THE EFFECTS OF DIFFERENT MATHEMATICS COURSE PROGRESSIONS ON

STUDENT MATHEMATICS ACHIEVEMENT THROUGHOUT THE

HIGH SCHOOL TRANSITION: A MIXED METHODS STUDY

by

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ABSTRACT

This study applies life course theory (Elder, 1998) to understand the effect of different mathematics course progressions throughout the high school transition period. The purpose of the study was two-fold: to investigate the effectiveness of two different high school's mathematics course progressions by examining mathematics achievement throughout the high school transition; and to relate students' experiences of their mathematics trajectory, formed by their mathematics course progression, to their transition to high school and throughout high school. Using mixed methods, achievement data from eighth to eleventh grade was evaluated from two Alabama high schools in the same school district. Independent samples t-tests, linear regression models, ANOVA, and ANCOVA were performed followed by interviews of three students from each school. Findings from this study indicate that there were significant differences in achievement at the two high schools at the beginning of the transition period and no significant differences in achievement at the end of the transition period. Significant predictors of achievement include prior achievement and the number of courses students took during the transition period. Furthermore, through student interviews factors that influenced student achievement were exposed. This study connects high school transition research with high school mathematics achievement research, and contributes to the lack of qualitative research of the high school transition.

DEDICATION

This dissertation is dedicated to my husband and son, whose patience and support has given me the strength to endure to the end and finish this project.

ACKNOWLEDGMENTS

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CHAPTER ONE

OVERVIEW OF THE STUDY

Introduction

Mathematics achievement is a complex entity and depends on multiple factors within and beyond the classroom environment. These include the broad directives of a national government and state-level mandates and the local school district policies that individual schools and classroom teachers must adhere. These directives and policies converge to influence students' academic, personal, and interpersonal development; all of which students must learn to navigate throughout their school experience. The goal of many education reform efforts in mathematics is to increase student achievement in order to prepare students for future endeavors (Urban & Wagoner, 2004). This achievement often depends on the amount of time spent in the math classroom as well as the type of math classes students take (Kemple, Herlihy, & Smith, 2005; Zelkowski, 2010).

Research documents a strong relationship between mathematics achievement and mathematics coursework taken in middle school and high school (College Entrance Exam Board, 2015; Schmidt et al., 2001; U.S. Department of Education, 2013), with large-scale national studies concluding that mathematics coursework matters to the academic wellbeing of students (Ma, 2000; Wilkins & Ma, 2002). Other studies show that increasing the number of mathematics courses taken in high school affects several types of achievement measures; including achievement growth throughout high school (Buddin & Croft, 2014; Clune & White, 1992;

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Gamoran & Hannigan, 2000; Schiller & Miller, 2000, 2003; Teitelbaum, 2003). This achievement growth often begins in high school with the Algebra 1 course.

Knowledge of algebraic concepts is a precursor to many advanced classes; thus, algebra serves as crucial gatekeeping function in schools (Silver, 1995). Furthermore, algebra is a uniquely challenging course drawing heavily upon the concrete procedural skills that students develop in elementary mathematics and requiring students to develop a new set of abstract reasoning skills (Filer & Chang, 2008). One aspect of the literature explores the effects of algebra placement policies on students' subsequent academic performance during high school (Allensworth, Nomi, Montgomery, & Lee, 2009; Clotfelter, Ladd, & Vigdor, 2015). Other inquiries examine the effects of more (or "double-dose") algebra on short-term achievement (Allensworth et al., 2009; Balfanz, Legters, & Jordan, 2004; Kemple & Herliby, 2004; Kemple et al., 2005; Nomi & Allensworth, 2009), as well as long-term achievement like high school graduation and college entry (Cortes, Goodman, & Nomi, 2013).

In the United States, the majority of students take their first formal algebra class in the ninth grade with just over a third of students taking algebra or a more advanced mathematics course in the eighth grade (United States Department of Education, 2013). So, for most students, the crucial algebra course coincides with the transition to the freshman year in high school. It is in this year students are exposed to more stringent academic requirements, not only in mathematics, but also in all core content that must be successfully completed for graduation; unlike middle school where failure often has no consequences (Alspaugh, 1998). This transition also involves a new environment, which offers students varied opportunities to express and extend themselves socially and academically while affording greater flexibility, more choices, and more freedom (Isakson & Jarvis, 1999; Langenkamp, 2011). As students make this

transition, the opportunities provided might not only focus on the academic structure but also take into consideration the other structures students encounter throughout the transition (Elder, 1998; Fulk, 2003). These structures can determine students' enrollment choices for the remainder of their mathematics coursework as well as shape their mathematics trajectory throughout high school.

This study focused on a specific population from two Alabama high schools in one school district and examined the effects of the different mathematics course taking progressions in each school. Students' mathematics achievement was examined throughout the high school transition period; defined in this study as from eighth through eleventh grade. Further, the mathematics trajectory that occurred as a result of this transition process was explored through structures from the theoretical framework of life course theory. These structures impact students as their trajectory is beginning to evolve when they enter high school. Thus, mathematics achievement was explored as a process throughout students' high school transition period. Mathematics achievement data over the transitional period and throughout the trajectory were collected and compared at the completion of the eighth grade, the Algebra 1 course, and the eleventh grade. Interviews were performed with students from both schools. Each of the schools utilized different mathematics course progressions.

Background of the Problem

The mathematics course taking progression students follow has been influenced by many reform efforts in mathematics education (Barlage, 1982; Herrera & Owens, 2001). These efforts have taken numerous routes to increase student achievement including new standards, new curriculum, and the incorporation of new knowledge about how students learn mathematics. Beginning with the 1957 Soviet Union launch of *Sputnik*, the quality of American schools has

been challenged. At this time, efforts to increase student achievement shifted from local governments to the federal government due to concern that students in the United States were falling behind in the areas of math and science (Barlage, 1982). At this time the federal government began placing emphasis on mathematics graduation requirements that brought about change to state mathematics graduation requirements. These requirements set up specific mathematics course taking progressions, all which affect student mathematics achievement and occur during the high school transition period (ACT, 2015e; Buddin & Croft, 2014; Ma & McIntyre, 2005; Ma & Wilkins, 2007).

Mathematics Graduation Requirements

The federal report, *A Nation at Risk*, published in 1983 by the United States Department of Education evoked criticism of American schools with a focus on economics and incited a commitment to "educational excellence" urging states to raise academic requirements for high school graduation. The report also recommended all students complete three courses in both math and science to graduate from high school (National Commission on Excellence in Education, 1983). Despite this recommendation, by 1990, only ten states had increased their minimum graduation requirements to three courses of math or science (National Center for Education Statistics, 1994). By 2000, only seventeen states required three math and three science courses to graduate and three states required four of each (Council of Chief State School Officers, 2000). Concerns regarding American's educational system continued to arise resulting in the passage of the *No Child Left Behind* (NCLB) legislation in 2001. Its purpose was to ensure that all students had access to an adequate education as defined by each individual state through mandated student standardized testing to measure school success. Ultimately, the law required all

students to reach 100% proficiency within 12 years on standardized tests (Urban & Wagoner, 2004).

As states increased the minimum number of mathematics credits required to graduate high school, they also specified particular types of mathematics courses students must complete. For most states, high school mathematics coursework begins with Algebra 1, the "gatekeeper course," which students must pass to continue taking subsequent advanced math courses (Paul, 2005). Ninth grade Algebra 1 students have the opportunity to complete Geometry in tenth grade, Algebra 2 in eleventh grade, and Pre-Calculus in twelfth grade. This is a standard progression toward high mathematics achievement that allows students to complete at least Algebra 2 for college access (Adelman et al., 2003).

However, as states and districts increased high school graduation requirements in mathematics, local educational agencies were faced with the challenge of equipping all students with math skills required in college and the workforce despite students working at widely varying skill levels. Concern arose that these additional requirements would increase course failures and dropouts (Grubb & Oakes, 2007) particularly in urban schools, where many students already begin ninth grade lacking a mastery of the skills necessary to successfully complete advanced mathematics coursework. In the United States' largest urban public school districts, 55% of ninth graders are performing below grade level in math when they enter high school (Council of the Great City Schools, 2009). According to the Global Report Card (2011), not one of the 20 largest United States school districts ranked above the 50th percentile in math when compared to other developed countries. Thus, at this time, the mathematics course progression in many states allowed for Algebra 1 and Geometry to be completed in two parts over four years,

Algebra A/B and Geometry A/B, with this satisfying four mathematics credits and the graduation requirement.

Statistics in 2011 from the National Assessment for Education Progress (NAEP) revealed only 34% of eighth-grade students performed at or above the "proficient level." A score at "proficient level" demonstrates solid academic performance and competency over challenging subject matter (Bottoms & Timberlake, 2012). In 2011, it was determined that states could begin to request flexibility from specific NCLB mandates if they were transitioning students, teachers, and schools to a system aligned with college- and career-ready standards for all students. Differentiated accountability systems had to be developed and reforms implemented to support effective classroom instruction and school leadership (The White House, Office of the Press Secretary, 2011). This release from NCLB and achievement statistics illustrated the perceived necessity of the Common Core State Standards (CCSS) launched in June 2010.

