

THE EFFECTIVENESS OF DEVELOPMENTAL EDUCATION: A REVIEW OF
SUCCESS AND PERSISTENCE IN GATEWAY MATH AND ENGLISH COURSES

A Dissertation
by
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Abstract

THE EFFECTIVENESS OF DEVELOPMENTAL EDUCATION: A REVIEW OF SUCCESS AND PERSISTENCE IN GATEWAY MATH AND ENGLISH COURSES

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The purpose of this study is to examine the success rates and persistence rates for students in North Carolina who are currently enrolled in gateway math and English courses in community colleges and to provide careful evaluation of Multiple Measures Placement policies and the Developmental Education Redesign. Students enrolled in community colleges throughout North Carolina were included in the analysis. This study employed a causal-comparative, nonexperimental research design, of which two distinct groups were identified for comparison. The comparison groups came from two cohorts of students enrolled in developmental math or English from fall to fall, 2011-2012 (Cohort 1, before the redesign), and fall to fall, 2016-2017 (Cohort 2, after redesign). A sample was taken from the records of students who were first-time college students at five participating North Carolina Community Colleges representing the three regions of the state. Overall, the results indicated that success rates and persistence rates have not improved in math, and only success rates

have improved for Multiple Measures students in English courses. Furthermore, out of the students placed in to gateway courses through Multiple Measures, some students were more likely than others to be successful.

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Chapter One

Introduction

Nationwide, about 42% of first-year undergraduates at two-year public institutions enroll in at least one remedial course throughout their time in college (Clotfelter, Ladd, Muschkin, & Vigdor, 2015). These programs focus on getting students “college ready” in reading, writing, and math. Traditionally, these courses were thought to increase student success through higher rates of curriculum-level course completion and, ultimately, graduation. However, current research indicates that students who enroll in developmental coursework have higher drop-out rates and are actually less likely to persist to graduation (Bailey, Jaggars, & Jenkins, 2015; Belfield & Crosta, 2012; Clotfelter, Ladd, Muschkin, & Vigdor, 2015; Parsad & Lewis, 2003). As a result, the North Carolina Community College system is looking at new ways to increase graduation rates by either eliminating developmental requirements for students or reducing the amount of time required to complete remedial coursework (State Board of Community Colleges, 2013).

With such strong policy implications, the need for developmental programs at the community college level has fallen under heavy scrutiny. In response to the cost of remediation and skepticism towards the effectiveness of these programs, policy and other interventions have been implemented throughout the nation. New enrollment and admissions initiatives in Texas, Florida, California, Tennessee, and Washington allow incoming high school students more opportunities to remediate prior to enrolling in college (Hagedorn & Kuznetsova, 2016). Additionally, in some states, performance-based funding has been allotted, along with prematriculation programs and new curricular approaches (Hagedorn & Kuznetsova, 2016). However, it is not known if these initiatives will prove to be effective in relation to costs or bolstering student success, persistence, or completion in developmental

education programs. Understanding the history and context of developmental education in the United States will provide insight into the current legislation that has changed the way these programs are designed and implemented.

Developmental Education

Developmental education was specifically created as a field of practice within postsecondary institutions to help underprepared students become college ready. While current developmental education programs may seem like a relatively recent phenomenon that resulted from the 1960's "open-door" admissions policies of public colleges and universities, they are not particularly new (Boylan, 1987). Instead, what we see today is a reformed model based on previous efforts from colleges and universities to respond to students who need additional assistance to be successful. In the United States, the historical roots of these efforts can be broken down into different time periods dating back to the mid-1600s (Arendale, 2011; Losak & Miles, 1992). Each of these time periods has a social history that has evolved along with the philosophical perspectives that influence each initiative. Throughout the years, developmental education has been impacted by the demographics of student diversity, evolving definitions, and the political and financial contexts (Losak & Miles, 1992). New redesign initiatives will be better understood within the larger context of how developmental education has evolved throughout history.

History of Developmental Education

Initially, developmental education in the United States began when the first colleges were established in the 1600s. These colleges replicated postsecondary education efforts brought over from Europe. Along with the schools came similar cultural norms, mainly, training of clergy and the creation of the ruling of new elite (Arendale, 2011). During this

time, most young adults did not choose to pursue a college education. While early admissions policies promoted acceptance of a wide diversity of students, the reality was that nearly all the students who attended these early prestigious universities were white, male, and from the privileged class (Arendale, 2011). At that time, students were having issues trying to meet admissions policies because they typically had deficiencies in foreign language requirements. Developmental education was created, in the form of tutoring programs, to better prepare students for this entrance prerequisite. By the 1700's, these developmental programs were expanded to include additional subject areas of mathematics, history, geography, and English for both entrance purposes and continued tutoring during courses (Arendale, 2011; Losak & Miles, 1992).

The second-time period that influenced the focus of developmental education occurred in the early to mid-1800's as a response to the American population expanding westward. The need to create new postsecondary institutions was essential. Since these institutions were created for the local population, remedial education and other forms of academic assistance were necessary to meet the needs of these academically underprepared students (Arendale, 2011). Coupled with a growing distain for a fixed and prescribed curriculum for all students, the continued need for academic assistance finally allowed remedial courses to be taken as electives. Preparatory schools were developed and implemented in conjunction with colleges and universities to provide interested students with the prerequisite skills needed for college success (Losak & Miles, 1992). It was the move from individual tutoring to the development of academic preparatory courses that solidified the need for strengthening students' knowledge and skills, especially before entry into the college curriculum (Arendale, 2011).

Developmental education was also impacted during the post-Civil War era as major changes occurred in higher education (Losak & Miles, 1992). From the 1860's through the 1940's federal legislation directly impacted the policies and practices in postsecondary institutions. Through the First Morrill Act of 1862, the Second Morrill Act, and increased financial support for minorities, this time period saw a sharp increase in the number of students entering college. Despite these efforts, discriminatory practices still occurred through new admissions policies. These policies were created through founding of The College Entrance Examination Board (CEEB), which standardized entrance criteria and allowed colleges to use standardized test scores for entrance decisions, as well as setting graduation criteria for high school (Arendale, 2011). The common belief at that time was that these policies were implemented to ensure meritocracy, so privilege would not be the basis for entry into college, since students would be at the same academic level out of high school. Unfortunately, adequate preparation was not the case, and preparatory schools were declining due to the new role of the high school and growth of junior, or community, colleges (Losak & Miles, 1992).

Colleges and universities quickly realized that many students lacked the sufficient skills needed to be successful, so remedial courses began being offered at the four-year institution, in addition to supplemental assistance, such as tutoring. By 1913, approximately 80% of postsecondary institutions offered tutoring, remedial courses, and other forms of service (Arendale, 2011). Additionally, during this time two-year colleges began to emerge for the purpose of providing the first part of a student's bachelor's degree. While the curriculum at a two-year and four-year college was similar initially, differences began to be pronounced towards the middle of the century (Losak & Miles, 1992).

From the mid-1900's through the mid-1990's another shift in developmental education became apparent. Developmental education was fully integrated within institutions, along with compensatory education, which was now providing learning assistance, tutoring, and supplemental instruction (Arendale, 2011). Changing school demographics influenced the long-held attitudes of most educators who previously thought higher education was exclusive to young adults graduating from high school. Veterans were now returning to college through federal funding such as the G.I. Bill, as were older students from diverse backgrounds (Losak & Miles, 1992). With vastly more students attending more types of higher education, improving entry performance was needed to accommodate those who would not meet entrance requirements. Along with additional federal initiatives, such as the Basic Educational Opportunity Grant (1972), two-year, open enrollment, "community colleges" also grew significantly. From 1950 – 1980 community colleges increased from 500 to about 1,200 (Losak & Miles, 1992). These changes provided new access to higher education for students who could not meet the entrance requirement of a four-year university, but most were underprepared. As a result, colleges integrated developmental education programs and remedial programs into the expanding curriculum.

The last time period, from the mid-1990s on, continued to expand developmental education along with learning assistance, tutoring, supplemental instruction and enrichment activities (Arendale, 2011). However, with this expansion came a strong political movement against remediation (Attewell, Lavin, Domina, & Levey, 2006). This increased access to higher education also continued to increase the diversity of the incoming students (Losak & Miles, 1992). Along with this diversity came the need to help more students adequately prepare for college-level coursework. By the 2000s, developmental education was firmly

integrated into colleges and universities. Approximately 99% of the two-year colleges and 75% of public four-year institutions offered some type of developmental or remedial instruction (Horn & Asmussen, 2014).

The initial movement against developmental education suggested that if students were not academically strong enough to manage college-level work, then they should not have been admitted into college (Trombley, 1998). This critique led many states to only offer developmental education in the community college and eliminate it from four-year institutions (Bettinger & Long, 2004). Other arguments against developmental education at that time suggested that students who had to take multiple developmental courses would not persist through graduation (Rosenbaum, 2001). Although the need for remediation seems clear, gaps in empirical records have led to a lot of debate on the effectiveness of these programs (Attewell, Lavin, Domina, & Levey, 2006).

Currently, developmental education is still regarded as one of the many reasons why students do not meet their academic goals in community colleges (Venezia & Hughes, 2013). Research still indicates that there are a large number of students who are entering colleges underprepared, so the need for remediation is still prevalent. However, with a heavy emphasis now being placed on retention and completion in colleges and universities, developmental education is viewed as an obstacle for students instead of a support system. The new trends for these programs include redesigned placement measures for students being required to take developmental courses and acceleration methods for faster course sequencing and completion (Venezia & Hughes, 2013). These trends have impacted policy decisions in North Carolina.

Developmental Education Redesign in North Carolina

The North Carolina Community College System decided to work towards redesigning developmental education programs, among other programs, through a variety of grants and initiatives awarded from 2009 - 2015. Five North Carolina community colleges were awarded a Completion by Design (CBD) grant from the Bill & Melinda Gates Foundation. This grant built on several key principles that proposed intentional, systematic, and structural changes that aimed to improve graduation rates without reducing the quality of a program and increasing costs (Bowling, Morrissey, & Fouts, 2014). In addition to the CBD, other colleges were awarded the Achieving the Dream (ATD) grant through the Lumina Foundation, which focused on increasing student success by using data to improve programs and services for students (Bowling, Morrissey, & Fouts, 2014). Moreover, one North Carolina community college was selected to participate in the Developmental Education Initiative (DEI) team, which included fifteen community colleges from across the nation. During 2009, the North Carolina DEI State Policy Council was also established with many of the same colleges participating. Overall, each of these grants and colleges worked in separate capacities to expand innovative developmental education programs that increased student success (Bowling, Morrissey, & Fouts, 2014).

The grants allowed for each college to come together and make recommendations to the North Carolina Community College System's Office (NCCCSO). After the recommendations were made, the NCCCSO established a State Advisory Board to work with the Core State Policy Team to review nine proposed state-level policy changes and six local policy areas (Bowling, Morrissey, & Fouts, 2014). These recommendations were categorized into four areas that would need differing types of support: (1) legislative action,

(2) cooperation with the public school system and the university system, (3) State Board of Community Colleges, or (4) local college level support. After a review of the policy implications, three final recommendations were suggested that allowed highly structured programs, alternative placement approaches, and updated comprehensive articulation agreements with the university system (Bowling, Morrissey, & Fouts, 2014).

Among other policy implications that are outside the scope of this study, the recommendations from the State Policy Team proposal aligned with the North Carolina DEI State Policy Council recommendations, which focused on developmental math, reading, and English courses. The underlying principles of the redesign were based on prior research that indicated 16-week semester courses do not meet the needs of many students and represent a common barrier for future success (Bailey, 2009; Liston, 2012). A modularization model was suggested that was directly modeled after the developmental redesign in Virginia (Asera, 2011). Task forces were established to recreate the curriculum and format.

Developmental Math Redesign

The initial redesign task force was established in 2010 and focused on math instruction. Prior to 2011 students could place into traditional 16-week, seated math (MAT) courses. The lowest entry MAT 050 course focused on basic math skills, MAT 060 focused primarily on math essentials, MAT 070 focused on introductory algebra, and MAT 080 focused on intermediate algebra (North Carolina Community College System, 2012). In 2012, most students enrolled in any degree program were required to receive passing scores through MAT 070 or the equivalent ACT scores through placement testing. Some students might have been exempt from MAT 080, depending on their major or program of study. For most colleges, students were required to receive a numerical grade of 80% or higher to pass

the course; if students did not achieve the 80%, they were required to reenroll in the course in a following semester. Prior to the state-mandated redesign, students entering developmental math courses had an average success rate of approximately 76% (North Carolina Community College System, 2012).

The new Developmental Math (DMA) curriculum has a diagnostic tool, and the course content is modularized and shorted to 4-week instruction periods. The modules include DMA 010 through DMA 080 and focus on topics ranging from basic numerical skills to intermediate algebra, which is addressed in Table 1. DMA 010, Operations with Integers, emphasizes integers and integer operations. DMA 020, Fractions and Decimals, focuses on effectively applying operations with fractions and decimals. DMA 030, Proportion/Ratios/Rates/Percent, emphasizes conceptual applications of ratios, rates, percentages, and proportions. DMA 040, Expressions, Linear Equations, Linear Inequalities, focuses on a conceptual understanding of the problems that result in graphic and algebraic representations of linear expressions, equations, and inequalities. In DMA 050, Graphs and Equations of Lines, graphic and algebraic representations of lines are addressed. DMA 060, Polynomials and Quadratic Applications, emphasizes graphic and algebraic representations of quadratics. DMA 070, Rational Expressions and Equations, explores using algebraic solutions to contextual rational applications. Lastly, in DMA 080, Radical Expressions and Equations, the emphasis is on how to manipulate radicals to solve real world applications involving radical equations. Students are only required to complete the modules in which they have demonstrated a deficiency, so they would not have to take sequential courses. Even if students place into each DMA module, they should be able to successfully complete the entire sequence within one academic year (DEI Update, 2011).

Table 1

Redesigned Developmental Math Courses

Number	Name	Course Learning Objectives
DMA 010	Operations with Integers	Conceptual applications of rations, rates, percent's, and proportions
DMA 020	Fractions and Decimals	Applies operations with fractions and decimals
DMA 030	Proportion/Rations/Rates/Percent	Conceptual applications of rations, rates, percent, and proportions
DMA 040	Expressions, Linear Equations, Linear Inequalities	Conceptual understanding of the problems that result in graphic and algebraic representations of linear expressions, equations, and inequalities
DMA 050	Graphs and Equations of Lines	Graphic and algebraic repressions of lines are addressed
DMA 060	Polynomials and Quadratic Applications	Emphasizes graphic and algebraic representations of quadratics
DMA 070	Rational Expressions and Equations	Algebraic solutions to contextual rational applications
DMA 080	Radical Expressions and Equations	Emphasis on understanding how to manipulate radicals to solve real world applications involving radical equations

In addition, the new modularized underlying framework for instruction focuses on the concept of mastery learning. With mastery learning, students must receive an 80% to pass the module (North Carolina Community College System, 2012). While colleges are allowed to award homework assignments to account for 10% of the final grade, 90% of the course grade is determined by a mastery test given to the students by the last day of the module. Traditional lecture instruction was not eliminated, but the primary mode of teaching is now

focused on independent study through the use of computer-guided coursework. The new curriculum can be flexible, allowing students to complete modules at a pace that is appropriate for their knowledge level (North Carolina Community College System, 2012). Classes may also be offered in varied formats, and embedded tutors may be available in the classrooms.

Developmental Reading and English Redesign

The second task force was established in 2011. This task force had similar principles that sought to integrate reading and writing and modularize course content. Again, mastery learning was the underlying framework so individualized learning could occur (Success NC, 2013). Unlike the DMA courses, Developmental Reading and English (DRE) does have a sequencing component. This means that students must complete each DRE module from the point of lowest-entry through DRE 098. The new courses combined previous ENG 080, and ENG 090, with Reading (RED) 080 and RED 090 into eight-week long DRE 096, DRE 097, and DRE 098 courses. Figure 1 shows how the course curriculum from the previous Developmental Reading and English courses were integrated into a combined curriculum.

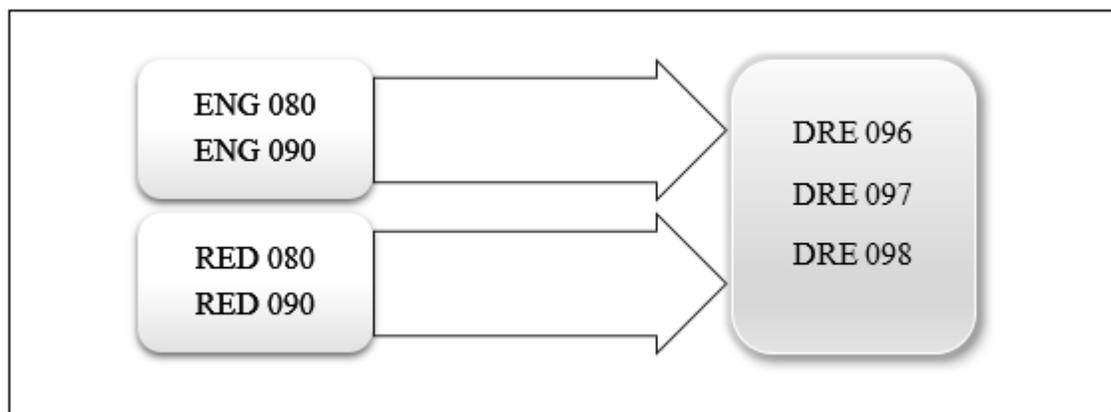


Figure 1. Integration of Developmental Reading and English Courses

DRE 096, Integrated Reading and Writing, develops proficiency in specific integrated and contextualized reading and writing skills and strategies so students can understand a variety of texts and compose effective paragraphs. A description of the course outcomes is described in Table 2. DRE 097, Integrated Reading and Writing II, emphasizes skills needed to understand a variety of complex academic and career texts and works towards composing essays with relevant valid evidence. DRE 098, Integrated Reading and Writing III, prepares students to understand a variety of texts at the career and college ready level and focuses on composing a documented essay. These course outcomes begin with basic academic and career-related texts through composing college-level documented essays and reading college-level texts (Success NC, 2013). As with DMA, DRE students must receive an 80% or higher achievement grade in order to master a module and move on to the next. The mastery test is given on the last day of the course (State Board of Community Colleges, 2013).

Table 2

Redesigned Reading and English Courses

Number	Name	Course Learning Objectives
DRE 096	Integrated Reading and Writing	Understand and apply a variety of academic and career related texts to composing effective paragraphs
DRE 097	Integrated Reading and Writing II	Understand and apply a variety of academic and career related texts to composing essays incorporating relevant, valid evidence
DRE 098	Integrated Reading and Writing III	Understand and apply a variety of academic and career related texts to composing a documented essay

Multiple Measures Placement Policy

The Developmental Education Initiative (DEI) State Policy Council made a second recommendation that impacted developmental education one year after the redesign was initiated. Their recommendation was to assess prior placement measures to determine if there were more effective ways to place enrolling students into college-level course work in community colleges. The standing entrance policies in North Carolina required incoming community college students to complete a placement test. At that time, North Carolina had approved the use of two nationally developed standardized tests, the ACT COMPASS and The College Board ACCUPLACER (Liston, 2012). After the test, each incoming student would then be placed into the appropriate developmental sequence or receive a score above the “cut-off” to place out of developmental coursework directly into curriculum level gateway courses.

In 2011, the DEI State Policy Team’s Assessment and Placement Committee contracted the Community College Research Center (CCRC) at Columbia University’s Teachers College to determine if there were more valid predictors of college performance (Liston, 2012). Results of the study indicated that high school grade point averages (GPA) was a better indicator of college success than placement tests. These results were then presented to the DEI State Policy Council. The council then developed a proposal for using high school GPA as an alternative measure for placement (Bowling, Morrissey, & Fouts, 2014). The state board approved the final proposal in February of 2013.

Timeline for Developmental Redesign Implementation

North Carolina first implemented the Developmental Redesign in fall of 2012, followed by the Multiple Measures Placement Policy in fall of 2015. The first phase, the

Developmental Math Redesign (DMA), began piloting at select community colleges in spring of 2012. By the fall of 2013, all of the colleges were mandated to fully implement the new 4-week module sequence (Kalamkarian, Raufman, & Edgecombe, 2015). The second phase, Developmental Reading and English (DRE), began piloting the new combined reading and English curriculum in spring of 2013. The mandatory full implementation was then required by fall of 2014 (Kalamkarian, Raufman, & Edgecombe, 2015). Lastly, the Multiple Measures Policy was adopted by colleges beginning in April of 2013, and by fall of 2016, all colleges were required to have fully implemented the new placement methods.

Theories that Influence Developmental Education

As the students who progress through developmental education are the focus of this study, understanding their development is crucial to understanding their experience and potential success. Student development theories are a lens through which researchers can explore that experience. These theories are part of a family of theories that explore how students develop through their college experiences. While there are a variety of contributors to this family of theories, typically they focus on internal factors, individual characteristics, or external factors.

While each family of theories has a unique place in developmental education, Vincent Tinto's Theory of Student Departure is the most comprehensive. Proposed in 2012, this theory focuses on reasons that students chose to leave institutions. Built from his earlier works, the Theory of Student Departure seeks to explain student retention by proposing that students leave from colleges because of the nature of their experiences and a misalignment between the interactions with the institution (Tinto, 2012). This is different from other theories that seek to understand why students choose to persist in higher education. Tinto's

theory connects to developmental education because the policies that have been implemented assume this particular subset of students is more likely to withdraw from college than students who are placed into college-level courses. Understanding the Theory of Student Departure will enable institutions to provide better support for developmental students.

Purpose of this Study

This purpose of this study is to examine the success and persistence of students who have had developmental courses in both the traditional and redesigned pathways, along with students who were not placed into developmental courses who would have been previously. Understanding the success and persistence of each pathway will give an examination of the overall impact of the developmental education redesign and the Multiple Measures Placement policies. Using Student Departure Theory as a lens, this study will seek to answer the following research questions:

1. Did traditional pathways or new pathways lead to greater success in gateway math and English courses?
2. Did traditional pathways or new pathways have an impact on persistence rates?
3. Did demographic characteristics impact the success of students enrolled in gateway math and English courses through Multiple Measures placement?

