identified in these roles. The data for the quantitative analysis included course taking outcomes of students who took at least one developmental math course at an ACCS institution between Fall 2012 to Summer 2022. Grades were analyzed from the first developmental math courses the students took and the subsequent first college level math course the students took.

Data Sources

Survey. A survey was conducted to gather information from Alabama community college full-time math instructors and administrators. Respondents were asked to describe any instruction offered using self-paced software to help students learn and work through developmental math. The following information was gathered:

- The terms and years that self-paced software was used (if any).
- When students used self-paced software (before taking developmental coursework, while taking developmental coursework, or in lieu of taking developmental coursework).
- Where students used self-paced software (on campus, off campus, or both).

A final section of the survey asked about the interventions offered by the institution to help students succeed in developmental math. Responses will provide details including:

- If the college offered boot camps, and when.
- If students learned in learning communities, and when.
- If tutors (including peer tutors) were available specifically to help with developmental math, and when.
- If any other supports were in place at the institution (including a description), and when.

Litwin (2003) explained that instruments may need to be assessed for reliability, including test-retest reliability (to ensure that responses would be reproducible, or sTable and consistent over administrations) and internal consistency reliability (to ensure that items that make up a scale are measuring the same concept). Neither of these was a concern for this survey; there were not multiple assessments, nor was there any scaling of items. Validity was assessed, though. According to Litwin (2003), face validity means that there has been an assessment of the goodness of survey items by individuals who are not experts in the area being studied and content validity means that there has been a formal assessment of the items to make sure that they include any information needed and do not include anything unnecessary to get the answers being sought. For the assessment of face validity, the survey was reviewed by individuals who have familiarity with postsecondary education, but without expertise related to developmental mathematics. Alabama Community College System personnel who work with colleges on efforts to improve developmental education outcomes evaluated the content validity of the survey items. The survey instrument is presented in Appendix 3. Three-hundred and fifty-five full-time and part-time mathematics faculty members and administrators were invited to participate in the survey, which was developed in and distributed using Qualtrics. An e-mail invitation was sent on April 19, 2023, and two reminders were sent over the next two weeks.

Archival Data. A data set of archival records was used for the quantitative analysis portion of the study. The Alabama Community College System Office of Organizational Effectiveness and Research provided the de-identified data set. The sample for this study included freshmen and sophomore level students who entered an Alabama community college anytime between Fall 2012 and Summer 2022 (inclusive). They first attempted a developmental math course within one year of graduating high school. Students who had attempted a college level course in a prior term or the same term as their developmental course were removed from the sample. No dual enrollment students were included, but auditing or transient students were. The following information was included for each student record:

- A random student identification number.
- A random college identification number.

- The developmental math course number that was attempted.
- The term that the student attempted the developmental math course.
- The grade earned in the developmental math course.
- The student's race.
- The student's gender.
- An indicator of whether the student received Pell funding during the term that the developmental math course was taken.
- The first college level math course the student took.
- The term the first college level math course was taken.
- The grade earned in the college level math course.

Variables

The survey information about interventions that were offered to help students pass developmental math was incorporated into the data set. The following fields were added based off of survey responses:

- A dummy variable indicating whether the college offered adaptive software.
- A dummy variable indicating whether the college offered non-mandatory tutoring.
- A dummy variable indicating whether the college offered mandatory tutoring.
- A dummy variable indicating whether the college offered a summer bridge program.
- A dummy variable indicating whether the college offered an on-going bridge program.
- A dummy variable indicating whether the college offered a learning community.
- A dummy variable indicating whether the MTH 098 curriculum was the classic one used or the new curriculum developed for the "Developmental Redesign."

For the statistical analysis, dummy variables were developed for the combination of interventions that were offered to students to capture whether students were exposed to no intervention, one intervention, or multiple interventions during the term in which they took their first developmental math course. For summer bridge programs, all students who attended the college at the time of the intervention received an indicator that they were exposed to that intervention, regardless of whether they took the course in the summer, fall, or spring term. This decision was made because some students failed to take their first developmental math course in the fall term immediately following the summer. Table 5 describes the variables that were used for the research.

Table 5

Variables Used to Answer Research Questions

Variables	Type	Description	Examples
Course Number	Information for Disaggregation	• The number of the course that was taken.	• MTH 090 • MTH 092 • MTH 098
Academic supports	Predictor	• Additional activities that are offered to help students become more proficient at demonstrating accepTable knowledge. • Start and end dates of academic support.	• Summer Boot Camp • Mandatory Tutoring • Adaptive Software
Student characteristics	Predictor	Variables that describe and group students into categories that can lead to disaggregation and comparison. These variables were dummy coded to be used in binary regression models.	• Gender (sex assigned at birth) • Race • Socio-economic status (as indicated by receiving Pell Funding)
Developmental math course outcomes	Dependent	Student success or lack of success in a math course that does not confer college level credit.	• Pass (A, B, C) • Failure to pass (D, F)
Persistence to college level math	Dependent	Student persistence to college level math within two years of attempting developmental math.	• Yes • No
college level math course outcomes	Dependent	Student success or lack of success in a math course that does confer college level credit.	• Pass (A, B, C) • Failure to pass (D, F)

Data Analysis

Survey responses were analyzed to determine what colleges offered what intervention(s) in what terms. Then, descriptive statistics were produced. Logistic regressions were conducted to determine what effect the interventions and combinations of interventions had on developmental math pass rates, the likelihood that students would take a college level course within two years of taking the developmental course, and pass rates for those subsequently take college courses.

Ethical Considerations

Researchers are cautioned to take care when performing in multiple roles (Gajjar, 2013). I function in the role of the chief data officer of the Alabama Community College System (ACCS), and therefore am responsible for evaluating the effectiveness of programs and activities that are instituted to help students succeed. To avoid bias related to the survey instrument, I consulted with a professional program evaluator who reviewed it and made suggestions to ensure validity and reliability. The survey itself is a research component that will help reduce potential bias. Instead of relying on my preconceived knowledge about what is being done in individual postsecondary institutions, I learned directly from the academic professionals in the field about what has been implemented to help students succeed in their developmental math studies. Informed consent clearly explained my research role and all participants who agreed to take the survey were told how their data was and was not used by me and the System Office. There was no incitive provided for participation and there were no consequences if they declined to participate. They were allowed to withdraw at any time without penalty. The survey was not anonymous, respondents' answers were kept confidential.

Another role I have at the ACCS is that I am the chair of the Institutional Research Board (IRB). I am aware that the study involves human subjects research, and I believed the research to be exempt from IRB oversight and review under 45 CFR 46.104.3 because the research will involve only survey procedures and analyses of secondary data (Office for Human Research Protections, 2023). I deferred that decision to other IRB professionals, though. I submitted research plans in a protocol to the Auburn University IRB for their judgement on this and I also asked a team of three other members of the ACCS IRB to review the research plan for their decision about exemption. Both boards agreed that the research was exempt. Since I am a primary gatekeeper of all data collected about and from ACCS students, I could identify students if I were to extract the quantitative data used in this study from the data system myself. To avoid this, I had a colleague extract the data and remove identifying information from the data set before providing it to me for the research.

Summary

Chapter three described the methodology that was used to answer the research questions. First, though, the research questions were reviewed, participants and variables were described, and procedures were explained. There was a discussion of the population and sample, how the data was collected, and procedures used for statistical analysis of the data. Last, reliability, validity, and ethical considerations were addressed.

Chapter 4 – Results

Introduction

The purpose of this section is to describe the findings from the survey and the results from the analyses. First, though, research questions will be reiterated. Next, this chapter presents descriptive statistics and then an explanation of the inferential statistical analyses that were conducted. Finally, results that address each research question for each intervention offered by the colleges will be described.

Research Questions

This research is designed to answer four broad questions:

1) What are the most common interventions (i.e., course structuring and academic supports) that have been used at Alabama Community Colleges any time from the Fall 2012 term to the Summer 2022 term related to developmental math education?

2a) How are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2022 related to student success (as defined by passing with an A, B, or C) in the first developmental math course taken within one year from high school graduation?

2b) How do these outcomes differ among students of different gender, race, or socio-economic status?

3a) How are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2022 related to student persistence to a college level math course within two years of attempting a developmental math course?

3b) How do these outcomes differ among students of different gender, race, or socio-economic status?

4a) How are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2023 related to student success (as defined by passing with an A, B, or C) in the first college level math course taken after successful completion (as defined by passing with an A, B, or C) of the first developmental math course?

4b) How do these outcomes differ among students of different gender, race, or socio-economic status?

Descriptive Statistics

Twenty-one Alabama community colleges were included in this research study. All 21 offer both technical programs and AA and AS degrees, which contain coursework designed to be transferred to a four-year institution. Three Alabama community colleges were not included. The colleges not included were Ingram State Community College, which serves incarcerated students, Marion Military Institute, a military junior college, and Reid State Community Colleges, which offers technical training with no coursework for students who intend to transfer to a four-year university.

Survey Results

Survey Respondents. Three-hundred and fifty-five full-time and part-time mathematics faculty members and administrators were asked to respond to the survey, and 55 partially or fully completed a survey, for a response rate of 15.49%. The number of responses and response rates from each college is shown in Table 6. No responses were received from five colleges. Because the survey was anonymous, there was no way to determine how many respondents were full-time faculty, part-time faculty, or administrators. When multiple responses were received from one college, they were compared to determine the most likely answer.

Table 6

Number of Responses and Response Rates from Each College

College	Responses (Rate)	College	Responses (Rate)	College	Responses (Rate)
1	3 (13.0%)	8 [b]	2 (50.0%)	15	4 (40.0%)
2[a]	0 (.0%)	9 [b]	8 (47.1%)	16	0 (.0%)
3[b]	3 (33.3%)	10 [b]	0 (.0%)	17	0 (.0%)
4	4 (23.5%)	11 [b]	4 (23.5%)	18	0 (.0%)
5	3 (50.0%)	12	2 (9.1%)	19	2 (7.7%)
6 [b]	1 (6.7%)	13	1 (14.3%)	20	7 (14.9%)
7	4 (17.4%)	14	6 (19.4%)	21	1 (6.7%)

[a]Minority-serving institution.
[b]Historically Black College

Survey Responses. Survey answers were analyzed to partly answer research question one. The first research question asked "[w]hat are the most common interventions (i.e., course structuring and academic supports) that have been used at Alabama Community Colleges any time from the Fall 2012 term to the Summer 2022 term related to developmental math education?" An analysis of the answers provided to the survey questions showed that colleges offered some interventions during some study terms and did not offer them in other study terms and that some interventions were offered all terms of the study. Additionally, it was not uncommon for colleges to offer students more than one intervention at the same time. Two colleges did not offer an intervention at any time during the study. Table 7 describes the interventions and combinations offered by the colleges.

Table 7

Student Support Interventions and Combinations Offered by Colleges

Intervention/Combination	Course	College
Learning Community	90 98	12 12
Mandatory Tutoring	90 98	6 6
Non-mandatory Tutoring	90 91 92 98	5, 7, 11, 14 11 11 7
Adaptive Software	90	20
Non-Mandatory Tutoring and a Summer Bridge Program	98	5
Non-mandatory Tutoring and Adaptive Software	90 98	1, 3, 4, 8, 9 3, 4, 9, 11, 14, 20
Adaptive Software and Mandatory Tutoring	90 98	15 15
Non-Mandatory Tutoring, a Summer Bridge Program, and Adaptive Software	90 98	13 1, 13
Non-mandatory Tutoring, a Learning Community, and Adaptive Software	90 98	19 19
Non-mandatory Tutoring, a Summer Bridge Program, an Ongoing Bridge Program, and Adaptive Software	98	8

In addition to the interventions offered by individual colleges, the Alabama Community College System as a whole made several changes over the years to try to help students succeed in developmental math. First, in 2016-2017 and 2017-2018, non-cognitive factors were considered in placement decisions. Student answers to questions about their study habits and how much they worked were used along with placement scores to determine what developmental class would be appropriate. Developmental education across Alabama community colleges was overhauled completely starting in 2018. One tenet of the redesign was to accelerate students through developmental math. The number of available developmental courses was streamlined to one, and relatively less prepared students were placed in higher level math. Those placed in college math were given co-requisite academic support to help them succeed. Those placed in the new MTH 098 course were the most underprepared students arriving on college doorsteps.

Archival Data

Description of the Dataset. Prior to the Fall 2018 academic year, ACCS colleges offered from one to four developmental education math courses. Placement decisions were typically made using scores from standardized tests. If a student was placed in the lowest course in a series, they would most likely be required to pass all higher developmental math courses before they could enter a college level math course. Schools began transitioning to the new, system-wide, developmental math model which included only one developmental math course (MTH 098) in Fall 2018. All colleges had adopted the model by Fall 2019. Table 8 shows the course combinations offered by the colleges during each term of the study.

Table 8

Course Combinations Offered by Colleges

Term	90, 91, 92	90, 91, 92, 98	90, 91, 98	90, 98	91, 92	91, 98	98
FA 2012	1	0	2	17	0	1	0
SP 2013	1	0	2	16	0	1	1
SU 2013	1	0	2	16	0	1	1
FA 2013	1	0	2	17	0	1	0
SP 2014	1	0	2	17	0	1	0
SU 2014	1	0	1	18	0	1	0
FA 2014	1	1	1	16	1	1	0
SP 2015	1	1	1	16	1	1	0
SU 2015	2	0	1	16	1	1	0
FA 2015	1	1	1	15	1	1	1
SP 2016	1	1	1	15	1	1	1
SU 2016	1	1	0	16	1	1	1
FA 2016	1	1	0	17	0	1	1
SP 2017	2	0	0	17	0	1	1
SU 2017	2	0	0	17	0	1	1
FA 2017	2	0	0	17	0	1	1
SP 2018	2	0	0	17	0	1	1
SU 2018	2	0	0	16	0	1	2
FA 2018	1	0	0	6	0	1	13
SP 2019	0	0	0	3	0	0	18
SU 2019	0	0	0	1	0	0	20
FA 2019	0	0	0	0	0	0	21
SP 2020	0	0	0	0	0	0	21
FA 2020	0	0	0	0	0	0	21
SP 2021	0	0	0	0	0	0	21
SU 2021	0	0	0	0	0	0	21
FA 2021	0	0	0	0	0	0	21
SP 2022	0	0	0	0	0	0	21
SU 2022	0	0	0	0	0	0	21

Description of the Sample. The data included 47,359 student records and covered 30 terms (from Fall 2012 to Summer 2022). The number of students who took developmental education dropped by almost 80% from the first year of the study (6,815) to the last year of the study (1,412). This is, in part, because of changes made across the system (as part of the "Developmental Redesign"). Different measures were used to place students, including using

ACT scores, high school math grades, and placement test scores. Additionally, students who were relatively less prepared for college level math, as indicated by the placement measures, were "accelerated" into college math. The graph in Figure 4 shows the overall sample size for each year. Figure 5 shows maximum, minimum, and average college sample size for each study year.

Figure 4

Overall Sample Size by Year

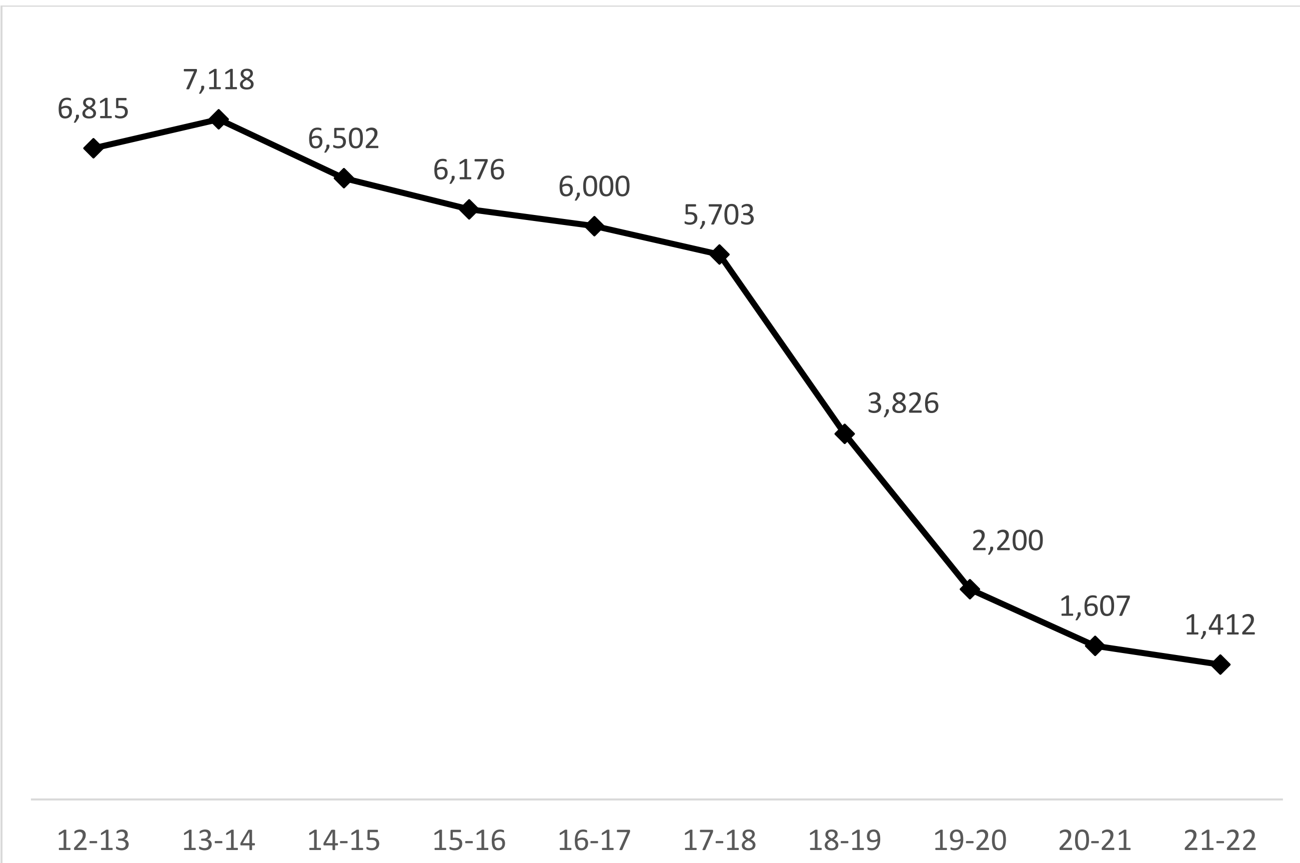
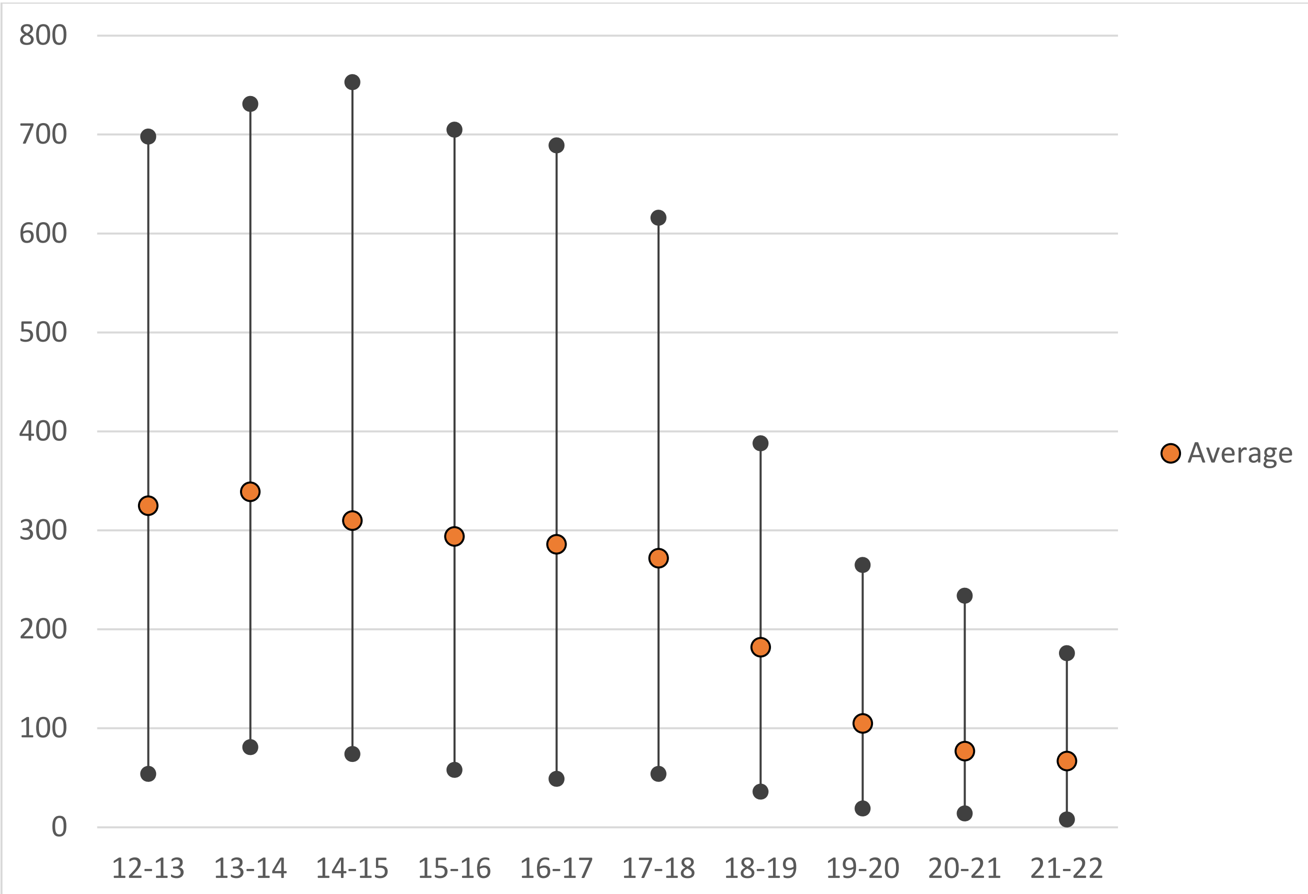


Figure 5

Maximum, Minimum, and Average College Sample Size by Year



Males were more likely to start in MTH 092, Black or African American students were more likely to start in MTH 090 and lower socioeconomic status students were more likely to start in MTH 090. Tables 9, 10, 11, and 12 show the demographic breakdown of students each year taking MTH 090, MTH 091, MTH 092, and MTH 098.

Table 9

Demographics of Students in MTH 090

Year	Male	Black or African American	Pell	Total
2012-2013	874 (31.38%)	1,476 (53.00%)	2,160 (77.56%)	2,785
2013-2014	1,012 (33.23%)	1,577 (51.79%)	2,394 (78.62%)	3,045
2014-2015	899 (34.03%)	1,434 (54.28%)	2,040 (77.21%)	2,642
2015-2016	842 (34.49%)	1,312 (53.75%)	1,860 (76.20%)	2,441
2016-2017	935 (36.14%)	1,332 (51.49%)	1,948 (75.30%)	2,587
2017-2018	986 (38.38%)	1,206 (46.94%)	1,908 (74.27%)	2,569
2018-2019	206 (38.79%)	261 (49.15%)	400 (75.33%)	531
2019-2020	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
2020-2021	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
2021-2022	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
Total	5,754 (34.66%)	8,598 (51.8%)	12,710 (76.57%)	16,600

Table 10

Demographics of Students in MTH 091

Year	Male	Black or African American	Pell	Total
2012-2013	152 (37.53%)	98 (24.20%)	285 (70.37%)	405
2013-2014	147 (32.59%)	105 (23.28%)	324 (71.84%)	451
2014-2015	231 (43.34%)	190 (35.65%)	379 (71.11%)	533
2015-2016	206 (38.79%)	174 (32.77%)	364 (68.55%)	531
2016-2017	137 (39.83%)	106 (30.81%)	241 (70.06%)	344
2017-2018	144 (41.38%)	107 (30.75%)	227 (65.23%)	348
2018-2019	59 (42.14%)	34 (24.29%)	87 (62.14%)	140
2019-2020	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
2020-2021	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
2021-2022	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
Total	1,076 (39.10%)	814 (29.58%)	1,907 (69.30%)	2,752

Table 11

Demographics of Students in MTH 092

Year	Male	Black or African American	Pell	Total
2012-2013	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
2013-2014	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
2014-2015	61 (38.36%)	79 (49.69%)	109 (68.55%)	159
2015-2016	67 (44.37%)	59 (39.07%)	82 (54.30%)	151
2016-2017	21 (43.75%)	11 (22.92%)	28 (58.33%)	48
2017-2018	33 (41.77%)	26 (32.91%)	44 (55.70%)	79
2018-2019	27 (42.19%)	28 (43.75%)	44 (68.75%)	64
2019-2020	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
2020-2021	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
2021-2022	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
Total	209 (41.72%)	203 (40.52%)	307 (61.28%)	501

Table 12

Demographics of Students in MTH 098

Year	Male	Black or African American	Pell	Total
2012-2013	1,411 (38.92%)	985 (27.17%)	2,266 (62.51%)	3,625
2013-2014	1,439 (39.73%)	924 (25.51%)	2,312 (63.83%)	3,622
2014-2015	1,248 (39.39%)	872 (27.53%)	2,008 (63.38%)	3,168
2015-2016	1,289 (42.22%)	830 (27.19%)	1,880 (61.58%)	3,053
2016-2017	1,242 (41.11%)	888 (29.39%)	1,862 (61.64%)	3,021
2017-2018	1,066 (39.38%)	948 (35.02%)	1,738 (64.20%)	2,707
2018-2019 [a]	1,177 (38.08%)	1,252 (40.50%)	2,161 (69.91%)	3,091
2019-2020[a]	795 (36.14%)	995 (45.23%)	1,607 (73.05%)	2,200
2020-2021 [a]	586 (36.47%)	632 (39.33%)	1,022 (63.60%)	1,607
2021-2022 [a]	540 (38.24%)	538 (38.10%)	961 (68.06%)	1,412
Total	10,793 (39.24%)	8,870 (32.25%)	18,817 (68.41%)	27,506

[a]A new curriculum was adopted for MTH 098, which colleges began implementing in Fall 2018.