The Common Core State Standards were developed based on two categories of standards, college- and career-readiness standards and K-12 standards, with the readiness standards focused on what students need to know before they leave high school and the K-12 standards focused on expectations in each grade level and relevant goals for student learning. These two categories were incorporated into English/language arts and mathematics standards. They outline rigorous content and application of knowledge through high-order skills and reflect knowledge and skills needed in college- and career-readiness for the 21st century (National Governors Association for Best Practices, Council of Chief State School Officers, 2010a). Mathematics achievement statistics from The Nation's Report Card (2015) since the implementation of the CCSS have remained about the same. In 2013 the percentage of proficient eighth-graders was 34% and decreased to 33% in 2015.

Mathematics Graduation Requirements in Alabama

By 2016, forty-two states, the District of Columbia, four territories, and the Department of Defense Education Activity had adopted the CCSS. The mathematics standards require all students to meet learning objectives at what is generally considered Algebra 2 level in order to be equipped with "algebraic thinking" skills (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2016) necessary to be college and career-ready. Despite states' adoption of the standards and the standards' requirement of Algebra 2 level competency, only eight states include language in their graduation requirements specifically stating Algebra 2 as a requirement for graduation from high school. Twelve states cite Algebra 2 may be completed or an equivalent course with this course most often being a career/technical substitution (Achieve, 2015).

Alabama's mathematics graduation requirements have included four Carnegie units of mathematics since 2004, with Algebra 1 and Geometry as required courses and students having a choice of their remaining two mathematics courses. With this requirement, students must enter ninth grade prepared for the Algebra 1 course and no other mathematics courses before the Algebra 1 course could be given a necessary Carnegie mathematics unit required for graduation. Along with this requirement, the state allowed students to complete the Algebra 1 standard requirements over the course of two years as Algebra A the first year and Algebra B the second year earning two Carnegie credits for such a pathway. Other states have called this pathway Algebra 1 part 1 and Algebra 1 part 2. The Geometry course could also be completed in the same manner to acquire four Carnegie units of mathematics credits (Alabama State Department of Education, 2003).

The Alabama State Department of Education (2013a) adopted the Alabama College- and Career-Ready Standards for Mathematics (ACCRS-M) in November 2010 comprised from the Common Core State Standards for Mathematics (CCSS-M) and the *2009 Alabama Course of Study: Mathematics*. Select Alabama education professionals used their academic and experiential knowledge to divide the high school conceptual categories from the CCSS-M (number and quantity, algebra, functions, modeling, geometry, and statistics and probability) into traditional mathematics courses taken by Alabama high school students: Algebra 1, Geometry, Algebraic Connections, Algebra 2, Algebra 2 with Trigonometry, and four more advanced level courses. In 2013, the standards were revised based on the first year of implementation. This revision included a change in the Alabama high school graduation requirements requiring all students to successfully complete, at a minimum, Algebra 2 to graduate. Since the ACCRS-M adoption, the state has allowed school systems to request approval if they wish to substitute an equivalent course for Algebra 2 (Alabama Learning Exchange, 2014). In some instances, computer science has been accepted, while computer aided design (CAD) courses have also received approval.

Alabama High School Math Progressions

Before the new Algebra 2 graduation requirement was implemented, approximately 65% of the high school graduates in the school district being studied never took Algebra 2. These students entered ninth grade taking Algebra A, proceeded to Algebra B in tenth grade, Geometry, and then enrolled in Algebraic Connections as a senior (See Figure 1). Other schools in the state had their least prepared new freshman students satisfy their four math credits with the progression of Algebra A, Algebra B, Geometry A, and Geometry B (also shown in Figure 1). These two course progressions were the most common for the least prepared mathematics

students entering high school before the state changed the high school graduation requirements requiring all students to successfully complete Algebra 2 to graduate.
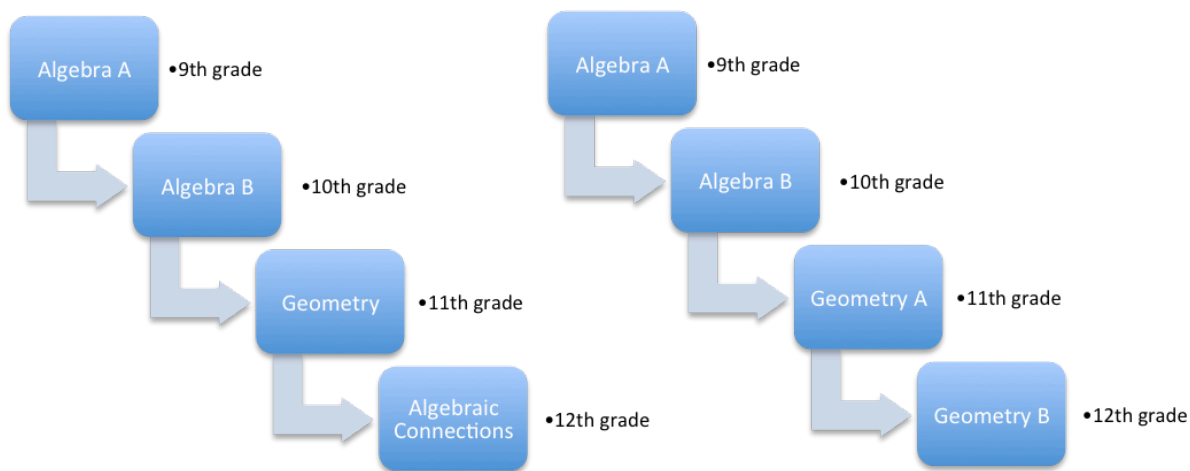
Figure 1. Sample high school math progressions prior to ACCRS-M

Because of the change in requirements, the course progression changed for these students to Algebra A, Algebra B, Geometry, and then Algebra 2 (See Figure 2). This modification is significant due to a one-year gap of concentrated algebraic concepts between Algebra B and Algebra 2 while a student is taking the Geometry course. In addition, the Algebra 2 course has an additional 34 content standards compared to the Algebraic Connections course. Not only does this increase the number of standards, but students in the district who take Algebra A and Algebra B, are at the greatest risk of not graduating on time due to a lower skill level when they enter high school.
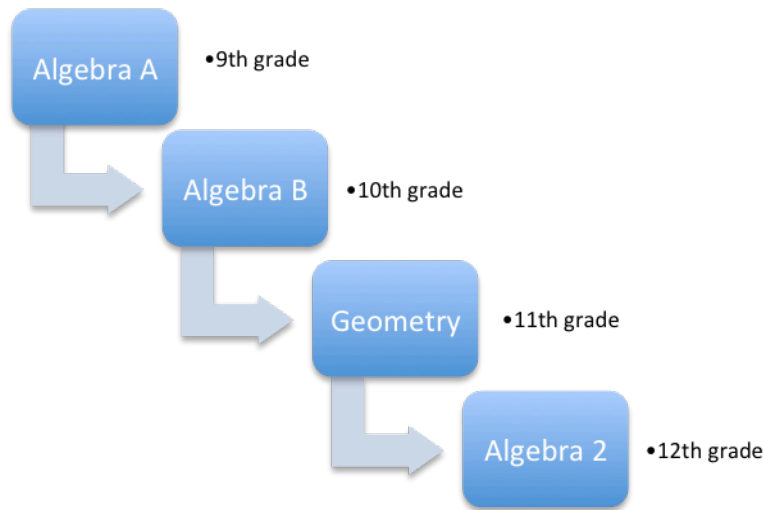
Figure 2. Sample high school math progression after ACCRS-M

High School Transition Period

Concurrent with the more stringent math graduation requirements, students enter these progressions as adolescent freshmen. They begin their mathematics trajectory of transitioning through high school with a bombardment of institutional changes and often experience much trepidation due to the plethora of events that take place in their lives during this time (Akos & Galassi, 2004; Connell, Spencer, & Aber, 1994; Felner, Ginter, & Primavera, 1982; Seidman, Aber, Allen, & French, 1996).

In addition, the transition to high school is often difficult for most adolescents with the ninth grade year becoming the "make or break" year for many students in regard to graduation (McCallumore & Sparapani, 2010). It is often accompanied with negative consequences including a decline in achievement (Alspaugh, 1998; Felner, Primavera, & Cauce, 1981; Fulk, 2003; Kayler & Sherman, 2009), which can ultimately influence their trajectory. Success in the ninth grade transition year is often a direct predictor of a student's graduating on time (Akos & Galassi, 2004; Alspaugh, 1998; Fulk, 2003; Kayler & Sherman, 2009; Leckrone & Griffith,

2006). According to Bornsheuer, Polonyi, Andrews, Fore, and Onwuegbuzie (2011), if students are unsuccessful in the ninth grade, then they are over six times less likely not to graduate on time than successful ninth grade students. Approximately 30% of the nation's high school dropouts never completed ninth grade (Neild, 2009). As students enter the high school transition period, a myriad of factors influence their mathematics trajectory. As a consequence, each trajectory affects mathematics achievement.