Methodology

This study employed a causal-comparative, nonexperimental research design using extant data from community college databases. Two distinct cohorts of students were compared with regard to their success and persistence through the traditional developmental pathway (Cohort 1) and the redesigned pathway (Cohort 2). Cohort 1 was enrolled in the traditional pathway from fall to fall, 2011-2012. Cohort 2 was enrolled in the redesigned

pathway from fall to fall, 2016-2017, or in cases where colleges carried out both initiatives prior to the 2016-2017, data was collected from fall to fall of the year preceding full implementation of both initiatives. The data collection for this study occurred during the summer and fall of 2017.

Data Collection

Data for both cohorts came from five community colleges in the three regions of North Carolina. Regions included were Western, Central, and Eastern. Colleges were invited to participate; therefore, the sample consists of volunteer institutions. De-identified student records were requested from these community colleges after completing required IRB processes for community colleges that agreed to participate in this study. From participating institutions, first-time college student records in the two cohorts list above were requested. Students were eliminated from the study if the following criteria were met:

1. The student did not take a gateway English or math course during their first academic year.
2. The student was not placed into gateway English and math courses through the ACT or SAT scores, placement test scores, or other composite scoring methods.

Limitations

The limitations of this study included context-specific elements that could impact the outcomes. First, the student record data was selected based on colleges who volunteered to participate. While all of the colleges in the regions listed above had an opportunity to participate, not all agreed to submit data for this study. Even though each college collected the data previously, the colleges who decided to participate may already be aware of success rates and persistence rates.

Secondly, as with any with ex-post facto study, there is no control over how the subject data was collected. The analysis included final grades, which was based on common learning objectives throughout the state. However, courses were still taught in a variety of formats and with a variety of methods. This study does not take these issues into account. Furthermore, instructor subjectivity must be acknowledged when reviewing any course grades. Different course instructors grade differently, and each school may place more of an emphasis on different learning outcomes. Different colleges may have had different grading scales as well. While the new developmental redesign that is reviewed for the study requires 80% or higher for students to receive a passing grade, prior courses were based on letter grades that may have not been assigned according to a ten- or seven-point scale. Additionally, the state requires particular student data to be collected, such as final grades; however, how the information is collected varies, and the individual college determines how the information is stored.

Finally, the North Carolina Community College System implemented three major initiatives that impacted developmental education over five years. However, it was left up to the individual colleges to decide when they would implement each one. Some colleges decided to roll out DMA, then DRE, and then Multiple Measures. Other colleges decided to implement DMA and DRE simultaneously. Due to this circumstance, it is not possible to discern the effectiveness of just one initiative on success and persistence. The students enrolling in coursework during the 2016-2017 academic year might have been characteristically different from the students who enrolled in college during the 2011-2012 year.

Definitions

The purpose of this study was to gain a better understanding of the Developmental Education initiatives in North Carolina by analyzing success rates, persistence rates, and demographic characteristics of students who were currently enrolled in gateway English and math courses. For the purposes of literature review, several variables were operationally defined as follows:

- Developmental education: courses designed to assist students who desire postsecondary credentials, but arrive academically unprepared for college-level math, reading, English, and study skills (Hagedorn & Kuznetsova, 2016). Developmental education is the integration of courses and support services guided by the principles of adult learning and development. Remedial education and “below college level” are interchangeable with the terminology.
- Developmental math redesign: course redesign efforts that include concepts of mastery learning, modularization, and acceleration.
- Developmental English redesign: course redesign efforts that include concepts of English and reading integration, mastery learning, modularization, and acceleration.
- Success: the successful completion of the course with a passing grade, or the letter “C” grade or above.
- Retention: one academic calendar year, fall to fall, for at least one course enrollment.

- Completion: any award or awards during the cohort year to help better determine retention, since the assumption is that students who have graduated prior to the following fall has completed their goals and therefore is not expected to return.
- Mastery learning: course pedagogy that requires at least an 80% or higher for successful completion of courses.
- Modularization: course redesign efforts that reduce overall course sequencing by breaking course content into specific units.
- Acceleration: any course redesign aimed at faster course completion than standard 16-week traditional course classes.
- Final Grade: the highest grade received or the actual grade received, if a student withdrew and reenrolled, or failed and reenrolled in the same course in a subsequent semester under review.
- Quality Points: Standard numeric conversion for letter grades A, B, C, D, and F. Quality Points are assigned as 4.0, 3.0, 2.0, 1.0, and 0.0, respectively.
- Multiple Measures: A placement policy method which looks at various indicators to determine how a student should be placed into coursework at the community college level. High School GPA has been designated as the primary measure for North Carolina Community Colleges.
- Gateway Courses: Gateway courses are credit bearing curriculum courses that are typically entry level and often taken within the first year of enrollment.

Significance

Ultimately, this research study provided insight into the success of remediation programs in community college. More specifically, with a clearer picture of the impact of developmental education programs in North Carolina, community colleges can add to the existing data to gain a deeper understanding of the potential advantages associated with continuing to offer courses that aid in learning of necessary foundational skills that further ensure student success. Additionally, if the research results indicated that developmental programs are an important component of subsequent success and persistence, then further research should be conducted to determine what other areas in an institutional setting might contribute to student departure.

Summary

The purpose of this study was to determine the impact of developmental education programs in North Carolina community colleges. Developmental education has been offered to students through various methods since the inception of college in the United States. Early remediation efforts focused on preparing students to enter universities through the use of tutoring. Tutoring programs evolved into preparatory courses and schools for students who wished to enter four-year institutions. Eventually, the continued increase in access to college created the need to integrate remedial programs into the curriculum, which expanded the role of these programs even further. Four-year institutions with competitive entrance requirements began to reduce the amount of remediation offered, so open-access, two-year community colleges emerged as the primary provider. Unfortunately, the effectiveness of developmental education programs has been questioned for the past couple of decades, so

many states, including North Carolina, have implemented new policies to address potential issues.

New initiatives in the state that impact developmental education include a redesign of developmental math, English, and reading courses. These redesign efforts shorten course sequencing, modularize course content, and allow for mastery learning. Developmental math modules focus on independent learning with a heavy emphasis on computer-guided coursework. Reading and English redesigns combined previous course curriculum into classes that offer both computer and traditional instruction. An additional initiative that impacts developmental education actually focuses on the placement methods students use to place into college courses. Multiple measures, including a student's high school GPA, are now used to determine eligibility for curriculum level classes.

In order to determine if developmental education programs have a positive impact on students, this research study reviewed gateway English and math courses. Success rates, persistence rates, and demographic characteristics were analyzed. A variety of community colleges throughout the state were included in the data to determine if there were any additional characteristics that may impact the effectiveness of these programs.

Chapter II

Review of Literature

This chapter will describe the current issues regarding student retention and completion in community colleges, in particular how retention and completion impacts developmental education. This chapter will also explore a theoretical framework that can be used to examine the context of developmental education and the existing state legislation. The development and progression of Student Development Theory will be explored to provide a solid foundation for Vincent Tinto's Theory of Student Departure and how it is applicable to the current research study. Finally, relevant research in developmental education will be examined to gain additional insight into how other states have implemented similar policies and the effectiveness of these programs.

The Completion Issue in Higher Education

There are numerous benefits of earning a college degree including longer life-spans, steadier job histories, and higher incomes than non-graduate counterparts (Gardner & Barefoot, 2013). Lifetime earnings for those who complete a bachelor's degree is on average \$750,000 more than those who only obtain a high school diploma (Gardner & Barefoot, 2013; Tinto, 2012). Even average lifetime earnings for those who complete an associate's degree are \$354,000 more than non-completion (Gardner & Barefoot, 2013; Tinto, 2012). Post-secondary degree attainment in the United States has become imperative, not only for the individuals, but also for the increasing demand for a competent and competitive workforce.

In response, a variety of state and federal initiatives and programs have been implemented to target students in higher education (Tinto, 2012). Initially, increased access

to college and closing the disparity gap were the focus of research and practice. A few landmark federal grants, such as the Servicemen's Readjustment Act (1944), Title IV of the Higher Education Act (1965), and the Basic Educational Opportunity Grant (1972) all increased opportunities and federal aid for students. At the state level, initiatives such as California's Master Plan for Higher Education (1960) and the popularization of community colleges, due to the Truman's Commission Report successfully increased the number of students enrolling in college. In addition, the Higher Education for the American Democracy (1947), served as a mechanism for increasing access to postsecondary institutions (Beach, 2011).

Some of these initiatives have met more success than others. For example, over the past 30 years, access to college has nearly doubled, from 9 million in 1980 to 20 million in 2011 (Gardner & Barefoot, 2013; Tinto, 2012). Additionally, the National Center for Education Statistics published that in fall 2016, approximately 20.5 million students are expected to attend American colleges and universities, constituting an increase of about 5.2 million since fall 2000 (National Center for Education Statistics, 2015). Clearly, increased access has allowed more students from diverse populations to enroll in college. From 2000 to 2014, the percentage of college students who were African American rose 3.1% and the percentage of Latino students rose 6.6%. While increasing minority enrollment has been successful, it has not been as successful as overall access. Out of the increased minority population, the overall increase shows that only 14.5 percent of the current college-enrolled students are African American and only 16.5% are Latino (National Center for Education Statistics, 2015).

Although increased access and opportunity has improved somewhat, student retention and completion has remained relatively low. The proportion of low-income students who completed a four-year degree within five years from 1989-90 was 16.7%, which then fell to 15.0% by 1995-96. On the other hand, high-income students during the same time period increased from 38.4% to 41.0% (Tinto, 2012). Currently, data provides a dismal picture of completion rates for both 4-year institutions and 2-year institutions. Nationwide, approximately 59% of students who began seeking a bachelor's degree at a 4-year institution in fall 2007 completed that degree within 6 years. Even worse, at 2-year open enrollment, degree-granting institutions, 71% of first time, full-time undergraduate students who began their pursuit of a certificate or associate's degree did not complete their programs within the same 3 to 6-year time period (National Center for Education Statistics, 2015). While selective universities and colleges have a distinct advantage, open enrollment institutions must accept any applicant. Regardless, every institution must try to compensate for an array of completion issues, some of these being financial, emotional, or academic.

To combat these issues, colleges have designed specific strategies to target attrition and to provide additional support for students who are likely to withdraw or be suspended from college due to poor academic achievements (Tinto, 2012). Nationwide each college has the flexibility to determine which strategies they will implement, but some of the more common recommendations include co-requisite remediation courses, structured schedules, and guided pathways (Jones, 2015). Colleges and universities have also implemented orientation and advising initiatives, college success courses, early alert systems, support programs, better financial aid counseling, and limitations on course drops or repeats (Moore & Shulock, 2010). Each of these strategies has contributed to the current structure of student

development within community colleges and inside the classroom. A description of the major contributors and theories will provide a foundational understanding of student development theory and how it informs current issues with student completion. This framework will be used as a lens to guide further research into developmental education in North Carolina Community Colleges.

Foundational Student Development Theories

Clearly, the benefits of a college degree are important. Not only will individuals make more money by attending college, but also increasing the number of students who successfully complete college will ultimately provide more opportunities for career advancement based on merit instead of privilege (Gardner & Barefoot, 2013). Globalization has led to remarkable new economic realities that fuel innovation through a fast-paced customized market (Gardner & Barefoot, 2011). For individuals to prepare for the 21st century workplace, education is essential. In the United States, more than 4,400 colleges and universities have been established to better prepare students (Gardner & Barefoot, 2013). Ensuring that students complete their college degrees enables them to have the opportunity for success beyond college. Through targeted programs such as developmental education, student retention and completion can increase because these programs offer a variety of support mechanisms. Reviewing how developmental education has been implemented through the lens of the Theory of Student Departure can highlight how developmental education impacts student success.

For example, students who successfully complete developmental math coursework are much more successful in subsequent courses than those who enroll directly into gateway courses (Bailey, Jeong, & Cho, 2010). Unfortunately, only about 21% of these students

actually complete the required sequences (Bonham & Boylan, 2012). Jenkins, Zeidenberg, and Calcagno (2007) determined that only 63% of Connecticut students that are placed into developmental education ever enroll in a remedial course. Similarly, another study found that 27% of the students referred to developmental reading did not enroll in the required courses, and 30% of students who placed into developmental mathematics did not enroll (Bailey, Jeong, & Cho, 2010). Lastly, it is important to understand the limitations of different types of research, especially in education. Studies that do not control for student differences prior to a developmental education intervention risk attributing all successful results to the intervention and do not consider alternate factors or characteristics that may impact success and retention rates (Collins, 2010).

Using a framework that aims to increase student success will allow for developmental students to flourish in a community college setting. The origins of student development theories in higher education emphasized the development of the “whole” student, and suggested practical ideas, and questions to be addressed among the student affairs practice (Jones & Dafina-Lazarus, 2016). Consequently, much of the research only focused on singular aspects of growth, so the entirety of the problem or aspects were not fully represented. Student Development Theory began to be equated solely with student affairs, which was a specific area of the colleges and universities focused on the idea of “meeting student needs,” and separate academic officials began providing guidance for students (Gillett-Karam, 2016). While important in the overall development of eventual theories, early research was situated in a positivist epistemological tradition so quantifiable measures were often sought, neglecting individual student experiences (Jones & Dafina-Lazarus, 2016).

Since then, the growth in theory for student development has been significant, especially in regard to the impact in an institution of higher education. By the late 1980s, more than twenty theories had been developed that addressed student growth or development (Terenzini, 1987). Of the theories that abound in student development research, most center on psychological or sociological/environmental factors that shape student growth and development. Interrelated families of thought within student development are typically categorized based on common characteristics. These families are psychosocial, cognitive-structural, and person-environment theories of student development (Jones & Dafina-Lazarus, 2016).

Psychosocial Theories of Student Development

Psychosocial theories of student development focus on factors that lie within an individual that make them more likely to succeed, or, on the contrary, more likely to withdraw (Jones & Dafina-Lazarus, 2016). These theories typically focus on traits usually encompassing individual abilities, intellectual attributes and personality traits that impact motivation, maturity, and perceived expectations (Jones & Dafina-Lazarus, 2016). While psychosocial theories are important to understand, they clearly do not account for all of the reasons individuals decide to persist through higher education. Instead, they often examine student development as sequential in nature, accomplished through certain tasks or stages, which need to be mastered or overcome before they can advance to the subsequent phase of development (Long, 2012). These tasks are frequently age-related, and most theorists working in the area of student development have focused on the developmental stages most closely related to the traditional age of college (Jones & Dafina-Lazarus, 2016).

The most influential theories from this family were developed by Chickering's Seven Vectors of Student Development (1969), Loevinger's Theory of Ego Development (1976),

and Super’s Theory of Career Development (1990). A review of each theory and main characteristics is provided in Table 3. Each of these theories impacts the later works of Vincent Tinto by framing the idea that factors within individuals influence their decision to persist or withdraw from college. Since the overall purpose of this study is to research developmental education to determine if these programs hinder or promote progress towards completion, understanding personal characteristics that contribute will provide insight into ways that colleges can identify students that may need additional support.

Table 3

Psychosocial Theories of Student Development

Name	Theory	Characteristics
Arthur Chickering	Seven Vectors of Student Development (1969)	Seven stages of identity development which students move through to form opinions, skills, and ethics.
Jane Loevinger	Theory of Ego Development (1976)	Nine milestones that individuals use to develop their “ego,” or moral reasoning and interpersonal relations.
Donald Super	Theory of Career Development (1993)	Five developmental stages that impact an individual’s career preferences and work choices.

Cognitive-structural Theories of Student Development

Similar to the psychosocial family of theories in student development research are the cognitive-structural theories. Cognitive-structural theories seek to explain how students think and reason, as well as how students organize and make meaning of their experiences. Within this family of theories, learning and reflection must occur, and change and empathy are values that underline the philosophy (Long, 2012). Ultimately, these theories focus on

the engagement of students in situations where they must reflect on a problem or issue and adapt their perspectives to meet the new environment. The foundation theories within this family are provided by Kohlberg’s Theory of Moral Development (1969) and Perry’s Theory of Intellectual and Ethical Development (1970). Both of these theories and characteristics are addressed in Table 4. Additionally, these theories have an overall impact on the Theory of Student Departure and ultimately developmental education. Tinto’s later works incorporate cognitive-structural theories by recognizing that students withdraw for a variety of reasons that are not all individual characteristics. While developmental education seeks to bridge the gap between under preparedness and completion, students must work through their experiences and adjust.

Table 4

Cognitive-structural Theories of Student Development

Name	Theory	Characteristics
Lawrence Kohlberg	Theory of Moral Development (1969)	A progression of changes in an individual’s cognitive structures that gives new understanding of their experiences.
William Perry	Theory of Intellectual and Ethical Development (1970)	Nine positions within four categories of stages that students will move through in regards to intellect and ethical development.

Person-environment Interactive Theories of Student Development

The last family of theories that impacts more recent research is person-environment theories. These theories focus on personal development and the complexity of experiences and challenges that shape individuals’ perspectives and subsequently their progress through

life. Typically, theories that fall into this category identify how the environment and the individuals' characteristics impact their overall experiences in college and life. Person-environment theories differ from earlier works because they focus primarily on the processes that facilitate student development, not just developmental outcomes (Astin, 1999). The major contributors to this thought of theory include Astin's Theory of Student Involvement (1975) and Pascarella's Theory on Student Change (1985). Table 5 summarizes each of the theories' main characteristics.

Table 5

Person-environment Interactive Theories of Student Development

Name	Theory	Characteristics
Alexander Astin	Theory of Student Involvement (1975)	Five fundamental concepts within an institution that impact students and overall success.
Ernest Pascarella	Theory on Student Change (1985)	Five direct and indirect variables of an institutions structural characteristics and campus culture will promote student change and cognitive development.

Tinto's Theory of Student Departure

The theory that guides this study actually combines elements from the three families of theory outlined above. The Theory of Student Departure (Tinto, 1987) seeks to explain student retention by proposing that students leave from colleges because of the nature of their experiences and interactions with the institution. Tinto's works (1975, 1982) draw heavily from many earlier person-environment theories but also acknowledge aspects of cognitive-structural and psychosocial perspectives. Tinto's work directly relates to what colleges can

do to increase student retention, so it provides a strong framework for building successful developmental education programs. Ultimately, this is one of the most widely used frameworks within student development research because it acknowledges multiple aspects within an institution and outside of an institution that all contribute to student success (Seidman, 2012).

The details of this framework were first explained in one of Tinto's later works, *Completing College: Rethinking Institutional Action* (2012). The background for much of this framework comes from Tinto's earlier published works. He first cautioned (1975) that students and institutions might have a different definition of departure and failure. While institutions only look for degree completion as the intended result of a student entering a college or university, students often leave for varying reasons that they do not consider failures. For example, students may decide to leave an institution due to career advancements, family obligations, or even health reasons. In these cases, students may decide to continue their college at a later time and do not feel that the departure is a result of failure.

Tinto also suggested that characteristics of both the student and the institution are unique and may not align with one another, so students may have unresolved conflicts that could result in departure (1975). He proposed that the sources of student departure are in three main areas: academic problems, failure to integrate socially and intellectually with the culture of the institution, or a low level of commitment to the institution. In order to increase student retention, then, institutions must deliberately integrate students by creating intentional opportunities for activities and interactions. While it is acknowledged that efforts outside of the institution must occur in order for most students to be successful, the focus is

on what institutions can do, as a whole, to promote positive outcomes. This framework suggests that four conditions must be met for student's success: expectations, support, assessment and feedback, and involvement. Each of these conditions must be established on campus to promote student success and enhance student retention.

Condition One: Expectations

The first condition that institutions must meet to improve student success is to establish clear expectations. Expectations fall into three broad categories: success in the institution, success in a particular program of study, and success in a course in which the student is enrolled (Tinto, 2012). These expectations are shaped by a variety of factors that ultimately are campus-wide, set forth by the administration, and carried out by faculty and staff. It is also exceedingly important for expectations to be set at a high level for students. Low expectations may result in poor performance and, possibly, attrition. Both formal and informal means are used to carry out sets of expectations for college students. Additionally, expectations must be reinforced regularly.

There are three factors Tinto's (2012) framework suggests when shaping student expectations. It is first important to set clear and consistent expectations for student behaviors, as well as the requirements for success. These expectations should be set by the institutional leaders, and then made real through institutional behaviors. An example would be setting institutional attendance policies, and then using retention specialists to follow up with students who are in jeopardy of violating the rules. Second, institutions should help students establish personal expectations and help guide them on what is required for successful completion of their chosen program of study. This is typically met through a variety of advising programs that institutions have set up for students. While advising should

be a continual, ongoing process, the first year a student is enrolled requires more intensive and proactive strategies. There are a wide variety of strategies that may be utilized, such as a first-year experience program, or designated early alert systems. Third, institutions should work with the faculty to ensure they set clear expectations for what is required for success within the classroom. Faculty need to make sure they express clear conditions for the required amount of effort to result in success within the classroom, and then continually reinforce these expectations. Typically, this can easily be done by modeling effort, discussing expectations, and providing quick and regular feedback through assignments and assessments.

In order for an institution's expectations to be evident, knowing what to do to succeed is vital to student success. Knowing the "roadmap," so to speak, means understanding the rules, regulations, and requirements for degree completion. These expectations are not as clearly understood for certain populations of college students, in particular, first generation students or low-income students (Tinto, 2012). Therefore, it is important for students to not only attend orientations, but to meet regularly with advisors or college personnel who help students navigate intended coursework or majors. One main reason for student departure is because of the lack of advice for students who change majors or do not complete enough courses in an intended major. This advice can come from informal networks, mentoring, formal advising, students support services, or, most importantly, the classroom.