Quantitative Analysis Methods

The dataset was split into four files, each with data from one class. Statistical procedures were conducted to determine if it would be appropriate to analyze the data for each class and include all colleges, or if there was significant variation across the colleges that would necessitate the use of logistic regressions for each college. Intraclass correlations were calculated to make the decision. Table 13 shows the intraclass correlations and standard errors for each class and each research question. It was determined that there was not sufficient variation across the colleges to run regression procedures by college. Instead, data from all students taking each course were analyzed in the same models.

Table 13

Intraclass Correlations (Standard Deviations)

Course	Passing Developmental Math	Taking a College Math in Two Years	Passing College Math
90	.105 (.031)	.050 (.016)	.048 (.017)
91	.164 (.092)	.033 (.022)	.088 (.057)
92	.015 (.020)	.009 (.014)	.000 (.000)
98	.030 (.009)	.029 (.010)	.041 (.014)

For each developmental math course, several procedures were conducted to answer research question two, which asked two questions. The first was “[h]ow are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2022 related to student success (as defined by passing with an A, B, or C) in the first developmental math course taken within one year from high school graduation?” The second question was “[h]ow do these outcomes differ among students of different gender, race, or socio-economic status?” First, Chi-square goodness of fit analyses were performed to determine if students had better or worse outcomes during the years non-cognitive factors were considered for placement. Second, Chi-square goodness of fit analyses were conducted to see if students performed better or worse when streamlined. Next logistic regression models tested the main effects of race, gender, and socioeconomic status and the main effect of interventions offered at individual colleges as well as the interaction between the intervention and race, the interaction between the intervention and gender, and the interaction between the intervention and socioeconomic status. First, the main effects were tested in the model:

Log (p/1-p) = B_0 + (B_1)(intervention) + (B_2)(Black or African American) + (B_3)(male)+ (B_4)(Pell recipient).

Second, interaction terms were added to the model:

Log (p/1-p) = B_0 + (B_1)(intervention) + (B_2)(Black or African American) + (B_3)(male)+ (B_4)(Pell recipient) + (B_2)(Black or African American*intervention) + (B_3)(male*intervention)+ (B_4)(Pell recipient*intervention).

The second set of logistic regressions were used to answer the third research question, which had two parts. The first part was "[h]ow are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2022 related to student persistence to a college level math course within two years of attempting a developmental math course?" The second part of question four was "[h]ow do these outcomes differ among students of different gender, race, or socio-economic status?" Main effects were tested in the first model:

Log (p/1-p) = B_0 + (B_1)(intervention) + (B_2)(Black or African American) + (B_3)(male)+ (B_4)(Pell recipient).

Second, interaction terms were added to the model:

Log (p/1-p) = B_0 + (B_1)(intervention) + (B_2)(Black or African American) + (B_3)(male)+ (B_4)(Pell recipient) + (B_2)(Black or African American*intervention) + (B_3)(male*intervention)+ (B_4)(Pell recipient*intervention).

The third set of logistic regressions were performed to answer the fourth research question. Again, the question had two parts. Part one was "[h]ow are common interventions in place at Alabama community colleges within Fall 2012 to Summer 2022 related to student success (as defined by passing with an A, B, or C) in the first college level math course taken after successful completion (as defined by passing with an A, B, or C) of the first developmental math course?" The second question was "[h]ow do these outcomes differ among students of different gender, race, age, or socio-economic status?" First, the main effects were tested in the model:

$\text{Log}\ (p/1\text{-}p) = B_0 + (B_1)(\text{intervention}) + (B_2)(\text{Black or African American}) + (B_3)(\text{male}) + (B_4)(\text{Pell recipient})$.

Second, interaction terms were added to the model:

$\text{Log}\ (p/1\text{-}p) = B_0 + (B_1)(\text{intervention}) + (B_2)(\text{Black or African American}) + (B_3)(\text{male}) + (B_4)(\text{Pell recipient}) + (B_2)(\text{Black or African American*intervention}) + (B_3)(\text{male*intervention}) + (B_4)(\text{Pell recipient*intervention})$.

Results

Non-cognitive Factors in Placement

Question 2 – Factors Related to Passing Developmental Math. The pass rate for MTH 090 across all study years was 66.1%. In 2016-2017, students performed significantly worse than other years, X^2 (1, N = 2,151) = 12.241, $p < .001$, $OR = .857$. Students did not have significantly different outcomes in 2017-2018. Black or African American students did significantly worse in both years. In 2016-2017 fewer passed, X^2 (1, N = 1,078) = 44.396, $p < .001$, $OR = .667$ as was the case in 2017-2018, X^2 (1, N = 966) = 29.957, $p < .001$, $OR = .702$. Males also had poorer outcomes. Fewer passed in 2016-2017, X^2 (1, N = 775) = 38.979, $p < .001$, $OR = .640$, and in 2017-2018, X^2 (1, N = 828) = 19.603, $p < .001$, $OR = .733$. The results extended to students who received Pell funding. In 2016-2017, more students failed X^2 (1, N = 1,603) = 28.728, $p < .001$, $OR = .763$. The same occurred in 2017-2018, X^2 (1, N = 1,574) = 11.402, $p < .001$, $OR = .840$.

The pass rate of students who started in MTH 091 was 74.9%. Overall, students did not perform significantly differently in either 2016-2017 or 2017-2018. Black or African American students had worse outcomes in 2017-2018, X^2 (1, N = 92) = 11.184, $p < .001$, $OR = .498$, but not 2016-2017. Males achieved success at about the same rate as the full population in both years, as did students who received Pell funds. In MTH 092, the pass rate for the entirety of the study was 61.7%. There was no significant difference in outcomes for either 2016-2017 or 2017-2018 for the full population, or for any of the samples of at-risk students.

Students who started in MTH 098 had a pass rate of 67.4%. Overall, students had better outcomes in both 2016-2017, X^2 (1, N = 2,502) = 4.667, $p = .031$, $OR = 1.10$ and 2017-2018, X^2 (1, N = 2,309) = 16.950, $p < .001$, $OR = 1.21$. Black or African American students, though saw worse performance in MTH 098. In 2016-2017, a lower percentage passed, X^2 (1, N = 705) =

14.979, $p < .001$, *OR* = .743, and the same pattern occurred in 2017-2018, X^2 (1, N = 760) = 8.757, $p = .003$, *OR* = .802. Male students and those who received Pell funding did not have a significantly different chance of passing or failing in either 2016-2017 or 2017-2018.

Streamlining

Question 2 – Factors Related to Passing Developmental Math. The percent of students who passed developmental math on their first attempt was 67.3%. The students who experienced the streamlined new MTH 098 curriculum were significantly less likely to pass, X^2 (1, N = 7,012) = 193.242, $p < .001$, *OR* = .713. This was true for Black or African American students, X^2 (1, N = 2,789) = 338.776, $p < .001$, *OR* = .504, males, X^2 (1, N = 2,603) = 131.843, $p < .001$, *OR* = .636, and students who received Pell funding, X^2 (1, N = 4,753) = 237.831, $p < .001$, *OR* = .638.

Question 3 – Factors Related to Taking College Level Math Within Two Years. Less than half (43.5%) of the students who took developmental math continued on to attempt a college level math within two years. Students in the streamlined MTH 098 course were more likely to do so, X^2 (1, N = 8,310) = 37.609, $p < .001$, *OR* = 1.15. Unfortunately, Black or African American students were less likely to take a college math course, X^2 (1, N = 1,486) = 13.991, $p < .001$, *OR* = .879. Neither males nor students on Pell were more or less likely to take a college level math course within two years of their first developmental math attempt.

Question 4 – Factors Related to Passing College Math. In all courses, among students who took a college level math course within two years of taking their first developmental math, 70.2% passed the college course. Students in the new (streamlined) MTH 098 course had no significantly different outcome than students who took other developmental math courses. Black or African American students who took MTH 098, though, were less likely to take a college math course in two years, X^2 (1, N = 1,144) = 28.157, $p < .001$, *OR* = .722. The same was true for males, X^2 (1, N = 1,109) = 4.558, $p = .033$, *OR* = .871 and students who received Pell funding, X^2 (1, N = 2,090) = 8.843, $p = .003$, *OR* = .869.

Learning Community

Question 2 – Factors Related to Passing Developmental Math. For MTH 090, The first logistic regression model was significant, X^2 (4, N = 400) = 22.623, $p < .001$, and explained about 8.0% of the variance. The second model was significant, X^2 (7, N = 400) = 27.769, $p < .001$, and explained about 9.7% of the variance. See Table 14 for more information.

Table 14

Learning Community Logistic Regression Results – Pass MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	1.631 (.320)	.620	2.69 (.794)	.213
Black	.645 (.371)	.392	.941 (.512)	.905
Male	.953 (.250)	.488	2.185 (.522)	.134
Pell	.287 (.365)	.223	.257 (.712)	.056
Black*Intervention			.402 (.747)	.223
Male*Intervention			.326 (.595)	.060
Pell*Intervention			1.133 (.830)	.881
Nagelkerke's R^2	.080		.097	

No MTH 091 or MTH 092 student had the opportunity to participate in a learning community. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 1,659) = 37.897, $p < .001$, and explained about 3.4% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,659) = 38.995, $p < .001$, and explained about 3.5% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 15 for more information.

Table 15

Learning Community Logistic Regression Results – Pass Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	1.379 (.126)	.011	1.149 (.274)	.612
Black	.544 (.201)	.002	.542 (.214)	.004
Male	.680 (.121)	.001	.694 (.153)	.017
Pell	.678 (.137)	.005	.618 (.170)	.005
Black*Intervention			1.163 (.641)	.814
Male*Intervention			.942 (.249)	.810
Pell*Intervention			1.311 (.285)	.341
Nagelkerke's R^2	.034		.035	

For the analysis of the new MTH 098 class, the first logistic regression model was significant, X^2 (4, N = 1,119) = 30.105, $p < .001$, and explained about 4.0% of the variance. X^2 (7, N = 1,119) = 37.415, $p < .001$, and explained about 4.9% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 16 for more information.

Table 16

Learning Community Logistic Regression Results – Pass New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	1.314 (.217)	.208	2.627 (.577)	.094
Black	.595 (.210)	.013	.542 (.214)	.004
Male	.651 (.144)	.003	.694 (.153)	.017
Pell	.579 (.162)	< .001	.618 (.170)	.005
Black*Intervention			883,470,472.478 (16226.482)	.999
Male*Intervention			.561 (.460)	.208
Pell*Intervention			.490 (.572)	.212
Nagelkerke's R^2	.040		.049	

Question 3 – Factors Related to Taking College Level Math Within Two Years. The first logistic regression model for MTH 090 was significant, X^2 (4, N = 463) = 12.631, $p = .013$, and explained about 3.8% of the variance. X^2 (7, N = 463) = 17.385, p = .015, and explained about 5.2% of the variance. See Table 17 for more information.

Table 17

Learning Community Logistic Regression Results –Take College Level Math Within Two Years of MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	1.045 (.308)	.887	2.07 (.615)	.236
Black	.657 (.381)	.270	.837 (.564)	.753
Male	.798 (.222)	.310	2.109 (.523)	.154
Pell	.472 (.240)	.002	.516 (.604)	.274
Black*Intervention			.576 (.804)	.493
Male*Intervention			.302 (.580)	.039
Pell*Intervention			.882 (.659)	.848
Nagelkerke's R^2	.038		.052	

No MTH 091 or MTH 092 student had the opportunity to participate in a learning community. For classic MTH 098, the first logistic regression model was significant, X^2 (4, N = 1,827) = 36.793, $p < .001$, and explained about 2.8% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,827) = 40.353, $p < .001$, and explained about 3.0% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 18 for more information.

Table 18

Learning Community Logistic Regression Results –Take College Level Math Within Two Years of Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.941 (.103)	.553	1.006 (.224)	.979
Black	.592 (.187)	.005	.517 (.202)	.001
Male	.649 (.102)	< .001	.681 (.135)	.005
Pell	.693 (.114)	.001	.715 (.147)	.022
Black*Intervention			2.729 (.579)	.083
Male*Intervention			.888 (.205)	.561
Pell*Intervention			.930 (.233)	.755
Nagelkerke's R^2	.028		.030	

The first logistic regression model run using the new MTH 098 data was significant, X^2 (4, N = 1,236) = 38.667, $p < .001$, and explained about 4.2% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,236) = 45.957, $p < .001$, and explained about 5.0% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 19 for more information.

Table 19

Learning Community Logistic Regression Results – Take College Level Math Within Two Years of New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.531 (.160)	< .001	.547 (.346)	.081
Black	.587 (.196)	.006	.517 (.202)	.001
Male	.654 (.124)	< .001	.681 (.135)	.005
Pell	.714 (.134)	.012	.715 (.147)	.022
Black*Intervention			10.861 (1.116)	.033
Male*Intervention			.810 (.342)	.538
Pell*Intervention			.949 (.362)	.885
Nagelkerke's R^2	.042		.050	

Question 4 – Factors Related to Passing College Math. For MTH 090, the first logistic regression model was not significant. When interactions were added, the model was still not significant. No MTH 091 or MTH 092 student had the opportunity to participate in a learning community. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 1,008) = 25.884, $p < .001$, and explained about 4.2% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,008) = 28.393, $p < .001$, and explained about 4.6% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 20 for more information.

Table 20

Learning Community Logistic Regression Results – Pass College Level Math After Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	1.312 (.177)	.125	1.432 (.410)	.382
Black	.467 (.304)	.012	.397 (.326)	.005
Male	.689 (.174)	.032	.631 (.219)	.036
Pell	.529 (.198)	.001	.583 (.241)	.025
Black*Intervention			3.615 (1.130)	.256
Male*Intervention			1.248 (.360)	.538
Pell*Intervention			.751 (.427)	.503
Nagelkerke's R^2	.042		.046	

For the new MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 659) = 23.682, $p < .001$, and explained about 5.8% of the variance. When interactions were added, the model was significant, X^2 (7, N = 659) = 26.353, $p < .001$, and explained about 6.5% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 21 for more information.

Table 21

Learning Community Logistic Regression Results – Pass College Level Math After New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	2.626 (.443)	.029	1.604 (.882)	.592
Black	.439 (.318)	.010	.397 (.326)	.005
Male	.629 (.213)	.029	.631 (.219)	.036
Pell	.599 (.233)	.028	.583 (.241)	.025
Black*Intervention			399,633,807.327 (16,382.087)	.999
Male*Intervention			1.067 (.957)	.946
Pell*Intervention			1.451 (.956)	.697
Nagelkerke's R^2	.058		.065	

Summer Bridge Program

There were only three students that had the opportunity to attend a summer bridge program as the only intervention to which they were exposed. Analyses were not conducted to test the effect of a summer bridge program in isolation from other interventions.

Mandatory Tutoring

Question 2 – Factors Related to Passing Developmental Math. For MTH 090, the first logistic regression model was significant, X^2 (4, N = 611) = 47.053, $p < .001$, and explained about 13.7% of the variance. When interactions were added, the model remained significant, X^2 (7, N = 611) = 60.792, $p < .001$, and explained about 17.5% of the variance. See Table 22 for more information.

Table 22

Mandatory Tutoring Logistic Regression Results – Pass MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	7.541 (.314)	< .001	11.284 (.916)	.008
Black	.527 (.344)	.063	.941 (.512)	.905
Male	.610 (.262)	.059	2.185 (.522)	.134
Pell	.552 (.414)	.151	.257 (.712)	.056
Black*Intervention			.309 (.753)	.119
Male*Intervention			.175 (.604)	.004
Pell*Intervention			3.573 (.859)	.138
Nagelkerke's R^2	.137		.175	

No MTH 091 or MTH 092 student was required to be tutored. The first logistic regression model for the classic MTH 098 class was significant, X^2 (4, N = 1,121) = 51.924, $p < .001$, and explained about 6.9% of the variance. When interactions were added, the model remained significant, X^2 (7, N = 1,121) = 52.106, $p < .001$, and explained about 6.9% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 23 for more information.

Table 23

Mandatory Tutoring Logistic Regression Results – Pass Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	5.321 (.316)	< .001	7.401 (.945)	.034
Black	.536 (.204)	.002	.542 (.214)	.004
Male	.685 (.148)	.010	.694 (.153)	.017
Pell	.613 (.167)	.003	.618 (.170)	.005
Black*Intervention			.884 (.725)	.865
Male*Intervention			.812 (.596)	.727
Pell*Intervention			.841 (.840)	.837
Nagelkerke's R^2	.069		.069	

For the new MTH 098 class, the first logistic regression model was significant, X^2 (4, N = 1,320) = 80.907, $p < .001$, and explained about 8.4% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,320) = 81.885, $p < .001$, and explained about 8.5% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 24 for more information.

Table 24

Mandatory Tutoring Logistic Regression Results – Pass New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.547 (.163)	< .001	.466 (.344)	.026
Black	.616 (.166)	.004	.542 (.214)	.004
Male	.680 (.127)	.002	.694 (.153)	.017
Pell	.631 (.150)	.002	.618 (.170)	.005
Black*Intervention			1.332 (.343)	.403
Male*Intervention			.946 (.278)	.841
Pell*Intervention			1.059 (.366)	.876
Nagelkerke's R^2	.084		.085	

Question 3 – Factors Related to Taking College Level Math Within Two Years. The first logistic regression model using MTH 090 data was significant, X^2 (4, N = 1,281) = 34.726, p < .001, and explained about 4.6% of the variance. When interactions were added, the model remained significant, X^2 (7, N = 1,281) = 39.621, p < .001, and explained about 5.2% of the variance. The race and socioeconomic variables contributed significantly to the variance in model one but did not do so in model two. See Table 25 for more information.

Table 25

Mandatory Tutoring Logistic Regression Results – Take College Level Math Within Two Years of MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.599 (.281)	.069	1.230 (.607)	.733
Black	.620 (.197)	.015	.837 (.564)	.753
Male	.740 (.172)	.079	2.109 (.523)	.154
Pell	.469 (.219)	< .001	.516 (.604)	.274
Black*Intervention			.707 (.601)	.564
Male*Intervention			.309 (.555)	.034
Pell*Intervention			.893 (.648)	.862
Nagelkerke's R^2	.046		.052	

No student in MTH 091 or MTH 092 was required to be tutored. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 1,521) = 156.392, $p < .001$, and explained about 13.1% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,521) = 167.455, $p < .001$, and explained about 14.0% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 26 for more information.

Table 26

Mandatory Tutoring Logistic Regression Results – Take College Level Math Within Two Years of Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.348 (.141)	< .001	.275 (.300)	< .001
Black	.701 (.147)	.016	.517 (.202)	.001
Male	.785 (.113)	.032	.681 (.135)	.005
Pell	.650 (.128)	< .001	.715 (.147)	.022
Black*Intervention			2.176 (.304)	.010
Male*Intervention			1.644 (.247)	.044
Pell*Intervention			.664 (.302)	.174
Nagelkerke's R^2	.131		.140	

For the new MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 1,488) = 113.472, $p < .001$, and explained about 9.9% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,488) = 113.791, $p < .001$, and explained about 9.9% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 27 for more information.

Table 27

Mandatory Tutoring Logistic Regression Results – Take College Level Math Within Two Years of New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.537 (.149)	< .001	.470 (.305)	.013
Black	.542 (.152)	< .001	.517 (.202)	.001
Male	.699 (.114)	.002	.681 (.135)	.005
Pell	.728 (.130)	.015	.715 (.147)	.022
Black*Intervention			1.102 (.313)	.756
Male*Intervention			1.098 (.252)	.710
Pell*Intervention			1.077 (.323)	.818
Nagelkerke's R^2	.099		.099	

Question 4 – Factors Related to Passing College Math. The first logistic regression model run using MTH 090 data was not significant. When interactions were added, the model was significant, X^2 (7, N = 167) = 14.386, p = .045, and explained about 11.2% of the variance. See Table 28 for more information.

Table 28

Mandatory Tutoring Logistic Regression Results – Pass College Level Math Within Two Years of MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention			.000 (13,841.410)	.999
Black			.762 (1.275)	.831
Male			.286 (1.426)	.380
Pell			(13841.410)	.999
Black*Intervention			.743 (1.349)	.826
Male*Intervention			5.435 (1.481)	.253
Pell*Intervention			622,915,440.796 (13,841.410)	.999
Nagelkerke's R^2			.112	

No MTH 091 student was required to be tutored. The same was true for MTH 092 students. For classic MTH 098, the first logistic regression model was significant, X^2 (4, N = 656) = 43.665, $p < .001$, and explained about 9.9% of the variance. When interactions were added, the model was significant, X^2 (7, N = 656) = 46.102, $p < .001$, and explained about 10.4% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 29 for more information.

Table 29

Mandatory Tutoring Logistic Regression Results – Pass College Level Math After Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.451 (.312)	.011	.261 (.708)	.058
Black	.456 (.284)	.006	.397 (.326)	.005
Male	.586 (.201)	.008	.631 (.219)	.036
Pell	.643 (.223)	.047	.583 (.241)	.025
Black*Intervention			1.384 (.654)	.619
Male*Intervention			.744 (.571)	.605
Pell*Intervention			1.961 (.698)	.335
Nagelkerke's R^2	.099		.104	

The first logistic regression model for the new MTH 098 class was significant, X^2 (4, N = 713) = 28.807, $p < .001$, and explained about 6.2% of the variance. When interactions were added, the model was significant, X^2 (7, N = 713) = 32.268, $p < .001$, and explained about 6.9% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 30 for more information.

Table 30

Mandatory Tutoring Logistic Regression Results – Pass College Level Math After New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	1.019 (.294)	.948	1.81 (.835)	.477
Black	.487 (.279)	.010	.397 (.326)	.005
Male	.615 (.196)	.013	.631 (.219)	.036
Pell	.517 (.229)	.004	.583 (.241)	.025
Black*Intervention			2.34 (.605)	.160
Male*Intervention			.912 (.502)	.854
Pell*Intervention			.297 (.846)	.151
Nagelkerke's R^2	.062		.069	

Results – Non-mandatory Tutoring

Question 2 – Factors Related to Passing Developmental Math. The first logistic regression model run using MTH 090 data was significant, X^2 (4, N = 3,951) = 169.49, $p < .001$, and explained about 5.8% of the variance. When interactions were added, the model was significant, X^2 (7, N = 3,951) = 179.642, $p < .001$, and explained about 6.1% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in model one but not model two. In model two, the interaction between gender and the intervention significantly contributed to the variance. See Table 31 for more information.

Table 31

Non-mandatory Tutoring Logistic Regression Results – Pass MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	1.177 (.243)	.501	1.056 (.677)	.935
Black	.542 (.075)	< .001	.941 (.512)	.905
Male	.631 (.070)	< .001	2.185 (.522)	.134
Pell	.726 (.085)	< .001	.257 (.712)	.056
Black*Intervention			.567 (.517)	.273
Male*Intervention			.282 (.527)	.016
Pell*Intervention			2.886 (.717)	.139
Nagelkerke's R^2	.058		.061	

No students in MTH 091 were exposed to non-mandatory tutoring alone. For MTH 092, all students at the one college that answered the survey had access to non-mandatory tutoring. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 4,359) = 127.433, $p < .001$, and explained about 4.2% of the variance. When interactions were added, the model was significant, X^2 (7, N = 4,359) = 134.633, $p < .001$, and explained about 4.4% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 32 for more information.

Table 32

Non-mandatory Tutoring Logistic Regression Results – Pass Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.911 (.087)	.282	.879 (.179)	.472
Black	.667 (.084)	< .001	.542 (.214)	.004
Male	.535 (.070)	< .001	.694 (.153)	.017
Pell	.741 (.075)	< .001	.618 (.170)	.005
Black*Intervention			1.261 (.233)	.320
Male*Intervention			.720 (.172)	.056
Pell*Intervention			1.245 (.190)	.248
Nagelkerke's R^2	.042		.044	

For the new MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 2,210) = 85.686, $p < .001$, and explained about 5.3% of the variance. When interactions were added, the model was significant, X^2 (7, N = 2,210) = 89.764, $p < .001$, and explained about 5.5% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 33 for more information.

Table 33

Non-mandatory Tutoring Logistic Regression Results – Pass New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.574 (.100)	<. 001	.426 (.197)	< .001
Black	.640 (.112)	< .001	.542 (.214)	.004
Male	.725 (.094)	< .001	.694 (.153)	.017
Pell	.776 (.102)	.013	.618 (.170)	.005
Black*Intervention			1.208 (.252)	.454
Male*Intervention			1.080 (.194)	.692
Pell*Intervention			1.421 (.214)	.101
Nagelkerke's R^2	.053		.055	

Question 3 – Factors Related to Taking College Level Math Within Two Years. The first logistic regression model testing MTH 090 data was significant, X^2 (4, N = 4,904) = 146.431, $p < .001$, and explained about 4.4% of the variance. When interactions were added, the model was significant, X^2 (7, N = 4,904) = 153.536, $p < .001$, and explained about 4.6% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in model one but not model two. The interaction between gender and the intervention significantly contributed to the variance in model two. See Table 34 for more information.

Table 34

Non-mandatory Tutoring Logistic Regression Results – Take College Level Math Within Two Years of MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.821 (.258)	.444	1.279 (.565)	.663
Black	.676 (.073)	< .001	.837 (.564)	.753
Male	.569 (.073)	< .001	2.109 (.523)	.154
Pell	.676 (.077)	< .001	.516 (.604)	.274
Black*Intervention			.804 (.568)	.702
Male*Intervention			.263 (.528)	.011
Pell*Intervention			1.317 (.609)	.651
Nagelkerke's R^2	.044		.046	

No students in MTH 091 experienced non-mandatory tutoring alone as an intervention. For MTH 092, all students at the one college that answered the survey had access to non-mandatory tutoring. For the test of the classic MTH 098 data, the first logistic regression model was significant, X^2 (4, N = 5,448) = 184.192, $p < .001$, and explained about 4.5% of the variance. When interactions were added, the model was significant, X^2 (7, N = 5,448) = 188.386, $p < .001$, and explained about 4.6% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 35 for more information.