Study Demographics

The study took place in a suburban Alabama city with a population of about 56,000. The city has had two high schools since 1962 and has three middle schools. Each high school has one exclusive feeder middle school and one middle school in which students attend either high school based on their physical address, thus the district is a mixed school district. The population in both high schools for the 2015-2016 school year was 2,416 students. School 1 had an enrollment of 1,438 students, whereas the enrollment of School 2 was 978 students. School enrollment has stayed consistent over the last four or five years. In the school district as a whole, 55.5% of students were eligible for free or reduced lunch programs; the racial-ethnic composition was 31.5% African-American, 24.0% Latino, 40.0% White, and 1.2% Asian. School 1 had 55.5% of students eligible for free or reduced lunch programs; the racial-ethnic composition was 37.0% African-American, 21.1% Latino, 39.2% White, and 0.9% Asian. School 2 had 55.8% of students who are eligible for free or reduced lunch programs; the racial ethnic composition was 30.9% African-American, 18.6% Latino, 46.9% White, and 0% Asian. Each school offers comparable academic, elective, and extracurricular programs.

Table 1

District and School Statistics, 2015-2016

Characteristic	District	School 1	School 2
Enrollment	8428	1438	978
Free and/or Reduced Lunch	55.5	55.5	55.8
African-American	31.5	37.0	30.9
Latino	24.0	21.1	18.6
White	40.0	39.2	46.9
Asian	1.3	0.9	0
AP Enrollment	9.5	8.0	11.7
Graduation Rate	86	87	86

Note. Statistics for 2015-2016 school year.

The organizational schedule for both high schools in the district was an alternating block schedule in which students took a total of eight classes annually and four different classes every other day. Upon the implementation of the ACCRS-M, it was determined in School 1 for incoming freshmen enrolled in Algebra A to attend class every day instead of every other day as all their other courses. This enabled them to complete Algebra B during the second semester; thus completing two Carnegie units in math during the freshman year. Classes met 80 minutes per day for 180 school days for a total of 14,400 minutes of mathematics instruction time for the entire year. Students then took Geometry in the tenth grade, Algebraic Connections in the eleventh grade, and Algebra 2 in the twelfth grade (See Figure 3). These classes met every other day for 180 school days for a total of 7,200 minutes. With this progression, students were afforded the opportunity to take Algebraic Connections, which is a course that connects their prior algebra knowledge from Algebra 1 to Algebra 2 rather than going directly from Geometry into Algebra 2. It was the intention of School 1 to offer the Algebra A/B course every day to ninth graders during the initial transition year to provide a more consistent exposure to algebra, to help prevent retention, and to allow students a better chance of success later in high school.

School 2's progression would be that of Figure 2, which does not include the Algebraic

Connections course. Table 2 compares the progressions and instruction time of both schools.
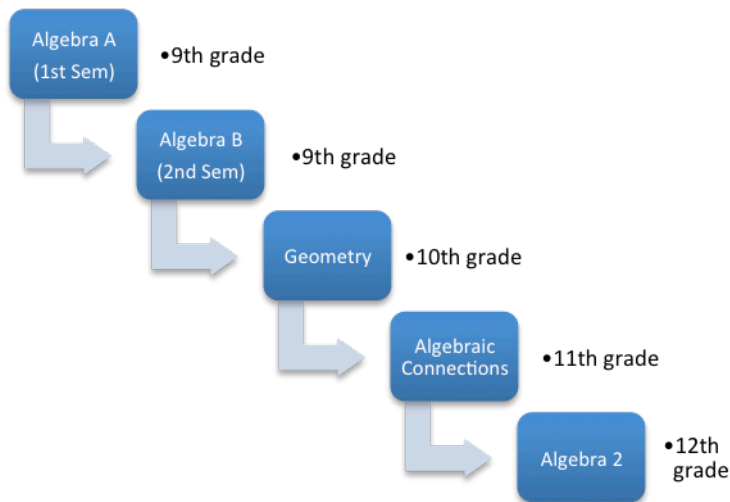
Figure 3. School 1 high school math progression after ACCRS-M

Table 2

High School Math Progression and Instruction Time Comparison by School

Grade	School 1	School 1 Instruction Time	School 2	School 2 Instruction Time
9	Algebra A & Algebra B	14,400 minutes	Algebra A	7,200 minutes
10	Geometry	7,200 minutes	Algebra B	7,200 minutes
11	Algebraic Connections	7,200 minutes	Geometry	7,200 minutes
12	Algebra 2	7,200 minutes	Algebra 2	7,200 minutes

Statement of the Problem

Although many factors are known to influence mathematics achievement some factors

can be manipulated and others cannot. Factors such as family and socioeconomic status are

fixed; however, school schedule and course progressions can be manipulated. These are the

factors that educators constantly strive to optimize. Research documents how changes in math

graduation requirements affect course taking and achievement (Buddin & Croft, 2014). The

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impetus of this study was the additional mathematics graduation requirement of Algebra 2 in the state of Alabama and how to prepare students to meet this minimum standard for graduation. The primary objective of this study was to investigate high school students' mathematics achievement through two different mathematics course taking progressions fulfilling the new graduation requirement.

As the progressions were accomplished over the high school transition period some students experienced an increase in mathematics achievement. Thus, the secondary objective was to determine the social-ecological supports that influenced an increase in individual student achievement over the high school transition period. This part of the study seeks to illustrate the multi-dimensional facets of mathematics achievement begin comprised of a wide range of influences (Conley, 2012; Mattern et al., 2014). These influences were explored through life course theory (Elder, 1998).

Student mathematics achievement for each progression was compared based on three mathematics assessments administered throughout the transition period. The relationship between mathematics course taking progressions and performance on standardized tests was examined to better understand how these progressions affected student mathematics achievement. Interviews of three students from each school followed the comparison of achievement of the two schools to help determine why these students displayed an increase in their individual mathematics achievement.

The study expands on Benner's (2011) conceptual model for the high school transition as a process rather than just a ninth grade event (See Figure 4) through the examination of the different mathematics course taking progressions and the subsequent achievement. The majority of high school transition research involves short-term longitudinal studies across the transition

from eighth grade to ninth grade (Path A), with no focus across middle school (Paths B and C), and no continuing focus across high school (Paths D and E). This study seeks to fill the gap in the literature by giving attention to mathematics achievement over a longer transition period advocated by the theoretical framework employed. Mathematics achievement is examined during the transition period from eighth to eleventh grade through the trajectory path of A to D and/or path A to E.
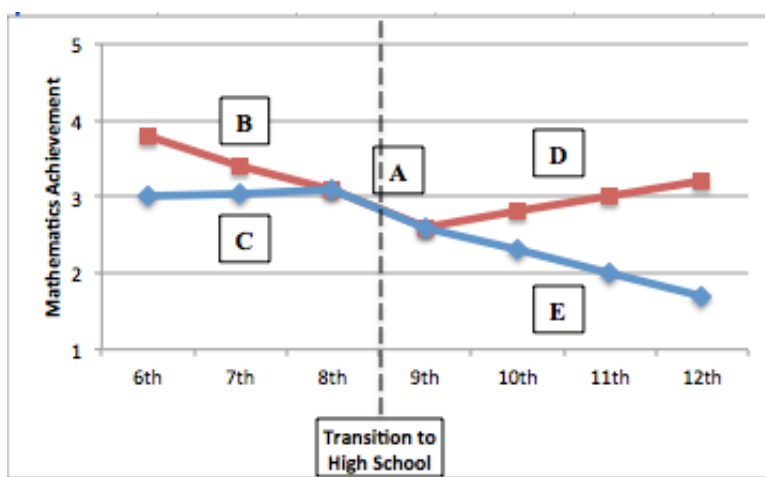
Figure 4. Conceptual model for understanding the high school transition period (Adapted from Benner, 2011).

The results of this study will provide school districts, administrators, and teachers, data about the effects of different mathematics course taking progressions on mathematics achievement. Furthermore, the results will give insight of how to provide the most effective mathematics course taking progressions and experiences to better prepare students for the high school transition period.

Theoretical Framework

The basis of the organization of this study was the examination of the second and fourth principles of Elder's (1998) life course theory: (a) the timing of transitions in a person's life; and

(b) the principle of human agency regarding the role of the individual in the construction of life course changes. Life course theory is a theory of human development that has emerged over the last 30 years. Its derivation lies in three areas of scholarship: social relations, life-span development, and age and temporality (Elder, Johnson, & Crosnoe, 2003). The premise of life course theory is best explained by how sociocultural, biological, and psychological structures interact over time to shape lives. Each individual and his or her responses to life occurrences are central to the theory. The individual plays an important role in shaping his life course and development, through choices and initiatives, which are always constrained by social forces and biological limitations (Elder, 1998). It is because of the high school transition period coinciding with such a volatile stage in adolescence (Felner et al., 1981) that life course theory was chosen for this study. At times of transition, attention must be broadened to encompass how changes in sociocultural contexts influence subsequent trajectories and educational outcomes (Elder & Giele, 2009).

According to Elder (1998), as changes occur in people's lives, their life trajectories are altered. The individual life course is composed of multiple, interdependent trajectories, such as family, social, and educational trajectories. When students enter high school, their life is changed dramatically (Benner, 2011). They are expected to be responsible in ways that differ from earlier expectations. The number of academic standards significantly increases as well teacher expectations. Students are expected to become more responsible for their own learning and teachers have less tolerance for misbehavior (Langenkamp, 2009). Also, students are given more freedom socially as they encounter the different climate of the high school (Anderson, Jacobs, Schramm, & Splittgerber, 2000). Their response to this sociocultural context is influenced by the structures they encounter and how they pass through the high school transition period also

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influences other areas of their lives (Elder & Giele, 2009) including mathematics achievement. Thus, it is pertinent to examine the context of the transition throughout students' mathematics course progression to determine what affected the students' mathematics trajectory leading to their mathematics achievement and examine how they managed the transition.