Within the classroom, expectations for effort and quality of work in order to succeed are also extremely important. Research shows that students who attend universities that have high academic expectations perform with higher levels of effort and perceive higher levels of academic or cognitive gains than students who attend colleges or universities with low

expectations (Tinto, 2012). Furthermore, there is a gap between the expected amounts of effort students expend on their studies and the actual amount students expend. Students spend far less time on their work than faculty deem necessary for successful completion of their courses (Tinto, 2012). This relative lack of effort suggests that faculty do not construct the accurate level of expectations for students in the classroom. Faculty should ensure they clearly articulate expectations and continue to enforce requirements for the course through feedback and assessments. Lastly, informal peer networks and the climate of the class and institution also influence students. Keeping consistent expectations throughout will increase levels of effort.

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required amount of effort to result in success within the classroom, and then continually reinforce these expectations.

Condition Two: Support

The second condition that institutions must meet to ensure student success is support. Success in college is also dependent on academic, social, and in some cases, financial support for students (Tinto, 2012). Again, for first generation or low-income students, institutional support is often recognized as being one of the most vital components to success. Furthermore, high expectations and support go hand in hand with student success (Reason, Terenzini, & Domingo, 2006). Institutions that set high expectations for students must provide needed support to help them succeed.

Academic support is the most important factor for student retention. Basic Skills programs, developmental or remedial courses, tutoring, study groups, supplemental instruction, and Summer Bridge programs are all critical for a student's ability to succeed in college (Tinto, 2012). Nationwide, many students enrolling in college are considered to be academically underprepared (National Center for Education Statistics, 2004). While remedial coursework does little to increase students' overall success, research does show successful completion of these courses does increase their chances, as compared to non-remedial students (Lavin, Alba, & Silberstein, 1981). These successes occur when contextualized learning happens within the classroom. While tutoring and additional instruction does help, learning communities, supplemental instruction, embedded tutors, and study strategies are most beneficial for student success (Tinto, 2008). These intervention strategies are found to be most successful if utilized within the student's first year of enrollment, or as early as possible.

Social support is also directly and indirectly linked to student success. In particular, a student's sense of belonging and membership in social communities is especially important within the first year of college (Tinto, 2012). During this time, students have to make a series of adjustments, from existing relationships to forming new ones. For some students, making this adjustment is not easy, so counseling, mentoring, and faculty and peer advising is critical. This support can also come in the form of positive interactions with faculty, staff, and student peers inside and outside of the classroom. Any extracurricular activities are beneficial for social support and may include advising, residential life, campus recreation programs, health services, career services, religious services, or any additional student life services (Tinto, 2012). Integration into the campus culture has been shown repeatedly to impact student success, so the more opportunities colleges and universities can provide socially, the better.

Lastly, financial support is important as well. Financial aid, loans, and grants influence student's choices. Monies can determine if a student enrolls in a public institution or private, or if they choose to enroll full time or part time (Tinto, 2012). Especially for low income students, higher levels of aid equate to higher levels of academic engagement and completion. Varying amounts of aid can also have an impact on student retention by influencing the amount of time that students can be socially and academically engaged on campus. It is important to note that the amount of impact that financial aid has on student success is varying, dependent on the perceived value of higher education. Regardless of the amount of financial support an institution provides for students, if students do not see the marked benefit in the long-term outcome of obtaining a post-secondary degree, aid may not be as important.

Condition Three: Assessment and Feedback

The third condition that must be met by institutions to increase student success is creating an environment that provides assessment of performances and feedback of information that enables all parties to adjust their behaviors to become more involved in learning activities (Tinto, 2012). In settings that can provide proper assessments and feedback, students can become more involved in the learning process and develop strategies that are helpful in creating success. In order for this assessment and feedback to be effective, it must be frequent, occur early, and be formative, as well as summative (Tinto 2012). Typically, colleges seek to assess student learning at initial entry, monitor student progress during their time at the college, and provide early alert systems for students having difficulties.

Assessing the learning of a student at the onset of their time in college can occur through a variety of measures. In most cases, colleges and universities use placement exams used to identify any areas where a student may demonstrate a deficiency. Based on the placement score, students may be required to take remedial courses prior to curriculum level coursework, or they may be required to enroll in some form of additional academic support. These exams must be reviewed for accuracy and used with care. Often, a designated “cutoff” score is established, and if students fall below that measure, they are placed into additional programs. While these programs are designed to help students be “college ready,” not every student that has been placed into them will actually need them. Focusing simply on predictive placement scores fails to recognize the impact of student experiences and the overall environment (Tinto, 2012).

On the other hand, classroom assessment and feedback is used continually to create “feedback loops” (Tinto, 2012). Pedagogy that promotes early and formative feedback is critical for student success. Using a variety of classroom techniques allows students and instructors to reflect and mutually agree on learning progress. Instructors may also utilize formal assessment tools that employ early warning systems. These early alert systems are designed to alert support staff to students who are struggling in class. Support personnel may then reach out to the student and offer alternative options for receiving academic support. It is important for these early alert systems to be used very early on and ensure that there is immediate response to student issues. If the response time is delayed, it undermines student learning (Tinto, 2012).

Condition Four: Involvement

The fourth condition that should be met to increase student success is involvement or engagement. The more engaged students are academically and socially with other people on campus, especially faculty and student peers, the more likely they will graduate from college (Tinto, 2012). This condition appears to be true for all students, across all demographics. Academic and social involvement influences achievement in multiple ways. Within the classroom, greater engagement leads to more meaningful and validating learning experiences, which leads to more effort and better performance (Tinto, 2012). Social involvement also impacts student success by decreasing the likelihood of isolation and withdrawal from school. Although the two concepts of academic and social involvement are distinct, they do overlap to create a relationship between engagement and learning. In other words, the impact of engagement on student performance reflects in part the institutional setting and cultural climate (Tinto, 2012).

In order to create involvement for students, providing a specific social and cultural setting among individuals whose values give it meaning is necessary (Tinto, 2012). This leads to a sense of belonging. This sense of belonging occurs through a supportive climate and ultimately impacts the decisions of students to leave or to stay at the institution. Trying to provide an inclusive community requires facilities ask themselves in what setting and to whom issues of involvement occur, and how different students may interpret those settings (Tinto, 2012). Then, finding quality ways to provide opportunities of involvement allows for students to find value and meaning in the environment.

Therefore, promoting involvement for student success occurs when colleges and universities find ways to actively promote retention. This can be a challenge for community colleges or institutions where there are higher rates of commuter students because they have less opportunity to be on campus. Research also shows that these students often do not engage in extracurricular activities as often as those who are residential students (Tinto, 2012). In this case, classroom involvement becomes the primary way to provide opportunities, so having positive learning experiences and proper pedagogical practices will foster these outcomes. Cooperative or collaborative learning and project or problem-based learning techniques will typically increase active learning strategies within the class, instead of the passive learning that occurs with traditional lecture courses (Tinto, 2012). These courses will foster a sense of community by requiring students to work together in order to reach their target learning objectives. Another classroom strategy that institutions have started to promote to increase a sense of belongingness is learning communities. This type of block scheduling, or co-registration, allows for the same students to enroll in at least two of the same courses during the same time to foster a sense of team mentality.

Although the issue of student departure has been researched for the past four decades, no single theory has been able to account for the need for developmental education and the likelihood of persistence of these students. Successful developmental education programs should be meeting each of the conditions provided by Tinto's framework, so aligning the relevant literature to the current study will strengthen the argument that remediation is actually of benefit to students who not have the necessary skills to be successful.

Empirical Research Using Student Departure Theory

Aspects of Student Departure Theory and the Student Engagement Model from Vincent Tinto have been used as a framework for a multitude of research studies. Early research sought to validate his work through empirical testing (Anderson, 1987; Chapman & Pascarella, 1983; Williamson & Creamer, 1988). While these studies produced mixed results, most partially supported Tinto's model (Rhee, 2008). Other research tested overall college withdrawal from both 2- and 4-year institutions. Chapman and Pascarella (1983) found that that different types of colleges were characterized by different types of student participation and academic life, which impacted the overall climate associated with each institution. While the results did support Tinto's model, variations were found by institutional type (Chapman & Pascarella, 1983).

Some studies focus on particular aspects of Tinto's work, such as social integration. Berger and Braxton (1998) suggest that in addition to social integration, organizational attributes also influence the persistence processes, so expanding the current model to include underlying institutional communication, fairness for policies and rule enforcement, and participating in departure decisions should increase retention. Research has also identified aspects of departure such as pre-entry attributes, academic engagement, and social

engagement. Natoli, Jackling, and Siddique (2015) suggest that pre-entry attributes had the biggest impact on student departure whereas a student's academic and social experiences had much less influence. More specifically, to retain students, those who are primarily responsible for the transition of students into the institution should work hard to promote student engagement (Natoli, Jackling, & Siddique, 2015). On the other hand, the concepts of academic and social integration in examining long-term persistence have not been found to have a substantial impact (Williamson & Creamer, 1988).

Additionally, Student Departure Theory has also been applied to factors that influence different types of withdrawal (Rhee, 2008). Tinto (1975) suggests that different types of withdrawal behavior, such as stop out, drop out, or transfer, are part of an individual's institutional commitments and part of the type of institution in which the student is enrolled. Using a multivariate analysis, findings support Tinto's theory that different types of withdrawal must be separated. Withdrawal is based on different reasons, and success or failure impacts different types of withdrawals differently. Additionally, students who hold orientations indicative of unconventional values indicate less value in college and higher likelihood of withdrawal (Simpson & Baker, 1980).

Tinto's work has been used extensively since its inception to understand reasons why college students may not persist. As with any theory or framework, criticisms emerge, and the overall significance of the results is mixed (Rhee, 2008). Additionally, Student Departure Theory and the Student Engagement Model have been used to research different conditions in which students may withdraw, but little has been done to apply it specifically to the issues that relate to developmental education in a community college setting.

Critiques of Student Departure Theory

The first critique of Student Departure Theory is that it does not account for the multitude of reasons students persist or withdraw. Various types of individual characteristics affect students from enrollment, including commitment to their goals and to the institution they were going to attend (McCubbin, 2003). This is of pivotal importance to commitment of a university, but it is not explicitly addressed in Tinto's work. While most critics focus on earlier work, not much attention is given to alternative reasons that students do not persist. Tinto does acknowledge that there are certain "pre-characteristics" that make some students more likely to persist than others; however, the degree to which each construct is expressed in an individual is not discussed at length. In addition to alternative variables that predict student attrition, academic integration may not be an important predictor of student attrition in non-traditional groups, on which Tinto focuses heavily (McCubbin, 2003).

The second main criticism relates to how the rates of departure from institutions of higher education differ for minorities. The racial and ethnic minority student patterns of college attendance and degree completion in the U.S. have changed in the last two decades. While both have increased, the rate of racial and ethnic minority students that depart from an institution differ from those of Caucasian students. Specifically, the six-year departure rate for Caucasians compared to Hispanic/Latino or African American students is 39.3%, 53.4%, and 60.4%, respectively (Braxton, Hirschy, & McClendon, 2004). While student departure theory can account for some discrepancies, there is clearly a marked difference that is still left unaccounted. Providing a single solution is not feasible, so the model should be adapted to better account for what colleges and universities can do to specifically target increasing completion for minority students.

Lastly, Tinto's model cannot be accurately utilized as a methodology or for certain analysis through statistics. While this criticism is technical, it considers that social science, as a research field, utilizes statistical measures when trying to make meaningful judgments about issues at hand. Integrating Tinto's model into particular statistical analysis has not been easy. Generally, causal analysis and modeling, and path analysis are not sufficiently able to use Tinto's model (Liu, 2002). Furthermore, operational definitions for Tinto's model were not clearly provided, so the analysis through certain statistics can provide varying results. Tinto did not intend for his theory to be incorporated into certain statistical analysis, so operational definitions for his variables were never stated (Liu, 2002). Ultimately, this impacts results, depending on how the researcher determines how to best define given variables.

While most critics focus on Tinto's earlier works, the current model still cannot adequately provide insight into the multitude of issues that cause student attrition (Jones & Dafina-Lazarus, 2016). Tinto has revised his original framework to try and address many of the inconsistencies he felt were also relevant to student departure, but many of the initial criticisms still exist to some extent. Typically, these relate to the insufficient support for individual characteristics that students bring with them entering college, the application of the model to differing types of students, such as non-residential students or minority students, and the inability to use the model in certain types of statistical research.

Student Departure Theory and Developmental Education

Across the nation, developmental or remedial courses in higher education have undergone massive change throughout the past few decades. While a drastic increase in enrollment led to many two-year institutions providing a majority of the developmental

courses, new challenges began to emerge throughout each state. In North Carolina, research was presented to leaders at the community college system office that indicated developmental coursework caused students to withdraw before being able to successfully complete a degree program (Bailey, Jaggars, & Jenkins, 2015; Belfield & Crosta, 2012; Clotfelter, Ladd, Muschkin, & Vigdor, 2015; Parsad & Lewis, 2003). Additionally, only 8% of students who were placed at the lowest levels of a traditional developmental math in North Carolina successfully completed a gateway math course, while the cost of providing these services consumed approximately 10% of the statewide community college budget (Liston, 2012).

Unfortunately, there has been a disconnect between theory and practice in developmental education, which leaves practitioners with an inability to address issues and provide clear solutions that defend the work while providing value against ongoing criticism (Hung & Higbee, 2005; Lundell & Collins, 1999). While there are typically many theories that contribute to the field, no single framework exists that addresses the entirety of this unique subset of students (Hung & Higbee, 2005). Therefore, to date, only particular aspects of any given theory are systematically applied to empirical research in developmental education. The scope of the current study uses Tinto's Theory of Student Departure to address ways that community colleges can strengthen their programs to provide more successful student outcomes. A brief review of similar applications of aspects of Tinto's theories will be provided to add to the value of developmental education programs.

Since developmental students are typically thought to not persist, some community colleges have initiated programs based on Tinto's "at-risk" students. For example, at Northeast Alabama Community College, learning communities were established with the

intention of providing a smooth transition between developmental courses and college-level courses (Buttram, 2016). These learning communities tried to integrate advertising, learning styles and strategies, mentoring and support systems, and intervention activities while assessing and evaluating the program (Buttram, 2016). Ultimately, the program demonstrated that these learning communities can provide positive results for the students who remain involved; however, 39% did not complete it (Buttram, 2016). On the other hand, similar research conducted by Weiss, Visher, Weissman and the Society for Research on Educational Effectiveness (2012) suggested that overall these learning communities in a community college do not produce higher rates of completion for underprepared students, but they have small positive impacts on credits earned and providing enhanced support.

Additionally, based on aspects of Tinto's research for student change and integration, some community colleges have developed summer bridge programs for developmental students. In Texas, these bridge programs were designed and implemented over one summer at six community colleges and two nonselective four-year universities. The program integrated accelerated instruction, student support, instruction on college-going skills, and a stipend for students who successfully completed (Wathington, Pretlow, & Barnett, 2016). The results of the study indicated that there is evidence that summer bridge programs targeted for developmental students do have a positive outcome in college-level course completion during the first year, but do not encourage long-term persistence (Wathington, Pretlow, & Barnett, 2016).

Other empirical research in developmental education that has been attributed to interventions based on Tinto has explored student outcomes related to these programs. Research conducted by Bremer, Center, Opsal, Medhanie, Jang, & Geise (2013) used

instructional data from three community colleges in different states to examine demographic characteristics of students and the outcome trajectories enrolled in developmental courses. Results indicated that there were several factors that increased student persistence, graduation, and higher overall grade point averages (GPA). These factors included the age of the students, race/ethnicity, program enrolled in, and gender (Bremer, Center, Opsal, Medhanie, Jang, & Geise, 2013). In addition, the study concluded that math ability upon entrance and student support, such as tutoring, did have an overall positive impact. However, the actual developmental coursework did not seem to have an influence on long-term success (Bremer, Center, Opsal, Medhanie, Jang, & Geise, 2013).

Rethinking Developmental Education in North Carolina

The empirical work in developmental education comes on the heels of a steady increase in enrollment in developmental education courses throughout the nation. In North Carolina alone, during the 2010-2011 academic year, 69% of recent high school graduates placed into at least one developmental course upon entering community college (Liston, 2012). Approximately 97% of the public, two-year colleges in the U.S. offer students various remedial or developmental courses (Trenholm, 2006). Most of these remedial courses were offered at community colleges as four-year institutions do not have many remedial offerings (Trenholm, 2006). All 58 colleges in the North Carolina Community College System offer remedial coursework (State Board of Community Colleges, 2013).

In 2009, the North Carolina Community College System began to consider the format in which developmental courses were being delivered to students. Based on community college initiatives that were implemented from the Completion by Design (CBD) and Achieving the Dream (ATD) grants, a statewide Developmental Education Initiative State

Policy Team (DEI) task force was created to review data and implement strategies that would increase the number of students enrolling and successfully completing college level courses (Liston, 2012). These initiatives are outlined in Chapter One.

The recommendations from the Developmental Education Initiative State Policy Team (DEI) task force proposed redesigns of developmental math, reading, and English courses. DEI contracted both the Community College Research Center (CCRC) and SuccessNC, through *Jobs for the Future* funding from the Lumina and the Bill and Melinda Gates Foundations to provide data for appointed task forces to generate recommendations for the redesign initiatives. The underlying principles of the redesign were based on prior research that indicated 16-week semester courses do not meet the needs of many students and represent a common barrier for future success (Liston, 2012).

Developmental Math Redesign

The initial redesign task force focused on math instruction, because the DEI recognized that most students enrolled in developmental coursework were placed into these courses. Therefore, the committee surmised that admission selection represented the biggest potential barrier to student success. Based on data provided by SuccessNC (2011), 24,819 math grades were evaluated to determine that there is a strong association between grades in math courses and grades received in the preceding courses. A majority of students enrolling in an initial math course receive C's, and the students who receive C's often end up with a D, F, or W in the subsequent course (DEI Update, 2011). With this research, gateway courses and developmental sequencing became a top priority.

In 2010, the DEI then appointed 18 faculty members from the state to serve on the Redesign Math Taskforce. The purpose of the taskforce was to streamline developmental

math courses, adopt guiding principles, and establish a mastery-based framework for instruction. The task force ultimately proposed guiding principles aimed to modularize the course content, to reduce redundancies, to implement new diagnostic tools and assessments, to align with the curriculum level competencies, and to provide professional development for instructors statewide (DEI Update, 2011). The new course re-designs are based on four-week, topic-specific modules. Students are only required to complete the modules in which they have demonstrated a deficiency and can skip unnecessary sequences. The modules include DMA 010 through DMA 080 and focus on topics ranging from basic numerical skills to intermediate algebra. If necessary, students should be able to complete the entire sequence within one academic year upon entering the institution (DEI Update, 2011).

In addition to the guiding principles, an underlying framework for instruction focuses on the concept of mastery learning. Students must master a module before they can move on to the next, so they are required to receive an 80% to obtain a passing grade (North Carolina Community College System, 2012). To determine the achievement level, a mastery test is given to the students by the last day of the module. One of the primary modes of teaching is focused on independent study; as a result, a critical component is the use of computer-guided coursework. The new curriculum can be flexible, allowing students to complete modules at a pace that is appropriate for their knowledge level (North Carolina Community College System, 2012). Classes may also be offered in varied formats, and embedded tutors may be available in the classrooms.

Similar programs, such as Math My Way (MMW), were implemented at Foothills College in California, and determined that the newly redesigned course was far more beneficial for students than the traditional lecture-style courses as measured by student GPA.

Students in the new courses had a higher cumulative math GPA with an average of 0.45 units higher than those in the control group (Silverman & Seidman, 2011). Likewise, the results from the Survive Master Achieve Review Transfer (SMART) program at Jackson State Community College in Tennessee showed positive effects on student success in developmental math. The redesign increased student averages on post-test scores and increased the number of students passing developmental mathematics courses by 45% (Bassett & Frost, 2010). Results from the study conducted by Ariovich and Walker (2014), indicated that although students in traditional courses initially had higher success rates than those in the redesigned courses, after subsequent math courses, students who enrolled in the redesigned courses were actually more successful. Overall, for students enrolled in traditional developmental math courses, 37% passed compared to a 28% overall pass rate for the modular redesigned courses; however, 54% of those who successfully completed their first modular sequence passed their next course compared to just 34% of those who successfully completed the traditional courses (Ariovich & Walker, 2014).

Similarly, two national studies were provided by the National Center for Academic Transformation (NCAT). The 2011 study recommended “emporium style” computer-guided courses for math in both developmental and curriculum-level courses. The 2013 study provided the results of the initial three-year redesign program and discussed reduced costs and increased retention rates in community colleges that participated. The results of each study indicated that if the colleges were successful at adapting and following through with all of the provided recommendations and guidelines, success rates for students within these courses increased significantly. Results from the 2011 study indicated that for developmental math, the percentage of students successfully completing the course increased

by 51% on average, while reducing the cost of instruction by approximately 30% (Twig, 2011). The 2013 indicated that, overall, about 83% of the colleges that were successful in the implementation showed much higher success rates than traditional formats. Additionally, about 29% of the institutions reduced their costs in offering coursework (Twig, 2013). Unfortunately, both studies recognized that most of the colleges that participated in the project were unable to adjust to all of the guidelines required. The research also acknowledged that with the mastery learning component, a majority of students will not accelerate through the coursework any quicker than the traditional format, and in most cases, it may actually take them longer to complete course sequences.

In contrast, two of the studies did not provide positive results. The My Math Lab/Math Zone research from the University of Southern Mississippi found no significant difference between the success rates of either of their course delivery methods based on final exam scores in MAT 101 courses (Ye & Herron, 2010). Also, results from the meta-analysis study by Trenholm (2006) included seven other research studies that focused on computer-guided instruction, student success rate characteristics, and retention rates. This study indicated that new computer-guided approaches may prove to be very beneficial for the current generation of college students, ages 18 – 29, who have been referred to as the “millennial generation,” but not for older learners. Learning outcomes for most of the studies conducted through the meta-analysis were shown to be improved over the traditional lecture style instruction, but retention rates were also analyzed and the results were mixed. Two studies reported improvements in retention, but two others reported decreases (Trenholm, 2006).