Table 35

Non-mandatory Tutoring Logistic Regression Results – Take College Level Math Within Two Years of Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.705 (.075)	< .001	.726 (.150)	.033
Black	.686 (.069)	< .001	.517 (.202)	.001
Male	.580 (.057)	< .001	.681 (.135)	.005
Pell	.728 (.060)	< .001	.715 (.147)	.022
Black*Intervention			1.372 (.215)	.141
Male*Intervention			.822 (.149)	.189
Pell*Intervention			1.018 (.161)	.913
Nagelkerke's R^2	.045		.046	

For the new MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 2,484) = 121.988, $p < .001$, and explained about 6.4% of the variance. When interactions were added, the model was significant, X^2 (7, N = 2,484) = 126.532, $p < .001$, and explained about 6.7% of the variance. In model one, race and gender significantly contributed to the overall variance. In model two, race, gender, and socioeconomic status contributed significantly. See Table 36 for more information.

Table 36

Non-mandatory Tutoring Logistic Regression Results – Take College Level Math Within Two Years of New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.544 (.089)	< .001	.449 (.171)	< .001
Black	.638 (.103)	< .001	.517 (.202)	.001
Male	.656 (.085)	< .001	.681 (.135)	.005
Pell	.853 (.091)	.083	.715 (.147)	.022
Black*Intervention			1.279 (.235)	.296
Male*Intervention			.941 (.174)	.725
Pell*Intervention			1.32 (.189)	.142
Nagelkerke's R^2	.064		.067	

Question 4 – Factors Related to Passing College Math. For MTH 090, the first logistic regression model was significant, X^2 (4, N = 961) = 22.412, $p < .001$, and explained about 3.1% of the variance. When interactions were added, the model was significant, X^2 (7, N = 961) = 26.817, $p < .001$, and explained about 3.7% of the variance. While race and socioeconomic status both significantly contributed to the overall variance of model one, none of the variables entered in model two contributed to the variance. See Table 37 for more information.

Table 37

Non-mandatory Tutoring Logistic Regression Results – Pass College Level Math After MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.371 (.517)	.055	.000 (13,841.419)	.999
Black	.696 (.143)	.012	.762 (1.275)	.831
Male	.792 (.150)	.121	.286 (1.426)	.380
Pell	.733 (.148)	.037	.000 (13,841.419)	.999
Black*Intervention			.914 (1.283)	.944
Male*Intervention			2.831 (1.434)	.468
Pell*Intervention			534,280,151.25 (13841.419)	.999
Nagelkerke's R^2	.031		.037	

No students in MTH 091 experienced non-mandatory tutoring as the sole intervention. At For MTH 092, all students at the one college that answered the survey had access to non-mandatory tutoring. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 2,369) = 82.267, $p < .001$, and explained about 5.0% of the variance. When interactions were added, the model was significant, X^2 (7, N = 2,369) = 84.68, $p < .001$, and explained about 5.1% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 38 for more information.

Table 38

Non-mandatory Tutoring Logistic Regression Results – Pass College Level Math After Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.593 (.122)	< .001	.471 (.245)	.002
Black	.568 (.120)	< .001	.397 (.326)	.005
Male	.667 (.099)	< .001	.631 (.219)	.036
Pell	.701 (.102)	< .001	.583 (.241)	.025
Black*Intervention			1.493 (.351)	.253
Male*Intervention			1.076 (.246)	.766
Pell*Intervention			1.245 (.266)	.409
Nagelkerke's R^2	.050		.051	

The first logistic regression model using the new MTH 098 data was significant, X^2 (4, N = 1,111) = 64.318, $p < .001$, and explained about 8.2% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,111) = 67.983, $p < .001$, and explained about 8.7% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 39 for more information.

Table 39

Non-mandatory Tutoring Logistic Regression Results – Pass College Level Math After New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.452 (.149)	< .001	.382 (.284)	< .001
Black	.672 (.179)	.027	.397 (.326)	.005
Male	.623 (.144)	.001	.631 (.219)	.036
Pell	.616 (.153)	.002	.583 (.241)	.025
Black*Intervention			2.047 (.389)	.066
Male*Intervention			.999 (.291)	.999
Pell*Intervention			1.069 (.313)	.832
Nagelkerke's R^2	.082		.087	

Results – Adaptive Software

Question 2 – Factors Related to Passing Developmental Math. The first logistic regression model procedure done with MTH 090 data was significant, X^2 (4, N = 310) = 10.141, p = .038, and explained about 4.4% of the variance. When interactions were added, the model was significant, X^2 (7, N = 310) = 18.131, p = .011, and explained about 7.8% of the variance. The race variable proved to significantly contribute to the variance in model one, while none of the variables contributed to the variance in model two. See Table 40 for more information.

Table 40

Adaptive Software Logistic Regression Results – Pass MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	1.129 (.279)	.664	.888 (.737)	.872
Black	.535 (.255)	.014	.941 (.512)	.905
Male	.994 (.256)	.982	2.185 (.522)	.134
Pell	.720 (.283)	.246	.257 (.712)	.056
Black*Intervention			.444 (.594)	.172
Male*Intervention			.330 (.603)	.066
Pell*Intervention			3.608 (.780)	.100
Nagelkerke's R^2	.044		.078	

The use of adaptive software was not available to MTH 091 or MTH 092 students. For classic MTH 098, the first logistic regression model was significant, X^2 (4, N = 2,178) = 106.737, $p < .001$, and explained about 6.9% of the variance. When interactions were added, the model was significant, X^2 (7, N = 2,178) = 112.464, $p < .001$, and explained about 7.2% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. Additionally, the interaction between gender and the intervention significantly contributed to the variance in the second model. See Table 41 for more information.

Table 41

Adaptive Software Logistic Regression Results – Pass Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.809 (.102)	.039	1.035 (.210)	.871
Black	.506 (.119)	< .001	.542 (.214)	.004
Male	.528 (.100)	< .001	.694 (.153)	.017
Pell	.618 (.108)	< .001	.618 (.170)	.005
Black*Intervention			.899 (.259)	.681
Male*Intervention			.621 (.203)	.019
Pell*Intervention			.983 (.221)	.939
Nagelkerke's R^2	.069		.072	

The first logistic regression model produced for the new MTH 098 course was significant, X^2 (4, N = 1,087) = 66.215, $p < .001$, and explained about 8.5% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,087) = 69.526, $p < .001$, and explained about 8.9% of the variance. Race and socioeconomic status contributed significantly to the variance in model one. The race, gender, and socioeconomic variables were significant contributors to the overall variance in model two. See Table 42 for more information.

Table 42

Adaptive Software Logistic Regression Results – Pass New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.302 (.197)	< .001	.207 (.395)	< .001
Black	.566 (.193)	.003	.542 (.214)	.004
Male	.768 (.141)	.062	.694 (.153)	.017
Pell	.627 (.156)	.003	.618 (.170)	.005
Black*Intervention			1.282 (.486)	.610
Male*Intervention			2.011 (.397)	.078
Pell*Intervention			1.041 (.437)	.927
Nagelkerke's R^2	.085		.089	

Question 3 – Factors Related to Taking College Level Math Within Two Years. For MTH 090, the first logistic regression model was significant, X^2 (4, N = 376) = 12.751, p = .013, and explained about 4.9% of the variance. When interactions were added, the model was significant, X^2 (7, N = 376) = 17.471, p = .015, and explained about 6.7% of the variance. Socioeconomic status contributed significantly to the variance in model one. The interaction between gender and the intervention was a significant contributor to the variance in model two. See Table 43 for more information.

Table 43

Adaptive Software Logistic Regression Results – Take College Level Math Within Two Years of MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.738 (.293)	.299	1.416 (.618)	.573
Black	.623 (.267)	.076	.837 (.564)	.753
Male	.827 (.253)	.451	2.109 (.523)	.154
Pell	.530 (.259)	.014	.516 (.604)	.274
Black*Intervention			.653 (.643)	.508
Male*Intervention			.290 (.601)	.039
Pell*Intervention			1.027 (.670)	.969
Nagelkerke's R^2	.049		.067	

Adaptive software was not available to students who took MTH 091 or MTH 092. For classic MTH 098, the first logistic regression model was significant, X^2 (4, N = 2,650) = 158.194, $p < .001$, and explained about 7.8% of the variance. When interactions were added, the model was significant, X^2 (7, N = 2,650) = 162.838, $p < .001$, and explained about 8.0% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. Additionally, the interaction between gender and the intervention significantly contributed to the variance in model two. See Table 44 for more information.

Table 44

Adaptive Software Logistic Regression Results –Take College Level Math Within Two Years of Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.593 (.087)	< .001	.696 (.171)	.034
Black	.554 (.101)	< .001	.517 (.202)	.001
Male	.544 (.084)	< .001	.681 (.135)	.005
Pell	.707 (.088)	< .001	.715 (.147)	.022
Black*Intervention			1.091 (.233)	.710
Male*Intervention			.695 (.173)	.035
Pell*Intervention			.970 (.184)	.867
Nagelkerke's R^2	.078		.080	

The first logistic regression model testing the new MTH 098 class data was significant, X^2 (4, N = 1,208) = 66.68, $p < .001$, and explained about 7.3% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,208) = 70.104, $p < .001$, and explained about 7.7% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 45 for more information.

Table 45

Adaptive Software Logistic Regression Results – Take College Level Math Within Two Years of New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.364 (.174)	< .001	.260 (.338)	< .001
Black	.570 (.177)	.001	.517 (.202)	.001
Male	.737 (.125)	.014	.681 (.135)	.005
Pell	.720 (.134)	.014	.715 (.147)	.022
Black*Intervention			1.564 (.415)	.281
Male*Intervention			1.723 (.348)	.118
Pell*Intervention			.995 (.373)	.990
Nagelkerke's R^2	.073		.077	

Question 4 – Factors Related to Passing College Math. For MTH 090 The first logistic regression model was not significant. When interactions were added, the model was not significant. No MTH 091 or MTH 092 student had the opportunity to use adaptive software. For classic MTH 098, the first logistic regression model was significant, X^2 (4, N = 1,243) = 50.946, $p < .001$, and explained about 6.0% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,243) = 53.733, $p < .001$, and explained about 6.3% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 46 for more information.

Table 46

Adaptive Software Logistic Regression Results – Pass College Level Math After Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.536 (.142)	< .001	.457 (.276)	.005
Black	.610 (.177)	.005	.397 (.326)	.005
Male	.609 (.141)	< .001	.631 (.219)	.036
Pell	.640 (.145)	.002	.583 (.241)	.025
Black*Intervention			1.791 (.387)	.132
Male*Intervention			.959 (.288)	.884
Pell*Intervention			1.145 (.303)	.655
Nagelkerke's R^2	.060		.063	

The first logistic regression model testing the new MTH 098 data was significant, X^2 (4, N = 630) = 13.547, p = .009, and explained about 3.4% of the variance. When interactions were added, the model was significant, X^2 (7, N = 630) = 20.898, p = .004, and explained about 5.2% of the variance. Race and gender both significantly contributed to the variance in model one. Race, gender, and socioeconomic status were significant contributors to the overall variance in model two. See Table 47 for more information.

Table 47

Adaptive Software Logistic Regression Results – Pass College Level Math After New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.940 (.386)	.873	.291 (.676)	.068
Black	.523 (.311)	.037	.397 (.326)	.005
Male	.659 (.209)	.046	.631 (.219)	.036
Pell	.642 (.228)	.052	.583 (.241)	.025
Black*Intervention			8.421 (1.241)	.086
Male*Intervention			1.941 (.781)	.396
Pell*Intervention			2.030 (.824)	.390
Nagelkerke's R^2	.034		.052	

Results – Adaptive Software and Mandatory Tutoring, Combined

Question 2 – Factors Related to Passing Developmental Math. The first logistic regression model used to test MTH 090 data was not significant. When interactions were added, the model was significant, X^2 (7, N = 494) = 16.653, p = .02, and explained about 4.6% of the variance. The interaction between gender and the intervention provided a significant contribution to the variance. See Table 48 for more information.

Table 48

Adaptive Software and Mandatory Tutoring, Combined Logistic Regression Results – Pass MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention			.848 (.738)	.823
Black			.941 (.512)	.905
Male			2.185 (.522)	.134
Pell			.257 (.712)	.056
Black*Intervention			.940 (.561)	.912
Male*Intervention			.248 (.570)	.014
Pell*Intervention			2.934 (.786)	.171
Nagelkerke's R^2			.046	

The combination of adaptive software and mandatory was not available to students in MTH 091 or MTH 092. For the classic MTH 098 data, the first logistic regression model was significant, X^2 (4, N = 1,358) = 48.029, $p < .001$, and explained about 5.0% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1.358) = 49.647, $p < .001$, and explained about 5.2% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 49 for more information.

Table 49

Adaptive Software and Mandatory Tutoring, Combined Logistic Regression Results – Pass Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.666 (.134)	.003	.609 (.291)	.088
Black	.616 (.159)	.002	.542 (.214)	.004
Male	.654 (.126)	< .001	.694 (.153)	.017
Pell	.650 (.143)	.003	.618 (.170)	.005
Black*Intervention			1.277 (.323)	.448
Male*Intervention			.838 (.270)	.512
Pell*Intervention			1.147 (.315)	.663
Nagelkerke's R^2	.050		052	

For the new MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 1,133) = 44.563, $p < .001$, and explained about 5.6% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,133) = 47.169, $p < .001$, and explained about 5.9% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 50 for more information.

Table 50

Adaptive Software and Mandatory Tutoring, Combined Logistic Regression Results – Pass New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.478 (.176)	< .001	.309 (.427)	.006
Black	.624 (.184)	.011	.542 (.214)	.004
Male	.689 (.139)	.007	.694 (.153)	.017
Pell	.655 (.157)	.007	.618 (.170)	.005
Black*Intervention			1.566 (.413)	.277
Male*Intervention			1.017 (.380)	.964
Pell*Intervention			1.492 (.451)	.375
Nagelkerke's R^2	.056		.059	

Question 3 – Factors Related to Taking College Level Math Within Two Years. The first logistic regression model used to test MTH 090 data was significant, X^2 (4, N = 689) = 9.665, p = .046, and explained about 2.0% of the variance. When interactions were added, the model was significant, X^2 (7, N = 689) = 15.357, p = .032, and explained about 3.2% of the variance. The race and socioeconomic variables significantly contributed to the variance in model one. In model two, the interaction between gender and the intervention provided significantly contributed to the variance. See Table 51 for more information.

Table 51

Adaptive Software and Mandatory Tutoring, Combined Logistic Regression Results – Take College Level Math Within Two Years of MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	1.03 (.272)	.914	1.325 (.612)	.646
Black	1.446 (.187)	.049	.837 (.564)	.753
Male	.763 (.189)	.153	2.109 (.523)	.154
Pell	.496 (.025)	.005	.516 (.604)	.274
Black*Intervention			1.856 (.598)	.301
Male*Intervention			.310 (.562)	.037
Pell*Intervention			.949 (.664)	.937
Nagelkerke's R^2	.020		.032	

No MTH 091 student had the opportunity to participate in the combination of the use of adaptive software and mandatory tutoring. The same was true for MTH 092 students. For classic MTH 098, the first logistic regression model was significant, X^2 (4, N = 1,677) = 36.664, $p <$ .001, and explained about 3.0% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,677) = 42.718, $p < .001$, and explained about 3.5% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. Additionally, the interaction between race and the intervention significantly contributed to the variance in model two. See Table 52 for more information.

Table 52

Adaptive Software and Mandatory Tutoring, Combined Logistic Regression Results – Take College Level Math Within Two Years of Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.822 (.109)	.073	.823 (.233)	.403
Black	.744 (.135)	.028	.517 (.202)	.001
Male	.684 (.106)	< .001	.681 (.135)	.005
Pell	.675 (.119)	< .001	.715 (.147)	.022
Black*Intervention			1.954 (.273)	.014
Male*Intervention			.997 (.219)	.987
Pell*Intervention			.819 (.251)	.427
Nagelkerke's R^2	.030		.035	

For the new MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 1,237) = 39.935, $p < .001$, and explained about 4.4% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,237) = 45.42, $p < .001$, and explained about 4.9% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. The interaction between race and the intervention also significantly contributed to the variance in model two. See Table 53 for more information.

Table 53

Adaptive Software and Mandatory Tutoring, Combined Logistic Regression Results –Take College Level Math Within Two Years of New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.564 (.162)	< .001	.543 (.413)	.140
Black	.651 (.172)	.013	.517 (.202)	.001
Male	.708 (.124)	.006	.681 (.135)	.005
Pell	.688 (.138)	.007	.715 (.147)	.022
Black*Intervention			2.326 (.382)	.027
Male*Intervention			1.271 (.349)	.493
Pell*Intervention			.740 (.434)	.489
Nagelkerke's R^2	.044		.049	

Question 4 – Factors Related to Passing College Math. The first logistic regression conducted using MTH 090 was not significant. When interactions were added, the model was still not significant. The combination of adaptive software and mandatory tutoring was not available to students in MTH 91 or MTH 092. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 773) = 26.725, $p < .001$, and explained about 5.7% of the variance. When interactions were added, the model was significant, X^2 (7, N = 773) = 28.356, $p < .001$, and explained about 6.0% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 54 for more information.

Table 54

Adaptive Software and Mandatory Tutoring, Combined Logistic Regression Results – Pass College Level Math After Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	2.267 (.271)	.003	1.379 (.550)	.559
Black	.441 (.271)	.003	.397 (.326)	.005
Male	.615 (.199)	.015	.631 (.219)	.036
Pell	.643 (.222)	.047	.583 (.241)	.025
Black*Intervention			1.193 (.603)	.770
Male*Intervention			.903 (.526)	.845
Pell*Intervention			1.913 (.618)	.294
Nagelkerke's R^2	.057		.060	

The first logistic regression model was significant when new MTH 098 data was tested, X^2 (4, N = 651) = 22.142, $p < .001$, and explained about 5.3% of the variance. When interactions were added, the model was significant, X^2 (7, N = 651) = 27.469, $p < .001$, and explained about 6.6% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 55 for more information.

Table 55

Adaptive Software and Mandatory Tutoring, Combined Logistic Regression Results – Pass College Level Math After New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.877 (.324)	.684	3.423 (1.169)	.293
Black	.501 (.294)	.019	.397 (.326)	.005
Male	.583 (.208)	.009	.631 (.219)	.036
Pell	.529 (.234)	.007	.583 (.241)	.025
Black*Intervention			3.285 (.740)	.108
Male*Intervention			.444 (.732)	.267
Pell*Intervention			.180 (1.179)	.146
Nagelkerke's R^2	.053		.066	

Results – Adaptive Software and Non-mandatory Tutoring, Combined

Question 2 – Factors Related to Passing Developmental Math. The first logistic regression for MTH 090 data was significant, X^2 (4, N = 4,131) = 157.157, $p < .001$, and explained about 5.0% of the variance. When interactions were added, the model was significant, X^2 (7, N = 4,131) = 165.566, $p < .001$, and explained about 5.3% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in model one. The interaction between gender and the interaction significantly contributed to the variance in model two. See Table 56 for more information.

Table 56

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results – Pass MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	814 (.242)	.395	.749 (.677)	.670
Black	.603 (.067)	< .001	.941 (.512)	.905
Male	.675 (.067)	< .001	2.185 (.522)	.134
Pell	.632 (.082)	< .001	.257 (.712)	.056
Black*Intervention			.637 (.516)	.382
Male*Intervention			.302 (.527)	.023
Pell*Intervention			2.498 (.717)	.202
Nagelkerke's R^2	.050		.053	

For MTH 091, the first logistic regression model significant, X^2 (4, N = 493) = 16.372, p = .003, and explained about 4.5% of the variance. When interactions were added, X^2 (7, N = 493) = 20.752, p = .004, and explained about 5.7% of the variance. In model one, gender and socioeconomic status significantly contributed to the variance. In model two, gender was the only variable that did the same. See Table 57 for more information.

Table 57

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results – Pass MTH 091

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.997 (.262)	.992	1.277 (.611)	.689
Black	.735 (.214)	.150	.650 (.236)	.067
Male	.666 (.199)	.042	.602 (.214)	.018
Pell	.575 (.225)	.014	.664 (.248)	.099
Black*Intervention			1.797 (.621)	.345
Male*Intervention			2.297 (.631)	.188
Pell*Intervention			.458 (.658)	.235
Nagelkerke's R^2	.045		.057	

No MTH 092 student had the opportunity to participate in the combination of the use of adaptive software and non-mandatory tutoring. The first logistic regression model that tested data from classic MTH 098 classes was significant, X^2 (4, N = 7,085) = 209.459, $p < .001$, and explained about 4.1% of the variance. When interactions were added, the model was significant, X^2 (7, N = 7,085) = 211.584, $p < .001$, and explained about 4.1% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. Additionally, the interaction between socioeconomic status and the intervention significantly contributed to the variance in model two. See Table 58 for more information.

Table 58

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results – Pass Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.719 (.081)	< .001	.676 (.173)	.024
Black	.662 (.060)	< .001	.542 (.214)	.004
Male	.628 (.053)	< .001	.694 (.153)	.017
Pell	.682 (.058)	< .001	.618 (.170)	.005
Black*Intervention			1.237 (.223)	.340
Male*Intervention			.894 (.163)	.490
Pell*Intervention			.676 (.173)	.024
Nagelkerke's R^2	.041		.041	

For the new MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 3,922) = 198.34, $p < .001$, and explained about 6.7% of the variance. When interactions were added, the model was significant, X^2 (7, N = 3,922) = 201.279, $p < .001$, and explained about 6.8% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 59 for more information.

Table 59

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results – Pass New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.538 (.086)	< .001	.413 (.181)	< .001
Black	.548 (.075)	< .001	.542 (.214)	.004
Male	.792 (.070)	< .001	.694 (.153)	.017
Pell	.771 (.076)	< .001	.618 (.170)	.005
Black*Intervention			1.001 (.229)	.997
Male*Intervention			1.184 (.172)	.325
Pell*Intervention			1.323 (.191)	.142
Nagelkerke's R^2	.067		.068	

Question 3 – Factors Related to Taking College Level Math Within Two Years. The first logistic regression model testing MTH 090 was significant, X^2 (4, N = 4,792) = 77.895, $p <$ .001, and explained about 2.4% of the variance. When interactions were added, the model was significant, X^2 (7, N = 4,792) = 82.97, $p < .001$, and explained about 2.6% of the variance. In model one, gender and socioeconomic status each significantly contributed to the overall variance. In model two, though, the interaction between gender and the intervention provided a significant contribution to the variance. See Table 60 for more information.

Table 60

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results – Take College Level Math Within Two Years of MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.726 (.257)	.213	1.051 (.566)	.930
Black	.938 (.075)	.390	.837 (.564)	.753
Male	.684 (.075)	< .001	2.109 (.523)	.154
Pell	.570 (.082)	< .001	.516 (.604)	.274
Black*Intervention			1.124 (.569)	.837
Male*Intervention			.316 (.529)	.029
Pell*Intervention			1.108 (.609)	.866
Nagelkerke's R^2	.024		.026	

For MTH 091, the first logistic regression model was significant, X^2 (4, N = 523) = 31.675, $p < .001$, and explained about 7.9% of the variance. When interactions were added, the model was significant, X^2 (7, N = 523) = 32.997, $p < .001$, and explained about 8.2% of the variance. The gender and socioeconomic variables proved to be significant contributors to the overall variance in model one and model two. See Table 61 for more information.

Table 61

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results – Take College Level Math Within Two Years of MTH 091

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.477 (.252)	.003	.344 (.469)	.023
Black	.897 (.209)	.605	.962 (.229)	.865
Male	.567 (.195)	.004	.534 (.208)	.003
Pell	.478 (.208)	< .001	.434 (.234)	< .001
Black*Intervention			.713 (.615)	.582
Male*Intervention			1.542 (.582)	.457
Pell*Intervention			1.590 (.537)	.388
Nagelkerke's R^2	.079		.082	

No MTH 092 student had the opportunity to participate in the combination of the use of adaptive software and non-mandatory tutoring. For the classic MTH 098 course data, the first logistic regression model was significant, X^2 (4, N = 8,169) = 262.369, $p < .001$, and explained about 4.3% of the variance. When interactions were added, the model was significant, X^2 (7, N = 8,169) = 267.966, $p < .001$, and explained about 4.4% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. The interaction between gender and the intervention also contributed to the variance in model two. See Table 62 for more information.

Table 62

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results –Take College Level Math Within Two Years of Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.749 (.072)	< .001	.834 (.148)	.221
Black	.764 (.054)	< .001	.517 (.202)	.001
Male	.586 (.047)	< .001	.681 (.135)	.005
Pell	.638 (.051)	< .001	.715 (.147)	.022
Black*Intervention			1.522 (.209)	.045
Male*Intervention			.843 (.144)	.235
Pell*Intervention			.877 (.156)	.402
Nagelkerke's R^2	.043		.044	

For the new MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 4,530) = 291.691, $p < .001$, and explained about 8.3% of the variance. When interactions were added, the model was significant, X^2 (7, N = 4,530) = 292.176, $p < .001$, and explained about 8.3% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 63 for more information.

Table 63

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results – Take College Level Math Within Two Years of New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.472 (.077)	< .001	.466 (.156)	< .001
Black	.589 (.070)	< .001	.517 (.202)	.001
Male	.676 (.064)	< .001	.681 (.135)	.005
Pell	.711 (.069)	< .001	.715 (.147)	.022
Black*Intervention			1.160 (.215)	.490
Male*Intervention			.989 (.153)	.943
Pell*Intervention			.991 (.166)	.954
Nagelkerke's R^2	.083		.083	

Question 4 – Factors Related to Passing College Math. For MTH 090, the first logistic regression model was significant, X^2 (4, N = 902) = 11.372, p = .023, and explained about 1.8% of the variance. When interactions were added, the model was significant, X^2 (7, N = 902) = 15.87, p = .026, and explained about 2.5% of the variance. Gender was a significantly contributing variable to the variance in model one, but not in model two. See Table 64 for more information.