Four principles define the theoretical implications of the life course theory. The first principle of historical time and place asserts that "the life course of individuals is embedded in and shaped by the historical times and places they experience over their lifetime" (Elder, 1998, p. 3). Historical events such as times of economic prosperity versus times of recession have an effect on human development. Life patterns differ dramatically for adolescents at different historical times due to the distinctive economic and societal issues of their prospective eras.

This leads to the second principle of "timing in lives … the developmental impact of a succession of life transitions or events is contingent on when they occur in a person's life" (Elder, 1998, p. 3). Because of the timing of the high school transition, some adolescents may experience a time of stress that alters their trajectory, whereas others may take advantage of the transition to escape former challenges from their former educational experiences. In addition, the timing of a student entering high school may correlate with puberty. If these two temporary disruptions during adolescence occur at the same time, they can negatively affect academic achievement (Johnson, Crosnoe, & Elder, 2011).

The third principle states historical events and individual experiences are connected through the lives of family members. Hardships, or the lack thereof, are shared through relationships. Adolescents from two-parent homes will often display different reactions throughout the transition than those from single-parent homes (Elder, 1998). Similarly, adolescents with greater responsibilities at home, such as caring for younger siblings because of

the absence of the parent due to work or other causes, will have an altered life course from those without these circumstances (Elder, 1998).

Lastly, "the [fourth] principle of human agency states that individuals construct their own life course through the choices and actions they take within the opportunities and constraints of history and social circumstances" (Elder, 1998, p. 4). The principle of human agency emphasizes the role of the individual in the construction of life course changes. Human development in life course theory represents a process of organism-environment transactions over time in which the organism plays an active role in shaping its own development (Elder, 1998). This principle highlights adolescents' varied reactions throughout the high school transition, where some may experience stressors that deflect trajectories (e.g., decreases in achievement), others may experience relative continuity in their developmental trajectory.

In this study, life course theory provided a lens in which to study students' mathematics achievement throughout the high school transition period and the mathematics trajectory that developed from their mathematics course progression. The interviews with students revealed information about students' lives and experiences throughout their specific course taking progression that affected their mathematics achievement. It also helped to emphasize adolescents' different responses to the transition and reveal characteristics that led to their subsequent trajectory. For example, how did students view their achievement throughout their mathematics course taking progression? What did they think affected their achievement? Was it how they took their math courses or did outside factors have more of an impact than what the school did? Furthermore, life course theory offered a different perspective of the high school transition by acknowledging the diversity of experience and reactions to the transition and the

resulting trajectory based on students' dispositions, social pathways (e.g., different schools), and changing sociocultural contexts (Elder & Giele, 2009).

Through this study I hoped to broaden and give added scope and depth to Elder's life course theory by applying it to the practice and intervention of a mathematics course progression throughout the high school transition period. Life course theory provided a purpose for the examination of the mathematics course progression models and helped to determine the effectiveness of the models through the dialogue with students. Thus, in accordance with Bettis and Mills (2006), this theoretical framework sought to "move … beyond the realm of descriptive into the realm of explanatory … [and] is not meant to be a straitjacket … [but] a very helpful tool" (p. 68). The study considers the structures affecting the high school transition period and how these affected students' mathematics achievement obtained through a specific mathematics course progression.

Purpose of the Study

The first purpose of the study was to investigate the effectiveness of two different high school's mathematics course progressions by examining mathematics achievement throughout the high school transition and the resulting achievement obtained through the different progressions. The second purpose of the study was to relate students' experiences of their mathematics trajectory, formed by their mathematics course progression, to their transition to high school and throughout high school. The aforementioned are all intertwined and combine to influence students' experiences, which shape their life course. Life circumstances and events that occurred during the transition and throughout each student's trajectory gave insight into student mathematics achievement. Elder's life course principles were evident and demonstrate how the timing of the transition, relationships, and human agency each affected achievement.

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Methodology and Data Collection

An explanatory sequential mixed methods study was used, utilizing the collection of qualitative data after a quantitative phase to explain and follow-up on the quantitative data collection and analyses (See Figure 5). In the quantitative phase of the study, student mathematics test scores were examined at the end of middle school and throughout high school. Eighth grade ACT Explore Mathematics test scores were used to identify prior achievement before entering high school. The ACT QualityCore Algebra 1 End of Course Test (EOCT) and the ACT Mathematics Test (eleventh grade) were used to measure mathematics achievement after the completing of the Algebra B course and eleventh grade. A qualitative phase was conducted to explore the high school transition of students experiencing the two different mathematics course progressions and to determine how the transition and progression affected students' mathematics trajectory. The use of qualitative methods sought to better explain and understand the quantitative data as to recognize the experiences of the students. A structured interview protocol was utilized and six students (three from School 1 and three from School 2) were purposively sampled. Students were chosen based on an observed increase in mathematics achievement throughout the high school transition period (from eighth grade to eleventh grade).

Figure 5. Explanatory sequential mixed methods protocol.

The use of mixed methods, quantitative and qualitative, allowed for a better understanding of the high school transition in that neither method, by itself, is sufficient to capture the trends and details of the transition as it relates to the high school mathematics course progression and mathematics achievement of students. Both methods serve as complements of each other, drawing on the strengths of each by utilizing an inductive-deductive research cycle, and allow for a more robust analysis of mathematics achievement across the high school transition as well as throughout high school (Teddlie & Tashakkori, 2009).

Statement of the Research Questions

The explanatory sequential mixed methods research design poses the following research questions at the outset of the study: a central question, quantitative research questions, a qualitative research question, and a question describing the integration of the quantitative and qualitative data.

Central Question

How does a different mathematics course progression impact students' high school transition and their subsequent mathematics achievement throughout high school?

Quantitative Research Questions

1. Is there a difference in mathematics achievement at the end of the Algebra A and Algebra B courses, as measured by test scores, for students who completed the courses every day in two semesters (one year) and students who completed the courses every other day in four semesters (two years)?

2. What effect did an extra mathematics course (Algebraic Connections) have on students' mathematics achievement as measured by the ACT?

Qualitative Research Question

1. What social-ecological supports might be leveraged to support an increase of students' mathematics achievement throughout the high school transition period?

Mixed Methods Research Question

1. In what ways do the qualitative interview data reporting the experiences of high school seniors, whose mathematics achievement increased over their high school transition period, help to explain the quantitative results about mathematics achievement reported from three achievement tests?

Significance of the Study

This research provides insight into how different mathematics course progressions affect student mathematics achievement. In addition, it brings to light how students traverse through the high school transition and how their mathematics achievement is affected by what they experience throughout the transition (e.g., progressions, requirements). The results of the study will contribute not only to mathematics achievement research but will broaden the narrow focus on high school transition research through the examination of student functioning beyond immediately before, and after the transition.

Furthermore, this research provides relevance with its exploration of students' entry into high school and the achievement they obtained as a result of their mathematics course progression. The effect of the transition and the course progression they followed formed their mathematics trajectory. A better understanding of students' perceptions about their trajectory can help educators better prepare ninth grade students for the high school transition and the structure of the mathematics courses they take throughout high school, which will help inform educational practice and policy in middle school and high school.

Finally, the utilization of a mixed methodology approach provides different perspectives of the problem. Qualitative data is often not generalizable, and when quantitative data of many individuals is examined, "the understanding of one individual is diminished" (Creswell & Plano Clark, 2011, p. 8). By employing both research methods, the limitations of each method are often offset by the strengths of the other. The quantitative data obtained from the study will allow conclusions to be formed regarding mathematics achievement, and the qualitative data from student interviews will allow their personal viewpoints to be exposed and thus enhance the understanding of their development throughout the high school transition and mathematics achievement.

Limitations and Delimitations

Limitations, according to Roberts (2010), are areas of the study over which the research has no control. This research study did have limitations. First, the results of this research may not be generalizable to populations outside of the single suburban school district where it was performed. Thus, the study could only be generalized to the population of the two high schools in this district or districts with similar demographics. This limitation of generalizability could also be seen in the unequal sizes of the two high schools, the School 1 sample size was more than double the sample size of School 2. These unequal sample sizes could have limited the power of the statistical tests; therefore, the results of these tests cannot be generalizable.

Another limitation to consider is that high school students most often do not try their best on standardized tests without an incentive or given a grade. Over recent years this problem has increased as student intrinsic motivation has declined with a majority of students (Usher & Kober, 2013). The examination of the test scores must take this into consideration.

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The third limitation involved the use of the ACT assessment suite as a measure of student mathematics achievement. The results of achievement tests are limited and cannot always show if learning has taken place or if there was quality instruction. Some students who have the appropriate knowledge to score well may be poor test takers or get nervous, which can cause them to score lower than normal. Other students may not understand the questions or lack the background knowledge that could help them better comprehend questions. However, according to Kaestle (2013), even though tests are reviewed for potential bias, it is impossible to create a fair, objective, reliable, unbiased test for every single student. Although the ACT assessments may not be the perfect measure of student achievement, it has been shown that performance on the ACT is influenced by achievement in high school mathematics courses (ACT, 2015e).