Along with student success rates of redesign programs, two of the studies included aspects of attitudes towards delivery methods. These results were also mixed. Ye and Herron (2010) looked at the attitudes towards the course delivery methods and the self-surveyed style of the students enrolled in each type of course. The study found that students enrolled in the Math Zone delivery had better attitudes than those in the traditional delivery, though the results are still not a significant difference. These results are similar to findings from Ariovich and Walker (2014), who determined that students were relatively ambivalent about computer-aided instructional delivery because they liked the self-paced aspects, but did not prefer less instructor involvement. Also, most of the students did not understand the value in mastery learning and had a hard time adjusting to the required amount of work outside of class. Attitudes from faculty were a little more negative. Unlike students, the faculty liked components of mastery learning and acceleration, but they did not adjust to their new roles in the computer-instructional delivery method. Most faculty felt the computers did not offer enough instruction towards gathering a particular solution and wanted to find easier ways to address learning gaps (Ariovich & Walker, 2014).

Finally, to address statewide success, the North Carolina Community College System Office published a study geared towards developmental math courses, but it focused on a qualitative data as a way to provide more insight on the perception of how the redesign was working. Within this report, feedback from participants regarding the modules indicated that most of the participants felt that half of the modules had too much content for the four-week timeline given and that eight weeks or 12 weeks would be more reasonable (Pellegrino & Jaeger, 2017). In addition to this report, one community college in North Carolina published results about the success of the developmental education redesign on its campus. Those

results indicated that for math prior to the reform, only 56-58% of all course attempters were successful. Then success sharply increased to 72-74% after the reform, but dropped to 65% after Multiple Measures was implemented (Manning & Frye, 2017).

Developmental English Redesign

The second task force was established a year later, in 2011, and was composed of 18 English and reading faculty from among the state's community colleges. Similar to the Math Task Force, the faculty team created its guiding principles based on the DEI's statewide policy initiatives. The guiding principles sought to integrate reading and writing, to shorten course sequencing, to align with academic goals, to be based on mastery learning within the parameters of individualized learning, and to facilitate flexible scheduling (Success NC, 2013). One differing aspect from the DMA courses is the sequencing component. Students enrolled in DRE must complete each pre-requisite course from the lowest level they place into through DRE 098 prior to enrolling in curriculum level.

The new courses combined previous ENG 070, ENG 080, and ENG 090 with RED 080 and RED 090 into eight-week long DRE 096, DRE 097, and DRE 098 courses. The curriculum was based on the recommended Lexile Framework for Reading® that uses semantic difficulty and syntactic complexity to determine the ability to comprehend text within a given range (Success NC, 2013). The topics from each course increased in complexity, from understanding a variety of basic academic and career-related texts, composing effective paragraphs, and composing essays through being able to understand a variety of complex texts at the career and college ready level and composing documented essays (Success NC, 2013). Like the DMA courses, DRE students must master a module before they can move on to the next, but they are required to receive an 80% on all essays

and exams to obtain a passing grade (State Board of Community Colleges, 2013). The approach to how mastery is determined varies among colleges, but the 80% mastery level is consistent.

English redesigns have also been addressed through acceleration or co-requisite courses. Acceleration programs combine two traditional developmental courses into one; co-requisite programs require developmental students to enroll in an add-on course upon enrollment in gateway English courses. Through the reading/writing acceleration program at Chabot College in California, students were allowed to enroll in a combined course that lasted one semester instead of the two sequential, semester long courses (Jaggers, Hodara, Cho, & Xu, 2015). Though students were successfully accelerated through developmental programs, the results of the study indicated that overall, there was little impact on successes within subsequent courses or higher retention rates.

On the other hand, the Accelerated Learning Program (ALP) at the Community College of Baltimore County allowed students who tested into upper-level developmental courses to enroll directly into gateway English courses while requiring them to take an additional developmental co-requisite course that served as a supplemental lab (Jaggers, Hodara, Cho, & Xu, 2015). Students who were required to take the co-requisite lab were required to meet immediately following the English class period. The lab discussed additional learning strategies, study strategies, and other relevant skills to aid in the overall understanding of the English course. This program did provide statistically positive results in both higher course completions for developmental students and in persistence.

Overall, limitations were included that acknowledged internal and external validity issues of the studies. Small sample sizes and the lack of control groups or non-equivalent

control groups were cited (Silverman & Seidman, 2011; Trenholm, 2006); convenience sampling issues and using only one computer-guided instructional program were also noted (Ye & Herron, 2010). While limitations are common with any quasi-experimental study, the accuracy of the results may be called into question. No further discussions were provided in any of the studies about other possible factors that may contribute to overall student improvement. It is also important to note that although a majority of these studies acknowledge that developmental students are less likely to graduate than those who do not enroll in developmental education, none of them provided any data on retention rates past subsequent courses, so even if higher success rates were attributed to program changes, there is no sufficient support that completion or graduation rates would increase.

Additional research in Developmental English redesigns focused on common issues related to integrating reading and writing into one developmental course, along with the challenges and preferred strategies (Saxon, Martirosyan, & Vick, 2015). While this study primarily focused on the issues, it was acknowledged that some students benefited from the accelerated combined format because it was more characteristic of a college-level experience. The results indicated that time management was identified as the biggest issue for students not being able to accelerate through the coursework successfully. The study also suggested that balancing reading and writing instruction was problematic, as well as finding appropriate curriculum materials, instructional issues, and placement testing issues (Saxon, Martirosyan, & Vick, 2015).

Furthermore, descriptive research aimed to understand perspectives of faculty and the impact of English and writing redesigns and aligning best practices for coursework. At one college, self-report data were collected from instructors who have taught in both traditional

and accelerated developmental courses. Overall, the instructors felt that teaching accelerated developmental education courses develops stronger rapport with students, so it is more rewarding. They also felt that there is a backward curriculum design, so the pedagogy differentiated teaching practices, but these courses provided faculty with more insight into non-cognitive issues and affective needs that impact the student learning. Lastly, it was also indicated that teaching accelerated courses might result in new perspectives on developmental education reform (Walker, 2015).

Best practices for designing integrated English and writing courses were also addressed (Dees, Moore, & Hoggan, 2016). The Theory of Reflective Practices gave the course instructors and administrators a framework of pedagogy that sought to incorporate an atmosphere that allowed for an autobiographical lens in which the perspective of the student and the teacher are known. This pedagogy incorporated online collaborative journals and departmental reflective work that fostered a sense of interpersonal relationships and allowed for deep self-reflection. The results of the research indicated that these faculty members felt that the online collaborative journals were useful and practical. They also recognized that their experiences provided slightly different vantage points, and exploring reflective activities uncovered underlying instructor philosophies in the classroom (Dees, Moore, & Hoggan, 2016). While the principles behind this study were offered as a way for other colleges and universities to explore the benefits of reflective practices, the study did not discuss the overall impact on student success.

Lastly, in North Carolina, research on the Developmental English redesign at one community college indicated that like students in the math redesign, success rates for Developmental English initially increased after the reforms were implemented, but later

declined after Multiple Measures policies were in place. According to the study, 70-75% of all course completers were successful, and then 73-80% were successful which dropped to 64-66% after the implementation of Multiple Measures (Manning & Frye, 2017).

Multiple Measures Placement Policy

The second recommendation from the DEI State Team focused on the actual placement measures used to determine entering course requirements. The standing entrance policies in North Carolina required incoming students in community colleges to complete a placement test that was used as a valid predictor of college performance. North Carolina had approved the use of two nationally developed standardized tests, the ACT COMPASS and The College Board's ACCUPLACER (Liston, 2012). Each of these exams took approximately one to two hours to complete and was relatively inexpensive to administer (Bostian, 2012). Based on the results of the test, each incoming student would either be placed into the appropriate developmental sequence or receive a score above the "cut-off" to place out of developmental coursework and be placed directly into curriculum-level gateway courses.

Although these placement policies had marked benefits, disadvantages were also prevalent. Most notably, through marginal errors, placement testing led many students to enroll in unnecessary developmental coursework, which unintentionally cost more money in the long run and decreased the students' chances of success. Research also indicates that there is approximately a 10% standard error of measurement around the scoring range with placement tests (Bostian, 2012). In addition, placement tests only account for the current skill level that is assessed through the exam. Placement testing examines a student's current content knowledge to determine college readiness; however, affective measures such as

motivation or student expectations also play a heavy role in student success. Other factors that impact placement test results include the multiple-choice format and the lack of preparation from most students prior to taking the exam (Bostian, 2012).

In 2011, the DEI State Policy Team's Assessment and Placement Committee contracted the Community College Research Center (CCRC) at Columbia University's Teachers College, again, to conduct a study to determine if high school transcript data would be a more accurate assessment of placing students into community college courses than traditional standardized tests (Liston, 2012). Research was based on previous literature that studied predictive measures, such as admissions and intelligence tests, and the relation to general college success. The study used a predictive modeling method that matched college transcripts for 20,000 North Carolina community college students with their high school transcripts to determine if initial high school GPAs were better at predicting college success than placement tests (Bostian, 2012).

The results of the study indicated that high school GPAs were significantly more predictive of college success than placements tests. GPAs are considered to be a "multiple measure," since they take into account long-term studying habits, continued student expectations, and content knowledge. Unweighted high school GPAs were clearly a superior predictor of college success as compared with the testing placements. The predicted mean of the college GPA of a student was .6 lower than the student's unweighted high school GPA (Belfield & Crosta, 2012). Although the results of the study demonstrated that high school GPAs were a better predictor than traditional placement tests, no recommendations were provided about what high school GPAs should be considered for placement or how long the placement measures should be valid.

Based on the results of the study by the CCRC, the DEI State Policy Team's Assessment and Placement Committee met with a Multiple Measures for Placement Committee, the North Carolina Association of Community College Presidents, the Community College Instructional Administrators Association, and the Student Development Administrators Association at various times from January 2011 through November 2012 before finalizing the new policies and making a recommendation to the State Board of Community Colleges on November 15, 2012 (State Board of Community Colleges, 2013). The final recommendation for implementation included an establishment of a hierarchy of measures that community colleges would use to determine the placement for incoming students.

The policies implemented from the State Board of Community Colleges (2013) included the following:

1. If a student has graduated from a North Carolina high school within the past five years, has an unweighted GPA of 2.6 or above, and has taken a designated 4th math course, he or she will be exempt from any DMA or DRE prerequisites and may enroll directly into gateway English or math courses;
2. If a student does not meet the previous benchmark but has graduated from a North Carolina high school within the past five years, the college will use ACT reading scores of 20 or ACT English scores of 18, and ACT math scores of 22; or, SAT writing scores of 500 or SAT critical reading scores of 500, and SAT math scores of 500 to determine if the student can place directly into gateway English or math courses;

3. If the student does not meet the previous benchmark or ACT/SAT scores, but has graduated within the past five years, the college will use the subject-area diagnostic assessment (ACCUPLACER, Asset, or COMPASS) to determine placement;
4. If a student has not graduated from a North Carolina high school within the past five years, the college will use the subject-area diagnostic assessment to determine placement; and
5. Each local college may establish their own policies for students who do not meet the above criteria.

An evaluation of studies related to Multiple Measures Placement Policies indicated that, overall, utilizing a variety of methods to place students into college-level coursework was beneficial. A review of high school transcript data found that a student's GPA was a better predictor of college success than diagnostic testing. Overall, high school GPA alone explained approximately 21% of the variation in college GPA, whereas the placement test did not increase this explained variation, which means that to predict college GPA, high school GPA is more valuable than the placement test (Belfield & Crosta, 2012). The study also indicated that students' high school GPA was a good indicator of their college GPA. Overall, students' college GPA was 0.6 lower than their high school GPA (Belfield & Crosta, 2012).

On the other hand, out of four methods that were analyzed at a mid-sized college in the Midwest, there was no significant difference in individual measures of academic success, but that using a combination of methods worked best for predicting student success rates. After assessing placement test scores, high school preparation, student self-referrals, or a

combination, no significant difference was found with course completion or persistence based on any measures (Marwick, 2002). Since this was the case, any individual measurement would yield similar results in the success of an accurate placement, but there was no marked disadvantage for college-level students by being placed into coursework through a combined set of measures. Therefore, it is in the student's benefit to have multiple measures taken into account when placing into higher-level coursework. A similar study also suggested that the placement assessments that are most commonly used are reasonably valid predictors of students' grades in college-level coursework, but alternative approaches to assessment that include academic, diagnostic, and affective measures can improve course placements (Hughes & Scott-Clayton, 2011).

Also, the cost of traditional placement tests is actually higher than what Multiple Measures placements would be. The issue of placement testing cost is that students being placed in unnecessary coursework take additional time and cost significantly more than if students are placed into courses that match their academic level. Although common placement exams are relatively cheap to administer, the reliability has not been shown to accurately place them into the correct level of coursework. There is a standard error of measurement of 10% of the score range for using placement tests, and only a 7% error for using common high school admissions test scores, such as the SAT or ACT (Bostian, 2012). This means that colleges pay more per student to administer a college entrance exam, and there is a better chance that the scores are not as predictive; but allowing students to take the ACT or the SAT, at no cost to the college, improves the chance of being placed into the correct level of coursework. Overall, a more reliable placement would save colleges money in the long run.

Additionally, similar policies and the impact on student success have been addressed. The Florida College & Career Readiness Initiative runs a voluntary program for high schoolers who express interest in continuing their education. These students are allowed to take a college placement exam in the 11th grade, and they can take remedial courses if they do not place out. If students successfully complete remediation in their 12th grade year, they are exempt from college developmental course (Florida College System, 2010). No results from this study were published; however, one similar study from the Early Assessment Program and Multiple Measures also allows students to have an opportunity in high school to take a placement exam followed by remedial coursework. Students who complete these courses with a “C” or higher are allowed to automatically enroll in college-level English in a California state college. Results indicated that students who are deemed “prepared” have a completion rate of 70.2% compared to a completion rate of 40.5% for unprepared students (Kurlaender & Larsen, 2013; Policy Analysis for California Education, 2012).

The Seamless Alignment and Integrated Learning Support (SAILS) program initiated another similar program in Tennessee. This program aligned with the Tennessee state initiative by improving college readiness for high school juniors and seniors. Students were allowed to take classes in high school that were offered through the community college system. If students successfully completed the coursework, they would be exempt from placement policies upon enrolling in college. Results from the pilot study indicated there was an 80% pass rate in SAILS math courses; however, only 25% - 30% of those students also completed a curriculum-level course prior to enrolling in college (Tennessee SAILS Program, 2014).

Also, research by the North Carolina Community College System Office on the Multiple Measures Placement Policy examined intervention strategies at selected community colleges that targeted students who enrolled in gateway courses and fell between a 2.6 – 3.0 GPA (Clery, Munn, & Howard, 2017). Colleges implemented either a co-requisite skills support course, supplemental instruction, or a front-loaded course module. Co-requisite skills courses and supplemental instruction were generally only mandatory for students who fell into the targeted GPA range. However, one college required that all students participate until they successfully “opted-out” through their performance in the concurrent curriculum course. In either case, these courses met weekly and used a variety of methods to support the fundamental learning necessary for success in gateway courses. Additionally, the front-loaded course was embedded in each gateway English and math course. This course reviewed the necessary skills students would need to be successful, and students would need to complete the entire sequence and receive a passing score to continue with the gateway course. Out of the five colleges that participated in some type of targeted intervention strategy, the average grade attained by students in the GPA range increased. Conversely, the number of students attaining D grades declined, and the number of students who withdrew from the targeted courses also declined (Clery, Munn, & Howard, 2017).

Lastly, results for the study conducted at one community college in North Carolina indicated that “at-risk” students who enrolled in gateway English at the onset of the developmental reforms had a success rate of 81%, as compared to the 77% of Non-Multiple Measures students, and by spring of 2017 only 67% of the same group were successful, as compared to 74% of non-Multiple Measures students (Manning & Frye, 2017).

Rationale and Purpose for this Study

Theoretical research in student development provides a foundation for thinking about how students and institutions interact. Within the developmental education realm, empirical literature provides both positive and negative outcomes for developmental initiatives. In this study, the developmental redesign in the North Carolina Community College System is the primary focus. The purpose of this study was to gain a better understanding of success rates and persistence rates for students who are currently enrolled in gateway English and math courses by providing a careful evaluation of Multiple Measures Placement policies and the Developmental Education Redesign. By assessing a large number of students prior to the new initiatives and after the full implementation state-wide, an empirical comparison was made. Additionally, the study looked at demographic characteristics of students to determine if there are any common characteristics for those who are not successful in gateway courses. Using Student Departure Theory as a lens, this study sought to answer the following research questions:

1. Did traditional pathways or new pathways lead to greater success in gateway math and English courses?
2. Did traditional pathways or new pathways have an impact on persistence rates?
3. Did demographic characteristics impact the success of students enrolled in gateway math and English courses through Multiple Measures placement?

Summary

Currently, there are many issues with regards to student retention and completion in the college setting. With such a strong emphasis placed on the benefits of receiving a college degree, there have been many national- and state-level policies and initiatives aimed to

address these issues. Since developmental education programs are often criticized as being an additional obstacle that decrease a student's chance for success, more recent policies and initiatives have sought to redesign the ways in which these courses are offered and have reduced the number of students who would be required to enroll in these programs. While a lot of research has been conducted to produce strategies for student success, state initiatives may not necessarily base program strategies on a solid theoretical foundation. Using a theoretical framework to support the value of developmental education programs is needed for the current study.

Vincent Tinto's Theory of Student Departure provides insight into ways to increase retention and completion. This theory has developed from many foundational theories in student development that have evolved from psychosocial theories, cognitive-structural theories, and person-environment interactive theories. The Theory of Student Departure presents four conditions that attribute to a student's success, which include the following: expectations, support, assessment and feedback, and involvement. While Tinto's theories have been used in empirical research for decades, there has been noted criticism. Despite this, the Theory of Student Departure will still be used to further explore developmental education since this area is unique and has yet to have a single consistently used framework to apply to research. Aspects of Tinto's work have been used in developmental education to provide insight into transitional programs and empirical research that impact this area of academia.

In North Carolina, developmental education has been overhauled through two state policies. The first initiative, the developmental redesign, requires traditional 16-week developmental courses to be modularized, integrated, and shortened. This redesign has been

implemented for math and has integrated both reading and English. The second initiative allows students to bypass placement testing and potentially enrolling in developmental courses, based on certain high school benchmarks. In regard to the developmental redesign, the current research was based on similar programs, which have provided mixed results as to the overall successes. Additionally, research on placement policies appears to favor Multiple Measures for assessing how a student should be placed into college-level courses; however, the policies implemented in North Carolina do not align with all of the recommendations.

While all of the conditions within Tinto's (2012) *Completing College: Rethinking Institutional Action* were addressed in the current research, particular attention will be paid to support, assessment and feedback, and involvement, as these conditions clearly do not align with the current way that developmental courses are being administered. In the framework, support requires colleges to adequately provide the aid necessary to help students rise to high expectations. Among other factors, developmental education was clearly identified as a necessary component to help students gain necessary skills to become college-ready, but current North Carolina mandates do not allow for these programs to thrive under the given restrictions.

In addition, assessment and feedback for students entering the college allow for students to be accurately placed into classes that meet their needs. Again, with the new North Carolina state-mandated policies, students will be allowed to bypass placement exams and move directly into curriculum-level coursework based on alternative measures from high school. When students do enter classes, assessment and feedback again play a pivotal role in their persistence. Best practices suggest that instructors should be able to provide clear

assessments and feedback that ensure students understand expectations and know how to improve.

Lastly, involvement ensures that students are fully integrated in a campus culture. While it is more challenging for commuter students, using proven pedagogical techniques can increase the chance for these students to become engaged inside the classroom.

Unfortunately, the nature of the developmental redesign has eliminated a variety of ways that instructors can administer their coursework, so many of the recommendations from Tinto cannot be implemented. Understanding reasons behind student attrition and having a clear framework to analyze the current research study in developmental education ultimately provided a clear assessment of how effective these new legislative mandates were in the state of North Carolina.

Chapter Three

Methodology

This chapter will describe the research methods for the current study. The research questions, hypothesis, context for the study, and operationally defined variables will be provided. Additionally, the research design, data collection, and data analysis will be discussed.

Research Purpose and Questions

The purpose of this study was to examine the impact of new developmental education initiatives in community colleges throughout North Carolina. As discussed in Chapter Two, there is little currently published research that looks specifically at success and persistence rates in North Carolina, so programs in other states have been evaluated and have provided mixed results.

In order to gain a better understanding of the Developmental Education initiatives in North Carolina, success rates, persistence rates, and demographic characteristics were examined for students who are currently enrolled in gateway English and math courses. Using Student Departure Theory (Tinto, 2012) as a lens, this study sought to answer the following research questions:

1. Did traditional pathways or new pathways lead to greater success in gateway math and English courses?
2. Did traditional pathways or new pathways have an impact on persistence rates?
3. Did demographic characteristics impact the success of students enrolled in gateway math and English courses through Multiple Measures placement?

Context

As discussed in Chapters One and Two, the new North Carolina state initiatives for the Developmental Redesign and the Multiple Measures Placement Policy were fully implemented by the fall of 2016; however, each of the colleges had different methods for how they chose to implement each new program. The first phase actually began in 2008 when the Developmental Education Initiative (DEI) team was established (Kalamkarian, Raufman, & Edgecombe, 2015). The principles and objectives for the first of the initiatives, the Developmental Math redesign, were released in 2011 by the DEI team. A few colleges began piloting those in spring of 2012. By the fall of 2012, some colleges began using the new Developmental Math curriculum, and by the fall of 2013, all of the colleges were mandated to fully implement the new curriculum (Kalamkarian, Raufman, & Edgecombe, 2015).