Table 64

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results – Pass College Level Math After MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.588 (.516)	.303	0 (13,841.231)	.999
Black	.865 (.158)	.361	.762 (1.275)	.831
Male	.721 (.157)	.037	.286 (1.426)	.380
Pell	.719 (.172)	.056	0 (13,841.231)	.999
Black*Intervention			1.142 (1.285)	.918
Male*Intervention			2.576 (1.434)	.509
Pell*Intervention			528,676,915.828 (13841.231)	.999
Nagelkerke's R^2	.018		.025	

The first MTH 091 logistic regression model was not significant. When interactions were added, the model was not significant. The combination of adaptive software and non-mandatory tutoring was not available to MTH 092 students. For classic MTH 098, the first logistic regression model was significant, X^2 (4, N = 3,658) = 49.454, $p < .001$, and explained about 2.0% of the variance. When interactions were added, the model was significant, X^2 (7, N = 3,658) = 56.881, $p < .001$, and explained about 2.3% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. In model two, the interaction between race and the intervention was a significant contributor to the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. In model two, the interaction between race and the intervention also significantly contributed to the variance. See Table 65 for more information.

Table 65

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results – Pass College Level Math After Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.684 (.115)	< .001	.468 (.240)	.002
Black	.778 (.094)	.008	.397 (.326)	.005
Male	.714 (.079)	< .001	.631 (.219)	.036
Pell	.789 (.083)	.004	.583 (.241)	.025
Black*Intervention			2.052 (.340)	.034
Male*Intervention			1.158 (.235)	.533
Pell*Intervention			1.407 (.257)	.183
Nagelkerke's R^2	.020		.023	

The first logistic regression model tested using new MTH 098 data was significant, X^2 (4, N = 1,717) = 53.631, $p < .001$, and explained about 4.5% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,717) = 61.503, $p < .001$, and explained about 5.2% of the variance. The race variable significantly contributed to the variance in model one. The race, gender, and socioeconomic variables were significant contributors to the overall variance in model two, as was the interaction between the Pell variable and the intervention. See Table 66 for more information.

Table 66

Adaptive Software and Non-mandatory Tutoring, Combined Logistic Regression Results – Pass College Level Math After New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.661 (.128)	.001	.364 (.260)	< .001
Black	.502 (.133)	< .001	.397 (.326)	.005
Male	.839 (.118)	.136	.631 (.219)	.036
Pell	.901 (.122)	.395	.583 (.241)	.025
Black*Intervention			1.288 (.357)	.477
Male*Intervention			1.502 (.260)	.118
Pell*Intervention			1.827 (.280)	.031
Nagelkerke's R^2	.045		.052	

Results – Non-mandatory Tutoring and Summer Bridge Program, Combined

Question 2 – Factors Related to Passing Developmental Math. The first logistic regression model that tested MTH 090 data was significant, X^2 (4, N = 137) = 14.746, p = .005, and explained about 13.8% of the variance. When interactions were added, the model was significant, X^2 (7, N = 137) = 18.733, p = .009, and explained about 17.3% of the variance. Socioeconomic status significantly contributed to the variance in model one. The same was not true in model two. See Table 67 for more information.

Table 67

Non-mandatory Tutoring and Summer Bridge Program, Combined Logistic Regression Results – Pass MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.775 (.370)	.491	2.787 (1.079)	.342
Black	.744 (.375)	.431	.941 (.512)	.905
Male	1.181 (.377)	.659	2.185 (.522)	.134
Pell	.200 (.535)	.003	.257 (.712)	.056
Black*Intervention			.601 (.769)	.509
Male*Intervention			.264 (.780)	.088
Pell*Intervention			.558 (1.094)	.594
Nagelkerke's R^2	.138		.173	

The combination of a summer bridge program and non-mandatory tutoring was not made available to students who took MTH 091 or MTH 092. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 1,012) = 29.884, $p < .001$, and explained about 4.3% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,012) = 34.51, $p < .001$, and explained about 4.9% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 68 for more information.

Table 68

Non-mandatory Tutoring and Summer Bridge Program, Combined Logistic Regression Results – Pass Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.526 (.300)	.032	.455 (.645)	.222
Black	.577 (.205)	.007	.542 (.214)	.004
Male	.661 (.147)	.005	.694 (.153)	.017
Pell	.660 (.163)	.011	.618 (.170)	.005
Black*Intervention			1.198 (.755)	.811
Male*Intervention			.476 (.631)	.240
Pell*Intervention			2.447 (.700)	.201
Nagelkerke's R^2	.043		.049	

The first logistic regression model run to test the new MTH 098 course data was significant, X^2 (4, N = 976) = 25.666, $p < .001$, and explained about 3.8% of the variance. When interactions were added, the model was significant, X^2 (7, N = 976) = 27.572, $p < .001$, and explained about 4.1% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 69 for more information.

Table 69

Non-mandatory Tutoring and Summer Bridge Program, Combined Logistic Regression Results – Pass New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.522 (.530)	.220	.779 (1.16)	.829
Black	.529 (.211)	.003	.542 (.214)	.004
Male	.705 (.152)	.021	.694 (.153)	.017
Pell	.615 (.168)	.004	.618 (.170)	.005
Black*Intervention			.213 (1.664)	.353
Male*Intervention			3.771 (1.419)	.349
Pell*Intervention			.498 (1.300)	.592
Nagelkerke's R^2	.038		.041	

Question 3 – Factors Related to Taking College Level Math Within Two Years. For MTH 090, the first logistic regression model was not significant. When interactions were added, the model was still not significant. No MTH 091 students had the opportunity to participate in the combination of non-mandatory tutoring and a summer bridge program, and the same was true for MTH 092 students. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 1,092) = 30.178, $p < .001$, and explained about 3.8% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,092) = 34.079, $p < .001$, and explained about 4.2% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 70 for more information.

Table 70

Non-mandatory Tutoring and Summer Bridge Program, Combined Logistic Regression Results – Take College Level Math Within Two Years of Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.635 (.289)	.116	.695 (.624)	.560
Black	.560 (.193)	.003	.517 (.202)	.001
Male	.653 (.131)	.001	.681 (.135)	.005
Pell	.735 (.142)	.031	.715 (.147)	.022
Black*Intervention			1.887 (.728)	.383
Male*Intervention			.465 (.605)	.206
Pell*Intervention			1.352 (.680)	.658
Nagelkerke’s R^2	.038		.042	

The first logistic regression model used to test the new MTH 098 class data was significant, X^2 (4, N = 1,062) = 30.269, $p < .001$, and explained about 3.9% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,062) = 33.934, $p < .001$, and explained about 4.4% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 71 for more information.

Table 71

Non-mandatory Tutoring and Summer Bridge Program, Combined Logistic Regression Results – Take College Level Math Within Two Years of New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.355 (.427)	.015	.351 (.820)	.201
Black	.558 (.197)	.003	.517 (.202)	.001
Male	.682 (.134)	.004	.681 (.135)	.005
Pell	.698 (.145)	.013	.715 (.147)	.022
Black*Intervention			5.685 (.992)	.080
Male*Intervention			1.063 (1.157)	.958
Pell*Intervention			.437 (.960)	.388
Nagelkerke's R^2	.039		.044	

Question 4 – Factors Related to Passing College Math. For MTH 090, the first logistic regression model was not significant. When interactions were added, the model was still not significant. The combination of non-mandatory tutoring and a summer bridge program was not made available to students who took MTH 091 or MTH 092. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 606) = 19.773, $p < .001$, and explained about 5.1% of the variance. When interactions were added, the model was significant, X^2 (7, N = 606) = 24.299, $p = .001$, and explained about 6.3% of the variance. The race and Pell variables significantly contributed to the variance in model one. The race, gender, and socioeconomic variables were significant contributors to the overall variance in model two. See Table 72 for more information.

Table 72

Non-mandatory Tutoring and Summer Bridge Program, Combined Logistic Regression Results – Pass College Level Math After Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.601 (.499)	.307	.128 (1.052)	.051
Black	.414 (.311)	.005	.397 (.326)	.005
Male	.688 (.215)	.082	.631 (.219)	.036
Pell	.602 (.235)	.031	.583 (.241)	.025
Black*Intervention			1.25 (1.240)	.857
Male*Intervention			10.137 (1.275)	.069
Pell*Intervention			2.863 (1.326)	.427
Nagelkerke's R^2	.051		.063	

The first logistic regression model that was used to test the new MTH 098 data was significant, X^2 (4, N = 591) = 19.615, $p < .001$, and explained about 5.2% of the variance. When interactions were added, the model was significant, X^2 (7, N = 591) = 27.167, $p < .001$, and explained about 7.2% of the variance. The race and socioeconomic variables significantly contributed to the variance in model one. The race, gender, and socioeconomic variables were significant contributors to the overall variance in model two. See Table 73 for more information.

Table 73

Non-mandatory Tutoring and Summer Bridge Program, Combined Logistic Regression Results – Pass College Level Math After New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.402 (.897)	.310	199,848,706.774 (28,420.721)	.999
Black	.425 (.324)	.008	.397 (.326)	.005
Male	.652 (.218)	.050	.631 (.219)	.036
Pell	.5400 (.241)	.011	.583 (.241)	.025
Black*Intervention			2.517 (56,841.443)	1.000
Male*Intervention			1.586 (49,226.133)	1.000
Pell*Intervention			.000 (40,192.97)	.999
Nagelkerke’s R^2	.052		.072	

Results – Adaptive Software, Non-mandatory Tutoring, and a Learning Community, Combined

Question 2 – Factors Related to Passing Developmental Math. For MTH 090, the first logistic regression model was significant, X^2 (4, N = 213) = 12.088, p = .017, and explained about 7.6% of the variance. When interactions were added, the model was significant, X^2 (7, N = 213) = 20.566, p = .004, and explained about 12.8% of the variance. In model one, Pell status was a significantly contributing variable to the variance. The interaction between gender and the intervention significantly contributed to the variance in model two. See Table 74 for more information.

Table 74

Adaptive Software, Non-mandatory Tutoring, and a Learning Community, Combined Logistic Regression Results – Pass MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	1.356 (.318)	.338	2.421 (.940)	.347
Black	.879 (.321)	.689	.941 (.512)	.905
Male	.717 (.330)	.315	2.185 (.522)	.134
Pell	.261 (.486)	.006	.257 (.712)	.056
Black*Intervention			.965 (.668)	.958
Male*Intervention			.144 (.682)	.005
Pell*Intervention			1.087 (.981)	.932
Nagelkerke's R^2	.076		.128	

No MTH 091 student had the opportunity to participate in the combination of adaptive software use, non-mandatory tutoring, and a learning community. Also, no MTH 092 student had the opportunity to participate in the combination of adaptive software use, non-mandatory tutoring, and a learning community. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 1,459) = 42.996, $p < .001$, and explained about 4.3% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,459) = 43.725, $p < .001$, and explained about 4.3% of the variance. No new MTH 098 student had the opportunity to participate in the combination of adaptive software use, non-mandatory tutoring, and a learning community. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 75 for more information.

Table 75

Adaptive Software, Non-mandatory Tutoring, and a Learning Community, Combined Logistic Regression Results – Pass Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.909 (.128)	.456	1.120 (.281)	.687
Black	.529 (.174)	<.001	.542 (.214)	.004
Male	.672 (.124)	.001	.694 (.153)	.017
Pell	.573 (.138)	<.001	.618 (.170)	.005
Black*Intervention			.928 (.366)	.838
Male*Intervention			.907 (.261)	.709
Pell*Intervention			.804 (.291)	.455
Nagelkerke's R^2	.043		.043	

Question 3 – Factors Related to Taking College Level Math Within Two Years. The first logistic regression model for MTH 090 was non-significant. When interactions were added, the model was not significant. No students in MTH 091, MTH 092, and MTH 098 with the new curriculum had the opportunity to participate in the combination of adaptive software use, non-mandatory tutoring, and a learning community. For classic MTH 098, though, the first logistic regression model was significant, X^2 (4, N = 1,640) = 46.855, $p < .001$, and explained about 3.8% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,640) = 48.898, $p < .001$, and explained about 4.0% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 76 for more information.

Table 76

Adaptive Software, Non-mandatory Tutoring, and a Learning Community, Combined Logistic Regression Results – Take College Level Math Within Two Years of Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.663 (.107)	< .001	.638 (.200)	.041
Black	.617 (.160)	.003	.517 (.202)	.001
Male	.678 (.106)	< .001	.681 (.135)	.005
Pell	.707 (.114)	.002	.715 (.147)	.022
Black*Intervention			1.600 (.330)	.154
Male*Intervention			.998 (.218)	.994
Pell*Intervention			.974 (.233)	.912
Nagelkerke's R^2	.038		.040	

Question 4 – Factors Related to Passing College Math. For MTH 090, the first logistic regression model was significant, X^2 (4, N = 50) = 10.059, p = .039, and explained about 25.8% of the variance. When interactions were added, the model was significant, X^2 (7, N = 50) = 11.516, p = .118, and explained about 29.2% of the variance. Receiving Pell funding significantly contributed to the variance in model one. None of the variables entered in model two significantly contributed to the variance. See Table 77 for more information.

Table 77

Adaptive Software, Non-mandatory Tutoring, and a Learning Community, Combined Logistic Regression Results – Pass College Level Math After MTH 090

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.140 (1.04)	.058	0 (13,841.400)	.999
Black	.840 (.791)	.825	.762 (1.275)	.831
Male	.156 (1.042)	.075	.286 (1.426)	.380
Pell	.144 (.962)	.044	0 (13,841.400)	.999
Black*Intervention			1.040 (1.670)	.981
Male*Intervention			.366 (2.124)	.636
Pell*Intervention			141,326,284.908 (13,841.400)	.999
Nagelkerke's R^2	.258		.292	

Again, no students in MTH 091, MTH 092, and MTH 098 with the new curriculum had the opportunity to participate in the combination of adaptive software use, non-mandatory tutoring, and a learning community. When the classic MTH 098 data was tested, though, the first logistic regression model was significant, X^2 (4, N = 815) = 25.799, $p < .001$, and explained about 4.9% of the variance. In model one, race was a significantly contributing variable. The race, gender, and socioeconomic variables were significant contributors to the overall variance in model two. When interactions were added, the model was significant, X^2 (7, N = 815) = 31.579, $p < .001$, and explained about 6.0% of the variance. See Table 78 for more information.

Table 78

Adaptive Software, Non-mandatory Tutoring, and a Learning Community, Combined Logistic Regression Results – Pass College Level Math After Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.776 (.191)	.185	.398 (.375)	.014
Black	.326 (.263)	< .001	.397 (.326)	.005
Male	.747 (.183)	.111	.631 (.219)	.036
Pell	.750 (.194)	.138	.583 (.241)	.025
Black*Intervention			.548 (.566)	.288
Male*Intervention			1.776 (.406)	.157
Pell*Intervention			2.246 (.417)	.053
Nagelkerke's R^2	.049		.060	

Results – Adaptive Software, Non-mandatory Tutoring, and Summer Bridge Program, Combined

Question 2 – Factors Related to Passing Developmental Math. The first logistic regression model run using MTH 090 course data was not significant. When interactions were added, the model remained non-significant. No MTH 091 or MTH 092 students had the opportunity to participate in the combination of the use of adaptive software, non-mandatory tutoring, and a summer bridge program. For classic MTH 098, The first logistic regression model was significant, X^2 (4, N = 1,015) = 31.565, $p < .001$, and explained about 4.5% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,015) = 34.794, $p < .001$, and explained about 4.9% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 79 for more information. For the new MTH 098 course, only five students were exposed to the combination of interventions. The data were not analyzed.

Table 79

Adaptive Software, Non-mandatory Tutoring, and Summer Bridge Program, Combined Logistic Regression Results – Pass Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.614 (.296)	.1	1.462 (.743)	.609
Black	.546 (.204)	.003	.542 (.214)	.004
Male	.697 (.148)	.014	.694 (.153)	.017
Pell	.572 (.165)	< .001	.618 (.170)	.005
Black*Intervention			.882 (.747)	.866
Male*Intervention			1.116 (.633)	.862
Pell*Intervention			.293 (.743)	.098
Nagelkerke's R^2	.045		.049	

Question 3 – Factors Related to Taking College Level Math Within Two Years. For MTH 090, the first logistic regression model was not significant. When interactions were added, the model was not significant. The combination of adaptive software, non-mandatory tutoring, and a summer bridge program was not made available to students who took MTH 091 or MTH 092. The first new MTH 098 logistic regression model was significant, X^2 (4, N = 1,101) = 36.26, $p < .001$, and explained about 4.5% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,101) = 41.187, $p < .001$, and explained about 5.1% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 80 for more information. For the new MTH 098 course, only five students were exposed to the combination of interventions. The data were not analyzed.

Table 80

Adaptive Software, Non-mandatory Tutoring, and Summer Bridge Program, Combined Logistic Regression Results –Take College Level Math Within Two Years of Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.717 (.270)	.217	2.042 (.648)	.271
Black	.482 (.192)	< .001	.517 (.202)	.001
Male	.645 (.131)	< .001	.681 (.135)	.005
Pell	.693 (.142)	.010	.715 (.147)	.022
Black*Intervention			.415 (.738)	.233
Male*Intervention			.379 (.603)	.108
Pell*Intervention			.522 (.634)	.306
Nagelkerke's R^2	.045		.051	

Question 4 – Factors Related to Passing College Math. For MTH 090, The first logistic regression model was not significant. When interactions were added, the model was not significant. No students in MTH 091 or MTH 092 had the opportunity to participate in the combination of the use of adaptive software, non-mandatory tutoring, and a summer bridge program. For the classic MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 609) = 24.285, $p < .001$, and explained about 6.4% of the variance. When interactions were added, the model was significant, X^2 (7, N = 609) = 26.707, $p < .001$, and explained about 7.0% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 81 for more information. For the new MTH 098 course, only five students were exposed to the combination of interventions. The data was not analyzed.

Table 81

Adaptive Software, Non-mandatory Tutoring, and Summer Bridge Program, Combined Logistic Regression Results – Pass College Level Math After Classic MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	5.004 (1.032)	.119	7,089,371,134,418.840 (1,399.077)	.998
Black	.403 (.325)	.005	.397 (.326)	.005
Male	.614 (.218)	.025	.631 (.219)	.036
Pell	.569 (.240)	.019	.583 (.241)	.025
Black*Intervention			7.303 (41,331.229)	1.000
Male*Intervention			.000 (9,633.051)	.998
Pell*Intervention			.000 (10,145.275)	.999
Nagelkerke's R^2	.064		.070	

Results – Adaptive Software, Non-mandatory Tutoring, Summer Bridge Program, and an Ongoing Bridge Program, Combined

Question 2 – Factors Related to Passing Developmental Math. The only students who were exposed to the combination of interventions were those in the new MTH 098 course. The first logistic regression model was significant, X^2 (4, N = 995) = 49.347, $p < .001$, and explained about 7.0% of the variance. When interactions were added, the model was significant, X^2 (7, N = 995) = 54.163, $p < .001$, and explained about 7.7% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 82 for more information.

Table 82

Adaptive Software, Non-mandatory Tutoring, Summer Bridge Program, and an Ongoing Bridge Program, Combined Logistic Regression Results – Pass New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.216 (.390)	< .001	.042 (1.441)	.028
Black	.599 (.208)	.014	.542 (.214)	.004
Male	.674 (.149)	.008	.694 (.153)	.017
Pell	.631 (.167)	.006	.618 (.170)	.005
Black*Intervention			4.325 (.934)	.117
Male*Intervention			.658 (.854)	.625
Pell*Intervention			2.591 (1.266)	.452
Nagelkerke’s R^2	.070		.077	

Question 3 – Factors Related to Taking College Level Math Within Two Years. Again, no students in MTH 090, MTH 091, MTH 092, or the classic MTH 098 were supported by the combination of interventions. For the new MTH 098 course, the first logistic regression model was significant, X^2 (4, N = 1,076) = 49.653, $p < .001$, and explained about 6.2% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,076) = 53.923, $p < .001$, and explained about 6.7% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 83 for more information.

Table 83

Adaptive Software, Non-mandatory Tutoring, Summer Bridge Program, and an Ongoing Bridge Program, Combined Logistic Regression Results –Take College Level Math Within Two Years of New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.264 (.392)	< .001	.146 (1.469)	.190
Black	.554 (.196)	.003	.517 (.202)	.001
Male	.658 (.133)	.002	.681 (.135)	.005
Pell	.719 (.145)	.023	.715 (.147)	.022
Black*Intervention			3.183 (.949)	.223
Male*Intervention			.324 (.941)	.231
Pell*Intervention			1.254 (1.313)	.863
Nagelkerke's R^2	.062		.067	

Question 4 – Factors Related to Passing College Math. Students enrolled in the new MTH 098 course were the only ones who experienced the combination of interventions. The first logistic regression was significant, X^2 (4, N = 595) = 23.013, $p < .001$, and explained about 6.1% of the variance. When interactions were added, the model was significant, X^2 (7, N = 595) = 23.013, $p = .002$, and explained about 6.1% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. See Table 84 for more information.

Table 84

Adaptive Software, Non-mandatory Tutoring, Summer Bridge Program, and an Ongoing Bridge Program, Combined Logistic Regression Results – Pass College Level Math After New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	795,768,423.598 (12,490.764)	.999	199,848,706.774 (52405.221)	1.000
Black	.397 (.326)	.005	.397 (.326)	.005
Male	.631 (.219)	.036	.631 (.219)	.036
Pell	.583 (.241)	.025	.583 (.241)	.025
Black*Intervention			2.517 (33,627.851)	1.000
Male*Intervention			1.586 (33,627.851)	1.000
Pell*Intervention			1.715 (44,029.192)	1.000
Nagelkerke's R^2	.056		.061	

Results – No Intervention

There were students in MTH 090 and MTH 091 that experienced no intervention. There were some students in MTH 098 that only experienced the new curriculum as an intervention.

Question 2 – Factors Related to Passing Developmental Math. For all courses, Chi-square analyses were done to determine if the developmental math pass rate for those students were different than the pass rate for students at colleges that offered one or more student support. Table 85 provides the results of those analyses.

Table 85

Results from Chi-Square Tests Comparing Colleges with Any Intervention to Colleges with No Intervention

Course	Research Question	Intervention	No Intervention	Chi-square Results
MTH 090	Pass MTH 090	64.1%	62.3%	NS (N = 77)
	Take College Math	23.6%	28.6%	NS (N = 77)
	Pass College Math	65.6%	75.0%	NS (N = 24)
MTH 091	Pass MTH 091	64.5%	79.7%	X^2 (1, N = 808) = 81.56, $p < .001$
	Take College Math	41.7%	49.3%	X^2 (1, N = 808) = 37.71, $p < .001$
	Pass College Math	56.0%	77.5%	X^2 (1, N = 397) = 73.30, $p < .001$
MTH 092	Pass MTH 092	68.0%		No Cases
	Take College Math	66.3%		No Cases
	Pass College Math	55.6%		No Cases
Classic MTH 098	Pass MTH 098	70.0%	74.8%	X^2 (1, N = 960) = 10.50, $p = .001$
	Take College Math	57.8%	66.6%	X^2 (1, N = 960) = 63.69, $p < .001$
	Pass College Math	70.9%	79.5%	X^2 (1, N = 644) = 23.94, $p < .001$
New MTH 098	Pass MTH 098	58.7%	48.7%	X^2 (1, N = 226) = 9.37, $p = .002$.
	Take College Math	46.3%	42.0%	NS (N = 226)
	Pass College Math	68.2%	72.6%	NS (N = 101)

For MTH 098, there was an intervention to test (the new math curriculum) for colleges that offered no other student support. The first logistic regression model that tested the intervention was significant, X^2 (4, N = 1,186) = 75.226, $p < .001$, and explained about 8.7% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,186) = 80.579, $p < .001$, and explained about 9.3% of the variance. The race and socioeconomic variables significantly contributed to the variance in model one. The race, gender, and socioeconomic variables were significant contributors to the overall variance in model two. See Table 86 for more information.

Table 86

No Intervention Logistic Regression Results – Pass MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.308 (.154)	< .001	.170 (.308)	< .001
Black	.537 (.196)	.002	.542 (.214)	.004
Male	.788 (.133)	.074	.694 (.153)	.017
Pell	.721 (.144)	.023	.618 (.170)	.005
Black*Intervention			1.081 (.540)	.885
Male*Intervention			1.642 (.312)	.112
Pell*Intervention			1.763 (.332)	.087
Nagelkerke's R^2	.087		.093	

Question 3 – Factors Related to Taking College Level Math Within Two Years. The first logistic regression model run using MTH 098 data tested the effects of the new MTH 098 curriculum. It was significant, X^2 (4, N = 1,319) = 76.501, $p < .001$, and explained about 7.6% of the variance. When interactions were added, the model was significant, X^2 (7, N = 1,319) = 82.471, $p < .001$, and explained about 8.2% of the variance. Race and gender significantly contributed to the variance in model one. The race, gender, and socioeconomic variables were significant contributors to the overall variance in model two, as did the interaction between receiving Pell funding and the intervention. See Table 87 for more information.

Table 87

No Intervention Logistic Regression Results – Take College Level Math Within Two Years of MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.350 (.139)	< .001	.197 (.277)	< .001
Black	.525 (.185)	< .001	.517 (.202)	.001
Male	.743 (.119)	.012	.681 (.135)	.005
Pell	.832 (.126)	.145	.715 (.147)	.022
Black*Intervention			1.276 (.495)	.622
Male*Intervention			1.401 (.284)	.235
Pell*Intervention			1.868 (.300)	.037
Nagelkerke's R^2	.076		.082	

Question 4 – Factors Related to Passing College Math. The first MTH 098 logistic regression model was significant, X^2 (4, N = 661) = 18.972, $p < .001$, and explained about 4.5% of the variance. When interactions were added, the model was significant, X^2 (7, N = 661) = 22.508, $p = .002$, and explained about 5.3% of the variance. The race and gender variables significantly contributed to the variance in model one. In model two, the race, gender, and socioeconomic variables were significant contributors to the overall variance. See Table 88 for more information.