The next limitation involved the students' interviews, which did not take place until twelfth grade, three years past the ninth grade transition. However, this delay may have led to an increase in validity due to their maturation and ability to reflect more truthfully on their experiences due to their place in the life course.

The fifth limitation was found in the qualitative strand of the study with the two-cycle coding of the interview transcripts. Different conclusions may have been obtained if multiple coders had been available. Intercoder agreement increases reliability and offers stability of response as well as adds strength to the data set (Creswell, 2013).

The final limitation was the mathematics course progressions were only analyzed through students' lived experiences through interviews and their mathematics achievement based on test scores. The quality of the mathematics instruction in each mathematics course throughout their trajectory could not be considered, as well as whether teachers included test preparation within their classroom instruction.

Delimitations involve the areas of the study in which the researcher has control and has imposed deliberately (Roberts, 2010). The first delimitation was that only students enrolled in Algebra A and Algebra B for the first time were part of the study. Therefore the perspectives of other ninth grade students enrolled in different mathematics courses with different mathematics progressions were not included in this study. The other delimitation was findings from the interview data cannot be generalized beyond the individuals interviewed.

Operational Definitions

- Alternating Block Schedule – often called "A/B" scheduling where classes meet every other day throughout the school year. Most often students take the same eight classes throughout the year for both semesters (Kramer, 1997a).

- Capital – "accumulated labor … [which] enables [one] to appropriate social energy in the form of … living labor" (Bourdieu, 1986, p. 83).

- Carnegie Unit - a standard unit of credit is awarded for a course in which the student successfully completes the objectives of the course and the equivalent of 140 clock hours of instruction (Silva, 2007).

- College- and-Career Ready – students are college- and-career ready if they "can qualify for and succeed in entry-level, credit-bearing college courses leading to a baccalaureate or certificate, or career pathway-oriented training programs without the need for remedial or developmental coursework" (Conley, 2012).

- Intensive Block Schedule – often the 4 x 4 block where classes meet longer than a six or seven period day. Students attend four classes every day completing one course in one semester and earning one credit for each class. Students then take four different classes the next semester (Kramer, 1997a).

- Mixed School District – school districts having several middle schools that feed into one or two high schools (Langenkamp, 2010).

- Transition- the movement of students from one school setting to the next (Uvaas & McKevitt, 2013).

- Uniform School District – school districts having one middle school that feeds into one high school (Langenkamp, 2010).

Summary

This study determined if having Algebra A/B every day, as students transitioned to high school, affected their mathematics achievement on the algebra end of course test. It also examined if the mathematics course progression with an additional math course (Algebraic Connections) increased achievement on the ACT Mathematics Test. This examination compared students who did not have Algebra A/B every day and did not have an additional mathematics course before taking the ACT Mathematics Test to students who did have Algebra A/B every day and did have an additional mathematics course. The study utilized student voice in interpreting students' view of their high school transition and subsequent mathematics trajectory. Through the use of student interviews from both groups, a broader perspective beyond the test scores was obtained. Furthermore, the results informed the school district which mathematics course progression might continue to be followed.

Overview of the Study

This study is organized into five chapters. This first chapter introduced the necessity for investigation into the relationship between the high school transition period, mathematics course progressions, and mathematics achievement through the lens of life course theory. The discussion included the purpose of the study, the research questions, and a brief discussion of

methodology. Chapter Two provides a review of the literature that supported the theoretical framework for this study. A description of the research design and methodology is provided in Chapter Three, followed by the results of the study in Chapter Four. Chapter Five concludes this study with a synthesis of the findings, including an interpretation of the results, and possibilities for future study.

CHAPTER TWO

REVIEW OF THE LITERATURE

This study is founded on the examination of student mathematics achievement throughout the high school transition obtained through different mathematics course taking progressions. This chapter examines the literature of three overarching themes relevant to mathematics achievement that serve as organizational topics: 1) assessment, 2) mathematics course taking progressions, and 3) life course theory (Elder, 1998).

Assessment

This section of the review offers a historical development of testing in the United States; including *norm-referenced tests* and *criterion* or *standards based tests.* The development of college- and career-readiness standards, the Common Core State Standards (CCSS) standards, and the predictive validity of the ACT are discussed.

Historical Development of Testing in the United States

The development of written testing in the United States dates back to 1845 when educational pioneer Horace Mann suggested that students in Boston Public Schools should prove their knowledge through written tests. His goal was to find and replicate the best teaching methods so that all the students could have equal opportunity to learn (Gallagher, 2003). These written exams were administered in place of traditional oral exams.

The late 19th century witnessed the popularization of the elective curriculum with an increase in coursework students took. This made the task of student assessment more complex in

that each discipline had its own independent achievement test and led to the convenience of using objective tests as opposed to multiple response tests. Therefore, schools began to "systematically collect data to construct comprehensive and comparable portraits of student learning" (Gallagher, 2003, p. 85).

During the early 20th century many of the first widely adopted school achievement tests were not designed to measure achievement but ability. The Army Alpha and Beta Tests, developed during World War I to sort soldiers by their mental abilities, became the model for schools. The most important test of ability, the College Entrance Examination Board—later renamed the Scholastic Aptitude Test (SAT)—began to be administered in the 1920s. The American College Test (ACT) was created in 1959 as an alternative to the SAT, and became widely accepted for college admissions (Walsh & Betz, 1995).

In the last half of the 20th century each decade brought about different waves of testing in the United States. In the post-World War II era of the 1950s, testing began to provide ways to track students into either a vocational or a professional program within a comprehensive high school (Urban & Wagoner, 2004). In the 1960s, the federal government started pushing new achievement tests designed to evaluate instructional methods and schools. As part of President Lyndon Johnson's *Great Society*, Congress passed the Elementary and Secondary Education Act (ESEA, 1965). The main intent of the ESEA was to provide funding to school programs that would allow equal access to a quality education for all elementary and secondary students in America, especially those students who were most disadvantaged. In the 1970s and early 1980s minimum-competency testing (MCT) became popular. As the name suggests, the skills tested were at very low levels of achievement. By 1983, thirty-four states had some form of MCT.

Norm-referenced tests. In the late 1980s through the 1990s, norm-referenced tests became the primary accountability measures for schools (Urban & Wagoner, 2004). A norm-referenced test is commonly referred to as a standardized test. Standardized testing means that a test is administered and scored in a predetermined, standard manner (Popham, 2016). Students presumably take the same test in the same conditions at the same time so that results can be attributed to student performance and not differences in the administration or form of the test (Wilde, 2002).

During the development of these tests, the test is administered to a sample group and the distribution of the sample group's scores is compared statistically to what is called a normal distribution. This distribution of scores is visualized in a bell shape where the mean, median, and mode are equal. Test items are considered 'good' items if they discriminate well and allow the scores to fall on the desired normal or bell curve. This process is sometimes known as "norming" the test. New test-takers scores are then referenced to the norm group and reported as they relate to the normal distribution (Berlak et al.,1992).

Criterion or s*tandards-*b*ased* p*erformance* t*ests*. In the late 20th and early 21st century most standardized tests shifted from norm-referenced tests to *criterion* or *standards-based performance tests*. These tests are designed to show how students achieve in comparison to standards, usually state standards. In contrast to norm-referenced tests, it is theoretically possible for all students to achieve the highest—or the lowest—score, because there is no attempt to compare students to each other, only to the standards (Wilde, 2002). These types of tests became part of the assessment of fourth, eighth, and twelfth graders as mandated by the No Child Left Behind Act of 2001 (NCLB). Through this mandate the federal government charged state

departments of education with developing standards and assessments that will serve their state's districts, schools, and students while meeting the accountability demands of federal laws.

By 2011, the United States Department of Education offered each state department of education the opportunity to request flexibility regarding specific requirements of NCLB. This was to be accomplished in exchange for rigorous and comprehensive state-developed plans designed to improve educational outcomes for all students (The White House, Office of the Press Secretary, 2011). In Alabama, "Plan 2020: Every Child a Graduate—Every Graduate Prepared for College, Work, and Adulthood in the 21st Century," was developed in 2012 as the state's flexibility request to the NCLB requirements (Alabama State Department of Education, 2013b). The plan was also a response to Alabama Act No. 2012-402 (A-F Report Card) (2012) requiring schools in the state to use state-authorized assessments. These assessments are used to measure student achievement, which is one indicator on each school's report card.

College- and Career-Readiness Standards

With the shift from norm-referenced tests to standards-based tests, educators, policy boards, legislatures, and researchers have given a lot of attention to readiness for college as a focus for development of standards. Conley (2012) defined *college readiness* in mathematics as the probability a student will succeed in college-level mathematics courses, while McCormick and Lucas (2011) define college readiness as the accumulation of knowledge in mathematics that students are required to have to pass their courses in college. One of the better-known efforts around college readiness is the standards developed by the ACT program to predict a student's readiness to succeed in college coursework.