The second phase began in conjunction with the math redesign, when the DEI team started work on the Developmental English and Reading redesign. In the fall of 2012 and spring of 2013, some of the community colleges began piloting the new English and reading curriculum, followed by initial full implementation in the fall of 2013. By the fall of 2014, it was mandatory for the remaining community colleges to implement the new combined English and reading curriculum (Kalamkarian, Raufman, & Edgecombe, 2015). Since these policies were happening simultaneously, some community colleges chose to implement both at the same time. Other colleges implemented on different schedules.

To further complicate the roll out, the Multiple Measures Policy initiative was also approved in the spring of 2013 by the DEI team (Kalamkarian, Raufman, & Edgecombe, 2015). This policy required a new diagnostic test, which was designed and implemented in

two parts. The first diagnostic test was for math. It was approved and subsequently started being used by each college in April of 2013. Two years later, in April of 2015, the diagnostic English test was approved and became the new placement test for each college (Kalamkarian, Raufman, & Edgecombe, 2015). Additionally, this policy required new placement measures for each college to use for assessment of all incoming students. While the scope of this study will not focus on the new diagnostic test, the placement measures that accompanied the test are included. Ultimately, a majority of the colleges began following the new policy by fall of 2015; however, it was not mandatory to fully implement it until fall of 2016. Figure 2 is a timeline of the phased implementation of each initiative.



Figure 2. Timeline of Developmental Initiatives in North Carolina.

Research Design

This proposed study used a non-experimental, causal-comparative research design. Non-experimental methods in quantitative research are typically more varied than the clearly

defined research methods in experimental research (Muijs, 2004). There are numerous types of non-experimental research designs, but they all differ from experimental research because they do not give any treatment (Patten, 2017). This study analyzed existing data sets that were previously collected by each community college. Using existing data from an official source is an efficient way of answering research questions, but there are issues that should be addressed. For example, the purposes for which the data was initially gathered may be different from what the research is trying to accomplish, and the reliability of the data is often unknown (Muijs, 2004). Even though each community college in North Carolina is required by the state to collect the same data, it may be categorized differently. These concerns were taken into consideration when conducting the data analysis.

With causal-comparative studies, also known as ex post facto studies, two criterion groups are compared with respect to a particular variable of interest (Tuckman & Harper, 2012). For this research study, the two groups that were used for comparison were the students that have taken developmental courses before the redesign and Multiple Measures Placement Policy, and those that did not. Typically, for casual-comparative studies one of the comparison groups has a particular characteristic that is hypothesized to cause a change in the dependent variable (Tuckman & Harper, 2012). In addition, causal-comparative studies follow two main characteristics of observing and describing a current condition and researching the past to identify a possible cause (Patten, 2017). In this case, the past characteristic is the traditional developmental education program because the comparison group includes students who were placed out of these courses, so there is an impact on their subsequent success and persistence rates. Furthermore, demographic characteristics were also examined to determine if there are any other characteristics that may have an impact.

Sampling Techniques

The sample for this study was comprised of students enrolled in community colleges in North Carolina. Since the entire community college population in North Carolina is very large, a sample population was taken for analysis. A sample population is a group which represents the population in which the researcher is interested (Patten, 2017). Sample selection was based on volunteerism sampling techniques, with at least one college participating from each of the three regions of North Carolina. Volunteerism sampling is often used when researchers need to gather data but do not have the ability to use a simple random sampling technique. There are two types of volunteerism, but both are based on the notion that individuals or groups will volunteer for the research (Patten, 2017).

Sample and Data Collection

The data collection for this study occurred during the summer and fall of 2017, to ensure that each college that participated had at least one full academic year of data after all of the related initiatives were implemented. Nine community colleges in North Carolina were asked to participate in the study, three from each region of the state. Emails were initially sent out to the Office of Institutional Effectiveness at each college detailing the study with a copy of the approved IRB, a template for extracting data, and a formal request to participate included. Of those nine colleges, eight initially agreed to participate. One college could not provide the data within the given timeframe, and two colleges were unable to extract the needed information from their records. Ultimately, five colleges provided data for the study.

As this is an ex post facto study, participants were not directly contacted. Instead, student data records were collected from the participating community colleges. Overall, a

sample size of 3,689 student records was collected. Student records were eliminated from the study for students who did not take a gateway English or math course during their first academic year of enrollment at their respective community college. Records from each college were de-identified.

Regionally, 31% ($n = 1,132$) of the student records came from the Western Region of the state, 33% ($n = 1,210$) from the Central Region, and 36% ($n = 1,347$) from the Eastern Region. Regional boundaries were determined by the counties in which the community college was located, within the geographical boundaries of the state. The records were categorized into two distinct groups, one cohort prior to the implementation of the new policies (Cohort 1), and one cohort a year after (Cohort 2). The cohorts ran from fall-to-fall, 2011-2012 (Cohort 1), and fall-to-fall, 2016-2017 (Cohort 2). In some cases, colleges fully implemented both initiatives prior to 2016-2017. In those cases, Cohort 1 came from fall to fall of the year preceding full implementation, and Cohort 2 came from the first full academic year after implementation.

Within the sample, the age range was 14 years old to 77 years old. Additionally, 59% ($n = 2,162$) were identified as female and 41% as male ($n = 1,527$). Fifty-one percent ($n = 1,894$) received federal financial aid, 34% ($n = 1,270$) did not receive financial aid, and 14% ($n = 525$) were not identified. The breakdown of household income of students is provided in Table 6.

Table 6

Household Income of Students by Percentage (n = 3,689)

Income Range	Percentage
Less than \$25,000	33% (n = 1,214)
\$25,000 - \$34,999	9% (n = 318)
\$35,000 - \$49,999	9% (n = 353)
\$50,000 - \$74,999	10% (n = 376)
\$75,000 - \$99,999	6% (n = 231)
\$100,000 or More	6% (n = 203)
Did not Indicate	27% (n = 994)

Additionally, a comparison between cohorts describing the breakdown of age, gender, financial aid status, and income is presented in Table 7.

Table 7

Student Records by Region, Age, Gender, Financial Aid, and Income by Cohort

	Cohort 1	Cohort 2
Region	603 (C)	607 (C)
	518 (E)	829 (E)
	514 (W)	618 (W)
Age	138 < 18yrs*	461 < 18yrs*
	1497 > 18yrs*	1593 > 18yrs*
Gender	974 (F)	1188 (F)
	661 (M)	865 (M)
Financial Aid	901 (Y)	993 (Y)
	567 (N)	703 (N)
	167 (UNK)	358 (UNK)
Income	607 < \$25,000*	606 < \$25,000*
	695 > \$25,000*	786 > \$25,000*
	333 (UNK)	661 (UNK)

Note. C = Central, E = Eastern, W = Western. * < indicates less than, > indicates greater than. F = Female, M = Male. Y = Yes, N = No, UNK = Unknown.

Other student record characteristics include race/ethnicity, first generation status, course load, and fall-to-spring and fall-to-fall registration status. Of those that self-identified,

2% ($n = 61$) were American Indian/Alaska Native; 1% ($n = 35$) Asian or Pacific Islander; 15% ($n = 552$) Black, Non-Hispanic, 6% ($n = 238$) Hispanic; 9% ($n = 343$) Other/Unknown/Multiple; 67% ($n = 2,457$) White, Non-Hispanic; and <1% ($n = 3$) were unidentified. Table 8 shows a total race/ethnicity breakdown by percentage. Twenty-nine percent ($n = 1,076$) of the total student records were first generation college students; 14% ($n = 516$) were not first generation; and 57% ($n = 2,097$) did not indicate. Sixty-one percent ($n = 2,261$) of student records had a full-time course load; 38% ($n = 1,412$) had a part time course load; and <1% ($n = 16$) were not identified. Lastly, 83% ($n = 3,069$) of students re-enrolled from fall to spring, 3% ($n = 96$) did not re-enroll, and 14% ($n = 524$) were not identified. For fall to fall enrollment, 63% ($n = 2,330$) of the students re-enrolled, 7% ($n = 241$) did not re-enroll, and 30% ($n = 1,118$) were not identified.

Table 8

Race/Ethnicity of Students by Percentage ($n = 3,689$)

Race/Ethnicity	Percentage
American Indian/Alaskan Native	2% ($n = 61$)
Asian or Pacific Islander	1% ($n = 35$)
Black, Non-Hispanic	15% ($n = 552$)
Hispanic	6% ($n = 238$)
Other/Unknown/Multiple	9% ($n = 343$)
White, Non-Hispanic	67% ($n = 2,457$)
Unidentified	1% ($n = 3$)

A further breakdown of enrollment per cohort by year (2011-2012 or 2016-2017) indicates that for Cohort 1, 65% ($n = 1,062$) of students re-enrolled fall-to-spring, and 62% ($n = 1,021$) re-enrolled fall-to-fall. Two percent ($n = 39$) of students did not re-enroll from fall-to-spring, and 6% ($n = 105$) did not enroll fall-to-fall. Of these records, from fall-to-spring,

33% ($n = 534$) were not identified, and from fall-to-fall, 31% ($n = 509$) were not identified. On the other hand, Cohort 2 indicates that 80% ($n = 1649$) of students re-enrolled fall-to-spring, and 63% ($n = 1,309$) re-enrolled fall-to-fall. Additionally, 3% of students did not re-enroll fall-to-spring, or 7% of students did not re-enroll fall-to-fall. At least 17% ($n = 348$) of student records did not indicate enrollment status for fall-to-spring, nor did 30% ($n = 609$) of fall-to-fall. Table 9 provides a breakdown of race, first generation status, course load, fall-to-spring enrollment, and fall-to-fall enrollment by cohort.

Table 9

Race, First Generation Status, Course Load, Fall-to-Spring, and Fall-to-Fall Factors by

Cohort

	Cohort 1	Cohort 2
Race/Ethnicity	21 (AI)	40 (AI)
	17 (AP)	18 (AP)
	184 (BLK)	368 (BLK)
	74 (HIS)	164 (HIS)
	218 (OTR)	128 (OTR)
	1120 (WHT)	1338 (WHT)
First Generation Status	530 (Y)	401 (Y)
	108 (N)	409 (N)
	997 (UNK)	1244 (UNK)
Course Load	1028 (FT)	1234 (FT)
	607 (PT)	820 (PT)
Fall-Spring	1421 (Y)	1648 (Y)
	215 (N)	406 (N)
Fall-Fall	1021 (Y)	1309 (Y)
	614 (N)	745 (N)

Note. AI = American Indian/Alaskan Native, AP = Asian or Pacific Islander, BLK = Black, Non-Hispanic, HIS = Hispanic, OTR = Other/Unknown/Multi, WHT = White, Non-Hispanic. Y = Yes, N = No, UNK = Unknown. FT = Full-time, PT = Part-time.

Data Analysis

Data was sent electronically to the researcher in an Excel format through secured servers. Each student record included de-identified information on age upon initial enrollment, gender, race/ethnic group, enrollment status for fall and spring of the subsequent semesters, placement methods for English and math, income range, region, federal grant funding, course load, and final grades from each gateway math or English 111 course taken. At one college, reading was used as a placement score for English courses instead of English/DRE. Each Excel file was cleaned and merged into a master list prior to coding for statistical analysis. The master file included the variables listed in Table 10.

Table 10

NC Community College Student Record Data

Column	Variable	Level;
1	Random ID	Nominal level
2	Cohort	Ordinal; Coded 2011FA or 2016FA
3	ENG 111 Final Grade	Ordinal; Letter Grades, A, B, C, D, F, W
4	MAT 140/3 Final Grade	Ordinal; Letter Grades, A, B, C, D, F, W
5	MAT 151/2 Final Grade	Ordinal; Letter Grades, A, B, C, D, F, W
6	MAT 171 Final Grade	Ordinal; Letter Grades, A, B, C, D, F, W
7	ENG/DRE Placement	Ordinal; MM, PTC, DEVC, WVR, TR
8	MAT Placement	Ordinal; MM, PTC, DEVC, WVR, TR
9	FA Enroll	Ordinal; Y, N, NA
10	SP Enroll	Ordinal; Y, N, NA
11	Gender	Nominal; M/F
12	Ethnic Decent	Nominal; AI; AP; BK; HIS, OTH; WHT
13	Age	Ratio; 14-77
14	Total Family Income Range	Ratio; Less than \$25,000 - \$100,000 or More
15	Region	Nominal; Western, Central, Eastern

For the primary analysis, final grades in gateway English 111, Math 140/143, Math 151/152, and Math 171 courses were extracted for all students who fit the aforementioned criteria. Additional data records were collected from the sample population that included

their age, gender, race/ethnicity, socioeconomic level, enrollment status for each semester, and placement method for gateway English and math course. Randomized IDs were used to ensure that individual students remained unidentifiable. Additional information from student records that were analyzed is as follows: Highest DMA (Developmental Math) Completion, DMA Completion Type, Highest DRE (Developmental English and Reading) Completion, DRE Completion Type, FA to FA Retention (Y or N, 2012FA or 2017FA at census), Spring Enrollment (Y or N, 2012SP or 2017SP), Award Completion, Gender, Age, Race/Ethnicity, Total Family Income during Cohort Year, First Generation, Has Pell during Cohort Year (Y, N), and Student Load during Cohort Term.

The data were uploaded into the software Statistical Package for the Social Sciences 24 (SPSS). For the analysis of data, both descriptive and inferential statistics were used. As with any statistic, the overall sample number determined what analysis was conducted. To address success, an Analysis of Variance (ANOVA) was used to analyze Quality Points for gateway math and English 111 courses and Cohorts 1 and 2. To address persistence, a Chi Square was used to determine relationships between the cohorts and the persistence, as well as each placement method (ENG/DRE & MAT/DMA) and persistence. Additionally, a binary logistic regression was used to predict the impact of demographics on success for students who were enrolled in gateway math and English 111 through Multiple Measures placement. Success was defined as the final letter grades of “A,” “B,” or “C.” Additionally, for some analyses, these letter grades were converted to Quality Points. In this case, success based on Quality Points was defined as “4.0,” “3.0,” and “2.0.”

For the purpose of the analysis the following variables were defined:

- Placement Credit: Students were placed into a gateway English 111 course through DRE/ENG/RED credit or into a gateway math course through a DMA/MAT credit.
- English 111: The first credit-bearing transferrable English course a student would be enrolled in at a North Carolina Community College.
- Gateway Math: Math 140, Math 143, Math 151, Math 152, or Math 171 will be used as the most common credit-bearing transferable math courses a student would be enrolled in at a North Carolina Community College.
- Quality Points: Standard numeric conversion for letter grades A, B, C, D, and F. Quality Points are assigned as 4.0, 3.0, 2.0, 1.0, and 0.0, respectively.
- Success (binary): Letter grades of A, B, and C. Non-success includes letter grades of D, F, and W.
- Cohort 1: Fall 2011. The last year traditional developmental courses were fully in place in the North Carolina Community College System.
- Cohort 2: Fall 2015 or Fall 2016, based on the first full year after each college implemented both developmental initiatives and Multiple Measures policies.
- Gender: Male or female.
- Race/Ethnicity: African American/Non-Hispanic, American Indian or Alaskan Native, Asian or Pacific Islander, Hispanic, or White/Non-Hispanic.
- Age: Age of first enrollment.
- First Generation Status: Students who are the first in their family to have completed any college degree, at the associate degree level or higher.
- Full-time/Part-time Load: 12 credit hours per semester or higher designates full-time status. Fewer than 12 credit hours per semester is part-time status.

- Federal Financial Aid: If a student has accepted a federal Pell grant during the first semester of enrollment.
- Total Family Income Range: Median household income upon the first semester of enrollment.
- Region: Western, central, or eastern region of North Carolina based on the North Carolina Geological Services.
- ENG-111/MAT-140/143/MAT-151/152/MAT-171 Final Grade: Some students took and withdrew or failed ENG or MAT during 2011FA and retook it in the spring. Either the highest grade received for the course OR the actual grade received (if the other grade was a W).
- Highest DMA/DRE Completion and Type: Because the study is looking at a 2011FA cohort, there is no Multiple Measures placement. In addition to that, there are various combinations of ENG and RED placement and completion since this was prior to the implementation of DRE. Multiple columns of data are included because different combinations of developmental courses are equivalent to DMA and DRE placement. A column for each developmental subject (ENG, RED, MAT, DRE, DMA) and a completion type (either the placement type or CCCTI if it is completed credit) are included. From this list, it was determined which students would be included or excluded.
- Award Completion: Completion of any award or awards during the 2011FA-2012SU is also provided for the same time period for a more accurate picture of retention (since we typically assume that students who have graduated prior to the following fall have completed their goals and therefore are not expected to return).

- Total Family Income during Cohort Year: This is the Total Family Income reported on that year's FAFSA. If the student did not complete a FAFSA, no income is listed.

Reliability

Simply stated, reliability serves to quantify the precision of a measurement instrument over numerous and consistent conditions, so the credibility of the scores produced by the instrument are trusted (Gushta & Rupp, 2010; Patten, 2017). When conducting experimental research, it is important to consider how reliable the results of a given measurement are; however, non-experimental research designs may not be able to address these issues. Reliability also refers to the extent to which measurement error is reduced (Muijs, 2004). Measurements will inevitably be impacted by both systematic and random errors, so reducing each will produce more reliable results. The methods that are commonly used to establish reliability are typically categorized based on internal consistency, test-retest methods, or parallel forms (Trochim, 2006). Internal consistency refers to the extent to which all of the items in an instrument are measuring the same phenomenon (Trochim, 2006). Test-retest determines the stability and is used to examine the extent to which a test gives the same measurement on two or more administrations (Trochim, 2006). Parallel forms investigate the extent to which multiple assessments are used to measure the same variable (Trochim, 2006). In the current study, reliability would not be able to be taken into account because there will be no measurement instrumentation for the independent variables. It is important to note that reliability and validity are interrelated; however, a measurement may have reliability and still may not be valid (Vito, Tewksbury, & Kunselman, 2014).

Validity

Similar to reliability, researchers must also consider the validity of a study. There are three general categories of validity: experimental, test, and diagnostic. Each of these categories focuses on different aspects of research. For the purpose of this research study, experimental validity and test validity will be discussed in more detail, but diagnostic validity will be beyond the scope of this dissertation. The first category, experimental validity, focuses on research design. Within experimental validity, internal and external validity should be addressed. *Internal validity* is the extent to which there is a causal link between the independent and dependent variables (Schenker & Rumrill, 2004). On the other hand, *external validity* is established based on the degree to which the sample population is representative of the larger population (Schenker & Rumrill, 2004). Ex post facto studies can have a high degree of external validity if a large representative sample of the population can be obtained. However, if samples are not randomly selected, it may limit the possibility of statistical inferences (Silva, 2010).

Test validity is the second category that addresses these issues. The purpose of test validity is to ensure that research is measuring what it is supposed to measure (Muijs, 2004). In many cases, an instrument must be developed to indirectly measure particular concepts related to the research. The methods used for establishing testing validity in research fall into three broad categories: judgmental validity, empirical validity, and judgmental-empirical validity. Judgment validity determines the appropriateness of the contents of a test and whether a measure appears to be valid. Empirical validity uses planned comparisons to see if a measure will yield a score that relates to certain criterion. Judgmental-empirical validity indicates how closely a test is measuring the intended construct (Patten, 2017).

Threats

Since causal-comparative studies do not manipulate independent variables, it is important to be cautious when making any generalizations or inferences from the results (Silva, 2010). For the current research, due to the lack of control of the independent variables, the researcher may not be able to account for confounding errors such as history, social interaction, maturation, instrumentation, selection bias, and mortality (Silva, 2010). Therefore, the researcher cannot be sure that independent variables caused the results. Of the threats to validity, the most common issues in ex post facto research relates to history and selection bias. Another risk to internal validity does not necessarily fall under the previous categories. When research is done retrospectively, prior threats to reliability and validity will also impact the results (Giuffre, 2010). In regard to external validity, the samples in this study are not randomly selected due to the use of volunteerism. When using volunteerism for a sampling method, it is possible that the sample selected may not accurately represent the general population, due to the fact that these colleges decided to participate for one reason or another. Ultimately, this will have a reactive effect on the generalizability of the findings because a sample drawn for a study that is dissimilar to the general population would provide results that were not applicable to the broader population (Adams, Raeside, & Khan, 2014).

Delimitations

The current study has a few delimitations, or boundaries. Mainly, there is no random assignment to treatment groups. Research conducted will look at pre-existing data from community colleges in North Carolina. Since state-wide policies eliminated the previous traditional developmental courses, it is not feasible to conduct a true experimental design study within the larger context of the community college courses. As with any non-

experimental research design, any conclusion that is drawn must be attributed to causality and not causation.

Furthermore, a majority of the current research will not focus on students who have placed out of developmental education courses for reasons other than Multiple Measures or other composite scoring methods. The data collected included students who entered gateway courses through a variety of methods, but this study examines those who have been impacted by developmental education or those who previously would have been. The new focus on retention and completion has increased attention on a select type of student, so those that are likely to persist regardless of new policies will not necessarily be addressed in this research study.

Summary

Two state-wide initiatives in North Carolina have been implemented to change the way developmental courses are being offered in the community college system. The current study seeks to examine the impact of these new initiatives on developmental programs by using a non-experimental, causal-comparative research design. The study collected two sets of data. The first set is from the last cohort of students to enroll in traditional developmental pathways, which occurred in the 2011-2012 academic year. The second set of data has been collected from fall-to-fall 2016-2017, or in cases where colleges carried out both initiatives prior to 2016-2017, data was collected from fall to fall of the year preceding the full implantation of both.

Since the study examined a state-wide policy, a sample population was taken for analysis. This sample was based on volunteerism from at least one college participating from each of the three regions in North Carolina. Of the five community colleges participating,

three were from the Western Region, two were from the Central Region, and one was from the Eastern Region. From participating colleges, records of students who were first-time college students were analyzed. For this analysis, final grades in gateway math and English courses (MAT 140/143, MAT 151/152, MAT 171, and ENG 111) were collected. Records that were eliminated included students who did not take a gateway English or math course during their first academic year and students who were not placed into gateway English and math courses through ACT or SAT scores, placement test scores, or other composite scoring methods. There are no associated risks with the study since it examined pre-existing data, and no direct benefits were prevalent.