Table 88

No Intervention Logistic Regression Results – Pass College Level Math After MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.716 (.290)	.248	.397 (.592)	.119
Black	.437 (.311)	.008	.397 (.326)	.005
Male	.608 (.202)	.014	.631 (.219)	.036
Pell	.655 (.221)	.055	.583 (.241)	.025
Black*Intervention			3.382 (1.215)	.316
Male*Intervention			.794 (.583)	.693
Pell*Intervention			2.363 (.618)	.164
Nagelkerke's R^2	.045		.053	

Results – No Survey Response

Question 2 – Factors Related to Passing Developmental Math. Although there are no interventions or combinations of interventions to test for colleges that did not answer the survey (except for the presentation of the new MTH 098 curriculum), Chi-square analyses were done to determine if the developmental math pass rate for those students were different than the pass rate for students at colleges that offered one or more intervention. Table 89 provides the results of those analyses.

Table 89

Results from Chi-Square Tests Comparing Colleges with Any Support(s) to Colleges with No Survey Response

Course	Research Question	Intervention	No Survey Response	Chi-square Results
MTH 090	Pass MTH 090	64.1%	61.3%	X^2 (1, N = 3,571) = 84.17, $p < .001$
	Take College Math	23.6%	24.6%	X^2 (1, N = 3,571) = 33.67, $p < .001$
	Pass College Math	65.6%	67.0%	NS (N = 950)
MTH 091	Pass MTH 091	64.5%	76.0%	X^2 (1, N = 1,124) = 64.68, $p < .001$
	Take College Math	41.7%	41.0%	X^2 (1, N = 1,124) = 22.43, $p < .001$
	Pass College Math	56.0%	77.6%	X^2 (1, N = 533) = 106.96, $p < .001$
MTH 092	Pass MTH 092	68.0%	55.6%	NS (N = 225)
	Take College Math	66.3%	56.1%	NS (N = 225)
	Pass College Math	55.6%	58.0%	NS (N = 135)
Classic MTH 098	Pass MTH 098	70.0%	74.8%	X^2 (1, N = 2,058) = 22.40, $p < .001$
	Take College Math	57.8%	59.4%	X^2 (1, N = 2,058) = 42.74, $p < .001$
	Pass College Math	70.9%	74.2%	X^2 (1, N = 1,184) = 10.46, $p = .001$
New MTH 098	Pass MTH 098	58.7%	63.3%	X^2 (1, N = 1,697) = 15.12, $p < .001$
	Take College Math	46.3%	49.2%	X^2 (1, N = 1,697) = 65.54, $p < .001$
	Pass College Math	68.2%	73.8%	X^2 (1, N = 799) = 13.90, $p < .001$

For MTH 098, there was an intervention to test (the new math curriculum) for colleges that failed to respond to the survey. The first logistic regression model that tested the intervention was significant, X^2 (4, N = 3,755) = 160.591, $p < .001$, and explained about 5.9% of the variance. When interactions were added, the model was significant, X^2 (7, N = 3,755) = 168.353, $p < .001$, and explained about 6.2% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. In model two, however, the interaction between race and the intervention was a significant contributor as well. See Table 90 for more information.

Table 90

No Survey Response Logistic Regression Results – Pass Classic or New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.604 (.073)	< .001	.584 (.159)	< .001
Black	.542 (.079)	< .001	.619 (.113)	< .001
Male	.780 (.076)	.001	.667 (.106)	< .001
Pell	.811 (.089)	.019	.771 (.124)	.037
Black*Intervention			.762 (.159)	.087
Male*Intervention			1.384 (.178)	.033
Pell*Intervention			1.092 (.178)	.622
Nagelkerke's R^2	.059		.062	

Question 3 – Factors Related to Taking College Level Math Within Two Years. The first logistic regression model run using MTH 098 data tested the effects of the new MTH 098 curriculum. It was significant, X^2 (4, N = 4,379) = 107.680, $p < .001$, and explained about 3.2% of the variance. When interactions were added, the model was significant, X^2 (7, N = 4,379) = 123.751, $p < .001$, and explained about 3.7% of the variance. The race, gender, and socioeconomic variables were significant contributors to the overall variance in both models. Additionally, the interaction between gender and the intervention significantly contributed to the variance in model two. See Table 91 for more information.

Table 91

No Survey Response Logistic Regression Results –Take College Level Math Within Two Years of Classic or New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.668 (.062)	< .001	.541 (.130)	< .001
Black	.804 (.067)	.001	.861 (.093)	.108
Male	.691 (.065)	< .001	.552 (.088)	< .001
Pell	.791 (.074)	.001	.732 (.100)	.002
Black*Intervention			.853 (.134)	.235
Male*Intervention			1.644 (.130)	< .001
Pell*Intervention			1.173 (.148)	.282
Nagelkerke's R^2	.032		.037	

Question 4 – Factors Related to Passing College Math. The first MTH 098 logistic regression model that tested the effect of the new MTH 098 curriculum was significant, X^2 (4, N = 2,614) = 15.082, p = .005, and explained less than 1% of the variance. When interactions were added, the model was significant, X^2 (7, N =2,614) = 23.637, $p < .001$, and explained about 1.4% of the variance. In both models, gender was a significantly contributing variable. See Table 92 for more information.

Table 92

No Survey Response Logistic Regression Results – Pass College Level Math After Classic or New MTH 098

	Model 1		Model 2	
Variables	*OR (SE)*	*p*-Value	*OR (SE)*	*p*-Value
Intervention	.935 (.100)	.500	.576 (.196)	.005
Black	1.048 (.110)	.670	.953 (.145)	.737
Male	.677 (.102)	< .001	.576 (.134)	< .001
Pell	.969 (.114)	.783	.820 (.152)	.191
Black*Intervention			1.251 (.223)	.314
Male*Intervention			1.437 (.208)	.081
Pell*Intervention			1.471 (.231)	.095
Nagelkerke's R^2	.009		.014	

Summary

This chapter first provided a review of the research questions to be answered by the analyses. Survey results were described. Also, descriptive and inferential statistical results were provided. Results were placed in context with each research question that they addressed and presented for each developmental course.

Chapter 5 – Discussion

Introduction

The purpose of this chapter is to provide an exploration and discussion about the findings from this research. First, there will be a summary of the findings related to each research question. The summary will be followed by interpretations of what was learned, including how that relates to previous research results. The narrative will cover findings related to overall student success in developmental math, interventions implemented at individual Alabama Community Colleges, and interventions applied at the system level. The chapter will end with some conclusions and recommendations for both community college practitioners and researchers.

Summary of Findings

The analysis of the survey and archival data helped provide answers to the four research questions of interest.

Research Question One

Research question one asked "[w]hat are the most common interventions (i.e., course structuring and academic supports) that have been used at Alabama Community Colleges any time from the Fall 2012 term to the Summer 2022 term related to developmental math education?" The colleges had developmental math sequences that consisted of a series of one to four courses. From Fall 2012 through Summer 2018, most colleges offered a sequence of two developmental math courses, MTH 090 and MTH 098. Most students were placed into MTH 098 as their first required developmental course as determined by their score on a placement test, such as the Compass and ACCUPLACER, both which were used at ACCS colleges. Starting in Fall 2018, though, all students took MTH 098, since that was the only remedial math course available under the terms of the “Developmental Education Redesign.” The number of students placed in developmental math dropped precipitously starting then, as well. The first year of the study, 2012-2013, almost 7,000 students were placed in developmental courses. In the last year of the study, 2021-2022, fewer than 1,500 students were placed in developmental math.

Colleges implemented a number of interventions designed to help students pass developmental math. Non-mandatory tutoring was the intervention most frequently offered by colleges, with 12 (57.1%) providing access to that service. Often, non-mandatory tutoring was made available in addition to other interventions. Nine (42.9%) colleges offered adaptive software as well as non-mandatory tutoring, two (9.5%) offered adaptive software, a summer-bridge program, and the option of being tutored, one (4.8%) college offered a summer-bridge program and non-mandatory tutoring, and one (4.8%) offered adaptive software, a learning community, and non-mandatory tutoring. Two (9.5%) colleges required students to attend tutoring. One (4.8%) of those two also offered a summer bridge program. One (4.8%) college offered a learning community as the sole intervention, and one (4.8%) college offered adaptive software as the only intervention available. See Appendix 4 for a description of what interventions were offered by colleges over what terms.

Research Question Two

There were two parts to the second research question. The first was “[h]ow are common interventions in place at Alabama community colleges within Fall 2012 to Summer 2022 related to student success (as defined by passing with an A, B, or C) in the first developmental math course taken within one year from high school graduation?” The second question was “[h]ow do these outcomes differ among students of different gender, race, or socio-economic status?” This discussion will begin with an exploration of the overall power of the logistic regression models to explain the variance in student performance related to their first math course. Then, results will be reviewed class-by-class to explore the effect of the interventions, the student characteristics, and the interaction between the interventions and characteristics.

In every case, the second model that included the interaction terms was as predictive of the variance as the first model or better. Still, the adjusted R^2 statistics indicate that most of the second models had weak explanatory power. The median amount of variation that was predicted was 5.8%. The highest amount of variation that was predicted by any intervention was associated with mandatory tutoring (17.5% for MTH 090).

MTH 090. Overall, students who received mandatory tutoring had a 91.9% chance of passing MTH 090. Unfortunately, males who received the intervention had a 14.9% chance of passing. Other interventions were unhelpful for male students, as well. Those exposed to non-mandatory tutoring has a 22.0% chance of passing, males exposed to mandatory tutoring and adaptive software combined had a 19.9% chance of passing, and those who experienced non-mandatory tutoring and adaptive software combined had a 23.2% chance of passing. With the combination of adaptive software, non-mandatory tutoring, and a learning community, males had the lowest chance of passing (12.6%). The significant odds ratios for passing MTH 090 are shown in Table 93.

Table 93

Significant Odd Ratios for Passing MTH 090

	Intervention	Black	Male	Pell
Learning Community	NS	NS	NS	NS
Interaction		NS	NS	NS
Mandatory Tutoring	11.284	NS	NS	NS
Interaction		NS	.175	NS
Non-mandatory Tutoring	NS	NS	NS	NS
Interaction		NS	.282	NS
Adaptive Software	NS	NS	NS	NS
Interaction		NS	NS	NS
Adaptive Software and Mandatory Tutoring	NS	NS	NS	NS
Interaction		NS	.248	NS
Adaptive Software and Non-mandatory Tutoring	NS	NS	NS	NS
Interaction		NS	.302	NS
Non-mandatory Tutoring and Summer Bridge Program	NS	NS	NS	NS
Interaction		NS	NS	NS
Adaptive Software, Non-mandatory Tutoring, and Learning Community	NS	NS	NS	NS
Interaction		NS	.144	NS
Adaptive Software, Non-mandatory Tutoring, and Summer Bridge Program (Overall NS)	--	--	--	--
Interaction		--	--	--

MTH 091. Males were significantly more at risk of failing MTH 091. Their chance of passing was 37.58%. There were no other significant findings related to main effects or interventions. The significant odds ratios for passing MTH 091 are shown in Table 94.

Table 94

Significant Odd Ratios for Passing MTH 091

	Intervention	Black	Male	Pell
Adaptive Software and Non-mandatory Tutoring	NS	NS	.602	NS
Interaction		NS	NS	NS

MTH 092. The MTH 092 course was offered at three colleges. However, only one of those responded to the survey and the entire population at that college was exposed to non-mandatory tutoring. Therefore, the effect of the intervention could not be assessed.

Classic MTH 098 vs. New MTH 098. Black or African American students, males, and students who received Pell funding were significantly less likely to pass MTH 098, overall. Black or African American students had a 35.1% chance of passing on their first attempt. Males had a 41.0% chance of passing. Students who received Pell funding had a 38.2% chance of passing MTH 098 on their first try. A comparison of outcomes at colleges that did not respond to the survey showed that Black or African students had a slightly increased chance of passing MTH 098 on their first attempt (38.2%), as did students who received Pell funding (43.5%). Males, though, had slightly lower chances of passing at colleges that did not respond to the survey (40.0%). An assessment of the effect of implementing the new curriculum (without any interventions) showed that students, overall, had a significantly lower (14.5%) chance of passing the course. At colleges that did not respond to the survey, though, students had a 36.9% chance of passing MTH 098 if they were exposed to the new curriculum. One interesting thing to note is that, for some unknown reason, males who took MTH 098 with the new curriculum at colleges that did not respond to the survey had a better than even chance of passing. Their chance to do so was 58.1%. The significant odds ratios for passing MTH 098 (classic vs. new curriculum) are shown in Table 95.

Table 95

Significant Odd Ratios for Passing MTH 098 (Classic vs. New Curriculum)

	Intervention	Black	Male	Pell
New Curriculum	.170	.542	.694	.618
Interaction		NS	NS	NS
No Survey Response – New Curriculum	.584	.619	.667	.771
Interaction		NS	1.384	NS

Classic MTH 098. As was already mentioned, Black or African Americans had a 35.1% chance of passing, males had a 41.0% chance to do so, and Pell funded students had a 38.2% chance of passing. Students who took MTH 098 using the classic curriculum and who were required to attend tutoring had an 88.1% chance of passing the course. Students who were exposed to non-mandatory tutoring and adaptive software had a 40.3% chance of passing on their first attempt. Male students who experienced the availability of adaptive software only had a 38.3% chance of passing. The significant odds ratios for passing the classic MTH 098 course are shown in Table 96.

Table 96

Significant Odd Ratios for Passing Classic MTH 098

	Intervention	Black	Male	Pell
Learning Community	NS	.542	.694	.618
Interaction		NS	NS	NS
Mandatory Tutoring	7.401	.542	.694	.618
Interaction		NS	NS	NS
Non-mandatory Tutoring	NS	.542	.694	.618
Interaction		NS	NS	NS
Adaptive Software	NS	.542	.694	.618
Interaction		NS	.621	NS
Adaptive Software and Mandatory Tutoring	NS	.542	.694	.618
Interaction		NS	NS	NS
Adaptive Software and Non-mandatory Tutoring	.676	.542	.694	.618
Interaction		NS	NS	.676
Non-mandatory Tutoring and Summer Bridge Program	NS	.542	.694	.618
Interaction		NS	NS	NS
Adaptive Software, Non-mandatory Tutoring, and Learning Community	NS	.542	.694	.618
Interaction		NS	NS	NS
Adaptive Software, Non-mandatory Tutoring, and Summer Bridge Program	NS	.542	.694	.618
Interaction		NS	NS	NS

New MTH 098. Again, overall, in MTH 098, Black or African American students had a 35.1% chance of passing on their first attempt, males had a 41.0% chance of doing so, and Pell funded students had a 38.2% chance of passing on their first try. Students exposed to mandatory tutoring had a 31.8% chance of passing the course and those who could opt to be tutored had a 29.9% chance passing. The availability of adaptive software was associated with a 17.2% chance of passing. If adaptive software was combined with mandatory tutoring, chances of passing rose to 23.6%. If it was combined with non-mandatory tutoring, chances rose to 29.2%. Students who were exposed to the greatest array of interventions–adaptive software, non-mandatory tutoring, a summer bridge program, and ongoing bridge programs–had the lowest chance of passing (4.0%). The significant odds ratios for passing the new MTH 098 course are shown in Table 97.

Table 97

Significant Odd Ratios for Passing New MTH 098

	Intervention	**Black**	**Male**	**Pell**
Learning Community	NS	.542	.694	.618
Interaction		NS	NS	NS
Mandatory Tutoring	.466	.542	.694	.618
Interaction		NS	NS	NS
Non-mandatory Tutoring	.426	.542	.694	.618
Interaction		NS	NS	NS
Adaptive Software	.207	.542	.694	.618
Interaction		NS	NS	NS
Adaptive Software and Mandatory Tutoring	.309	.542	.694	.618
Interaction		NS	NS	NS
Adaptive Software and Non-mandatory Tutoring	.413	.542	.694	.618
Interaction		NS	NS	NS
Non-mandatory Tutoring and Summer Bridge Program	NS	.542	.694	.618
Interaction		NS	NS	NS
Adaptive Software, Non-mandatory Tutoring, and Summer Bridge Program, Ongoing Bridge Program	.042	.542	.694	.618
Interaction		NS	NS	NS

Research Question Three

Research question three had two parts. Part one was "[h]ow are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2022 related to student persistence to a college level math course within two years of attempting a developmental math course?" The second part of question four was "[h]ow do these outcomes differ among students of different gender, race, or socio-economic status?" Again, it is useful to discuss how predictive the model that included the intervention performed, compared to the model that included student characteristics, compared to the final model that also included a variable that indicated if a student passed the developmental math course the on the first attempt. A course-by-course discussion will follow with an examination of the individual variables in the models and the interaction of the interventions and student characteristics.

The interventions being present in the developmental math course held very little power to predict the variability in the likelihood that students would take a college level course within two years of their first attempt at a developmental course. The median amount of variability that was explained was about 5.1%. In MTH 090, the full model that tested the effects of adaptive software predicted the most variance at 6.7%. In MTH 091, the model that tested the effects of adaptive software and non-mandatory tutoring explained 8.2% of the variance. The full model that tested the effects of mandatory tutoring explained the largest amount of variance in both the classic MTH 098 course and the new MTH 098 course (1.4% and 1.0%, respectively). The median amount of variance that was explained by the models was 1.4%.

MTH 090. Males who were exposed to many interventions had a lower chance of taking a college level course within two years of first attempting MTH 098. Their chances were:

- 23.2% with a learning community,

- 23.6% with mandatory tutoring,
- 20.8% with non-mandatory tutoring,
- 22.5% with adaptive software,
- 23.7% when adaptive software was combined with mandatory tutoring, and
- 24.0% when adaptive software was combined with non-mandatory tutoring.

Table 98 shows the significant odds ratios for taking a college level course within two years of the first MTH 090 course.

Table 98

Significant Odd Ratios for Taking a College Level Course after MTH 090

	Intervention	Black	Male	Pell
Learning Community	NS	NS	NS	NS
Interaction		NS	.302	NS
Mandatory Tutoring	NS	NS	NS	NS
Interaction		NS	.309	NS
Non-mandatory Tutoring	NS	NS	NS	NS
Interaction		NS	.263	NS
Adaptive Software	NS	NS	NS	NS
Interaction		NS	.290	NS
Adaptive Software and Mandatory Tutoring	NS	NS	NS	NS
Interaction		NS	.310	NS
Adaptive Software and Non-mandatory Tutoring	NS	NS	NS	NS
Interaction		NS	.316	NS
Non-mandatory Tutoring and Summer Bridge Program (Overall NS)	--	--	--	--
Interaction			--	--
Adaptive Software, Non-mandatory Tutoring, and Learning Community (Overall NS)	--	--	--	--
Interaction			--	--
Adaptive Software, Non-mandatory Tutoring, and Summer Bridge Program (Overall NS)	--	--	--	--
Interaction			--	--

MTH 091. For MTH 091, the combination of adaptive software and non-mandatory tutoring was associated with a lower likelihood that students would take a college level math course within two years of attempting the developmental course. Their chance of doing so was 25.6%. Overall, males had a 34.8% chance of doing so, but when they were exposed to the intervention their chances of passing dropped to 24.0%. Black or African American students had a 30.3% chance of passing. Table 99 shows the significant odds ratios for taking a college level course within two years of the first MTH 091 course.

Table 99

Significant Odd Ratios for Taking a College Level Course after MTH 091

	Intervention	**Black**	**Male**	**Pell**
Adaptive Software and Non-mandatory Tutoring	.344	NS	.534	.434
Interaction		NS	.316	NS

MTH 092. The MTH 092 course was offered at three colleges. However, only one of those responded to the survey and the entire population at that college was exposed to non-mandatory tutoring. Therefore, the effect of the intervention could not be assessed.

Classic MTH 098 vs. New MTH 098. Overall, members of each sub population studied had lower likelihoods of taking a college level course within two years of first attempting the MTH 098 class with or without the new curriculum. Blacks or African Americans had the lowest chance at 34.1%, followed by males at 40.5%. Students who received Pell funding had a 41.7% chance of continuing to a subsequent college level course within two years. At colleges that did not respond to the survey, males had a 35.6% chance of taking a college level math course within two years of first attempting MTH 098. Students who received Pell funding had a 42.3% chance of doing the same. Students at colleges that offered no interventions and who experienced the new MTH 098 curriculum had a diminished (16.5%) chance of taking a college level math course within two years of attempting the new MTH 098 course. Conversely, students at colleges that did not respond to the survey and who experienced the new MTH 098 course had a 35.1% chance of continuing on to college level math. At those colleges, the same pattern occurred in relation to question three as question two. In this case, males who took MTH 098 with the new curriculum at colleges that did not respond to the survey had a 62.2% chance of taking a college level course within two years of their first developmental math attempt. Table 100 shows the significant odds ratios for taking a college level course within two years of the first MTH 098 course (classic vs. new curriculum).

Table 100

Significant Odd Ratios for Taking a College Level Course after MTH 098 (Classic vs. New Curriculum)

	Intervention	Black	Male	Pell
New Curriculum	.197	.517	.681	.715
Interaction		NS	NS	NS
No Survey Response – New Curriculum	.541	NS	.552	.732
Interaction		NS	1.644	NS

Classic MTH 098. As was mentioned, overall in MTH 098, Blacks or African Americans had a 34.1% chance of taking a college level math course within two years of their first attempt at the classic MTH 098 course. Males had a 40.5% chance of doing so, and students who received Pell funding had a 41.7% chance of continuing to a subsequent college level course within two years. Mandatory Tutoring; non-mandatory tutoring; the use of adaptive software; and the combination of adaptive software, non-mandatory tutoring, and a learning community were all associated with lower chances of students, overall, taking a college level course within two years of their first attempt at MTH 098. The sample of students who were exposed to mandatory tutoring had the lowest chance at 21.6%. Students who took the classic MTH 098 course and were able to use adaptive software, opt-in to tutoring, and engage with a learning community had a 38.9% chance of taking a college math course within two years. Students who were exposed to adaptive software had a 41.0% chance of doing so, and students who took the course and who could choose to be tutored had a 42.1% chance of persisting to a college level math course within two years.

Black or African American students were more likely to take a college level math course within two years of their first developmental attempt if they were required to be tutored or if they were exposed to adaptive software combined with both mandatory and non-mandatory tutoring. Those who were exposed to mandatory tutoring alone had a 68.5% chance of persisting to a college level course. Those who were required to be tutored with exposure to adaptive software had a 66.1% chance of taking college math within two years. Students who were given the opportunity to attend non-mandatory tutoring with exposure to adaptive software had a 60.3% chance of taking a college level math course within two years. Males were more likely to take a college level math course within two years of their first attempt at MTH 098 if they were required to be tutored. Their chance of doing so was 62.2%. If males were exposed to adaptive software, they were still more likely to take a college course within two years. However, their chances (41.0%) were less than one percentage point higher than the chances for males, overall (40.5%). Table 101 shows the significant odds ratios for taking a college level course within two years of the first classic MTH 098 course.

Table 101

Significant Odd Ratios for Taking a College Level Course after Classic MTH 098

	Intervention	Black	Male	Pell
Learning Community	NS	.517	.681	.715
Interaction		NS	NS	NS
Mandatory Tutoring	.275	.517	.681	.715
Interaction		2.176	1.644	NS
Non-mandatory Tutoring	.726	.517	.681	.715
Interaction		NS	NS	NS
Adaptive Software	.696	.517	.681	.715
Interaction		NS	.695	NS
Adaptive Software and Mandatory Tutoring	NS	.517	.681	.715
Interaction		1.954	NS	NS
Adaptive Software and Non-mandatory Tutoring	NS	.517	.681	.715
Interaction		1.522	NS	NS
Non-mandatory Tutoring and Summer Bridge Program	NS	.517	.681	.715
Interaction		NS	NS	NS
Adaptive Software, Non-mandatory Tutoring, and Learning Community	.638	.517	.681	.715
Interaction		NS	NS	NS
Adaptive Software, Non-mandatory Tutoring, and Summer Bridge Program	NS	.517	.681	.715
Interaction		NS	NS	NS

New MTH 098. Again, among all students who took MTH 098 regardless of curriculum, members of each sub population had lower chances of taking a college level course within two years of first attempting the new MTH 098 class. Blacks or African Americans had the lowest chance at 34.1%, males had a 40.5% chance, and students who received Pell funding had a

41.7% chance of continuing to a subsequent college level course within two years. Four interventions significantly contributed to the variance of the likelihood that students would progress to a college course within two years from first attempting the new MTH 098 course. Students who received mandatory tutoring had a 32.0% chance of continuing to college math. Students who were exposed to non-mandatory tutoring had a 31.0% chance of doing so. Students who experienced the availability of adaptive software had a 20.6% chance of taking a subsequent college level math course within two years. Students who were exposed to both adaptive software and non-mandatory tutoring had a 31.8% chance of persisting to a college math course within two years.

Surprisingly, Black or African American students who were exposed to the availability of a learning community had much greater likelihood of continuing on to take a college level math course within two years. Their chance of doing so was 91.6%. The combination of adaptive software and mandatory tutoring was also associated with a better chance of passing (69.9%) for Black or African American students than the general Black or African American sample (34.1%). Table 100 shows the significant odds ratios for taking a college level course within two years of the first new MTH 098 course.