In 1997, ACT released its College Readiness Standards (ACT, 2014) which identified detailed, research-based descriptions of the skills and knowledge required for success in entry

level postsecondary courses and described skills associated with specific score ranges across its assessments. These score ranges were determined based on the context of the use of the scores in college admissions and course-placement decisions. Content area specialists analyzed the skills and knowledge students need in order to respond successfully to test items that were answered correctly by 80% or more of the students who scored within each score range. Multiple test forms were used along with tables that showed the percentages of students in each score range that answered each test item correctly showing the item difficulties. These were then calculated separately based on groups of students whose scores fell within each of the defined score ranges. Each content specialist compiled lists of the knowledge and skills necessary in each score range. These were merged, discussed, and adjusted to develop the final list of skills and understandings. These procedures were performed with multiple test forms of each of the ACT assessments in the ACT assessment suite (ACT, 2014).

To determine the content validity of their research, ACT had a national independent panel of content experts from high school and the university level to provide independent, authoritative reviews of the standards. Seventy percent or more of the consultants' ratings were *Agree* or *Strongly Agree* when judging whether the Standards adequately described the skills required by the test items and whether the Standards adequately represented the cumulative progression of skills from the lowest to the highest score ranges. ACT conducts regularly scheduled independent reviews by national panels of subject matter experts as well as periodically conducts internal reviews of the Standards (ACT, 2014).

Common Core State Standards

The Common Core State Standards (CCSS) Initiative effort was undertaken to both adopt higher standards and build assessments based on the college- and career-readiness work ACT

had already made foundational (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010a). The Initiative adopted the ACT definition of college- and career-readiness as "the acquisition of the knowledge and skills a student needs to enroll and succeed in credit-bearing, first-year courses at a postsecondary institution (such as a two- or four-year college, trade school, or technical school) without the need for remediation" (ACT, 2014, p. 1). Curriculum surveys conducted by ACT of high school and college faculty, as well as, the statistical studies examining the relationship between performance on the different ACT-developed tests and outcomes in college courses, provided a substantial foundation for the development of the CCSS. This statistical evidence from ACT helped the Initiative in providing an empirical link between mastery of specific skills and academic performance in entry-level college courses across two- and four-year colleges (Clough & Montgomery, 2015).

In mathematics, the core academic skills framework of the ACT College Readiness Standards includes five domains: Number and Quantity, Operations and Algebra, Functions, Geometry, and Statistics and Probability (ACT, 2010). These domains thoroughly address all the six conceptual categories of the CCSS for Mathematical Content: Number and Quantity, Algebra, Functions, Modeling, Geometry, and Statistics and Probability (ACT, 2010; National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010b). In addition to Mathematical Content the CCSS also contain eight Mathematical Practices:

- make sense of problems and persevere in solving them;
- reason abstractly and quantitatively;
- construct viable arguments and critique the reasoning of others;
- model with mathematics;

- use appropriate tools strategically;

- attend to precision; and

- look for and make use of structure.

The ACT College Readiness Standards also address these practices with the exception of one; the practice of using appropriate tools strategically (ACT, 2010; National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010b).

Predictive Validity of the ACT

The ACT College Readiness Standards are widely recognized throughout research as a threshold for establishing a student's college readiness (Dahlin & Tarasawa, 2013). Early studies show the ACT is as good as or better at evaluating academic success than the SAT (Boyce & Paxson, 1965; Chase, 1963; Westen & Lenning, 1973). In 1973, Lenning and Maxey published a report that analyzed the predictive validity of the ACT at "selective" colleges, defined as a college that had a "preponderance of students with exceptional academic ability" (p. 397). Prior to this research, there was a question as to whether the ACT would be as accurate of a predictor of student success as the SAT. The criteria used to determine these schools were an average student ACT score of 24.5 or higher and a SAT total mean of 1200 or above. He found that the predictive validity of the ACT was as satisfactory for the selective institutions as it is for the more typical institutions. He also concluded that the ACT and SAT are both valid predictors, and when the tests did not show similar results; the data favored the ACT score over the SAT score.

More recently, the ACT Mathematics Test has also been compared to the National Assessment of Educational Progress (NAEP) in Mathematics (National Assessment Governing Board, 2009). The National Assessment Governing Board (NAGB) examined the domain definitions and test specifications for both tests to provide information about the alignment of the

NAEP and the ACT to determine whether NAEP scores should be used to make inferences about twelfth grade students' academic college readiness. Panels of high school and postsecondary mathematics instructors, each with extensive experience in the assessments, analyzed similarities and differences in the content and cognitive skills measured by the two assessments. NAEP frameworks and ACT College Readiness Standards were used in the comparisons. They found the assessments to be very comparable with only two differences: (a) the NAEP Mathematics domain emphasizes probability, statistics, data analysis, and transformations to a greater extent than the ACT Mathematics domain; and (b) higher-order analytic and evaluative skills are assessed to a greater degree on the NAEP, primarily through the use of constructed-response. In addition, elements in the NAEP content domain were found to be consistent with all of the ACT College Readiness Standards (NAGB, 2009).

Other recent studies (ACT, 2009; Lorah & Ndum, 2013; Radunzel & Noble, 2012a, 2012b) report that meeting the ACT mathematics standard is positively associated with several college outcomes including earning a grade of B (or C) or higher in mathematics courses taken in the first year of college, continuing to the second year of college at the same institution, achieving a cumulative college grade point average (GPA) of 2.00 or higher, and completing a college degree. An important feature of these studies is the variation in the mathematics preparation of the samples of high school students, which ranged from no high school mathematics through Calculus I (ACT, 2009; Radunzel & Noble, 2012b).

Using data not collected by ACT, Harwell, Moreno, and Post (2016) examined the relationship between the ACT mathematics standard and college mathematics achievement for students who completed three, four, or five years of high school mathematics coursework. A large sample of 11,324 students who attended one of 27 four-year postsecondary institutions in

the upper Midwest was used to study this relationship. Their sample was generally consistent with the previous studies (ACT, 2009; Lorah & Ndum, 2013; Radunzel & Noble, 2012a, 2012b) using students with no mathematics to five years of coursework. Students who met the standard were three times more likely to earn at least a B in their first college mathematics course compared with those not meeting the standard and two-and-half times more likely to earn at least a C.

All of these studies support the predictive validity of the ACT and suggest that the ACT College Readiness Standards, and consequently the CCSS, are useful predictors of mathematics achievement. States are charged with the responsibility of creating mathematics courses and devising course taking progressions that incorporate these standards, which are measured by the state-authorized assessments. At the onset of this study, those assessments mandated by the state of Alabama included the following assessments in the ACT assessment suite: the ACT Explore in eighth grade, the ACT QualityCore Algebra 1 EOCT at the completion of the Algebra 1 course (ninth or tenth grade), and the ACT in eleventh grade. (These individual assessments are explained in detail in Chapter Three.) According to ACT (2014), when used together these assessments give educators "a powerful, interrelated sequence of instruments to measure student educational achievement and assess college readiness from eighth through twelfth grade" (p. 1) relative to ACT's College Readiness Standards and, by extension, relative to the CCSS. Hence, this study examines mathematics achievement, based on these assessments and student experiences, obtained through different mathematics course taking progressions, which are defined and explored in the next section of this literature review.

Mathematics Course Taking Progressions and Achievement

Mathematics course taking progressions are described by Schneider, Swanson, and Riegle-Crumb (1997) as course sequences; strands of courses that span a student's educational career. They provide a pathway that students travel as they progress toward mastery of skills needed for college- and career-readiness. Course progressions are directed by the mathematics graduation requirements adopted by each individual state and defined by statutes and regulations as passed by each state legislature. These requirements vary widely among states. All states with the exception of Nebraska and New Jersey express their required coursework in Carnegie units, with one unit reflecting one year of coursework. Twenty of the 50 states require students begin with the Algebra 1 course in ninth grade (Education Commission of the States, 2017). As students transition to high school many are unprepared for their first course in their mathematics course taking progression; the Algebra 1 course (Clotfelter et al., 2015; Domina, Penner, Penner, & Conley, 2014; Liang, Heckman, & Abedi, 2012) and often experience achievement loss in ninth grade (Alsapaugh, 1998, 2000; Langenkamp, 2009; Rice, 2001; Smith, 2006). Due to this, schools have generated additional learning opportunities for these students in order for them to further develop or display mathematical understanding. Many schools have incorporated an extended learning time or "double-dose" of instruction in mathematics (Allensworth et al., 2009; Balfanz, et al., 2004; Kemple & Herliby, 2004; Kemple et al., 2005; Nomi & Allensworth, 2009) as part of student mathematics course progressions. In addition, modification of the school schedule is also evident in providing further support (Arnold, 2002; Gruber & Onwuegbuzie, 2001; Harmston, Pliska, Ziomek, & Hackman, 2003; Lewis, Dugan, Winokur, & Cobb , 2005; Evans, Tokarczyk, Rice, and McCray, 2002; Tokarczyk, Rice, & McCray, 2002; Trenta & Newman, 2002; Zelkowski, 2010).