Additional data was collected from the sample population to include age, gender, race/ethnicity, socioeconomic level, enrollment status for each semester, and placement method for gateway math and English. This data provided information on the highest DMA and DRE completed, the completion type, the fall to fall retention, spring enrollment, award completion, total family income during the cohort year under review, first generation status, Pell information, and the course load. This data was analyzed using Statistical Package for the Social Sciences 24 (SPSS).

As with any statistical research design, threats to reliability and validity should be addressed. Most notable, for this research study, generalizations should not be made since it is not a true research design. In regard to internal validity, history and selection bias must be considered since the study is using pre-existing data. Additionally, a threat to external validity is the sample selection of volunteerism. Also, a study's delimitations should be addressed. In this case, the traditional developmental pathways have been eliminated, so no experimental design can be used to compare groups. Furthermore, the scope of the study is

only on developmental students or those that would have been placed into these programs.

These students are not the only students enrolled in community college, so when the research reviews persistence, it will not address all of the issues related to a larger set of students.

Chapter Four

Results

This chapter will discuss the results of the study. The purpose of this study was to determine the impact of developmental education programs on student success and persistence. This study utilized an ex post facto methodology to examine students who were enrolled in North Carolina Community Colleges before and after two state initiatives were implemented that relate to developmental education. A brief summary of state-wide initiatives in North Carolina will be provided below. Overall, 3,689 student records were collected from five participating community colleges throughout the state of North Carolina. The following chapter provides participant information, along with data collection, data analysis, and the results of the study in relation to each of the study's guiding questions.

Brief Summary of Developmental Education Initiatives in North Carolina

The Developmental Education Initiatives in North Carolina included two state-wide changes. Initially, colleges were tasked with remodeling traditional seated 16-week developmental courses into modularized, integrated, and shortened formats. In addition to the shortened math sequencing, the redesign also combined previous Developmental English and Developmental Reading into three sequenced courses.

The second initiative that impacted developmental education focused on placement methods for students. By factoring in students' high school GPA as a primary placement indicator, this new initiative, called Multiple Measures Placement, allowed students to bypass placement testing and enroll directly into gateway courses. As a result, Multiple Measures policies provide more opportunities for incoming students to bypass developmental

coursework. The impact of these policies has not been heavily studied to date, and, therefore, the purpose of this study is to examine that impact.

Operational Definitions for Analysis

For the purpose of the analysis the following variables were defined:

- Placement Credit: Students were placed into a gateway English 111 course through DRE/ENG/RED credit or into a gateway math course through a DMA/MAT credit.
- English 111: The first credit-bearing transferrable English course a student would be enrolled in at a North Carolina Community College.
- Gateway Math: Math 140, Math 143, Math 151, Math 152, or Math 171 will be used as the most common credit-bearing transferable courses a student would be enrolled in at a North Carolina Community College.
- Quality Points: Standard numeric conversion for letter grades A, B, C, D, and F. Quality Points are assigned as 4.0, 3.0, 2.0, 1.0, and 0.0, respectively.
- Success (binary): Letter grades of A, B, and C. Non-success include letter grades of D, F, and W.
- Cohort 1: Fall, 2011. The last year traditional developmental courses were in place in the North Carolina Community College System.
- Cohort 2: Fall 2015 or Fall 2016, based on the first full year after each college implemented both developmental initiatives and Multiple Measures policies.
- Gender: Male or female.
- Race/Ethnicity: African American/Non-Hispanic, American Indian or Alaskan Native, Asian or Pacific Islander, Hispanic, or White/Non-Hispanic.
- Age: Age of first enrollment.

- First Generation Status: Students who are the first in their family to have completed any college degree, at the associate degree level or higher.
- Full-time/Part-time Load: 12 credit hours per semester or higher designates full-time status. Fewer than 12 credit hours per semester is part-time status.
- Federal Financial Aid: If a student has accepted a federal Pell grant during the first semester of enrollment.
- Total Family Income Range: Median household income upon the first semester of enrollment.
- Region: Western, central, or eastern region of North Carolina based on the North Carolina Geological Services.
- ENG-111/MAT-140/143/MAT-151/152/MAT-171 Final Grade: Some students took and withdrew or failed ENG or MAT during 2011FA and retook it in the spring. Either the highest grade received for the course OR the actual grade received (if the other grade was a W).
- Highest DMA/DRE Completion and Type: Because the study is looking at a 2011FA cohort, there is no Multiple Measure placement. In addition to that, there are various combinations of ENG and RED placement and completion, since this was before DRE. Multiple columns of data will be included, because different combinations of developmental courses are equivalent to DMA and DRE placement. A column for each developmental subject (ENG, RED, MAT, DRE, DMA) and a completion type (either the placement type or CCCTI if it is completed credit) will be included. From this list, it will be determined which students will be included or excluded.

- Award Completion: Completion of any award or awards during the 2011FA-2012SU will also be provided for the same time period, for a more accurate picture of retention (since we typically assume that students who have graduated prior to the following fall have completed their goals and therefore are not expected to return).
- Total Family Income during Cohort Year: This is the Total Family Income reported on that year's FAFSA. If the student did not complete a FAFSA, no income will be listed.

Research Question One

In order to investigate the first research question, student records from the sample were analyzed for only those students who completed gateway MAT 140/143, MAT 151/152, or MAT 171, or English 111 within their first year of enrollment. Student records that were eliminated included those that were placed into courses through placement test scores, waivers, transfers, or unknown. The remaining records that were included were those who were placed into gateway through either a developmental course or Multiple Measures. A further breakdown of the data was by Cohort 1, which occurred prior to the initiatives, and Cohort 2, which occurred after. Additionally, student records from each gateway math course were merged, due to small size of cases per course. In a case where a student completed two math courses within the same cohort year, a duplicate record was made so final grades could be assessed for each course completion. Also, Multiple Measures placements did not exist in Cohort 1, so no records were included. The result yielded 393 total records for all math courses (57 for Developmental; 336 for Multiple Measures). Table 11 shows a breakdown of student records by final grade/percentage, placement credit method, and Cohort 1 or 2.

Table 11

Math Final Grades and Quality Points by Cohort and Placement Method

MATH FINAL GRADES AND QUALITY POINTS							
Cohort	A (4.0)	B (3.0)	C (2.0)	D (1.0)	F (0.0)	W (NA)	Total
Cohort 1 DEVC PLACEMENT	9 (34.6%)	8 (30.8%)	4 (15.4%)	1 (3.8%)	1 (3.8%)	3 (11.5%)	26 (100.0%)
Cohort 1 Total	9 (34.6%)	8 (30.8%)	4 (15.4%)	1 (3.8%)	1 (3.8%)	3 (11.5%)	26 (100.0%)
Cohort 2 DEVC PLACEMENT	6 (19.4%)	8 (25.8%)	5 (16.1%)	5 (16.1%)	3 (9.7%)	4 (12.9%)	31 (100.0%)
Cohort 2 MM PLACEMENT	78 (23.2%)	96 (28.6%)	71 (21.1%)	39 (8.6%)	20 (6.0%)	42 (12.5%)	336 (100.0%)
Cohort 2 Total	84 (22.9%)	104 (28.3%)	76 (20.7%)	34 (9.3%)	23 (6.3%)	46 (12.5%)	367 (100.0%)
Total DEVC PLACEMENT	15 (26.3%)	16 (28.1%)	9 (15.8%)	6 (10.5%)	4 (7.0%)	7 (12.3%)	57 (100.0%)
Total MM PLACEMENT	78 (23.7%)	96 (28.6%)	71 (21.1%)	29 (8.6%)	20 (6.0%)	42 (12.5%)	336 (100.0%)
All Total	93 (23.7%)	112 (28.5%)	80 (20.4%)	35 (8.9%)	24 (6.1%)	49 (12.5%)	393 (100.0%)

Additionally, 1,372 ENG 111 student records were initially included (521 for Developmental; 851 for Multiple Measures). Table 12 shows a breakdown of student records by final grade/percentage, placement method, and cohort year.

Table 12

English 111 Final Grades and Quality Points by Cohort and Placement Method

ENGLISH FINAL GRADES AND QUALITY POINTS							
Cohort	A (4.0)	B (3.0)	C (2.0)	D (1.0)	F (0.0)	W (NA)	Total
Cohort 1 DEVC PLACEMENT	64 (20.4%)	121 (38.5%)	59 (18.8%)	13 (4.1%)	20 (6.4%)	37 (11.8%)	314 (100.0%)
Cohort 1 Total	64 (20.4%)	121 (38.5%)	59 (18.8%)	13 (4.1%)	20 (6.4%)	37 (11.8%)	314 (100.0%)
Cohort 2 DEVC PLACEMENT	39 (18.8%)	56 (27.1%)	48 (23.2%)	13 (6.3%)	22 (10.6%)	29 (14.0%)	207 (100.0%)
Cohort 2 MM PLACEMENT	306 (36.0%)	238 (28.0%)	152 (17.9%)	43 (5.1%)	45 (5.3%)	67 (7.9%)	851 (100.0%)
Cohort 2 Total	345 (32.6%)	294 (27.8%)	200 (18.9%)	56 (5.3%)	67 (6.3%)	96 (9.1%)	1058 (100.0%)
Total DEVC PLACEMENT	103 (19.8%)	177 (34.0%)	107 (20.5%)	26 (5.0%)	42 (8.1%)	66 (12.7%)	521 (100.0%)
Total MM PLACEMENT	306 (36.0%)	238 (28.0%)	152 (17.9%)	43 (5.1%)	45 (5.3%)	67 (7.9%)	851 (100.0%)
All Total	409 (29.8%)	415 (30.2%)	259 (18.9%)	69 (5.0%)	87 (6.3%)	133 (9.7%)	1372 (100.0%)

Quality Points were then generated based on the final grade records. Quality Points are used in GPA calculations, so they are a standard numeric conversion for letter grades (McCutchen & Riney, 2016). For letter grades A, B, C, D, and F, Quality Points are assigned as 4.0, 3.0, 2.0, 1.0, and 0.0, respectively. Since there are no Quality Points awarded for withdrawals, students that received a “W” were excluded from the final analysis. The total number for the final analysis in math yielded 344 student records, and for ENG111 there

were 1239 records. For math, the overall mean for Quality Points for students that were placed through developmental courses in the first cohort was 3.0. For the second cohort, the overall mean for Quality Points of students placed through developmental was 2.64 and through Multiple Measures was 2.62. English 111 student records had an overall mean of 2.71 Quality Points for developmental placement in the first cohort. The overall mean of Quality Points in the second cohort was 2.43 and 2.91 for developmental placement and Multiple Measures placement, respectively. Mean Quality Points by Cohort and Placement methods are presented in Table 13.

Table 13

Mean Quality Points by Cohort and Placement Methods

	Mean Quality Points
Cohort 1	
DEVC Math	3.00
DEVC English	2.71
Cohort 2	
DEVC Math	2.64
MM Math	2.62
DEVC English	2.43
MM English	2.91

A one-way ANOVA was conducted to compare the success of students in gateway courses by their placement method. Students could be placed into a gateway course by taking

a developmental course first and receiving a credit, or by placing through Multiple Measures. A one-way ANOVA was also conducted to compare the success of students in gateway courses by their cohort. Cohort 1 occurred when traditional developmental pathways were the only way to place into a gateway course, and Cohort 2 occurred after the new initiatives allowed students to place into gateway courses through alternate methods like Multiple Measures. An ANOVA is used when comparing differences between several means (Field, 2013). In this study, the means are the placement methods and the cohort for both math and English. The analysis was made to determine the following:

- If Developmental or Multiple Measures placement methods had an impact on overall Quality Points in both math and English.
- If Cohort 1 or 2 had an impact on overall Quality Points in both math and English.

For this analysis, Cohort 1 is operationally defined as fall of 2011 and Cohort 2 is operationally defined as fall 2015 or fall 2016. These parameters are based on the first full year after each college implemented both developmental initiatives and Multiple Measures policies. ANOVAs require that the dependent variable (outcome) is at least at the ordinal level (Field, 2013). Since success is operationally defined in this study as students final grade in their gateway course (A, B, C), letter grades were converted to Quality Points. Therefore, success by Quality Points would be any numeric average at 2.0 points or above.

The first analysis compared the success of students enrolled in gateway math courses by math placement methods. The results of the between subjects-effects for math placement methods are provided in Table 14. The analysis revealed that there was not a significant

effect on Quality Points between placement methods at the $p < .05$ level [$F(1,342) = 2.48, p = .116$].

Table 14

Univariate Analysis of Variance (ANOVA) Between Gateway Math and Placement Methods

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Between Groups	1	3.46	3.46	2.48	.116
Within Groups	342	477.15	1.39		
Total	343	480.62			

The second analysis compared the success of students enrolled in gateway math courses by cohort. Cohort 1 occurred prior to state initiatives, and Cohort 2 occurred after. The results of the between subjects-effects for cohorts and success are provided in Table 15. The analysis revealed that there was not a significant effect on Quality Points between cohorts at the $p < .05$ level [$F(1,342) = 2.48, p = .116$].

Table 15

Analysis of Variance (ANOVA) Between Gateway Math and Cohorts

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Between Groups	1	3.46	3.46	2.48	.116
Within Groups	342	477.15	1.39		
Total	343	480.62			

For the second set of analyses, an ANOVA was used to compare the success of students enrolled in gateway English courses by English placement methods. Students could be placed into gateway English courses through developmental courses or Multiple Measures. The results of the between subjects-effects for placement methods and success are provided in Table 16. The analysis revealed that there was a significant effect on Quality Points between placement methods at the $p < .05$ level [$F(1,1237) = .21.37, p = .000$].

Table 16

Analysis of Variance (ANOVA) Between Gateway English and Placement Methods

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Between Groups	1	28.43	28.48	21.37	.000
Within Groups	1237	1648.47	1.33		
Total	1238	1676.95			

Lastly, an ANOVA was also conducted to compare the success of students enrolled in gateway English 111 by cohort. The results of the between subjects-effects are provided in Table 17. The analysis revealed that for the gateway course of English 111, there was not a significant effect on Quality Points between Cohort 1 and 2 [$F(1,1237) = 2.20, p = .138$].

Table 17

Univariate Analysis of Variance (ANOVA) Between English 111 and Cohorts

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Cohort	1	2.98	2.98	2.20	.138
English placement	1237	1673.97	1.35		
Total	1238	1676.95			

Research Question Two

In order to examine the second research question, only the records of students who completed gateway MAT 140/143, MAT 151/152, MAT 171, or English 111 within their first year of enrollment were analyzed. Persistence is operationally defined in this study as fall-to-fall retention, by either a “yes” or “no.” Student records who received a “yes” were enrolled in at least one course for both the following spring and fall semesters. For the first analysis, to examine the overall persistence of students, no student records were eliminated. Then, to examine the persistence of students based on placement credits, the records that were eliminated included those that were placed into courses through placement test scores, waivers, transfers, or unknown.

Pearson Chi-Squares were used to determine the impact of the independent variables of cohorts and placement credit types on persistence. A Chi-Square is used to determine if there is a relationship between two categorical variables (Field, 2013). Although Chi-Squares can be run without recoding, weighted cases can be used to analyze a z-test. For each analysis, categorical variables were re-coded for the statistical procedure chosen. Since the sets of variables in this case were categorical, they were coded as “1” or “2” for the analysis. Table 18 shows how each set of variables was coded. Additionally, a frequency table for each analysis was created to weigh variable categories to examine differences between each set of variables in each analysis.

Table 18

Variable Coding for Analysis

Variable	Coding
Persistence (Fall-to-Fall)	“Yes” = 1, “No” = 2
Cohort	Cohort 1 = 1, Cohort 2 = 2
Placement Credit	Developmental = 1, Multiple Measures = 2

For the first analysis, 3,689 student records were included. Table 19 shows the count and percentage of student records included in the sample based on Cohort 1 or 2 to determine the overall impact of persistence before and after state initiatives. For the second set of analyses, 1,250 ($n = 493$ Developmental; $n = 757$ Multiple Measures) math records were included, and 1,504 ($n = 547$ Developmental; $n = 957$ Multiple Measures) English records were included.

Table 19

Persistence by Cohort

Cohort	Persistence		Total
	Yes	No	
Cohort 1	1021 (62.5%)	614 (37.5%)	1635 (100.0%)
Cohort 2	1309 (63.7%)	745 (36.3%)	2054 (100.0%)
Total	1358 (63.2%)	2330 (36.8%)	3689 (100.0%)

Table 20 shows an overall count of student records and persistence based on math courses.

Table 20

Persistence by Math Placement

Persistence	Math Course Placement		Total
	Developmental Courses	Multiple Measures	
Yes	345 _a	504 _b	849
% within placement	(70.0%)	(66.6%)	(67.9%)
No	148 _a	253 _b	127
% within placement	(30.0%)	(33.4%)	(32.1%)
Total	493 (100.0%)	757 (100.0%)	1250 (100.0%)

Note. Each subscript letter denotes a subset of math course placement categories whose column proportions do not differ significantly from each other at the .05 level.

Table 21 shows an overall count of student records and fall enrollment based on English 111.

Table 21

Persistence by English Placement

Persistence	English 111 Course Placement		Total
	Developmental Courses	Multiple Measures	
Yes % within placement	386 _a (70.6%)	629 _a (65.7%)	1015 (67.5%)
No % within placement	161 _a (29.4%)	328 _a (34.4%)	489 (32.5%)
Total	547 (100.0%)	957 (100.0%)	1504 (100.0%)

Note. Each subscript letter denotes a subset of English course placement categories whose column proportions do not differ significantly from each other at the .05 level.

To analyze the overall persistence of students in each cohort, a Pearson Chi-Square was used to determine the significance of the variables. Analyzing the overall impact of persistence with no regard to placement credits can help to determine if both of the new state initiatives have increased persistence and retention since Cohort 1 occurred prior to the new initiatives and Cohort 2 occurred after the full implementation of both. The results of the analysis indicate that there was no significant association on persistence between each cohort $\chi^2 (1) = .644, p = .422$. The results of the Chi-Square are reported in Table 22.

Table 22

Chi-Square Test and Descriptive Statistics for Persistence by Cohort

	Persistence	
	Yes	No
Cohort 1	1021 (62.4%)	614 (37.6%)
Cohort 2	1309 (63.7%)	745 (36.3%)

Note. $\chi^2 = 6.44$, $df = 1$. Numbers in parentheses indicate column percentages.

* $p = .442$

Persistence based on placement credits through developmental or Multiple Measures placement was also measured using a Pearson Chi-Square with a z-test to compare proportions and determine significance of the variables. A Pearson Chi-Square with a z-test was also run to analyze the persistence of students who took gateway math courses based on placement credit methods. For students who were placed into a gateway math course, there was not a significant association on persistence between the types of placement methods $\chi^2(1) = 1.58$, $p = .208$. The results of the Chi-Square for math enrollment are presented in Table 23.

Table 23

Chi-Square Test on Persistence by Math Placement

	Enrollment	
	Yes	No
Developmental placement	345 (40.6%)	148 (36.9%)
Multiple Measures placement	504 (59.4%)	745 (63.1%)

Note. $\chi^2 = 1.58$, $df = 1$. Numbers in parentheses indicate column percentages.

* $p = .208$

A Pearson Chi-Square was also run with a z-test to compare proportions and determine if there was an impact on persistence based on English 111 placement methods. Since weighted cases were used, a z-test compared the proportions of the total frequency of the second column to the first row to show if proportions were significantly different (Field, 2013). For students who were placed into English 111 courses, there was a marginally significant association on persistence between the types of placement methods $\chi^2 (1) = 3.71$, $p = .054$. Results of the Chi-Square for fall enrollment are presented in Table 24.

Table 24

Chi-Square Test on Persistence by English Placement

	Persistence	
	Yes	No
Developmental placement	386 (38.0%)	161 (32.9%)
Multiple Measures placement	629 (62.0%)	328 (67.1%)

Note. $\chi^2 = 3.71$, $df = 1$. Numbers in parentheses indicate column percentages.

* $p = .054$

Research Question Three

In order to examine the third research question, records of students who completed gateway MAT 140/143, MAT 151/152, MAT 171, or English 111 within their first year of enrollment were analyzed. Student records that were first eliminated included those that were placed into courses through placement test scores, developmental courses, waivers, transfers, or unknown. The remaining records included 335 math and 725 English 111. Table 25 shows math and English record counts. For this analysis, categorical variables had to be recoded as a binary “0” or “1.” Since the dependent variable was categorical, it was

recoded as “1” for success (A, B, C) and “0” for non-success (D, F, W). Independent variables included categorical information on the following demographic characteristics: gender, race/ethnicity, first generation status, student financial aid status, family income range and region, along with the numerical age upon first enrollment data. The American Indian/Alaskan Native and Asian or Pacific Islander levels in race/ethnicity were merged with the Multi-race/Other/Unknown, due to low numbers for each. Additionally, since race/ethnicity, family income range, and region had more than two levels, they were numerically coded. For race/ethnicity, White, Non-Hispanic was coded as “1,” Multirace/Other/Unknown was coded as “2,” Hispanic was coded as “3,” and African American was coded as “4.” For family income range, under \$25,000 was coded as “1,” \$25,000 - \$34,999 was coded as “2,” \$35,000 - \$49,999 was coded as “3,” \$50,000 - \$74,999 was coded as “4,” \$75,000 - \$99,999 was coded as “5,” and \$100,000 or more was coded as “6.” Regionally, central was coded as “1,” eastern was coded as “2,” and western was coded as “3.” Lastly, age was coded as “0” for under 18 years of age and “1” for 18 years or older.