Table 102

Significant Odd Ratios for Taking a College Level Course after New MTH 098

	Intervention	Black	Male	Pell
Learning Community	NS	.517	.681	.715
Interaction		10.861	NS	NS
Mandatory Tutoring	.470	.517	.681	.715
Interaction		NS	NS	NS
Non-mandatory Tutoring	.449	.517	.681	.715
Interaction		NS	NS	NS
Adaptive Software	.260	.517	.681	.715
Interaction		NS	NS	NS
Adaptive Software and Mandatory Tutoring	NS	.517	.681	.715
Interaction		2.326	NS	NS
Adaptive Software and Non-mandatory Tutoring	.466	.517	.681	.715
Interaction		NS	NS	NS
Non-mandatory Tutoring and Summer Bridge Program	NS	.517	.681	.715
Interaction		NS	NS	NS
Adaptive Software, Non-mandatory Tutoring, and Summer Bridge Program, Ongoing Bridge Program	NS	.517	.681	.715
Interaction		NS	NS	NS

Research Question Four

Research question four was like research question two, except it focused on success in college level courses. The first part of the two-part question was "[h]ow are common interventions in place at Alabama Community Colleges within Fall 2012 to Summer 2022 related to student success (as defined by passing with an A, B, or C) in the first college level math course taken after successful completion (as defined by passing with an A, B, or C) of the first developmental math course?" The second question was "[h]ow do these outcomes differ among students of different gender, race, age, or socio-economic status?" Like research questions two and three, a discussion of the overall power of the models to explain the variation in the likelihood that students would pass a college math course (if they took such a course within two years of taking their first math course will occur. Last, results will be reviewed class-by-class to explore the effect of the interventions, the student characteristics, and the interaction between the interventions and characteristics.

Overall, the second models that tested the interaction effects in addition to the main effects were better at predicting the likelihood that students would pass their first college math course within two years of first attempting the developmental math course. Still, the amount of variance that was explained was fairly low, with the median amount being 6.3%. Astonishingly, the model that tested the combination of adaptive software in MTH 090 predicted 29.2% of the variance. For the classic MTH 098 course, the model that tested the use of mandatory tutoring held the greatest explanatory power (10.4%). The largest amount of variance explained for the new MTH 098 models was 8.7%, which was from the model that included non-mandatory tutoring.

MTH 090. The main effects and the intervention or combination of interventions was not associated with students having a higher or lower likelihood of passing their first college math course if they took one within two years of passing MTH 090.

MTH 091. The main effects and the intervention or combination of interventions was not associated with students having a higher or lower likelihood of passing their first college math course if they took one within two years of passing MTH 091.

MTH 092. The MTH 092 course was offered at three colleges. However, only one of those responded to the survey and the entire population at that college was exposed to non-mandatory tutoring. Therefore, the effect of the intervention could not be assessed.

Classic MTH 098 vs. New MTH 098. Overall, among students who took MTH 098 as their first developmental course and passed, Blacks or African Americans had the lowest chance of passing their first attempt at a college level math course taken within two years (28.4%), followed by students who received Pell funding (38.7%). Males had a 41.7% chance of passing on their first attempt of a subsequent college level course taken within two years. At colleges that did not respond to the survey, all students who took MTH 098 with the new curriculum and who had passed that class had a 36.6% chance of passing the first college level math course if they took one within two years. Males had the same chance (36.6%) of doing so. Table 103 presents significant odds ratios for passing a college level course after passing MTH 098 (classic vs. new curriculum).

Table 103

Significant Odd Ratios for Passing a College Level Course after MTH 098 (Classic vs. New Curriculum)

	Intervention	Black	Male	Pell
New Curriculum Alone	NS	.397	.631	.583
Interaction		NS	NS	NS
No Survey Response – New Curriculum Alone	.576	NS	.576	NS
Interaction		NS	NS	NS

Classic MTH 098. Overall, among all students who took MTH 098, Black or African American students had a 28.4% chance of passing their first college level math course within two years of passing the MTH 098 course. The chance for males to do the same was 38.7%. Pell funded students had a 36.8% chance of passing their first college math course within two years of passing the MTH 098 class. Students who passed classic MTH 098 and who were exposed to non-mandatory tutoring, adaptive software, and the combination of non-mandatory tutoring ad adaptive software had lower chances of passing their first college level math course if they took one within two years of passing their first developmental math course (32.0%, 31.4%, and 31.9%, respectively). Student members of sub populations who experienced any intervention, though, were not significantly less likely to pass their first college level math course. In fact, Black or African American students who had the opportunity to use adaptive software and non-mandatory tutoring had a 67.2% chance of passing their first college math, which was almost 40% higher than the overall Black or African American student sample (which had a 28.4% chance of succeeding). Table 104 presents significant odds ratios for passing a college level course after passing the classic MTH 098 course.

Table 104

Significant Odd Ratios for Passing a College Level Course after Classic MTH 098

	Intervention	Black	Male	Pell
Learning Community	NS	.397	.631	.583
Interaction		NS	NS	NS
Mandatory Tutoring	NS	.397	.631	.583
Interaction		NS	NS	NS
Non-mandatory Tutoring	.471	.397	.631	.583
Interaction		NS	NS	NS
Adaptive Software	.457	.397	.631	.583
Interaction		NS	NS	NS
Adaptive Software and Mandatory Tutoring	NS	.397	.631	.583
Interaction		NS	NS	NS
Adaptive Software and Non-mandatory Tutoring	.468	.397	.631	.583
Interaction		2.052	NS	NS
Non-mandatory Tutoring and Summer Bridge Program	NS	.397	.631	.583
Interaction		NS	NS	NS
Adaptive Software, Non-mandatory Tutoring, and Learning Community	NS	.397	.631	.583
Interaction		NS	NS	NS

New Math 098. African American students, males, and Pell funded students who passed MTH 098 had the same chance of passing their first college level math course if one was taken within two years regardless of if they took the classic or new curriculum. Black or African American students had a 28.4% chance of doing so, males had a 38.7% chance of doing so, and students who received Pell funding had a 36.8% chance. Overall, students who were exposed to non-mandatory tutoring in the new MTH 098 course had a lower chance of passing their first college math if they took that course within two years of passing MTH 098; their chance for success was 27.6%. Students who experienced the combination of adaptive software and non-mandatory tutoring had a 26.7% chance of passing their first college math course within two years of passing their first developmental course.

With one exception, for students in all sub populations, the exposure to any intervention was not associated with significantly lower chances of passing their first college level math course within two years of passing the new MTH 098 course. The exception was for Pell students who had the opportunity to attend non-mandatory tutoring and use adaptive software. Their chances of passing the first college level math course within two years of passing the new MTH 098 course was 64.6%.

At schools that did not implement any other intervention besides the introduction of the new MTH 098 curriculum, there was not a significant risk associated with that implementation for students as a whole, Black or African American students, males, or students who received Pell funding. At colleges that did not respond to the survey, being Black or African American or receiving Pell funding did not significantly lower the chance of passing a college level math course within two years of passing the first attempted developmental math course. Males, though, had a 36.5% chance of doing so. The same was true for students who took the new MTH 098 course; they had a 36.5% chance of passing the subsequent college math course. Sub populations (Black or African Americans, males, and Pell funded students) were not significantly less likely to pass a college level math course if one was taken within two years of passing MTH 098. Table 105 presents significant odds ratios for passing a college level course after passing the new MTH 098 course.

Table 105

Significant Odd Ratios for Passing a College Level Course after New MTH 098

	Intervention	Black	Male	Pell
Learning Community	NS	.397	.631	.583
Interaction		NS	NS	NS
Mandatory Tutoring	NS	.397	.631	.583
Interaction		NS	NS	NS
Non-mandatory Tutoring	.382	.397	.631	.583
Interaction		NS	NS	NS
Adaptive Software	NS	.397	.631	.583
Interaction		NS	NS	NS
Adaptive Software and Mandatory Tutoring	NS	.397	.631	.583
Interaction		NS	NS	NS
Adaptive Software and Non-mandatory Tutoring	.364	.397	.631	.583
Interaction		NS	NS	1.827
Non-mandatory Tutoring and Summer Bridge Program	NS	.397	.631	.583
Interaction		NS	NS	NS

Interpretations Related to the Literature

Overall Success in Developmental Math

It is evident that most efforts to remediate underprepared students fail to increase the likelihood that they will pass their first attempt at developmental math. This may be due to the vast number of students who arrive at community colleges extremely underprepared. This is particularly true in Alabama, where less than a fourth of public school eleventh graders demonstrated proficiency in math (Alabama Achieves, 2023). ACT scores further revealed that, overall, males and scored almost four points below the level indicative of college readiness, Black or African American students scored more than six points below that level, and economically disadvantaged students scored more than five points below that level. The results of this research reinforced the idea that Black or African American, male, or students in lower socioeconomic circumstances are less prepared to succeed at college math. Members of those groups who started with MTH 098 all had significantly lower chances of passing on their first attempt.

These research results supported the findings of Bailey et al. (2015). They found that about half of students that they studied who took remedial courses completed a college level math course. In this study, at least in MTH 098, Black or African American students, males, and Pell funded students were significantly less likely to take a college level math course within two years of their first attempt at developmental math. And, if those students passed their first attempt at MTH 098, they were still highly unlikely to pass their first attempt at a college level math course if one was taken within two years.

Outcomes Related to Interventions at Individual Colleges

Although the principles of andragogy, according to Knowles, Holton, and Swanson (2005, p. 64 – 68) posit that adult learners (which arguably community college students are) prefer independence and are intrinsically motivated to learn, the evidence from this study seems to suggest otherwise. Mandatory tutoring involves activities that more closely resemble Piaget's and Vygotsky's ideas that teaching and learning occur in a dynamic (or interdependent) environment (Moore, 2003), and that student support that was most highly related to student success in the first attempted developmental math class was mandatory tutoring. Students who received mandatory tutoring in either MTH 090 or classic MTH 098 had much greater chances of passing on their first attempt. Unfortunately, though, males who experienced mandatory tutoring in MTH 090 were quite a bit less likely to pass the class. That was not true in either the classic MTH 098 course or the new MTH 098 course.

Even though mandatory tutoring was linked to higher odds for passing some developmental math courses, non-mandatory tutoring did not seem to benefit students. Students did not have a greater chance of passing their first attempted math course, which is what Jaafar et al. (2015) found to be true in their research. In MTH 090, males who received non-mandatory tutoring were significantly more likely to fail on their first attempt. Further, while Howell and Walkington (2022) learned that tutoring was linked to a greater likelihood that students would complete their developmental sequence, the findings of this study did not agree. Students who received either mandatory or non-mandatory tutoring were not any more likely to take a college level math class (which evidences the fact that they completed the developmental sequence) than other students. In MTH 090, males who experienced tutoring (mandatory or non-mandatory) were significantly less likely to take a college level math course within two years.

Baier et al. (2019) found that learning community engagement was connected to students earning higher grade point averages. This study did not include an analysis of grade point averages after the first and second years of college; however, students who were involved in a learning community did not have a significantly higher chance of succeeding in any developmental math course. This lends some indirect support against the Baier et al. (2019) findings.

Despite prior research by Weltman et al. (2018) that found that the use of adaptive software to be beneficial, this research showed different results. For students attempting to pass their first developmental math course, the availability of adaptive software at best had no significant impact on outcomes. The more advanced the course was that was first attempted, the more likely the introduction of adaptive software was detrimental to student success. Adaptive software alone was not significantly related to the outcome of students in MTH 090. In the new MTH 098 course, though, students who were exposed to adaptive software were much less likely to pass the course. In the classic MTH 098 course, males who were exposed to adaptive software had a less than even chance of passing.

Two interventions could not be studied in isolation using the available data. There were not enough students who were exposed to a summer bridge program or an ongoing bridge program to determine the effect that would have on student outcomes. The findings by other researchers, such as Kallison and Stader (2012) and Worthington et al. (2016) showed that bridge programs had mixed results. This might be explained because the programs that were studied incorporated other interventions, such as learning in groups (like with learning communities) and acceleration. The findings from this study were mixed as well, and that might be caused, in part, by the same reason (bridge programs were offered in conjunction with other interventions). For example, students who were exposed to the use of adaptive software, non-mandatory tutoring, a summer bridge program, and an ongoing bridge program were less likely to pass MTH 098.

Outcomes Related to Interventions at the Alabama Community College System

One of the positive outcomes cited related to the consideration of non-cognitive factors in placement decisions was that fewer students would be placed in developmental math (Cullinan et al., 2018). This may have occurred at Alabama Community Colleges in the two years that non-cognitive factors were used in combination with placement test scores. The number of students attempting their first developmental course in 2015-2016 (the year before non-cognitive factors were considered) was 6,176. The number dropped 8.3% to 5,703 by the second year that non-cognitive factors were considered. The implementation of the new placement strategy was associated with mixed success related to student pass rates. Students may have been over placed. It is likely that more students who were relatively more prepared were placed in higher level developmental math courses. This may explain why more students failed MTH 090; the worst prepared were the only students who were placed in that class after the change. While placement looks to be fairly accurate for courses above MTH 090, the same cannot be said to be true for Black or African American students, who performed worse in MTH 091 and MTH 098. One reason that the results were mixed related to the use of non-cognitive factors, perhaps, is that the intervention did not fully adhere to the suggestion made by Cullinan et al. (2018) that colleges take their unique cultures into account when deciding what factors to include in placement decisions. Maybe a one-size-fits-all approach was not the best way to implement this intervention.

The goal of streamlining students into fewer developmental classes, as recommended by Bailey et al. (2015), is to reduce the number of remedial courses that students face on their pathway toward college level coursework. The results of this study did not support the findings of Hodara and Jaggars (2014) that indicated that students who took a streamlined sequence of one developmental math course would be more likely to take and pass a college math course. The introduction of the new MTH 098 course as the only available developmental course was associated with students having a much lower likelihood of taking a college level course within two years. This might not be a result of the deletion of other developmental courses, though. Students who took the course with the new curriculum were much less likely to pass the course than students who took MTH 098 with the classic curriculum. Therefore, the cause might be the changed curriculum.

Conclusions and Recommendations for Practitioners and Researchers

There is no doubt that lack of college preparedness is a crisis in Alabama and beyond. This is especially true for mathematics. Most students who graduate from high school are not prepared to succeed at college level math. When students are not ready to pass college math, they are less likely to experience a host of positive outcomes, such as graduating college and getting well-paying employment. This leads to difficulty for states to fill their workforce needs. Colleges have tried many different interventions to help students successfully get through remedial coursework. Colleges have worked with high schools to better align high school course content with college content. They have also worked to make sure that students are placed in the most appropriate developmental course for their level of preparedness. There have been many supportive interventions for students upon enrollment at colleges, such as encouraging engagement in bridge programs and learning communities, offering tutoring, and allowing students to use adaptive software that provides the opportunity for them to work at their own pace. Last, some colleges have eliminated developmental coursework in part or altogether (streamlining).

Unfortunately, one of the interventions that may be robustly helpful is mandatory tutoring. The reason that this is unfortunate is because of the uniqueness of community college students, who often have adult responsibilities, such as working and caretaking for children and adults. These students tend to benefit from more flexibility rather than less, so mandating that they attend tutoring may cause additional hardship. Also, a reason that mandatory tutoring might not be the easiest intervention to implement is because there is a relatively high cost to employing tutoring staff, especially as faculty are increasingly aging out of the workforce, causing increased competition.

More can be learned from schools that mandated tutoring for developmental math students. Students should be asked to provide information about what they found most useful from tutoring. Also, other colleges could adopt strategies that have been used to fill staffing needs. For example, colleges that require tutoring may offer online sessions or rely on student tutors to ensure that student needs are met. They may also understand what hours the tutoring center should be open for students. Last, colleges might opt to share staffing. For example, several colleges are within 50-miles or closer. Tutors (or even faculty) could be employed at more than one institution.

In a way, streamlining students might prove to provide an opportunity to help developmental math students. Although students may be less likely to pass a streamlined course of study, the overall number of students who must be remediated will be greatly reduced. A recommendation for colleges is to transition faculty who are no longer needed to teach developmental math to a role providing mandatory tutoring services. Some of the cost savings that are achieved from remediating fewer students could be used to staff tutoring centers more fully and during hours that will meet the need for student flexibility.

Although this research offered a comprehensive study of many developmental math interventions to help students succeed, there is a great deal of work that can be done to extend these findings. It would be interesting to see what is happening around developmental math support at colleges that did not complete the survey. This is especially true because males, in particular, at those schools had positive outcomes in the new MTH 098 course related to pass rates and the likelihood of continuing to college level math. Follow-up research could include focus groups or interviews at those institutions. Additional data might add clarity to the interventions offered and how they affect students. Better records would also help sharpen the focus of research. It was obvious from the survey answers that the institutional memory for what interventions have been implemented may be suspect. Because colleges tend to add interventions, remove interventions, and make changes to interventions in a desperate attempt to find some solution to help students in developmental math, it is important to be able to rely on records of when that took place to research the impacts of the interventions.

It is crucial that colleges continue to implement interventions to help Black or African American students, males, and students of lower socioeconomic strata. There are reasons that those students are so much less likely to succeed despite interventions designed to help. Those reasons need to be explored and mediated. For example, colleges may want to work with local high schools to offer supplemental instruction or support for these students. Not because they are members of these sub-populations, but because data show that they are less prepared to succeed at college by the time they graduate. Also, college administrators need to explore practices at other community colleges within and outside the State to learn what interventions and interventions have been most helpful to those students.

Additionally, there needs to be more research on the data set used in this study. The outcomes that were researched involved student activity when they were enrolled at an Alabama Community College. There was no examination of other outcomes. The point of the intense focus on developmental math education is to help students graduate and secure good employment. It would be interesting to better understand the graduation rates of these students as well as the time to completion related to interventions that were put in place. Also, additional research would aid in understanding employment trends related to student remediation.

Finally, when system-wide interventions are implemented, they need to be more deliberative. More research needs to be done when programs are piloted to get information to further inform the implementation. Also, they need to be left in place a sufficient amount of time to study the outcomes. It seems to be unclear what the full impact was of using non-cognitive measures to help place students because the intervention was only in place for two years before extensive changes were again made to math placement. When an intervention or program is fully implemented, continuous study needs to occur, and professionals need to review the results and make adaptations as indicated. Last, professionals “on the ground” at colleges need to be allowed to regularly come together to discuss what is going on at their campuses to share best practices. Also, there needs to be continuing professional development to make sure that all professionals are offering services in ways intended. For example, placement coordinators need to be trained about placement rules, tutors need to be trained about how to actively engage with students and about when to intervene if adaptive software is being used as a tool to enhance learning. With continued laser focus on meeting developmental education students’ needs, the odds of them succeeding in college and beyond will be increased.

References

ACT, Inc. (2015). ACT Engage user guide. https://www.act.org/content/dam/act/unsecured/documents/EngageUserGuide.pdf

ACT, Inc. (2016). Development and validation of ACT Engage: Technical manual. https://www.act.org/content/dam/act/unsecured/documents/act-engage-technical-manual.pdf

Alabama Achieves. (2023). *Business Rules.* https://www.alabamaachieves.org/reports-data/school-data/business-rules/

Alabama Community College System (2018). *College Readiness Task Force Report and Recommendations.*

An Act Relating to College Instruction, SB 1720 (2013). Retrieved September 22, 2022, from https://www.flsenate.gov/Session/Bill/2013/1720/BillText/Filed/HTML

Anderson, P., Pribesh, S., & Williams, M. R. (2020). A matched-samples comparison of pass rates for students coenrolled in developmental education and college level math compared to similar non-coenrolled students. *Community College Enterprise, 26*(2), 24-36. https://link.gale.com/apps/doc/A649236445/AONE?u=anon~1d2a7692&sid=googleScholar&xid=9dcf4086

Baier, S. T., Gonzales, S. M., & Sawilowsky, S. S. (2019). Classroom learning communities' impact on students in developmental courses. *Journal of Developmental Education, 42*(3), 6-8, 28.

Bailey, T. R., Jaggars, S. S., & Jenkins, D. (2015). Redesigning America's community colleges. Harvard University Press.

Bannier, B. (2007). *Predicting mathematics learning center visits: An examination of correlating variables.* Learning Assistance Review (TLAR), 12(1), 7-16.

Belfield, C., & Bailey, T. (2017). The labor market returns to sub-baccalaureate college: A review [working paper]. Center for Analysis of Postsecondary Education and Employment. https://ccrc.tc.columbia.edu/publications/labor-market-returns-sub-baccalaureate-college-review.html

Bohlig, E. M., Bullock, C. M., Garza, M., Hartman, C., Lovseth, K., & Yu, H. (2018). Developmental education and community college student success: Are the odds ever in their favor? *Texas Education Review, 6*(1), 53-74. https://doi.org/10.15781/T2C24R520

Boylan, H. R., Calderwood, B. J., & Bonham, B. S. (2017). College completion: Focus on the finish line. National Center for Developmental Education. https://ncde.appstate.edu/sites/ncde.appstate.edu/files/Completing%20College%20-Focus%20on%20The%20Finish%20Line.pdf

Calhoun Community College. (2023). *Adult ed bridge program.* https://calhoun.edu/adult-education/adult-education-bridge-program/

Campbell, E., & Cintron, R. (2018). Accelerating remedial education in Louisiana. *New Directions for Community Colleges, 2018*(182), 49–57. https://doi.org/10.1002/cc.20301

Center for Community College Student Engagement. (2016). Expectations meet reality: The underprepared student and community colleges. https://www.ccsse.org/docs/Underprepared_Student.pdf

Centers for Disease Control and Prevention. (2019). Office of Management and Budget (OMB) directive no. 15: Race and ethnic standards for federal statistics and administrative reporting. Retrieved September 26, 2022, from https://wonder.cdc.gov/wonder/help/populations/bridged-race/directive15.html

Chekour, A. (2018). Computer assisted math instruction: A case study for MyMathLab learning system. In J. Silverman and V. Hoyos (Eds.), *Distance Learning, E-Learning and Blended Learning in Mathematics Education*, (49-68). Springer International Publishing. https://doi.org/10.1007/978-3-319-90790-1_4

Chen, X. (2016). Remedial coursetaking at U.S. public 2- and 4-year institutions: Scope, Experiences, and Outcomes [statistical analysis report]. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. https://nces.ed.gov/pubs2016/2016405.pdf

Clery, S. (2011). Gateway coursework: Time to Completion. *Data points: Keeping informed about Achieving the Dream Data, 6*(3).

College Board (2019). Multiple factors in college placement decisions. Retrieved 12/3/2022 from https://accuplacer.collegeboard.org/accuplacer/pdf/multiple-factors-in-college-placement-decisions.pdf

College Board. (2023). *ACCUPLACER: Practice for ACCUPLACER.* https://practice.accuplacer.org/login

Community College Survey of Student Engagement. (n.d.). Understanding survey results. Retrieved August 29, 2022, from https://www.ccsse.org/survey/reports/2022/understanding.cfm#breakout

Community College Survey of Student Engagement. (2022). Nontraditional & traditional-aged students. Retrieved August 29, 2022, from https://www.ccsse.org/survey/reports/2022/reports.cfm

Complete College America. (n.d.). Corequisite support. Retrieved June 3, 2021, from https://completecollege.org/strategy/corequisite-support/

Cook, A. G. (2016). SOARing to new heights with underprepared students. *NADE digest, 8*(1), 2-9. Retrieved December 3, 2022, from https://files.eric.ed.gov/fulltext/EJ1178218.pdf

Council on Occupational Education. (2022). Member directory. Retrieved October 1, 2022, from https://council.org/membership/

Creswell, J. W. (2012). *Qualitative inquiry and research design: Choosing among five approaches.* Sage Publications, Inc.

Cullinan, D., Barnett, E., Kopko, E., Lopez, A., & Morton, T. (2019). Expanding access to college level courses. Community College Research Center. https://ccrc.tc.columbia.edu/publications/expanding-access-College Level-courses.html

Cullinan, D., Barnett., E. Ratledge, A., Welbeck, R., Belfield, C., & Lopez, A. (2018). Toward better college course placement: A guide to launching a multiple measures assessment system. Community College Research Center. https://ccrc.tc.columbia.edu/media/k2/attachments/2018_Multiple_Measures_Guide_1.pdf

Cung, B., Xu, D., Eichhorn, S. & Warschauer, M. (2019). Getting academically underprepared students ready through college developmental education: Does the course delivery format matter? *American Journal of Distance Education, 33*(3), 178-194, https://doi.org/10.1080/08923647.2019.1582404

Dadgar, M., & Weiss, M. J. (2012). Labor market returns to sub-baccalaureate credentials: How much does a community college degree or certificate pay? [working paper]. Community

College Research Center. http://ccrc.tc.columbia.edu/media/k2/attachments/labor-market-returns-sub-baccalaureate-college-review.pdf

Edgecombe, N. (2011). Accelerating the academic achievement of students referred to developmental education [working paper]. Community College Research Center. https://ccrc.tc.columbia.edu/media/k2/attachments/accelerating-achievement-developmental-education-brief.pdf

Enterprise State Community College. (2023). *Placement testing.* https://www.escc.edu/admissions/placement-testing/

Fields, R., & Parsad, B. (2012). Test and cut scores used for student placement in postsecondary education: Fall 2011. National Assessment Governing Board. https://www.nagb.gov/content/dam/nagb/en/documents/commission/researchandresources/test-and-cut-scores-used-for-student-placement-in-postsecondary-education-fall-2011.pdf

Grubbs, S. J. (2020). The American community college: History, policies and issues. *Journal of Educational Administration and History, 52*(2), 193–210. https://doi.org/10.1080/00220620.2019.1681385

Guy, G. M., Cornick, J., & Beckford, I. (2015). More than math: On the affective domain in developmental mathematics. *International Journal for the Scholarship of Teaching and Learning, 46(*2), 176-196. https://doi.org/10.1177/0091552118759419

Hanson, M. (2021). Pell grant statistics. EducationData.org. https://educationdata.org/pell-grant-statistics.