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Mathematics Graduation Requirements

By 2016, 42 states, the District of Columbia, four territories, and the Department of Defense Education Activity had adopted the CCSS (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2016). The Alabama State Board of Education adopted the CCSS along with additional Alabama standards in November 2010 and began implementation of the new math standards in 2012 (Alabama State Department of Education, 2013a). With the adoption of the CCSS, Alabama graduation requirements were changed to include more rigorous mathematics coursework by adding an Algebra II course or its equivalent. Students must continue to earn four Carnegie units of mathematics but must include the following courses: Algebra I; Geometry; Algebra II with Trigonometry or Algebra II, or its equivalent/substitute; and an additional math course from the "*Alabama Course of Study: Mathematics* or mathematics-credit eligible courses from Career and Technical Education/Advanced Placement/International Baccalaureate/postsecondary courses/SDE-approved courses" (Alabama State Department of Education, 2013a, p. 138). These Carnegie units may be attained through a complex system of mathematics course taking progressions as shown in Appendices A and B, illustrating mathematics as the most hierarchically and sequentially organized high school subject (Alabama State Department of Education, 2013a; Stevenson, Schiller, & Schneider, 1993).

With the adoption of the CCSS, many other states have also increased their graduation requirements. At least one more year of math instruction was required in 27 states for the high school graduation class of 2013 than for the class of 2006 (Zinth & Dounay, 2006). In 2013, 42 states required students to take at least three years of math (Achieve, 2015). Several researchers have studied the relationship between mathematics graduation requirements and mathematics

achievement. Clune and White (1992) and Schiller and Muller (2000) both found the quantity of mathematics course taking has an effect on standardized achievement tests. Schiller & Muller (2003) replicated these results by gender and race/ethnicity. All three studies controlled for student characteristics including socioeconomic status, aptitude, and prior achievement. From a policy perspective, these studies suggest the possibility that increased mathematics graduation requirements would have a positive effect on mathematics achievement. However, other studies exploring the effects of increased graduation requirements found no achievement effect.

In 2003, Teitelbaum examined data from the U.S. Department of Education's National Educational Longitudinal Study (NELS) which collected information from a nationally representative sample of students in 1988, 1990, and 1992, when most were eighth, tenth, and twelfth graders, respectively. The data from the NELS contained surveys, high school transcripts, and test score information. It was obtained four years after 41 states had established or strengthened their graduation requirements. Teitelbaum used multilevel modeling to explore and explain the interrelationships among high school graduation requirement policies, student characteristics, and three outcome measures: the number of mathematics credits students earned in high school, the levels at which students stopped taking these subjects, and gains in academic achievement as measured by test scores. His results indicated that high school graduation requirement policy was not associated with student achievement in math as measured by test score gains from eighth to twelfth grade showing students at schools with higher graduation requirements did not outperform their peers at schools with lower graduation requirements on the NELS standardized tests. These findings suggest that increasing the number of credits students have to earn in mathematics to graduate from high school by itself may not be sufficient to improve student proficiency in mathematics.

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More recent research by Buddin and Croft (2014) assessed how changes in math graduation requirements affected course taking, achievement, and college enrollment. They explored the effects of the 2005 Illinois law setting the minimum math requirement as three units—including Algebra I and Geometry—and science as two units. They used student-level data from nine Illinois high school graduation classes to explore the effects of the reform, particularly students in the bottom half of their graduating class. They compared trends for the districts that were affected by the new requirements (treated) relative to other districts that already required the new mandate (untreated). In both the treated and untreated districts about 90% of high-ranking students were already taking three or more years of math prior to the graduation requirement reform. Math course taking increased from about 67% to 80% for the low-ranking students whether they were in the treated or untreated districts. Although more students were taking at least three more math courses than before, the trend in untreated districts differed little, if at all, from the trend in treated districts. In regards to achievement, there was not a statistically significant difference in the trends between districts for either high- or low-ranked students. ACT math scores increased by 0.7 points for low-ranking students in untreated districts compared to 0.6 points for low-ranking students in treated districts. Despite the law not significantly affecting course taking and achievement, there seemed to be an effect on college enrollment where enrollment rose in both districts, faster in the treated districts (Buddin & Croft, 2014).

As districts try to increase student mathematics achievement, additional course requirements alone are not sufficient as the literature indicates. They must also consider how just the transition to high school itself may affect student achievement, especially in the ninth grade.

Achievement Loss in Ninth Grade

It is well established that one of the most demanding phases for students is that of school transition, especially the one from middle to high school (Langenkamp, 2011; Neild, 2009; Uvaas & McKevitt, 2013). Entering a new learning context requires students to adapt to harder tasks and to achieve different goals (Benner, 2011). High school transition research has established students experience achievement loss in ninth grade (Alsapaugh, 1998, 2000; Langenkamp, 2009; Rice, 2001; Smith, 2006). Alspaugh (1998) compared achievement of three different transition groups each comprised of 16 school districts for a total of 48 school districts in Missouri: one group transferring from a K-8 school to one high school, another that transferred from one elementary school to one middle school to one high school (linear transition), and one group that came from two or three elementary schools to one middle school to one high school (pyramid transition). The Missouri Mastery Achievement Test (MMAT), consisting of reading, mathematics, science, and social studies subtests, measured achievement. The students involved in the most transitions (pyramid) experienced a greater achievement loss than the linear transition. The students attending middle schools experienced a greater achievement loss than the students from a K-8 school. Alspaugh (1998) contended as the number of students per grade increased, the achievement associated with the transition to high school increased.

Langenkamp (2009) conducted a study similar to Alspaugh examining achievement through the different pathways students followed as they transitioned to high school. She used nationally representative data from the National Longitudinal Study of Adolescent Health (Add Health) and its education component, the Adolescent Health and Academic Achievement (AHAA) study. Student surveys and transcript data were analyzed from students following a

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uniform pathway (comparable to Alspaugh's (1998) linear transition), mixed pathway (students transitioning from multiple middle schools to one high school), and a divergent pathway (students transitioning alone or with very few students from their middle school class). Students from each pathway experienced a decline in academic performance from eighth to ninth grade and those following a divergent pathway had the greatest loss of achievement.

Achievement across the transition was also examined in a panel study of groups of 60 seventh-grade students that transitioned to 52 randomly selected national public high schools (Rice, 2001). Using data from the Longitudinal Study of American Youth (LSAY), which includes annual mathematics and science achievement test scores, achievement gain scores were used "to indicate the effect of the transition on student progress over time, and prior achievement gain" (p. 380). Results showed academic progress decreased over the transition for students who exhibited higher achievement gain scores in seventh-grade relative to students with lower gain scores. This type of result over the transition can yield another negative result over time as reported by Smith (2006) in that achievement loss over the high school transition was a strong predictor of high-achieving students leaving college in their first year.

The studies by Langenkamp (2009), Rice (2001) and Smith (2006) further solidify the foundational research of Alspaugh (1998) and support findings that high rates of school mobility were significantly related to decreased academic performance. Because of this, it is even more prudent for districts to take school mobility into consideration as they develop and provide mathematics courses for ninth grade students. As students transition to high school they must be prepared for the mathematics courses they are required to take. An understanding of the algebra course, the impetus of most high school mathematics course taking progressions, should be in the forefront.

Algebra as a Gatekeeper

In most states Algebra 1 is the first course in student's high school mathematics progression and the first credit-earning course fulfilling most high school math graduation requirements (Education Commission of the States, 2017). As such, Algebra 1 has been described as the gatekeeper to educational opportunity (Silver, 1995) and a predictor of later academic success (Adelman, 2010). Without algebra, the passageway to more advanced academic and vocational opportunity is limited (Smith, 1996). Successful completion of Algebra 1 should be the benchmark defining mathematical literacy because it provides more than a set of skills in dealing with quantitative relationships. Algebra 1 standards introduce students to mathematics as a style or method of thinking, involving modeling, problem solving, abstraction, and the formalization of patterns and functions (Silver, 1995). This is presumed useful in three contexts: (a) it may enhance preparation for the growing number of positions in the labor force that do not require education beyond high school but call for increasingly higher levels of mathematical and technical literacy; (b) it may provide stronger preparation for community colleges that require a background in mathematics; and (c) it may increase the number of students capable of mastering the higher levels of mathematics necessary for college admission and for majors and careers in mathematics and science (Allensworth et al., 2009; Gamoran & Hannigan, 2000).

For this reason, the National Council of Teachers of Mathematics (NCTM) has recommended that all students be taught underlying algebraic principles in early elementary grades so as to prepare them for the rigors of the high school algebra course (NCTM, 1989, 2000, 2014). "Algebra occupies a special place among the various domains [of mathematics] because it is more than a topical domain. It provides linguistic and representative tools for work

throughout mathematics" (RAND Mathematics Study Panel, 2003, p. 48). It is also an area of

critical importance identified by CCSS (National Governors Association Center for Best

Practices, Council of Chief State School Officers, 2010a), and consequently, for most students it

also occurs at the time of the high school transition becoming the springboard of a student's

trajectory throughout his or her mathematics progression in high school (Kemple, Connell,

Legters, & Eccles, 2006).