Table 25

Multiple Measures Student Enrollment in Gateway Math and English Courses

	“Success” (A, B, C)	“Non-Success” (D, F, W)	Total
Math Student Count	245	90	335
English Student Count	646	79	725

A binary logistic regression was used to analyze how the likelihood of demographic characteristics of gender, age, ethnicity, first generation status, financial aid status, full-time

load, family income range, and region might impact the success of Multiple Measures students in gateway math courses. Odds ratios were then calculated to analyze the effect size by quantifying the relationship between the variables (Field, 2013). For this analysis, success was defined by the letter grades “A,” “B,” or “C.” Binary logistic regression is used when the dependent variable is categorical and has two outcomes (Field, 2013). Initially, all demographic factors were used for the analysis, but some factors were excluded by comparing the significance among the regression models. Before analyzing a binary logistic regression, determining which model is the best fit should be determined (Field, 2013). After running block models for comparison, the following variables were excluded: gender, age, ethnicity, first generation status, full-time load, income range, and region. After re-running the binary regression for financial aid status only, the Omnibus test of Model Coefficients showed a model Chi-Square significance of $\chi^2 (1) = 5.13, p = 0.23$, indicating that the model was a good fit for the data. Results show that students who do not receive federal financial aid were 1.75 times more likely to be in the predicted success group than students who did receive financial aid $b = .561, Wald \chi^2 (1) = 5.02, p = .024$, with a 95% CI of 1.07 to 2.85. Results of the binary regression are presented in Table 26.

Table 26

*Binary Logistics Regression Analysis for Variables Predicting Success in Gateway Math**Courses*

Source	<i>B</i>	<i>SEB</i>	Wald χ^2	<i>p</i>	<i>OR</i>	<i>95% CI OR</i>
No Financial Aid	.56	.24	5.09	.024	1.75	[1.07, 2.85]

Note. Control is Student Received Financial Aid. OR = Odds Ratio. CI = Confidence Interval.

A binary logistic regression and odds ratios were also used to analyze the likelihood that the demographic characteristics of gender, age, ethnicity, first generation status, financial aid status, full-time load, family income range, and region will impact success of Multiple Measures students in gateway English courses. For this analysis, success was defined by the letter grades of “A,” “B,” or “C.” After running block models for comparison, gender, full-time load, financial aid status, and income range were excluded. After rerunning the binary regression for ethnicity, age, and region, the Omnibus test of Model Coefficients showed a model Chi-Square significance of $\chi^2 (6) = 25.50, p < .001$, indicating that the model was a good fit for the data.

Of the demographic characteristics, ethnicity was significant. Results show that white students were 2.58 times more likely to be in the predicted success group than students who were African American at $b = .951, \text{Wald } \chi^2 (1) = 11.64, p = .001$, with a 95% CI of 1.49 to 4.46. Also, moderately significant results include student records that were identified as Multi-race/Other/Unknown, which had 2.57 higher success than African American students

at $b = .945$, Wald $\chi^2 (1) = 3.68$, $p = .055$, with a 95% CI of .981 to 6.76. There was no significance between the region and success. Results of the binary logistic regression are presented in Table 27.

Table 27

Binary Logistics Regression Analysis for Variables Predicting Success in Gateway English

Courses

Source	<i>B</i>	<i>SEB</i>	Wald χ^2	<i>p</i>	<i>OR</i>	<i>95% CI OR</i>
Ethnicity						
White	.95	.27	11.64	1	2.58	[1.49, 4.46]
Multi/Other	.94	.49	3.68	1	2.57	[.98, 6.74]
Hispanic	.62	.43	2.08	1	1.86	[.80, 4.33]
Age	-1.06	.44	5.85	1	.016	[.14, .81]
Region						
Central	-.519	.38	1.78	1	.182	[.27, 1.27]
Eastern	.139	.40	.11	1	.731	[.52, 2.57]

Note. Controls are African American, Under 18 years of age, and Western region (omitted from table). OR = Odds Ratio. CI = Confidence Interval.

Summary

Results of the data analysis are presented for this ex-post facto study whose purpose was to determine if there was an impact on student success, persistence, and demographic factors. The data analyzed students who were enrolled in traditional developmental pathways, students who have been enrolled in newly designed developmental pathways, and students who have been placed out of developmental courses through Multiple Measures placement policies. The sample population for this study included two cohorts of first-time

North Carolina community college students. This study included 3,689 student records that were collected from five community colleges across North Carolina (two western, two central, one eastern).

One-way ANOVAs were used to address the success of students in gateway math and English courses. Quality Points were assigned as a numeric indicator of final grades, which means withdrawals were excluded from the analysis. For gateway math courses, the analysis revealed that there was no significant effect on final grades based on placement methods or cohorts. For English 111, there was a significant association between the final grades and placement methods, but not for cohorts.

Chi-Squares were then used to analyze data to address student persistence. Overall, persistence between students in Cohort 1 and Cohort 2 showed no significant difference, based on gateway courses and all placement methods. Chi-squares were also run to address persistence based on math placement credit type and fall-to-fall enrollment, and gateway English placement credit type and fall-to-fall enrollment. Results indicated that the math placement type does not have an impact on fall-to-fall enrollment. Similarly, the gateway English placement type does not have an impact on fall-to-fall enrollment.

Lastly, binary logistics regression models and odds ratios were used to analyze demographic characteristics and how they impact students enrolled in gateway math and English 111 and courses that have been placed through Multiple Measures policies. Initially, eight characteristics were analyzed including region, age, gender, financial aid status, family income range, race/ethnicity, first generation status, and full or part time course loads. For gateway math courses, the only demographic characteristic that impacted success was financial aid. Students who did not received federal financial aid were 1.75 times more

likely to be in the predicted success group than students who did receive financial aid. For English 111, the analysis shows that white students were 2.58 times more likely to be in the predicted success group than students who were African American.

Chapter Five

Conclusion

This chapter will provide a brief discussion about the underlying framework from Vincent Tinto and how it relates to the current redesign efforts in developmental education in North Carolina. Also, an analysis of the results from this study will be provided to discuss how it relates to current literature and framework, as well as addressing any gaps that may currently exist. Limitations of the research will be addressed along with implications for practitioners. Finally, recommendations for future research will be included.

Summary of Student Departure Theory and Developmental Education Initiatives

The Theory of Student Departure by Vincent Tinto lays a framework for completing college that provides clear recommendations for ways in which institutions can increase student success and completion. These recommendations include four main conditions: expectations, support, assessment and feedback, and involvement (Tinto, 2012). Nationwide and in North Carolina, there have been recent efforts to increase student completion at the community college level. Many of the new initiatives that have been implemented to address completion issues have targeted developmental education programs because a large number of first-year students are required to enroll in at least one of these courses. Traditional developmental education programs are actually aligned with many of the recommendations provided by Tinto's framework, such as support and assessment and feedback since these students are deemed "at risk."

Although developmental courses are designed to help students become "college ready," current research indicates that they are not effective in increasing success or persistence (Bailey, Jaggars, & Jenkins, 2015; Belfield & Crosta, 2012; Clotfelter, Ladd, Muschkin, & Vigdor, 2015; Parsad & Lewis, 2003). To address these issues, new initiatives

in North Carolina have accelerated and combined developmental coursework or eliminated placement requirements for students who would have previously enrolled in these classes (State Board of Community Colleges, 2013). These changes inadvertently minimized the recommended conditions provided by Tinto. Tinto's framework provides the guiding principles for this study, which sought to examine the impact of the developmental education reforms in North Carolina on success in math and English courses, as well as on persistence of students overall.

Analysis of Results

By examining academic success in gateway courses, an assessment can be made about the effectiveness of the new initiatives from the North Carolina Community College System relating to the redesign of developmental courses and Multiple Measures Placement Policies. These initiatives either shorten developmental courses or eliminate this need for many students who would have previously enrolled in developmental courses. Results will be discussed in relation to the guiding questions.

Success in Gateway Courses Based on Placement Methods and Cohorts

To address the success within gateway courses for the current research study, Quality Points based on final grades were analyzed. Quality Points were used as a grade calculation to convert letter grades. Success based on Quality Points includes a "4.0," "3.0," and "2.0." Additionally, the letter grades of "A," "B," or "C" were defined as "success" for separate analysis.

Math. The results of the one-way ANOVA indicated that success in gateway math courses has not been significantly impacted by placement method types. This indicates that neither the developmental redesign nor Multiple Measures Placement Policy made students

more successful. Overall, the mean Quality Points for students that were placed into gateway math through developmental courses was 2.64 as opposed to 2.62 for those who entered through placement policies. Also, it's important to keep in mind that prior to the initiatives, the course mean of Quality Points for students who were placed into gateway math after taking at least one developmental math course was 3.0. After the initiatives, the course mean for students placed into gateway math after taking at least one developmental course was 2.64, and 2.62 for students placed through Multiple Measures. While placement methods do not seem to be an adequate indicator of success in gateway courses, reviewing the average mean before and after the initiatives does indicate that in relation to placement methods, neither the redesigned developmental students nor Multiple Measures students were as successful as traditional developmental students, but not to a significant level.

Similarly, when looking at the overall student success as defined by Quality Points, cohort did not have a significant impact. Cohort 1 occurred prior to the developmental redesign and Multiple Measures placements, and Cohort 2 occurred after. This result indicates that the combination of the new placement methods and the new redesign are not making students more successful than the traditional pathways. While Cohort 1 had mean Quality Points of 3.0 as compared to Cohort 2 ($M = 2.6$), these differences were not statistically significant. Lastly, when looking at success by percentages, 80.8% of traditional developmental students were successful, with a letter grade of "A," "B," or "C," whereas after the initiatives, only 67% of redesigned developmental students and Multiple Measures students were considered successful by receiving an "A," "B," or "C." Clearly, more research should be done to determine what may be causing developmental students to do worse in gateway courses in recent years.

English. Unlike math, success as defined by Quality Points was significantly impacted for developmental students and Multiple Measures students in English 111. Overall, students who placed into English 111 through Multiple Measures had a higher mean Quality Points at 2.91, as compared to developmental courses at 2.60 at the $p < .05$ level [$F(1,1237) = 21.37, p = .000$]. However, prior to the initiatives, the overall course mean of Quality Points for students who were placed into gateway English 111 after taking at least one developmental English course was 2.71. After the initiatives, the overall course mean for students placed into English 111 after taking at least one developmental course was 2.43, and for students placed through Multiple Measures the overall course mean of Quality Points was 2.91. So, while Multiple Measures students seem to be doing better than traditional developmental students, the redesigned developmental students are doing worse. A breakdown by percentages shows that 77% of traditional developmental students received an “A,” “B,” or “C,” whereas after the initiatives, redesigned developmental students and Multiple Measures students were successful with 79.3% receiving an “A,” “B,” or “C.” When reviewing the percentages for developmental students only, there is a decrease in success. While 77% of traditional developmental students were successful, only 69.1% of the redesigned developmental students are successful in gateway English 111.

When examining the combined success, a comparison was made between Cohort 1 and Cohort 2. The results indicate that, overall, students in English 111 are doing better now than they were prior to the developmental redesign and placement policies, but not to a significant level. The results show that the mean Quality Points was 2.17 prior to initiatives, and mean Quality Points increased to 2.80 after the initiatives.

Persistence in Gateway Courses Based on Placement Methods

Another important factor to consider when analyzing the state's new initiatives relates to persistence and eventual completion. If students were being more successful after state-wide mandates, then it would be expected that more students would persist towards program completion. In North Carolina, published research from the community college system that pertains to persistence was conducted at six community colleges and only focused on target group intervention strategies. The results of the study on Multiple Measures indicated that a majority of colleges experienced a reduction in withdrawals of target students in gateway math courses that had some type of intervention strategy (Clery, Munn, & Howard, 2017). The second study published by the state was a qualitative study focused on developmental math that was used to inform administrators. Regarding retention, this study indicated that both departmental and administrative strategies needed to be implemented to increase attendance, registration rates, and retention rates (Pellegrino & Jaeger, 2017). Additional research has been conducted at the college level. At one community college in North Carolina, approximately 72-74% of developmental students were being retained fall-to-spring, and 45-46% were being retained fall-to-fall. After the Multiple Measures Placement Policies were enacted, that number decreased to only 70% fall-to-spring were retained, and only 40% were retained fall-to-fall (Manning & Frye, 2017). Prior research on similar initiatives across the U.S. has indicated that along with success, most students who have been in redesigned accelerated pathways or have been placed through alternate placement methods have shown that persistence (Twigg, 2011; Twigg, 2013). However, some studies also show that results are mixed in relation to persistence (Trenholm, 2006).

To address persistence, this study first examined fall-to-fall enrollment for both cohorts of students to determine if any more students were persisting after the initiatives as opposed to before. These students were placed into courses through all available methods, so it would not be clear if developmental programs had been impacted. To address this issue, an analysis was also conducted to determine if either developmental students or Multiple Measures students were more likely to persist, based on how they were placed into gateway math or English 111 courses.

The results indicated that there was no significant difference in persistence from fall-to-fall enrollment based on cohort year, which means that out of the sample colleges, retention has not increased regardless of the redesign or placement method. Overall, in the first cohort, 62.4% of students were retained fall-to-fall, as compared to 63.7% for the second cohort. Additionally, there was no significant difference in persistence based on how students were placed into a gateway math or English. For students placed into gateway math through developmental courses, 70.0% persisted fall-to-fall whereas only 66.6% placed through Multiple Measures persisted. Similarly, 70.6% of students who were placed into gateway English 111 through developmental courses persisted, but only 65.7% of Multiple Measures students did.

Demographic Factors that Impact Multiple Measures Student Success

Lastly, demographic characteristics were examined for their impact on student success for those students who have been placed into gateway courses through Multiple Measures, since these students are not as likely to receive any additional support mechanisms prior to enrolling in these classes. Due to limited published research on demographic factors that impact this particular subset of students in similar initiatives, an assessment can only be

made based on “at-risk” students in general. Numerous research studies have documented that students who are less likely to be successful include first generation students, minority students, and students who are from lower socioeconomic backgrounds (Nagda & Zuniga, 2003; National Center for Education Statistics, 2003; Tinto, 2012). The current study examines the likelihood of Multiple Measures students being successful in gateway math courses or English 111 based on the following demographic factors: Gender, Race/Ethnicity, Age, First Generation Status, Financial Aid Status, Total Family Income Range, and Region of North Carolina.

The results indicated that for gateway math courses, the only significant demographic factor was whether a student received financial aid or not. Students who did not receive financial aid were about 1.75 times more likely to be successful than students who did receive financial aid. For English 111, the only significant demographic factors that impacted success were race/ethnicity. White students were 2.58 times more likely to be successful than African American students, and multi-racial students were also 2.57 times more likely to be successful than African American students.

The Effectiveness of Developmental Education

Taken altogether, the results of this study indicate that developmental math students are not more successful in gateway math courses than they were prior to the implementation of each initiative. Similarly, developmental English students are not as successful in gateway English courses as they were before. Students placed into gateway English courses through Multiple Measures do seem to be more successful than students who entered these courses through developmental programs. Still yet, in relation to developmental students, it is clear

that the state initiatives have not had the intended benefits of increasing student success, so it is important to consider additional methods for increasing success.

Second, there is no impact on persistence based on any new initiatives. One of the main arguments for accelerating and modularizing course work along with requiring alternate placement methods was to increase persistence. If developmental education was truly a barrier for completion and graduation, then the efforts to reduce the amount of time students were required to be enrolled in these programs should have resulted in higher persistence for students after the initiatives were implemented. Contrary to this prediction, persistence did not increase for the developmental students or Multiple Measures students. Furthermore, persistence did not increase for the overall student population regardless of how they entered a gateway math or English course. Clearly, the initiatives have not had the intended impact on persistence, completion, or graduation.

Lastly, demographic characteristics were considered in relation to students who were placed into gateway math and English courses through Multiple Measures policies. While the results did not indicate there was a significant impact on success based on many of the characteristics, financial aid and race/ethnicity did predict more success for certain sets of students. It is important to consider if the initiatives could be better designed and implemented to ensure equity among successes.

Limitations

As with any study, limitations should be considered. First, colleges volunteered to participate in this study, and the considerable variation between community colleges should be acknowledged. Although there is a common course library provided by the state for curriculum-level courses, only the course designations, information, and learning outcomes

are required. This allows for individual colleges to have some flexibility in the way these courses are offered, the methods for how these courses are offered, and how the data is collected. For example, at one community college in the western part of the state, the emporium model for developmental math was developed using a hybrid model of class time and lab time that met five days a week. In another community college, both hybrid and fully seated courses were implemented that only met three days a week. Also, some community colleges utilized full-time developmental staff within a developmental program, while other colleges had developmental instructors within each math and English department. So, while recommendations for the developmental redesign and Multiple Measures Placement Policies were provided in more detail than for standard curriculum courses, it would still be unlikely that each college implemented each initiative in the exact same way and at the same time.

Also, the time between when the first redesign was implemented and the last initiative was implemented is considerable. In some colleges, the first cohort was taken from fall of 2011, and the last cohort was collected from fall of 2017. Also, based on the breakdown of demographic characteristics per cohort, the difference between the populations in each cohort was similar. However, the population of students might have changed in other ways during this timeframe, so the results should be reviewed with caution. Furthermore, generalizability to other states with similar programs should not be assumed.

Revisiting the Conceptual Framework

Tinto suggests that colleges can increase success and persistence by ensuring that certain criteria are met. When applying Tinto's model of student success to developmental education programs in NC, the traditional methods were more closely aligned with at least two criteria, *support* and *assessments and feedback*. In relation to *support*, traditional

developmental programs included additional wrap-around services that incorporated academic, financial, and social support. After the initiatives, many of the community colleges did not continue to offer developmental education as its own program due to budgeting constraints. As a result, these services are now divided among different departments and in different areas on campus. While the preexisting services are available, having them scattered across campus makes it a lot less likely that developmental students would utilize these services.

Assessment and feedback is the other area of Tinto's model that has not been provided to students in the same manner as before the redesign. Traditionally, *assessment and feedback* were an integrated part of seated coursework. Instructors had time weekly with students to discuss and evaluate progress. While the new Reading and English courses (DRE) are still typically offered as a seated option, the new math courses are often taught in a computer lab setting, and both types of classes are taught in an accelerated format. This gives instructors less time to give quality assessment and feedback to students within their classes, especially for math, since there is a heavy emphasis on computer-guided coursework.

Additionally, reviewing Tinto's framework can provide insight into how the new initiatives in the state are addressing each of the conditions and if they align with best practices. Currently, it seems that the new developmental courses do align with some aspects, but most are disregarded. For example, cognitive and affective factors have not yet been identified, nor have cooperative and collaborative learning components. Likewise, Bonham and Boylan (2012) discuss the importance of technology for supplemental instruction, not for the primary modes of learning. Developmental students inherently have a different background and context for learning, so it is important to consider

recommendations for the specific population. Ultimately, if the state-mandated initiatives have not yielded the intended impact on success and persistence, then additional research and subsequent action should take place to better align pathways that would lead to an increase in completion.

Implications for Practitioners

There are several implications for practitioners regarding the effectiveness of traditional developmental programs and the impact of the new state-wide initiatives. First, if the state's policy agenda is to ensure that more students are persisting through to program completion, then different strategies should be sought. Based on the results, fall-to-fall enrollment has not increased by a significant level, regardless of any redesigns or placement method policies that have been enacted. Finding alternate ways to reduce the likelihood that students will drop out is still necessary. Researching frameworks, such as the Theory of Student Departure, may provide a foundation for colleges to build on.

Second, in gateway math courses, success has decreased for the redesigned developmental students and Multiple Measures students. If the state wants to ensure that, overall, our students are being successful, then providing additional support or new targeted intervention strategies is necessary for particular courses. While students enrolled in English 111 seem to be more successful than prior to the initiatives, math is still a required core course for degree completion in Associate in Applied Science programs, Associate in Arts, and Associate in Science programs.

The state has recently recommended a new developmental/placement redesign, Developmental 2.0, which may address some of these issues. This new redesign incorporates a new way to place students into curriculum level courses, by increasing the minimum high

school GPA requirement to 2.8 and requiring a co-requisite course for students who fall into an “at-risk” target range of 2.8 – 3.0. The co-requisite courses will in essence eliminate traditional developmental courses altogether, but will allow for intense supplemental instruction in conjunction with the curriculum level course to provide students with the foundational skills needed to successfully complete both. The co-requisite courses are required to carry the same amount of contact hours and credit hours as the curriculum level course that they are attached to, so students enrolled in gateway math may end up taking up to 10 credit hours of math in a semester.

Additionally, for students who fall under the minimum GPA requirements of 2.8, a “transition” center will be developed at each college in the Basic Skills department to give students at the lowest levels a semi-structured environment where they can use computer-guided instruction and mastery learning to become college ready. Since the transition center will be run through Basic Skills, students will not pay for courses or receive any credit for successfully completing the modules. Since these recommendations have not yet been approved, it may be two years before any serious implementation may occur.

Last, it appears that certain demographic characteristics do impact course success for students who have been placed into gateway math and English 111 courses through Multiple Measures. Again, if the goal is to increase the overall success and completion, then targeting intervention strategies for students who are more likely to not be successful would be important. Therefore, at an institutional level, there needs to be a complete understanding of the best practices for developmental education. With the state initiatives, the community colleges in North Carolina are somewhat limited in what flexibility they have when delivering the new course content; however, they can incorporate additional instructional

recommendations, such as embedded tutoring and active engagement with course content, as needed. With mixed results from other colleges to draw from, it is important that each of the community colleges in North Carolina looks at its specific student population to try and find ways to accommodate student learning.

Many of the community colleges do already provide additional tutoring services and financial aid, but there are more federal programs that could also be implemented in conjunction with what colleges are already offering. For example, TRIO services are offered at some community colleges. This program targets first-generation college students and provides a variety of additional services to help students be successful. Similarly, the Minority Male Mentoring program focuses on minority males and provides additional tutoring, mentoring, and support. In order to increase the overall success and likelihood that all students will persist, taking a closer look at students that are not being successful provides more insight into how to approach intervention strategies.

Recommendations for Future Research

This study highlights the need for future research on policy implementation in developmental education. First, more research should be done on gateway math courses in relation to success and persistence. If the state wants to ensure that more students are being successful and persisting at the community college level, gathering more in-depth data on students in math would be beneficial. Most of the previous research has only looked at overall course success and persistence, or has only been conducted at one or two community colleges. This study examined a relatively small sample of developmental education or Multiple Measures students in transfer gateway math courses, but different community colleges offer additional math courses, especially for Associate in Applied Science programs.