Hodara, M., & Jaggers, S., S. (2014). An examination of the impact of accelerating community college students' progression through developmental education. *Journal of Higher Education, 85*, 246-276. https://doi.org/10.1353/jhe.2014.0006

Hodara, M., & Xu, D. (2014). Does developmental education improve labor market outcomes? Evidence from two states [working paper]. Center for Analysis of Postsecondary Education and Employment. https://ccrc.tc.columbia.edu/media/k2/attachments/does-developmental-education-improve-labor-market-outcomes.pdf

Holmes, G., & Abington-Cooper, M. (2000). Pedagogy vs. andragogy: A false dichotomy? *JOTS, 26(*2). https://doi.org/10.21061/jots.v26i2.a.8

Howell, E., & Walkington, C. (2022). Factors associated with completion: Pathways through developmental mathematics. *Journal of College Student Retention: Research, Theory & Practice, 24*(1), 43-78. https://doi.org/10.1177/1521025119900985

Hu, S. (2015). Learning from a bold experiment. *Inside Higher Education.* Retrieved from https://www.insidehighered.com/views/2015/01/29/essay-making-most-floridas-remedial-reform

Hughes, K. L., & Scott-Clayton, J. (2011). Assessing developmental assessment in community colleges. *Community College Review, 39*(4), 327–351. https://doi.org/10.1177/0091552111426898

IPEDS Technical Review Panel #51 (2016). *Report and suggestions from IPEDS Technical Review Panel #51: Gender*. Retrieved November 12, 2023, from https://ipedstrp.rti.org/.

Jaafar, R., Toce, A., & Polnariev, B. A. (2015). A multidimensional approach to overcoming challenges in leading community college math tutoring success. *Community College*

Journal of Research and Practice, 40(6), 534-549. https://doi-org.spot.lib.auburn.edu/10.1080/10668926.2015.1021406

Jaggars, S., S., & Bickerstaff, S. (2018). Developmental education: The evolution of research and reform. In M. B. Paulson (Ed.), Higher education: Handbook of theory and research, 33, 469-503.

Jaggars, S. S., & Xu, D. (2016). Examining the earnings trajectories of community college students using a piecewise growth curve modeling approach. *Journal of Research on Educational Effectiveness, 9*(3), 445–471. https://doi.org/10.1080/19345747.2015.1116033

Jepsen, C., Troske, K., & Coomes, P. (2014). The labor-market returns to community college degrees, diplomas, and certificates. *Journal of Labor Economics, 32*(1), 95–121. https://doi.org/10.1086/671809

Kallison, J. M., & Stader, D. L. (2012). Effectiveness of summer bridge programs in enhancing college readiness. *Community College Journal of Research and Practice, 36*(5), 340-357. https://doi.org/10.1080/10668920802708595

Kamin, D. C. (2016). The common core state standards for mathematics and college readiness. *The Mathematics Educator, 25*(Special Issue), 52-70. Retrieved September 21, 2022, from https://files.eric.ed.gov/fulltext/EJ1142886.pdf

Kane, T. J., Boatman, A., Kozakowski, W., Bennett, C., Hitch, R., & Weisenfeld, D. (2018). Remedial math goes to high school: An evaluation of the Tennessee SAILS program. Center for Education Policy Research. https://cepr.harvard.edu/files/cepr/files/sails_research_report_final.pdf

Kane, T. J., Boatman, A., Kozakowski, W., Bennett, C., Hitch, R., & Weisenfeld, D. (2021). Is college remediation a barrier or a boost? Evidence from the Tennessee SAILS program. *Journal of Policy Analysis and Management, 40*(3), 883-913. http://doi.org/10.1002/pam.22306

Kanter, M., Ochoa, E., Nassif, R., & Chong, F. (2011, July 21). Meeting President Obama's 2020 college completion goal [PowerPoint slides]. https://www.ed.gov/sites/default/files/winning-the-future.ppt

Kashyap, U. & Santhosh, M. (2017). Corequisite model: An effective strategy for remediation in freshmen level QR course. *Journal of STEM Education, 18*(2), 23-29. Retrieved from https://www.jstem.org/jstem/index.php/JSTEM/article/view/2234/1857

Knudson, R. S. (1979). Humanagogy anyone? *Adult Education Quarterly, 29*(4), 261-264. https://doi-org.spot.lib.auburn.edu/10.1177/074171367902900406

Komarraju, M., Ramsey, A., & Rinella, V. (2013). Cognitive and non-cognitive predictors of college readiness and performance: Role of academic discipline. *Learning and Individual Differences, 24*, 103-109. https://doi.org/10.1016/j.lindif.2012.12.007

Kosiewicz, H., & Ngo, F. (2020). Giving community college students choice: The impact of self-placement in math courses. *American Educational Research Journal, 57*(3), 1358-1391. https://doi.org/10.3102/0002831219872500

Kwak, J. (2020, June). What are gateway courses and why do they matter to equity in higher ed? Every Learner Everywhere. Retrieved September 12, 2022, from https://www.everylearnereverywhere.org/blog/what-are-gateway-courses-and-why-do-they-matter-to-equity-in-higher-ed/

Lawson State Community College. (n.d.). *Programs: Developmental education at Lawson State Community College.* https://www.lawsonstate.edu/programs/lscc_programs/developmental_education.aspx

Lesik, S. A., Santoro, K. G., & DePeau, E. A. (2015). Evaluating the effectiveness of a mathematics bridge program using propensity scores. *Journal of Applied Research in Higher Education, 7*(2), 331-345. https://doi.org/10.1108/JARHE-01-2014-0010

Logue, A. W., Watanabe-Rose, M., & Douglas, D. (2016). Should students assessed as needing remedial mathematics take college level quantitative courses instead? A randomized controlled trial. *Educational Evaluation and Policy Analysis, 38*(3), 578–598. https://doi.org/10.3102/0162373716649056

March 2 Success. (n.d.). *Frequently asked questions.* https://www.march2success.com/main/faq

Markle, R., Olivera-Aguilar, M., Jackson, T., Noeth, R., & Robbins, S. (2013). Examining evidence of reliability, validity, and fairness for the SuccessNavigator assessment. Educational Testing Service. https://doi.org/10.1002/j.2333-8504.2013.tb02319.x

Mattern, K. D., & Packman, S. (n.d.). Predictive validity of ACCUPLACER scores for course placement: A meta-analysis [research report]. CollegeBoard. https://files.eric.ed.gov/fulltext/ED561046.pdf

Matthews, D. (2012). A Stronger Nation Through Higher Education. Lumina Foundation. https://www.luminafoundation.org/stronger-nation/report/2021/#page/downloads

McGraw Hill. (2023). *Mathematics*: *ALEKS*. Retrieved October 2, 2023 from https://www.mheducation.com/highered/highered/aleks-mathematics.html

Melnikova, Y., Long, V., & Adams, C. (2020). Tutoring lab attendance and time spent on homework: Impact on student performance in College Algebra. *Conference Papers –*

Psychology of Mathematics & Education of North America, 1452-1453. http://doi.org/10.51272/pmena.42.2020

Merriam, S. B. (2001). Andragogy and self-directed learning: Pillars of adult learning theory. *New Directions for Adult & Continuing Education, 89*(3), 3-13. https://doi.org/10.1002/ace.3

Mitchell, T. (2022, July 1). Department of Education regulatory topics comment letter. Retrieved November 12, 2023, from https://www.acenet.edu/Documents/Comments-ED-IPEDS-070122.pdf.

Mohring, P. M. (1989). *Androgy and Pedagogy. A comment on their erroneous usage.* Training and Development Project Number Twenty-Nine. https://files.eric.ed.gov/fulltext/ED305509.pdf

Mometrix. (2023). *Accuplacer practice test.* https://www.mometrix.com/academy/accuplacer-practice-test/

Moore, A. (2003). *Teaching and learning: Pedagogy, curriculum, and culture.* RoutledgeFalmer, New York. https://d1wqtxts1xzle7.cloudfront.net/31453460/Teaching_And_Learning_Pedagogy__Curriculum_And_Culture_By_Alex_Moore-libre.pdf?1392345407=&response-content-disposition=inline%3B+filename%3DTeaching_And_Learning_Pedagogy_Curriculu.pdf&Expires=1674963266&Signature=BiPy~af9cnQy5thtcmpRswhjEyHQ4qPE8GqhAXnJpQK0UOEyWeMDyZE4Ae791jTib~i4Znz0oE6qUjCSg5X3vWRT4e88oF7oYIn60lxHWqWYDmQ0mmu6AxFbETtmgbqdtdizp8CX~N8R7XD~VB0lw~A8BKcJ3efXN0Z6~stP2CdNJsoHWzMQ5QfGYbu~JqXcpxgOMW~ooypr6ERs1SwheMWU~WwlQjBIXlHmXB~7w1zOH8ckNGScPPOzHf0wykRxCmZ485-

yYdsaBARKsPwC~5G5poLM~qdSI3ogIJyzlDkYLyMscgSSnIUUq5MfvHI0T8kzZQCl
HJUzCUF3hChYGw__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA

Morgan, R. E., Dragon, C., Daus, G., Holzburg, J., Kaplan, R. Menne, H., Smith, A. S., & Spiegelman, M. (2020). Update on Terminology of Sexual Orientation and Gender Identity Survey Measures. FCSM-20-03

Morton, T. (2022). *Reviewing the research on informed self-placement: Practices, justifications, outcomes, and limitations* [Research brief]. Center for the Analysis of Postsecondary Readiness. Retrieved November 12, 2023, from https://files.eric.ed.gov/fulltext/ED622178.pdf.

National Center for Economic Statistics Integrated Postsecondary Data System Technical Review Panel. (n. d.). Report and suggestions from IPEDS technical review panel #51: Gender. Retrieved September 7, 2022, from https://edsurveys.rti.org/IPEDS_TRP_DOCS/prod/documents/TRP51_Summary.pdf

National Center for Education Statistics. (n.d.). Integrated Postsecondary Data System (IPEDS), Student Financial Aid component final data (2001-02 – 2018-19) and provisional data (2019-20). Retrieved August 29, 2022, from https://nces.ed.gov/ipeds/trendgenerator/

National Center for Education Statistics. (2016, June 1). National Assessment of Educational Progress history of framework changes. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. https://nces.ed.gov/nationsreportcard/mathematics/frameworkcomparison.asp

National Center for Education Statistics. (2018). Digest of Education Statistics. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. https://nces.ed.gov/programs/digest/d18/Tables/dt18_311.50.asp

National Center for Education Statistics. (2019a). The nation's report card: Results from the 2019 mathematics and reading assessments at grade 12. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. https://www.nationsreportcard.gov/mathematics/supportive_files/2019_infographic_G12_math_reading.pdf

National Center for Education Statistics. (2019b). Student enrollment: How many students enroll in postsecondary institutions annually? [trend generator]. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Retrieved June 3, 2021, from https://nces.ed.gov/ipeds/TrendGenerator/app/build-Table/2/2?rid=1&cid=65

National Center for Educational Statistics. (2022a). Instructions for IPEDS completions component. Integrated Postsecondary Data System. Retrieved September 7, 2022, from https://surveys.nces.ed.gov/ipeds/public/survey-materials/instructions?instructionid=30080

National Center for Educational Statistics. (2022b). 12-month enrollment full instructions. Integrated Postsecondary Data System. Retrieved September 7, 2022, from https://surveys.nces.ed.gov/ipeds/public/survey-materials/instructions?instructionid=30039

National Center for Educational Statistics. (2022c). GR- 2yr – full instructions. Integrated Postsecondary Data System. Retrieved September 7, 2022, from https://surveys.nces.ed.gov/ipeds/public/survey-materials/instructions?instructionid=30059

National Center for Educational Statistics. (2022d). Admissions full instructions. Integrated Postsecondary Data System. Retrieved September 7, 2022, from https://surveys.nces.ed.gov/ipeds/public/survey-materials/instructions?instructionid=30102

National Center for Educational Statistics. (2022d). Fall enrollment full instructions. Integrated Postsecondary Data System. Retrieved September 7, 2022, from https://surveys.nces.ed.gov/ipeds/public/survey-materials/instructions?instructionid=30077

Ngo, F., Chi, W. W., & Park, E. S. Y (2018). Mathematics course placement using holistic measures: Possibilities for college students. *Teachers College Record, 120*(2), 1-42. https://doi.org/10.1177/016146811812000205

Ngo, F. J., & Velasquez, D. (2020). Inside the math trap: Chronic math tracking from high school to community college. *Urban Education 00*(0), 1-29. https://doi.org/10.1177/0042085920908912

Northeast Alabama Community College. (2023). *Accuplacer placement.* https://www.nacc.edu/admission-financial-aid/admissions/accuplacer-placement

Office for Human Research Protections. (2020, June 23). *Human Subject Regulations Decision Charts: 2018 Requirements.* Retrieved October2, 2023 from https://www.hhs.gov/ohrp/regulations-and-policy/decision-charts-2018/index.html#c2

Obama, B. (2009, February 24). Remarks of President Barak Obama – as prepared for delivery [Address to Joint Session of Congress]. https://obamawhitehouse.archives.gov/the-press-office/remarks-president-barack-obama-address-joint-session-congress

OECD. (2020). Education at a glance 2020: OECD indicators. OECD. https://doi.org/10.1787/69096873-en

OECD. (2021). Education at a glance: Educational attainment and labour-force status [data set]. OECD Education Statistics. https://doi.org/10.1787/889e8641-en

Office of Information and Regulatory Affairs. (n. d.). ICR documents. Office of Management and Budget. Retrieved September 7, 2022, from https://www.reginfo.gov/public/do/PRAViewDocument?ref_nbr=202202-1850-008

Park, T., Woods, C. S., Hu, S., Jones, T. B. & Tandberg, D. (2018). What happens to underprepared first-time-in-college students when developmental education is optional? The case of developmental math and intermediate algebra in the first semester. *The Journal of Higher Education, 89*(3), 318-340. http://doi.org/10.1080/00221546.2017.1390970

Park-Gaghan, T. J., Mokher, C. G., Hu, X., Spencer, H., & Hu, S. (2020). What happened following comprehensive developmental education reform in the sunshine state? The impact of Florida's developmental education reform on introductory college level course completion. *Educational Researcher 49*(9), 656-666. http://doi.org/10.3102/0013189X20933876

Pearson. (2023). *MyLab: Math.* Retrieved October 2, 2023 from https://mlm.pearson.com/northamerica/mymathlab/index.html

Peterson, C. M. & Ray, C. M. (2013). Andragogy and metagogy: The evolution of neologisms. *Journal of Adult Education, 42*(2), 80-85.

Pratt, B. M., Hixon, L., & Jones, N. A. (2015). Measuring race and ethnicity across the decades: 1790–2010. United States Census Bureau. Retrieved September 26, 2022, from https://www.census.gov/data-tools/demo/race/MREAD_1790_2010.html

Rheinheimer, D. C., Grace-Odeleye, B., Francois, G. E., & Kusorgbor, C. (2010). Tutoring: A support strategy for at-risk students. *The Learning Assistance Review, 15*(1), 23-33, https://files.eric.ed.gov/fulltext/EJ886384.pdf

Rutgers Graduate School of Education Center for MSIs. (2022). List of minority serving institutions. https://cmsi.gse.rutgers.edu/sites/default/files/2022%20MSI%20List.pdf

Scott-Clayton, J. (2012). Do high-stakes placement exams predict college success? [working paper]. Community College Research Center. https://ccrc.tc.columbia.edu/media/k2/attachments/high-stakes-predict-success.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. https://doi.org/10.3102/0162373713517935

Serhan, D. & Almeqdadi, F. (2020). Students' perceptions of using MyMathLab and WebAssign in mathematics classroom. *International Journal of Technology in Education and Science (IJTES), 4*(1), 12-17. https://doi.org/10.46328/ijtes.v4i1.23

Snyder, T. D., de Brey, C., & Dillow, S. A. (2019). Digest of education statistics, 2018. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. https://nces.ed.gov/pubsearch/getpubcats.asp?sid=091#061

Southern Association of Colleges and Schools Commission on Colleges. (2022, July). Accredited and candidate list. https://sacscoc.org/app/uploads/2019/11/Institutionswebmemlist.pdf

Southern Regional Education Board (2013). SREB readiness courses: Transitioning to college and careers. https://www.sreb.org/sites/main/files/file-attachments/2013_readiness_backgrounder.pdf

Southern Regional Education Board (2015). Community colleges in the south: Strengthening readiness and pathways. https://www.sreb.org/sites/main/files/file-attachments/commcollegecom_2015.pdf?1491839378

Southern Regional Education Board (2018). Alabama state progress report: Looking closer. https://www.sreb.org/sites/main/files/file-attachments/2018progress_al.pdf?1529590787

Southern Union State Community College (2023). *Learning communities.* https://www.suscc.edu/programs/learning-communities.cms

Spencer, T. (2022). *ACT scores down only a fraction for the class of 2021, despite pandemic.* Public Affairs Research Council of Alabama. https://parcalabama.org/act-scores-down-only-a-fraction-for-the-class-of-2021-despite-pandemic/

Steinhauer, A., & Lovell, E. D. (2021). Non-traditional community college students' academic pursuits: Time, connectedness, support, wages and research. *Community College Journal of Research and Practice, 45*(3), 223–226. https://doi.org/10.1080/10668926.2019.1666066

Story, M. (Ed.). (2015). Reclaiming the American dream: A 50-year retrospective of the Alabama Community College System. Alabama Community College System.

Strom, P. S., & Strom, R. D. (2014). Adolescents in the Internet Age (2nd ed.). Information Age Publishing.

Strowbridge, E. D. (1987). Mathematics and developmental education. *New Directions for Community Colleges, 57*, 87-96. https://doi-org.spot.lib.auburn.edu/10.1002/cc.36819875710

Tapia, M., & Marsh, G. E., II (2004). An instrument to measure mathematics attitudes. *Academic Exchange Quarterly, 8*(2), 16-21. http://www.pearweb.org/atis/tools/48

United States Census Bureau. (2019). Educational attainment [2019: ACS 1-year estimates subject Table]. https://data.census.gov/cedsci/Table?q=ACSDT1Y2019%20Race%20by%20Educational%20Attainment&tid=ACSST1Y2019.S1501

United States Department of Education. (n.d.). Federal Pell Grants. Federal Student Aid. Retrieved August 29, 2022, from https://studentaid.gov/understand-aid/types/grants/pell

Varsity Tutors. (2023). *Free ACCUPLACER arithmetic practice tests.* https://www.varsitytutors.com/accuplacer_arithmetic-practice-tests

Volokhov. (2014). Differences in study skills knowledge between traditional and nontraditional students. *AURCO Journal, 20*. http://www.aurco.net/Journals/AURCO_Journal_2014/Study_Skills_Volokhov_AURCO_Vol20_2014.pdf

Wathington, H., Pretlow, J., & Barnett, E. (2016). A good start? The impact of 217exas' developmental summer bridge program on student success. *The Journal of Higher Education, 87*(2), 150-177. http://doi.org/10.1353/jhe.2016.0010

Weiss, M. J., & Headlam, C. (2019). A randomized controlled trial of a modularized, computer-assisted, self-paced approach to developmental math. *Journal of Research on*

Educational Effectiveness 12(3), 484-513, https://doi.org/10.1080/19345747.2019.1631419

Weiss, M. J., Visher, M. G., Weissman, E. & Wathington, H. (2015). The impact of learning communities for students in developmental education: A synthesis of findings from randomized trials at six community colleges. *Educational Evaluation and Policy Analysis 37*(4), 520-541. https://doi.org/10.3102/0162373714563307

Weltman, H. R., Timchencko, V., Sofios, H. E., Ayres, P. & Marcus, N. (2018). Evaluation of an adaptive tutorial supporting the teaching of mathematics. *European Journal of Engineering Education, 44*(5), 787-804. https://doi.org/10.1080/03043797.2018.1513993

Westrick, P. A., & Allen, J. (2014). Validity evidence for Act Compass Placement Tests. ACT. http://www.act.org/content/dam/act/unsecured/documents/ACT_RR2014-2.pdf

The White House (1997). Revisions to the standards for the classification of federal data on race and ethnicity. The Office of Management and Budget. Retrieved September 26, 2022, from https://obamawhitehouse.archives.gov/omb/fedreg_1997standards

Woods, C. S., Park, T., Hu, S., & Jones, T. B. (2018). How high school coursework predicts introductory college level course success. *Community College Review, 46*(2), 176-196. https://doi.org/10.1177/0091552118759419

Xu, Z., Backes, B., Oliveira, A, & Goldhaber, D. (2022). Ready for college? Examining the effectiveness of targeted interventions in high school. *Educational Evaluation and Policy Analysis, 44*(2), 183-209. https://doi.org/10.3102/01623737211036728

Appendix 1

Alabama Community Colleges by Type and Special Mission

College	Type	Special Mission
Bevill State Community College	Community College	
Bishop State Community College	Community College	Historically Black College
Central Alabama Community College	Community College	
Chattahoochee Valley Community College	Community College	
Coastal Alabama Community College	Community College	

Enterprise State Community College	Community College	
Gadsden State Community College	Community College	Historically Black College
George C. Wallace Community College	Community College	
George Corley Wallace State Community College	Community College	Primarily Black Institution
H. Councill Trenholm State Community College	Community College	Historically Black College
J. F. Drake Community and Technical College	Community College	Historically Black College
J. F. Ingram State Technical College	Technical College	Correctional Education
Jefferson State Community College	Community College	
John C. Calhoun Community College	Community College	
Lurleen B. Wallace Community College	Community College	

College	**Type**	**Special Mission**
Marion Military Institute	Community College	Military Academy Preparation
Northeast Alabama Community College	Community College	
Northwest-Shoals Community College	Community College	
Reid State Technical College	Technical College	
Shelton State Community College	Community College	Historically Black College
Snead State Community College	Community College	

Southern Union State Community College	Community College	
T. A. Lawson State Community College	Community College	Historically Black College
Wallace State Community College	Community College	

Appendix 2

ACCS Math Courses

Developmental Courses Prior to 2018

COURSE DESCRIPTIONS: COLLEGE PREPARATORY/DEVELOPMENTAL STUDIES

SECTION IV – D: MATHEMATICS (MTH)

DPT.	CRS.		"THEORY"		"EXPERIMENTAL"		"MANIPULATIVE"		COURSE
PRE	NUM	COURSE TITLE	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS
MTH	080	MATHEMATICS LABORATORY	1-2	1-2	0	0	0	0	1-2

PREREQUISITE: As required by program.

This course is designed to offer supplemental help to students in mathematics. Students work in a laboratory situation under qualified instructors. This course may be repeated as needed. Emphasis is on arithmetic and algebra as determined by the individual need of the students. ***NCA***

DPT.	CRS.		"THEORY"		"EXPERIMENTAL"		"MANIPULATIVE"		COURSE
PRE	NUM	COURSE TITLE	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS
MTH	090	BASIC MATHEMATICS	2-4	2-4	0	0	0	0	2-4

PREREQUISITE: As required by program.

Modified Hours in Table 4-30-02

This is a developmental course reviewing arithmetical principles and computations designed to help the student's mathematical proficiency for selected curriculum entrance. ***NCA***

DPT.	CRS.		"THEORY"		"EXPERIMENTAL"		"MANIPULATIVE"		COURSE
PRE	NUM	COURSE TITLE	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS
MTH	091-092	DEVELOPMENTAL ALGEBRA I-II	2-4	2-4	0	0	0	0	2-4

PREREQUISITE: MTH 090 or appropriate mathematics placement score.

Modified Hours in Table 4-30-02

This sequence of developmental courses provides the student with a review of arithmetic and algebraic skills designed to provide sufficient mathematical proficiency necessary for entry into Intermediate College Algebra. ***NCA***

DPT.	CRS.		"THEORY"		"EXPERIMENTAL"		"MANIPULATIVE"		COURSE
PRE	NUM	COURSE TITLE	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS
MTH	098	ELEMENTARY ALGEBRA	3	3	0	0	0	0	3

PREREQUISITE: MTH 090 or appropriate mathematics placement score.

This course is a review of the fundamental arithmetic and algebra operations. The topics include the numbers of ordinary arithmetic and their properties; integers and rational numbers; the solving of equations; polynomials and factoring; and an introduction to systems of equations and graphs. ***NCA***

COURSE DESCRIPTIONS: COLLEGE PREPARATORY/DEVELOPMENTAL STUDIES

Section IV — MATHEMATICS (MTH)

10/9/18

SUMMARY OF CHANGES			
Date	**CRS #**	**COURSE TITLE**	**RECENT CHANGES**
6/22/18	MTH 098	ELEMENTARY ALGEBRA	Updated to reflect changes approved by the College Readiness Task Force.
10/9/18	MTH 099	SUPPORT FOR INTERMEDIATE COLLEGE ALGEBRA	Updated to reflect changes approved by the College Readiness Task Force.
COMMENTS:			

SECTION IV – D: MATHEMATICS (MTH)

DPT.	CRS.		"THEORY"		"EXPERIMENTAL"		"MANIPULATIVE"		COURSE
PRE	NUM	COURSE TITLE	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS
MTH	080	MATHEMATICS LABORATORY	1-2	1-2	0	0	0	0	1-2

PREREQUISITE: As required by program.

This course is designed to offer supplemental help to students in mathematics. Students work in a laboratory situation under qualified instructors. This course may be repeated as needed. Emphasis is on arithmetic and algebra as determined by the individual need of the students. ***NCA***

DPT.	CRS.		"THEORY"		"EXPERIMENTAL"		"MANIPULATIVE"		COURSE
PRE	NUM	COURSE TITLE	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS
MTH	090	BASIC MATHEMATICS	2-4	2-4	0	0	0	0	2-4

PREREQUISITE: As required by program or appropriate placement score.

Modified Hours in Table 4-30-02

The purpose of this course is to provide students with skills in basic mathematics. Minimum content includes whole numbers, integers, fractions, decimals, ratio and proportions, percents, and an introduction to algebra. Additional topics may include systems of measurement and basic geometry. At the conclusion of this course students are expected to be able to perform basic mathematical operations. ***NCA***

DPT.	CRS.		"THEORY"		"EXPERIMENTAL"		"MANIPULATIVE"		COURSE
PRE	NUM	COURSE TITLE	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS
MTH	091	DEVELOPMENTAL ALGEBRA I	2-4	2-4	0	0	0	0	2-4

PREREQUISITE: MTH 090 or appropriate mathematics placement score.

Modified Hours in Table 4-30-02

This course provides a study of the fundamentals of algebra. Topics include the real number system, linear equations and inequalities, and graphing linear equations in two variables. ***NCA***

DPT.	CRS.		"THEORY"		"EXPERIMENTAL"		"MANIPULATIVE"		COURSE
PRE	NUM	COURSE TITLE	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS
MTH	092	DEVELOPMENTAL ALGEBRA II	2-4	2-4	0	0	0	0	2-4

PREREQUISITE: MTH 091 or appropriate mathematics placement score.

This course provides a study of the fundamentals of algebra. Topics include laws of exponents, polynomial operations, and factoring polynomials. ***NCA***

DPT.	CRS.		"THEORY"		"EXPERIMENTAL"		"MANIPULATIVE"		COURSE
PRE	NUM	COURSE TITLE	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS
MTH	098	ELEMENTARY ALGEBRA	4	4	0	0	0	0	4

PREREQUISITE: None

This course provides a study of the fundamentals of algebra. Topics include the real number system, linear equations and inequalities, graphing linear equations and inequalities in two variables and systems of equations. This course does not apply toward the general core requirement for mathematics.

DPT.	CRS.		"THEORY"		"EXPERIMENTAL"		"MANIPULATIVE"		COURSE
PRE	NUM	COURSE TITLE	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS	WEEKLY CONTACT HOURS	CREDIT HOURS
MTH	099	Support for Intermediate College Algebra	1 – 2	1 – 2	0	0	0	0	1 – 2

PREREQUISITE: Appropriate mathematics placement score or MTH 098 Elementary Algebra. (Note that MTH 099 is required for students completing MTH 098 Elementary Algebra.)

COREQUISITE: MTH 100 Intermediate College Algebra

This Learning Support course provides corequisite support in mathematics for students enrolled in MTH 100. The material covered in this course is parallel to and supportive of the material taught in MTH 100. Emphasis is placed on providing students with additional academic and noncognitive support with the goal of success in the students' paired MTH 100 class. This course does not apply toward the general core requirement for mathematics.

Appendix 3

Alabama Community College System Developmental Math Questionnaire

Start of Block: Introduction

Q1 Thank you for clicking on the link to take this survey! It should take no longer than 15 minutes for you to complete this questionnaire. Although your answers are not anonymous, your responses will be held in complete confidence. No information will ever be released to anyone, and none of your responses will be linked with your identity. All results will be presented in summary form.

End of Block: Introduction

Start of Block: Demographic Information

Q2 What institution is your primary employer?

▼ Bevill State Community College (1) … George Corley Wallace State Community College (Selma) (24)

Q3 What is your primary job title?

▼ Dean (1) … Part-time/adjunct instructor (5)

Q4 Are you…

O probationary

O non-probationary

Q5 How long have you been employed in the math department at your institution (years and months)?

O Years _____

O Months _____

Q6 How long have you been employed in a math department at ANY OTHER post-secondary institution (two-year or four-year, public or private, for-profit or non-profit)?

O Years_____

O Months_____

Display This Question:

If Q3 = Dean

Or Q3 = Division Chair

Or Q3 = Department Chair

Q7 In a typical fall semester, how many math faculty members teach **math** at your institution?

- Full-time faculty (1) ____

- Part-time/adjunct faculty (2) ____

Display This Question:

If Q3 = Dean

Or Q3 = Division Chair

Or Q3 = Department Chair

Q8 In a typical fall semester, how many math faculty members teach **developmental math** courses at your institution?

O Full-time faculty_____

O Part-time/adjunct faculty_____

End of Block: Demographic Information

Start of Block: Descriptive Information from Administrators

Display This Question:

If Q3 = Dean

Or Q3 = Division Chair

Or Q3 = Department Chair

Q9 What is the current sequence of developmental math courses that are available to students at your institution?

O Math 090 and Math 098

O Only Math 098

O Math 091 and Math 092

O Other (please describe) ____

Q10 At your institution, has a different developmental math course sequence been used at any time from Fall 2010 to Summer 2020?

O Yes

O No

O I don't know

Display This Question:

If Q10 = Yes

Q11 What terms was the different developmental math course sequence been used?

- O First term and year used?____

- O Last term and year used?____

Display This Question:

If Q10 = Yes

Q12 What course numbers were in the different sequence (select all that apply)?

- [ ] Math 090
- [ ] Math 091
- [ ] Math 092
- [ ] Math 098
- [ ] Other____

Display This Question:

If Q9 = Math 090 and Math 098

And Q3 = Dean

Or Q3 = Division Chair

Or Q3 = Department Chair

Q13 In a typical academic year (fall, spring, summer), how many of the following sections were taught at your institution in a traditional (not online or hybrid) setting?

O 090 ____

O 098 ____

Display This Question:

If Q9 = Only Math 098

And Q3 = Dean

Or Q3 = Division Chair

Or Q3 = Department Chair

Q14 In a typical academic year (fall, spring, summer), how many of the following sections were taught at your institution in a traditional (not online or hybrid) setting?

O 098 ____

Display This Question:

If Q9 = Math 091 and Math 092

And Q3 = Dean

Or Q3 = Division Chair

Or Q3 = Department Chair

Q15 In a typical academic year (fall, spring, summer), how many of the following sections were taught at your institution in a traditional (not online or hybrid) setting?

- O 091____
- O 092____

Display This Question:

If Q9 = Other (please describe)

And Q3 = Dean

And Q3 = Division Chair

And Q3 = Department Chair

Q16 In a typical academic year (fall, spring, summer), how many of the following sections were taught at your institution in a traditional (not online or hybrid) setting?

- O 090____
- O 098____
- O 091 ____
- O 092____

Display This Question:

If Q9 = Math 090 and Math 098

And Q3 = Dean

Or Q3 = Division Chair

Or Q3 = Department Chair

Q17 In a typical academic year (fall, spring, summer), how many of the following sections are taught at your institution in an online or hybrid setting?

O 090____

O 098____

Display This Question:

If Q9 = Only Math 098

And Q3 = Dean

Or Q3 = Division Chair

Or Q3 = Department Chair

Q18 In a typical academic year (fall, spring, summer), how many of the following sections are taught at your institution in an online or hybrid setting?

O 098 ____

Display This Question:

If Q9 = Math 091 and Math 092

And Q3 = Dean

Or Q3 = Division Chair

Or Q3 = Department Chair

Q19 In a typical academic year (fall, spring, summer), how many of the following sections are taught at your institution in an online or hybrid setting?

O 091____

O 092____

Display This Question:

If Q9 = Other (please describe)

And Q3 = Dean

And Q3 = Division Chair

And Q3 = Department Chair

Q20 In a typical academic year (fall, spring, summer), how many of the following sections are taught at your institution in an online or hybrid setting?

O 090____

O 098____

O 091 ____

O 092____

Display This Question:

If Q3 = Dean

Or Q3 = Division Chair

Or Q3 = Department Chair

Q21 At any time from Fall 2010 to Summer 2020, has your institution used self-paced software to for students to learn and work through developmental math material?

- O Yes, before they enroll in developmental courses
- O Yes, while they are enrolled in developmental courses
- O Yes, in lieu of enrollment in developmental courses
- O No

Display This Question:

If Q21 = Yes, before they enroll in developmental courses

Or Q21 = Yes, while they are enrolled in developmental courses

Or Q21 = Yes, in lieu of enrollment in developmental courses

Q22 Was this software available to students…

- O from a location on campus?
- O using their technology off campus?
- O Both on and off campus?

Display This Question:

If Q21 = Yes, before they enroll in developmental courses

Or Q21 = Yes, while they are enrolled in developmental courses

Or Q21 = Yes, in lieu of enrollment in developmental courses

Q23 What terms has your institution had such software available to students?

- First term it was available?____

- Last term it was available?____

End of Block: Descriptive Information from Administrators

Start of Block: Descriptive Information from administrators and instructors

Q24 What types of academic supports have been made available to help students with developmental math at anytime between Fall 2010 and Summer 2020 (select all that apply)?

- ☐ A summer math “boot camp”
- ☐ Learning communities
- ☐ Tutors/peer tutors to help with **developmental math**
- ☐ Other

Display This Question:

If Q24 = A summer math “boot camp”

Q25 What terms was a summer “boot camp” available to help students with developmental math?

O First term available?____

O Last term available?____

Display This Question:

If Q24 = A summer math “boot camp”

Q26 Was it/is it mandatory that students engage in a summer “boot camp” if they were determined to need developmental math?

O Yes

O No

Display This Question:

If Q24 = A summer math “boot camp”

Q27 What terms were learning communities available to help students with developmental math?

O First term available?____

O Last term available?____

Display This Question:

If Q24 = Learning communities

Q28 Was it/is it mandatory that students engage in a learning community when taking developmental math courses?

O Yes

O No

Display This Question:

If Q24 = Tutors/peer tutors to help with developmental math

Q29 What terms were tutors/peer tutors available to help with developmental math?

O First term this was available?____

O Last term this was available?____

Display This Question:

If Q24 = Tutors/peer tutors to help with developmental math

Q30 Was it/is it mandatory that students attend tutoring/peer tutoring when taking developmental math courses?

O Yes

O No

Display This Question:

If Q24 = Other

Q31 What other academic supports were made available at any time from Fall 2010 to Summer 2020 to help students with developmental math?

- Type of first other support?____
- Terms when first other support was available?________________________________
- Type of second other support?____
- Terms when second other support was available?______________________________
- Type of third other support?____
- Terms when third other support was available?________________________________

End of Block: Descriptive Information from administrators and instructors

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Appendix 4

Interventions Offered by College and by Term

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
1	FA2012	Yes	Yes				
1	SP2013	Yes	Yes				
1	SU2013	Yes	Yes				
1	FA2013	Yes	Yes				
1	SP2014	Yes	Yes				
1	SU2014	Yes	Yes				
1	FA2014	Yes	Yes				
1	SP2015	Yes	Yes				
1	SU2015	Yes	Yes				
1	FA2015	Yes	Yes				
1	SP2016	Yes	Yes				
1	SU2016	Yes	Yes				
1	FA2016	Yes	Yes				
1	SP2017	Yes	Yes				
1	SU2017	Yes	Yes				
1	FA2017	Yes	Yes				
1	SP2018	Yes	Yes				
1	SU2018	Yes	Yes				
1	FA2018	Yes	Yes				
1	SP2019	Yes	Yes				
1	SU2019	Yes	Yes				
1	FA2019	Yes	Yes				
1	SP2020	Yes	Yes				
1	SU2020	Yes	Yes				
1	FA2020	Yes	Yes				
1	SP2021	Yes	Yes				
1	SU2021	Yes	Yes				
1	FA2021	Yes	Yes				
1	SP2022	Yes	Yes				
1	SU2022	Yes	Yes		Yes		

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
3	FA2012	Yes	Yes				
3	SP2013	Yes	Yes				
3	SU2013	Yes	Yes				
3	FA2013	Yes	Yes				
3	SP2014	Yes	Yes				
3	SU2014	Yes	Yes				
3	FA2014	Yes	Yes				
3	SP2015	Yes	Yes				
3	SU2015	Yes	Yes				
3	FA2015	Yes	Yes				
3	SP2016	Yes	Yes				
3	SU2016	Yes	Yes				
3	FA2016	Yes	Yes				
3	SP2017	Yes	Yes				
3	SU2017	Yes	Yes				
3	FA2017	Yes	Yes				
3	SP2018	Yes	Yes				
3	SU2018	Yes	Yes				
3	FA2018	Yes	Yes				
3	SP2019	Yes	Yes				
3	SU2019	Yes	Yes				
3	FA2019	Yes	Yes				
3	SP2020	Yes	Yes				
3	SU2020	Yes	Yes				
3	FA2020	Yes	Yes				
3	SP2021	Yes	Yes				
3	SU2021	Yes	Yes				
3	FA2021	Yes	Yes				
3	SP2022	Yes	Yes				
3	SU2022	Yes	Yes				

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
4	FA2012	Yes	Yes				
4	SP2013	Yes	Yes				
4	SU2013	Yes	Yes				
4	FA2013	Yes	Yes				
4	SP2014	Yes	Yes				
4	SU2014	Yes	Yes				
4	FA2014	Yes	Yes				
4	SP2015	Yes	Yes				
4	SU2015	Yes	Yes				
4	FA2015	Yes	Yes				
4	SP2016	Yes	Yes				
4	SU2016	Yes	Yes				
4	FA2016	Yes	Yes				
4	SP2017	Yes	Yes				
4	SU2017	Yes	Yes				
4	FA2017	Yes	Yes				
4	SP2018	Yes	Yes				
4	SU2018	Yes	Yes				
4	FA2018	Yes	Yes				
4	SP2019	Yes	Yes				
4	SU2019	Yes	Yes				
4	FA2019	Yes	Yes				
4	SP2020	Yes	Yes				
4	SU2020	Yes	Yes				
4	FA2020	Yes	Yes				
4	SP2021	Yes	Yes				
4	SU2021	Yes	Yes				
4	FA2021	Yes	Yes				
4	SP2022	Yes	Yes				
4	SU2022	Yes	Yes				

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
5	FA2012		Yes				
5	SP2013		Yes				
5	SU2013		Yes				
5	FA2013		Yes				
5	SP2014		Yes				
5	SU2014		Yes				
5	FA2014		Yes				
5	SP2015		Yes				
5	SU2015		Yes				
5	FA2015		Yes				
5	SP2016		Yes				
5	SU2016		Yes				
5	FA2016		Yes				
5	SP2017		Yes				
5	SU2017		Yes				
5	FA2017		Yes				
5	SP2018		Yes				
5	SU2018		Yes				
5	FA2018		Yes				
5	SP2019		Yes				
5	SU2019		Yes				
5	FA2019		Yes				
5	SP2020		Yes				
5	SU2020		Yes				
5	FA2020		Yes				
5	SP2021		Yes				
5	SU2021		Yes		Yes		
5	FA2021		Yes		Yes		
5	SP2022		Yes		Yes		
5	SU2022		Yes		Yes		

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
6	FA2012			Yes			
6	SP2013			Yes			
6	SU2013			Yes			
6	FA2013			Yes			
6	SP2014			Yes			
6	SU2014			Yes			
6	FA2014			Yes			
6	SP2015			Yes			
6	SU2015			Yes			
6	FA2015			Yes			
6	SP2016			Yes			
6	SU2016			Yes			
6	FA2016			Yes			
6	SP2017			Yes			
6	SU2017			Yes			
6	FA2017			Yes			
6	SP2018			Yes			
6	SU2018			Yes			
6	FA2018			Yes			
6	SP2019			Yes			
6	SU2019			Yes			
6	FA2019			Yes			
6	SP2020			Yes			
6	SU2020			Yes			
6	FA2020			Yes			
6	SP2021			Yes			
6	SU2021			Yes			
6	FA2021			Yes			
6	SP2022			Yes			
6	SU2022			Yes			

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
7	FA2012		Yes				
7	SP2013		Yes				
7	SU2013		Yes				
7	FA2013		Yes				
7	SP2014		Yes				
7	SU2014		Yes				
7	FA2014		Yes				
7	SP2015		Yes				
7	SU2015		Yes				
7	FA2015		Yes				
7	SP2016		Yes				
7	SU2016		Yes				
7	FA2016		Yes				
7	SP2017		Yes				
7	SU2017		Yes				
7	FA2017		Yes				
7	SP2018		Yes				
7	SU2018		Yes				
7	FA2018		Yes				
7	SP2019		Yes				
7	SU2019		Yes				
7	FA2019		Yes				
7	SP2020		Yes				
7	SU2020		Yes				
7	FA2020		Yes				
7	SP2021		Yes				
7	SU2021		Yes				
7	FA2021		Yes				
7	SP2022		Yes				
7	SU2022		Yes				

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
8	FA2012		Yes				
8	SP2013		Yes				
8	SU2013		Yes				
8	FA2013		Yes				
8	SP2014		Yes				
8	SU2014		Yes				
8	FA2014		Yes				
8	SP2015	Yes	Yes				
8	SU2015	Yes	Yes				
8	FA2015	Yes	Yes				
8	SP2016	Yes	Yes				
8	SU2016	Yes	Yes				
8	FA2016	Yes	Yes				
8	SP2017	Yes	Yes				
8	SU2017	Yes	Yes				
8	FA2017	Yes	Yes				
8	SP2018	Yes	Yes				
8	SU2018	Yes	Yes				
8	FA2018	Yes	Yes				
8	SP2019	Yes	Yes				
8	SU2019	Yes	Yes		Yes		
8	FA2019	Yes	Yes		Yes	Yes	
8	SP2020	Yes	Yes		Yes	Yes	
8	SU2020	Yes	Yes		Yes	Yes	
8	FA2020	Yes	Yes		Yes	Yes	
8	SP2021	Yes	Yes		Yes	Yes	
8	SU2021	Yes	Yes		Yes		
8	FA2021	Yes	Yes				
8	SP2022	Yes	Yes				
8	SU2022	Yes	Yes				

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
9	FA2012	Yes	Yes				
9	SP2013	Yes	Yes				
9	SU2013	Yes	Yes				
9	FA2013	Yes	Yes				
9	SP2014	Yes	Yes				
9	SU2014	Yes	Yes				
9	FA2014	Yes	Yes				
9	SP2015	Yes	Yes				
9	SU2015	Yes	Yes				
9	FA2015	Yes	Yes				
9	SP2016	Yes	Yes				
9	SU2016	Yes	Yes				
9	FA2016	Yes	Yes				
9	SP2017	Yes	Yes				
9	SU2017	Yes	Yes				
9	FA2017	Yes	Yes				
9	SP2018	Yes	Yes				
9	SU2018	Yes	Yes				
9	FA2018	Yes	Yes				
9	SP2019	Yes	Yes				
9	SU2019	Yes	Yes				
9	FA2019	Yes	Yes				
9	SP2020	Yes	Yes				
9	SU2020	Yes	Yes				
9	FA2020	Yes	Yes				
9	SP2021	Yes	Yes				
9	SU2021	Yes	Yes				
9	FA2021	Yes	Yes				
9	SP2022	Yes	Yes				
9	SU2022	Yes	Yes				

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
11	FA2012		Yes				
11	SP2013		Yes				
11	SU2013		Yes				
11	FA2013		Yes				
11	SP2014		Yes				
11	SU2014		Yes				
11	FA2014		Yes				
11	SP2015		Yes				
11	SU2015		Yes				
11	FA2015		Yes				
11	SP2016		Yes				
11	SU2016		Yes				
11	FA2016		Yes				
11	SP2017		Yes				
11	SU2017		Yes				
11	FA2017		Yes				
11	SP2018		Yes				
11	SU2018		Yes				
11	FA2018		Yes				
11	SP2019		Yes				
11	SU2019		Yes				
11	FA2019	Yes	Yes				
11	SP2020	Yes	Yes				
11	SU2020	Yes	Yes				
11	FA2020	Yes	Yes				
11	SP2021	Yes	Yes				
11	SU2021	Yes	Yes				
11	FA2021	Yes	Yes				
11	SP2022	Yes	Yes				
11	SU2022	Yes	Yes				

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
12	FA2012						Yes
12	SP2013						Yes
12	SU2013						Yes
12	FA2013						Yes
12	SP2014						Yes
12	SU2014						Yes
12	FA2014						Yes
12	SP2015						Yes
12	SU2015						Yes
12	FA2015						Yes
12	SP2016						Yes
12	SU2016						Yes
12	FA2016						Yes
12	SP2017						Yes
12	SU2017						Yes
12	FA2017						Yes
12	SP2018						Yes
12	SU2018						Yes
12	FA2018						Yes
12	SP2019						Yes
12	SU2019						Yes
12	FA2019						Yes
12	SP2020						Yes
12	SU2020						Yes
12	FA2020						Yes
12	SP2021						Yes
12	SU2021						Yes
12	FA2021						Yes
12	SP2022						Yes
12	SU2022						Yes

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
13	FA2012						
13	SP2013						
13	SU2013						
13	FA2013						
13	SP2014						
13	SU2014				Yes		
13	FA2014		Yes		Yes		
13	SP2015		Yes		Yes		
13	SU2015		Yes		Yes		
13	FA2015	Yes	Yes		Yes		
13	SP2016	Yes	Yes		Yes		
13	SU2016	Yes	Yes		Yes		
13	FA2016	Yes	Yes				
13	SP2017	Yes					
13	SU2017	Yes					
13	FA2017	Yes					
13	SP2018	Yes					
13	SU2018	Yes					
13	FA2018	Yes					
13	SP2019	Yes					
13	SU2019	Yes					
13	FA2019	Yes					
13	SP2020	Yes					
13	SU2020	Yes					
13	FA2020	Yes					
13	SP2021	Yes					
13	SU2021	Yes					
13	FA2021	Yes					
13	SP2022	Yes					
13	SU2022	Yes					

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
14	FA2012		Yes				
14	SP2013		Yes				
14	SU2013		Yes				
14	FA2013		Yes				
14	SP2014		Yes				
14	SU2014		Yes				
14	FA2014		Yes				
14	SP2015		Yes				
14	SU2015		Yes				
14	FA2015		Yes				
14	SP2016		Yes				
14	SU2016		Yes				
14	FA2016		Yes				
14	SP2017		Yes				
14	SU2017		Yes				
14	FA2017		Yes				
14	SP2018		Yes				
14	SU2018		Yes				
14	FA2018		Yes				
14	SP2019		Yes				
14	SU2019		Yes				
14	FA2019		Yes				
14	SP2020	Yes	Yes				
14	SU2020	Yes	Yes				
14	FA2020	Yes	Yes				
14	SP2021	Yes	Yes				
14	SU2021	Yes	Yes				
14	FA2021	Yes	Yes				
14	SP2022	Yes	Yes				
14	SU2022	Yes	Yes				

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
15	FA2012	Yes		Yes			
15	SP2013	Yes		Yes			
15	SU2013	Yes		Yes			
15	FA2013	Yes		Yes			
15	SP2014	Yes		Yes			
15	SU2014	Yes		Yes			
15	FA2014	Yes		Yes			
15	SP2015	Yes		Yes			
15	SU2015	Yes		Yes			
15	FA2015	Yes		Yes			
15	SP2016	Yes		Yes			
15	SU2016	Yes		Yes			
15	FA2016	Yes		Yes			
15	SP2017	Yes		Yes			
15	SU2017	Yes		Yes			
15	FA2017	Yes		Yes			
15	SP2018	Yes		Yes			
15	SU2018	Yes		Yes			
15	FA2018	Yes		Yes			
15	SP2019	Yes		Yes			
15	SU2019	Yes		Yes			
15	FA2019	Yes		Yes			
15	SP2020	Yes		Yes			
15	SU2020	Yes		Yes			
15	FA2020	Yes		Yes			
15	SP2021	Yes		Yes			
15	SU2021	Yes		Yes			
15	FA2021	Yes		Yes			
15	SP2022	Yes		Yes			
15	SU2022	Yes		Yes			

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
19	FA2012	Yes	Yes				Yes
19	SP2013	Yes	Yes				Yes
19	SU2013	Yes	Yes				Yes
19	FA2013	Yes	Yes				Yes
19	SP2014	Yes	Yes				Yes
19	SU2014	Yes	Yes				Yes
19	FA2014	Yes	Yes				
19	SP2015	Yes	Yes				
19	SU2015	Yes	Yes				
19	FA2015	Yes	Yes				
19	SP2016	Yes	Yes				
19	SU2016	Yes	Yes				
19	FA2016	Yes	Yes				
19	SP2017	Yes	Yes				
19	SU2017	Yes	Yes				
19	FA2017	Yes	Yes				
19	SP2018	Yes	Yes				
19	SU2018	Yes	Yes				
19	FA2018	Yes	Yes				
19	SP2019	Yes	Yes				
19	SU2019	Yes	Yes				
19	FA2019	Yes	Yes				
19	SP2020	Yes	Yes				
19	SU2020	Yes	Yes				
19	FA2020	Yes	Yes				
19	SP2021	Yes	Yes				
19	SU2021	Yes	Yes				
19	FA2021	Yes	Yes				
19	SP2022	Yes	Yes				
19	SU2022	Yes	Yes				

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
20	FA2012	Yes					
20	SP2013	Yes					
20	SU2013	Yes					
20	FA2013	Yes					
20	SP2014	Yes					
20	SU2014	Yes					
20	FA2014	Yes					
20	SP2015	Yes					
20	SU2015	Yes					
20	FA2015	Yes	Yes				
20	SP2016	Yes	Yes				
20	SU2016	Yes	Yes				
20	FA2016	Yes	Yes				
20	SP2017	Yes	Yes				
20	SU2017	Yes	Yes				
20	FA2017	Yes	Yes				
20	SP2018	Yes	Yes				
20	SU2018	Yes	Yes				
20	FA2018	Yes	Yes				
20	SP2019	Yes	Yes				
20	SU2019	Yes	Yes				
20	FA2019	Yes	Yes				
20	SP2020	Yes	Yes				
20	SU2020	Yes	Yes				
20	FA2020	Yes	Yes				
20	SP2021	Yes	Yes				
20	SU2021	Yes	Yes				
20	FA2021	Yes	Yes				
20	SP2022	Yes	Yes				
20	SU2022						

College	Term	Adaptive Software	Non-mandatory Tutoring	Mandatory Tutoring	Summer Boot Camp	Ongoing Boot Camp	Learning Community
21	FA2012						
21	SP2013						
21	SU2013						
21	FA2013						
21	SP2014						
21	SU2014						
21	FA2014						
21	SP2015						
21	SU2015						
21	FA2015						
21	SP2016						
21	SU2016						
21	FA2016						
21	SP2017						
21	SU2017						
21	FA2017						
21	SP2018						
21	SU2018						
21	FA2018						
21	SP2019						
21	SU2019						
21	FA2019						
21	SP2020						
21	SU2020						
21	FA2020						
21	SP2021						
21	SU2021						
21	FA2021						
21	SP2022						
21	SU2022				Yes		