Learning more about all of the curriculum level math courses and which courses lead to more success could help address any skills gaps that seem to occur.

Similarly, additional research should address gateway English courses. While overall, students seem to be doing better in English 111 than before, developmental students at the colleges that were analyzed in this study are doing worse. Furthermore, approximately 21% of our students who would have fallen into the traditional developmental pathways are still not succeeding. This study does not take into account course success or persistence for students who were placed through placement, waivers, or transfers, so research on the overall impact may provide additional insight into finding ways to further increase success and persistence. Also, English course outcomes are more subjective than math. Future research should address any changes that have been made to course curriculum at each college to ensure the same outcomes are still being met with the same expectations.

Program completion also needs to be researched further. The push for more completion has acted as a catalyst for numerous changes within the community college system. While the intentions are clearly aimed at improving student success, these changes may have been implemented with little data from which to build. Since the standard completion rates for Associate degree seeking students is based on a 6-year timeline, the final impact will not be able to be determined for five more years; however, more research at the individual college level can provide more insight into the likelihood of overall success. If the initiatives are not improving completion and graduation rates, then the sooner an accurate assessment can be made, the better. Looking at a more holistic approach to persistence might prove to be necessary. For example, in addition to program redesigns, appropriate advising and support can be integrated into all aspects of a student's time at a community college.

Also, more research should be done on demographic characteristics and the impact on success, along with what targeted intervention strategies are likely to be helpful. Again, this study only looked at a small subsection of students enrolled in community college courses. While these students are likely to be deemed “at-risk,” demographic factors for all students should be researched at the community college level in North Carolina. The state-wide system is so large that it is important to gather and analyze as much data as possible, so any changes that may be made in the future can benefit the greatest number of students.

Lastly, when reviewing Tinto’s framework, four conditions should be met by institutions to increase the chances of success for students. While this study looked at the possible effectiveness of two major initiatives, qualitative data should also be gathered to better determine how the four conditions are being met and the impact they have on success within the classroom and within the institution. Additionally, if these conditions are not being met, researching how colleges can adapt these conditions to ensure that students will be successful and persist through to graduation is imperative.

Resources

- Adams, J., Raeside, R., & Khan, H. A. (2014). *Research methods for business and social science students*. New Delhi: Sage Publications Pvt. Ltd.
- Anderson, K. L. (1987, November). *Persistence, student background, and integration/commitment: Variation by definition of persistence and institutional type*. Paper presented at the annual meeting of the ASHE, Baltimore, MD.
- Arendale, D. R. (2011). Then and now: The early years of developmental education. *Research & Teaching in Developmental Education, 27*(2), 58.
- Ariovich, L. A., & Walker, S. A. (2014). Assessing course redesign: The case of developmental math. *Research & Practice in Assessment, 9*(1), 45-57.
- Asera, R. (2011). *Innovation at scale: How Virginia community colleges are collaborating to improve developmental education and increase student success*. Boston, MA: Jobs for the Future.
- Astin, A.W. (1975). *Preventing students from dropping out*. San Francisco, CA: Jossey-Bass.
- Astin, A.W. (1999). Student involvement: A developmental theory for higher education. *Journal of College Student Development, 40*(5), 518-529.
- Attewell, P., Lavin, D., Domina, T., & Levey, T. (2006). New evidence on college remediation. *Journal of Higher Education, 77*(5), 886-924.
- Bailey, T. (2009). Challenge and opportunity: Rethinking the role and function of developmental education in community college. *New Directions for Community Colleges, 145*, 11-30.

- Bailey, T.R., Jaggars, S.S., & Jenkins, D. (2015). *Redesigning college for student success*. Boston, MA: Harvard University Press.
- Bailey, T., Jeong, D. W., & Cho, S.W. (2010). Student progression through developmental sequences in community colleges. *Community College Research Brief* (Report No. 46). Retrieved from Community Colleges Research Website:
<http://ccrc.tc.columbia.edu/media/k2/attachments/student-progression-through-developmental-sequences-brief.pdf>
- Bassett, M. J., & Frost, B. (2010). Smart math: Removing roadblocks to college success. *Community College Journal of Research and Practice*, 34(11), 869-873. doi: 10.1080/10668926.2010.509232
- Beach, J. M. (2011). *Gateway to opportunity? [electronic resource]: A history of the community college in the United States*. Sterling, V.A.: Stylus Pub.
- Belfield, C. R., & Crosta, P. M. (2012). *Predicting success in college: The importance of placement tests and high school transcripts* (CCRC Working Paper No. 42). New York, NY: Columbia University.
- Berger, J.B. & Braxton, J.M. (1998). Revising Tinto's interactionalist theory of student departure through theory elaboration: Examining the role of organizational attributes in the persistence process. *Research in Higher Education*, (2), 103.
- Bettinger, E., & Long, B.T. (2004). *Shape up or ship out: The effects of remediation on students at four-year colleges* (Working Paper No. 10369). Cambridge, MA: National Bureau of Economic Research.
- Bonham, B. S., & Boylan, H. R. (2012). Developmental mathematics: Challenges, promising practices, and recent initiatives. *Journal of Developmental Education*, 36(2), 14-21.

- Bostian, B. (2012). Why traditional placement testing is being replaced by multiple measures. *Leadership Abstracts*, 25(12), 6-9.
- Bowling, R. E., Morrissey, S., & Fouts, G. M. (2014). State-level reforms that support college-level program changes in North Carolina. *New Directions for Community Colleges*, 2014(167), 73-86. doi:10.1002/cc.20112
- Boylan, H. R. (1987). The historical roots of developmental education. *Research in Developmental Education*, 4(5), 3-6.
- Braxton, J.M., Hirschy, A.S., & McClendon, S.A. (2004). Understanding and reducing college student departure, *ASHE-ERIC Higher Education Report*, 30(3), 1-4.
- Bremer, C. D., Center, B. A., Opsal, C. L., Medhanie, A., Jang, Y. J., & Geise, A. C. (2013). Outcome trajectories of developmental students in community colleges. *Community College Review*, 41(2), 154-175. doi:10.1177/0091552113484963
- Buttram, S. (2016). Beginning a learning community: Pilot fall 2006. *Journal of Developmental Education*, 40(1), 29-31.
- Chapman, D.W., & Pascarella, E.T. (1983). Predictors of academic and social integration of college students. *Research in High Education*, 19 (3), 295-322.
doi:10.1007/BF00976509
- Chickering, A.W. (1969). *Education and identity*. San Francisco, CA: Jossey-Bass.
- Clery, S., Munn, B., & Howard, M. (2017). *North Carolina multiple measures: Implementation and outcomes final report*. Bethesda, MD: Coffee Consulting, LLC.
- Clotfelter, C. T., Ladd, H. F., Muschkin, C., & Vigdor, J. L. (2015). Developmental education in North Carolina community colleges. *Education Evaluation and Policy Analysis*, 37(3), 354-375.

- Collins, M. L. (2010). Bridging the evidence gap in developmental education. *Journal of Developmental Education*, 34(1), 2-25.
- Dees, L., Moore, E., & Hoggan, C. (2016). Reflective practice and North Carolina's developmental reading and English redesign efforts. *NADE Digest*, 9(1), 8-12.
- DEI Update. (2011). *Rethinking developmental math in North Carolina* (Issue Brief). Raleigh, NC: North Carolina Community College System.
- Di Tommaso, K. K. (2010). The connection between role model relationships and self-direction in developmental students. *Research & Teaching in Developmental Education*, 27(1), 4-19.
- Field, A. (2013). *Discovering statistics using IBM SPSS Statistics (4th ed.)*. Thousand Oaks, CA: Sage Publications.
- Florida College System. (2010). *College and career readiness initiative: College placement testing results for high school students* (Report Edition 2010-04). Tallahassee, FL: Florida Department of Education.
- Gardner, J.H., & Barefoot, B.O. (2011). *Step by step to college and career success*. Bostin, NY: Bedford/St Martin's.
- Gardner, J.H., & Barefoot, B.O. (2013). *Your college experience: Strategies for success*. Bostin, NY: Bedford/St Martin's.
- Gillett-Karam, R. (2016). Moving from student development to student success. *New Directions for Community Colleges*, 2016(174), 9-21. doi:10.1002/cc.20199
- Giuffre, M., (2010). Designing research: Ex post facto designs, *Journal of PeriAnesthesia Nursing*, 12(3), 191-195.

- Gushta, M. & Rupp, A. (2010). Reliability. In N. J. Salkind (Ed.), *Encyclopedia of research design* (pp. 1238-1242). Thousand Oaks, CA: SAGE Publications Ltd. doi: 10.4135/9781412961288.n377
- Hagedorn, L. S., & Kuznetsova, I. (2016). Developmental, remedial, and basic skills: Diverse programs and approaches at community colleges. *New Directions for Institutional Research*, 2015(168), 49-64. doi:10.1002/ir.20160
- Horn, A. S., Asmussen, J. G. (2014). *The traditional approach to developmental education: Background and effectiveness*. Research Brief. Midwestern Higher Education Compact.
- Hughes, K. L. & Scott-Clayton, J. (2011). *Assessing developmental assessment in community college* (CCRC Working Paper 19). Community College Research Center. Retrieved from the Community College Research Center website:
<http://ccrc.tc.columbia.edu/media/k2/attachments/assessing-developmental-assessment.pdf>
- Hung, C. J., & Higbee, J. L. (2005). Addressing the "theory crisis" in developmental education: Ideas from practitioners in the field. *Research & Teaching in Developmental Education*, 22(1), 5-26.
- Jaggars, S. S., Hodara, M., Cho, S., & Xu, D. (2015). Three accelerated developmental education programs: Features, student outcomes, and implications. *Community College Review*, 43(1), 3-26. Retrieved from <http://nclive.org/cgi-bin/nclsm?url=http://search.proquest.com/docview/1643111973?accountid=9834>

- Jenkins, D., Zeidenberg, M., & Calcagno, J. C. (2007). Developmental placement policies and student success in the Connecticut community colleges. *Community College Research Center*, 36.
- Jones, S. (2015). The game changers: Strategies to boost college completion and close attainment gaps. *Change: The Magazine of Higher Learning*, 47(2), 24-29.
- Jones, S. R., & Dafina-Lazarus, S. (2016). Evolution of student development theory. *New Directions for Student Services*. DOI: 10.1002/ss.20172
- Kalamkarian, H. S., Raufman, J., & Edgecombe, N. (2015). *Statewide developmental education reform: Early implementation in Virginia and North Carolina*. Community College Research Center. Retrieved from website:
<https://ccrc.tc.columbia.edu/media/k2/attachments/statewide-developmental-education-reform-early-implementation.pdf>
- Kohlberg, L. (1969). State and sequence: The cognitive developmental approach to socialization. *Handbook of socialization theory*. Chicago, IL: Rand McNally.
- Kurlaender, M., & Larsen, M. G. (2013). K-12 and postsecondary alignment: Racial/ethnic differences in freshman course-taking and performance at California's community colleges. *Education Policy Analysis Archives*, 21(16), 1-29.
- Lavin, D., Alba, R., & Silberstein, R. (1981). *Right versus privilege: The open admissions experiment at the City of University of New York*. New York, NY: Free Press.
- Liston, C. (2012). *Reconsidering how to place students enrolling in North Carolina's community colleges* (NCCCS Academic & Student Services Policy Brief). Retrieved from the North Carolina Community College website:

http://www.nccommunitycolleges.edu/sites/default/files/state-board/program/prog_2_expanded_version.pdf

Liu, R. (2002, June). *A methodological critique of Tinto's student retention theory*. Paper present at 42nd Annual Forum for the Association for Institutional Research. Toronto, Ontario, Canada.

Loevinger, J. (1976). *Ego development*. San Francisco, CA: Jossey-Bass.

Long, D. (2012). Theories and models of student development. In L.J. Hinchliffe & M. A. Wong (eds.), *Environments for Student Growth and Development: Librarians and student affairs in collaboration*, (pp. 41-55), Chicago: Association of College & Research Libraries.

Losak, J., & Miles, C. (1992). *Foundations and contexts of developmental education in higher education*. Retrieved from: <https://files.eric.ed.gov/fulltext/ED369438.pdf>

Lundell, D. B., & Collins, T. C. (1999). Toward a theory of developmental education: The centrality of "discourse." *The expanding role of developmental education*. Marrow, GA: National Association for Developmental Education.

Manning, T. M., & Frye, B. (2017). *The success of developmental education reform at Central Piedmont Community College*. Charlotte, NC: Central Piedmont Community College.

Marwick, J. (2002). Alternative methods of mathematics placement. *The Community College Enterprise*, 8(2), 41-50.

- McCubbin, I. (2003). *An examination of criticisms made of Tinto's 1975 student integration model of attrition*. Retrieved from:
<http://www.psy.gla.ac.uk/%7Esteve/localed/icubb.pdf>
- McCutchen, G., & Riney, E. (2016). *Success by design, (4th ed.)*. Plymouth, MI: Macmillan Learning Curriculum Solutions.
- Moore, C., & Shulock, N., (2010). *Divided we fail: Improving completion and closing racial gaps in California's community colleges*. Sacramento, CA: Institution for Higher Education Leadership and Policy.
- Muijs, D. D. (2004). *Doing quantitative research in education: with SPSS*. London, GB: SAGE Publications Ltd.
- Nagda, B., & Zuniga, X. (2003). Fostering meaningful racial engagement through intergroup dialogues. *Group Processes and Intergroup Relations*, 6(1), 111-128.
- National Center for Education Statistics. (2003). *Descriptive summary of 1995-96 beginning postsecondary students: Six years later*. NCES Statistical Analysis Report, 2003-151. Washington, DC: U.S. Department of Education, Office of Education Research and Improvement.
- National Center for Education Statistics. (2004). *Remedial education at degree-granting post-secondary institutions in fall 2000*. NCES Statistical Analysis Report 2004-2010. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.

- National Center for Education Statistics. (2015). *Institutional retention and graduation rates for undergraduate students*. Retrieved from U.S. Dept. of Education, Institute of Education Sciences, National Center for Education Statistics website:
http://nces.ed.gov/programs/coe/indicator_cva.asp
- Natoli, R., Jackling, B., & Siddique, S. (2015). Insights into departure intention: A qualitative case study. *Education Research & Perspectives*, 42(1), 459.
- North Carolina Community College System. (2012). *Developmental education: Mathematic competencies*. Retrieved from:
<http://www.nccommunitycolleges.edu/Programs/devmath.htm>
- Parsad, B., & Lewis, L. (2003). *Remedial education at degree-granting postsecondary institutions in fall 2000* (NCES 2004-010). Washington, DC: U.S. Department of Education, Institute of Education Sciences.
- Pascarella, E. (1985). College environment influences on learning and cognitive development: A critical review and synthesis. In J. Smart (ed), *Higher Education: Handbook of theory and research*, (pp. 1-61), New York: Springer Dordrecht Heidelberg.
- Patten, M. (2017). *Understanding research methods: An overview of the essentials* (9th ed.). New York, NY: Routledge.
- Pellegrino, L., & Jaeger, A. J. (2017). *Developmental math modules (DMA) discussions report*. Raleigh, NC: North Carolina State University.
- Perry, W.G., Jr. (1970). *Forms of intellectual and ethical development in the college years*. New York, NY: Holt, Rinehart, and Winston.

- Policy Analysis for California Education. (2012). *California's early assessment program: Its effectiveness and the obstacles to successful program implementation*. Stanford, CA: Stanford University.
- Reason, R., Terenzini, P., & Domingo, R. (2006). First things first: Developing competence in the first year of college. *Research in Higher Education*, 47(2), 271-299.
- Rhee, B. (2008). Institutional climate and student departure: A multinomial multilevel modeling approach. *Review of Higher Education*, 31(2), 161.
- Rosenbaum, J. (2001). *Beyond college for all*. New York: Russell Sage.
- Saxon, P. D., Martirosyan, N. M., & Vick, N. (2015). The effectiveness of tutoring on developmental English grades. *Community College Enterprise*, 21(1), 11-26.
- Schenker, J., & Rumrill P. D, Jr. (2004). Causal-comparative research designs. *Journal of Vocational Rehabilitation*, 21(3), 117-121.
- Seidman, A. (2012). *College student retention: Formula for student success (2nd ed.)*. Lanham: Rowman & Littlefield Publishers.
- Silva, C. (2010). Ex post facto study. In N. J. Salkind (Ed.), *Encyclopedia of research design* (pp. 466-466). Thousand Oaks, CA: SAGE Publications Ltd. doi: 10.4135/9781412961288.n145
- Silverman, L. H., & Seidman, A. (2011). Academic progress in developmental math courses: A comparative study of student retention. *J. College Student Retention*, 13(3), 267-287. doi: 10.2190/CS.13.3.a
- Simpson, C., & Baker, K. (1980). Conventional failures and unconventional dropouts: Comparing different types of university withdrawals. *Sociology of Education*, 53(4), 203-214.

- State Board of Community Colleges. (2013). *Proposed policy: Multiple measures for placement (Draft)*. Retrieved from the North Carolina Community College website: http://www.ncccommunitycolleges.edu/sites/default/files/state-board/program/prog_2_expanded_version.pdf
- Success NC (2011). *Highlights of research on developmental math student success in subsequent math courses* (Creating Success Research Brief). Retrieved from SuccessNC website: <http://www.successnc.org/sites/default/files/creatinguccess.pdf>
- Success NC (2013). *DRE courses, final version*. Retrieved from SuccessNC website: http://www.successnc.org/sites/default/files/initiative-docs/DRE%20Document%20Final%20Version%204.25.13.pdf_0.pdf
- Super, D. E. (1990). *Career choice and development: Applying contemporary theories to practice, 2nd Ed.* San Francisco, CA: Jossey-Bass.
- Tennessee SAILS Program. (2014). *Case study*. New York, NY: Pearson.
- Terenzini, P. T. (1987, November). *A review of selected theoretical models of student development and collegiate impact*. Paper presented at ASHE Annual Meeting. Baltimore, Maryland.
- Tinto, V. (1975). Dropouts from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, 45, 89-125.
- Tinto, V. (1982). Limits of theory and practice in student attrition. *Journal of Higher Education*, 53, 687-700.
- Tinto, V. (1987). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago, IL: The University of Chicago Press.

- Tinto, V. (2008). "Access without Support is not an Opportunity." Keynote speech given at the annual Institute for Chief Academic Officers, Council of Independent Colleges, Seattle, Washington.
- Tinto, V. (2012). *Completing college: Rethinking institutional action*. Chicago, IL: The University of Chicago Press, Ltd.
- Trenholm, S. (2006). A study on the efficacy of computer-mediated developmental math instruction for traditional community college students. *Research & Teaching in Developmental Education*, 22(2), 51-62.
- Trochim, William M. (2006). *The research methods knowledge base, 2nd Edition*. Retrieved from: <http://www.socialresearchmethods.net/kb/>
- Trombley, W. (1998). Remedial education under attack. *National CrossTalk*, 6(3), 1.
- Tuckman, B. W., & Harper, B. E. (2012). *Conducting educational research (6)*. Lanham, MD, US: Rowman & Littlefield Publishers.
- Twigg, C. A. (2011). The math emporium: Higher education's silver bullet. *Change*, 43(3), 25-34. doi:10.1080/00091383.2011.569241
- Twigg, C. A. (2013). Improving learning and reducing costs: Outcomes from changing the equation. *Change*, 45(4), 6-14. doi:10.1080/00091383.2013.806169
- Venezia, A., & Hughes, K. L. (2013). Acceleration strategies in the new developmental education landscape. *New Directions for Community Colleges*, 2013(164), 37-45. doi:10.1002/cc.20079
- Vito, G. F., Tewksbury, R. A., & Kunselman, J. C. (2014). *Introduction to criminal justice research methods: An applied approach*. Springfield, Illinois: Charles C. Thomas.

- Walker, M. W. (2015). Exploring faculty perceptions of the impact of accelerated developmental education courses on their pedagogy: A multidisciplinary study. *Research & Teaching in Developmental Education, 32*(1), 12-34.
- Wathington, H. P., Pretlow, J., & Barnett, E. (2016). A good start? The impact of Texas' developmental summer bridge program on student success. *Journal of Higher Education, 87*(2), 150-177.
- Weiss, M. J., Visher, M., & Weissman, E. (2012). The impact of learning communities for developmental education students: A synthesis of findings from randomized experiments at six community colleges. *Educational Evaluation and Policy Analysis, 37*(4), 520-541.
- Williamson, D. R. & Creamer, D. G. (1988). Student attrition in 2- and 4-year colleges: Application of a theoretical model. *Journal of College Student Development, 29*(3), 210-217.
- Ye, N. & Herron, S. S. (2010). A comparison of computer-based and traditional college algebra courses. *Journal of Applied Global Research, 3*(7), 40-49.

Vita

Erin Elizabeth Cooper was born in Morganton, North Carolina, to Joe and Elizabeth Cooper. She graduated from Freedom High School in Morganton in June 2001. In May 2005, she graduated from Appalachian State University with a Bachelor of Science degree in Psychology. The following fall, she began her master's program at the Metropolitan College at Boston University. She was awarded her Master of Criminal Justice degree in May 2007. Five years later, she returned to Appalachian State University to complete her Education Specialist degree in Higher Education with a concentration in Adult and Developmental Education. She was awarded her Ed.S. in December 2013. In August 2015, she commenced work toward her Ed.D. in Educational Leadership at Appalachian State University.

Dr. Cooper is currently the Director of Academic Support at Caldwell Community College and Technical Institute and serves as an instructor for Academic Success related courses. She has been heavily involved in Developmental Education for the past 10 years at various community colleges. In addition, she serves as the Secretary for the North Carolina Tutoring and Learning Association and is a member of Pi Gamma Mu, International Honor Society in Social Sciences. She also serves as the Executive Assistant for the Professional Firefighters and Paramedics of North Carolina. She currently resides in Hickory, North Carolina, with her dog Peyton.