Because of the increased recognition of the phenomenon of algebra as gatekeeper, there

has been a growing trend for more students to take algebra in eighth grade. All California

students have been required to take algebra in the eighth grade since 2004. All students

scheduled to complete a full Algebra 1 course take the Algebra 1 California Standards Test

(CST). From 2004 to 2010, the percentage of students scoring proficient or advanced on the

Algebra 1 CST increased from 39% to 46% with an effect size of .17. However, at the same

time, more evidence showed many more students are now struggling with algebra. A much larger

percentage of students who took the Algebra 1 CST in 2010 compared to 2003 scored below or

far below, basic proficiency (Williams et al., 2011).

Other researchers have investigated the impact of California's accelerated entry into early

algebra and its effect on student performance in math courses as students transition through high

school (Clotfelter et al., 2015; Domina et al., 2014; Liang et al., 2012). Clotfelter et al. (2015)

found that students affected by the acceleration initiative scored significantly lower on end-of-

course tests in algebra, and were significantly less likely to pass standard follow-up courses such

as Geometry or Algebra 2. Domina et al. (2014) discovered the acceleration did increase the

probability of students taking higher-level mathematics courses and created more skill-

heterogeneous eighth grade mathematics classrooms. Unfortunately, the authors also report the

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rate of sixth through tenth grade mathematics achievement growth slowed, particularly for students in the middle of the skills distribution. Liang et al. (2012) found that simply encouraging more students to take eighth grade algebra does not by itself lead to significantly more students taking advanced mathematics in high school, nor does it lead to substantial increases in mathematics achievement. Furthermore, they discovered that students who scored below proficient in eighth grade algebra had a lower chance of successfully passing the following year's mathematics test compared to students who passed the standardized test for general mathematics.

Beginning in 1997, Chicago Public Schools (CPS)—one of the largest urban public school districts in the United States with 85% of students eligible for free or reduced lunch— required all ninth grade students to take Algebra I (Allensworth et al., 2009). Mathematics scores on the Tests of Academic Proficiency (TAP) showed no significant differences for students with lowest, low, and average incoming achievement in regression-adjusted comparisons of multiple pre- and post-policy cohorts (Allensworth et al., 2009). In addition, Nomi and Allensworth (2009) indicated that high-achieving students exhibited lower achievement in the same-type comparisons.

Although universal algebra policies reduce the possibility of prepared students being denied access to algebra, these studies indicate such policies have created another problem: more underprepared students enrolled in algebra classes. A further examination of the research reveals, achievement gains are only present in settings that were accompanied by strong supports for struggling students, particularly more time for algebra instruction. This extended learning time is often called "double-dose" (Allensworth et al., 2009; Balfanz, et al., 2004; Kemple & Herliby, 2004; Kemple et al., 2005; Nomi & Allensworth, 2009).

Extended Learning Time/"Double-Dose"

Due to achievement loss in ninth grade and the importance of the Algebra course, students who enter high school achieving at a slower rate than others may require additional support beyond their daily, required mathematics course (Cortes et al., 2013). The Common Core State Standards in Mathematics (CCSS-M) suggests five strategies schools may employ to support these students:

- creating a school-wide community of support for students;

- providing students a "math support" class during the school day;

- after-school tutoring;

- extended class time in mathematics; and

- additional instruction during the summer (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010b, p. 5).

Research verifies an increase in mathematics achievement with the implementation of these strategies (Allensworth et al., 2009; Balfanz, et al., 2004; Kemple & Herliby, 2004; Kemple et al., 2005; Nomi & Allensworth, 2009). Many high school transition programs allow for low-achieving ninth grade students enrolled in Algebra 1 to receive an extra period of instruction each day to compensate for students' low skills and allow them the opportunity to take higher-level mathematics. One successful reform model using extended time is the Talent Development High School (TDHS) model, a comprehensive high school reform initiative that aimed to improve the academic achievement of students in low-performing public high schools with some part of the model implemented in 43 districts in 15 states (Kemple & Herliby, 2004; Kemple et al., 2005). The model involved changes in curriculum and instruction intended to

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affect all students in the school as well as the faculty and was developed by the Institute for Research and Reform in Education (IRRE) and the Center for Research on the Education of Students Placed At Risk (CRESPAR) (Kemple et al., 2006; Letgers, Balfanz, Jordan, McPartland, 2002).

The TDHS model design included common planning time and professional development for teachers as well as extra academic help sessions for students (Kemple & Herliby, 2004). TDHSs also contained a Ninth Grade Success Academy, which included (a) a 90-minute "double-dose" of mathematics each day for every ninth grader, a first-semester research-based catch-up course (Transition to Advanced Mathematics) for students to overcome poor preparation to succeed in math courses and a second-semester Algebra I course, (b) a ninth grade seminar course focusing on development of self-management and interpersonal skills to help prepare students for the demands of high school; and (c) for teachers a common planning period, intensive and sustained professional development including 25 to 30 hours that was course specific, and implementation support including in-classroom curriculum coaching (Balfanz et al., 2004; Kemple et al., 2005).

Students' mathematics achievement in two districts using the TDHS model were examined by Balfanz et al. (2004) and they found that ninth grade students significantly outperformed students in control schools in each district when controlling for students' prior achievement, ninth grade attendance, age, and gender. With respect to long-term achievement, Kemple et al. (2005) also found higher eleventh grade mathematics achievement among THDS students compared to control schools using regression-adjusted scores on the state standards assessment in mathematics, for an average effect size of 0.38 across three cohorts of students. In addition, Kemple et al. (2005) noted that TDHSs decreased the percentage of students scoring at

the lowest level ("below basic") on the assessment by 11 percentage points and increased the percentage at or above proficient by six percentage points compared to control schools.

Using a comparative interrupted time-series analysis of five high schools in Philadelphia from 1999-2004, Quint (2006) conducted a more rigorous, independent evaluation of the model and its practices. The student characteristics of the schools were 75% African-American, 23% Hispanic with 86% eligibility for free or reduced lunch, as well as 86% of the students below basic level in math and 76% below in reading on state assessments. Certain aspects of the model, to which Quint attributes its success, are the well-designed curriculum, lesson plans developed for the program, and the professional development, which included ongoing coaching, support, and technical assistance provided by IRRE and CRESPAR (Quint, 2006). For the TDHS model to be a success, all its components should be in effect and supported by administration in the school district (including cost) and the implementing school. CRESPAR estimates the cost of the model to be approximately $250-300 per student per year (Quint, 2006).

Another "double-dose" example was studied in the Rockville Centre School District in New York. The district serves about 3,500 students, with 10% to 15% eligible for free or reduced lunch (Burris, Welner, & Bezoza, 2010). Beginning in 1995, Rockville required all sixth and seventh grade students to take accelerated mathematics to prepare for Algebra I in eighth grade. They mandated that all classes be heterogeneous by ability (Welner & Burris, 2006). Teachers were given common planning periods and to support students Rockville initiated alternate-day workshop classes alongside the mathematics courses and provided after-school help four afternoons a week (Burris & Welner, 2005). Although the workshops were optional for some students, students who were struggling were expected to attend. The average class size was eight students (Burris, Heubert, & Levin, 2006; Burris et al., 2010). About 25% of all students took a

workshop class at some point during their algebra course (Burris et al., 2006). Achievement was measured pre- and post-policy, and independent samples *t*-tests yielded no significant differences for high-achieving students but significantly higher scores were evident in pre- and post policy regression-adjusted comparisons for all students (Burris et al., 2006).

As the literature purports, requiring all students to take algebra can lead to successful outcomes. However, states and districts must take serious the fact that some students will be underprepared and will need extra time and support to increase achievement. Because of this, nearly half of large urban districts in the United States employ some type of "double-dose" design to support low-achieving students (Cortes et al., 2013). As seen from these "double-dose" examples, most were accompanied with other components to aid in the high school transition and the mathematics achievement of ninth graders.

In my study, the "double-dose" was implemented as part of School 1's mathematics course progression and occurred in the ninth grade transition year with students taking the Algebra A and B courses every day for two semesters in one school year. In contrast, School 2 students took the same courses every other day for four semesters in two school years (ninth and tenth grades). This allowed for School 1 students to take an additional math course in eleventh grade year before taking Algebra 2 in the twelfth grade. In addition, the high school employing the "double-dose" (School 1) offered other components to aid in the high school transition. These included:

- principals and counselors meeting with eighth grade students before the transition;
- eighth grade students visiting and touring the high school campus;
- the high school providing an orientation during the student visit with high school programs, clubs, and activities being presented often by high school students;

- a curriculum fair for parents and students to ask questions of high school teachers regarding academics and extracurricular activities;

- ninth grade orientation before school starts where students are given schedules and may tour the school on their own; and

- an advisory period throughout the school year for students to connect to ninth grade peers and the same teacher every day to help with any problems that may occur throughout the school year.

The different mathematics course progression of the Algebra courses in each school under study were possible due to both schools utilization of the alternating block schedule. This schedule allowed for School 1 to alter their Algebra courses and offer them every day instead of every other day, thus the Algebra course being taught like an intensive block schedule in School 1 encompassing the entire year, not just one semester. The advantages and disadvantages of these different schedules are discussed in the next section.

School Schedule

The schedule of the school day can have an impact on ninth graders during their transition to high school and their mathematics achievement (Carroll, 1990). Two types of scheduling are most prevalent in high schools: the traditional 45- to 50-minute period schedule and the block schedule. Until the late 1980s and early 1990s, most high schools employed the traditional 45- to 50-minute period schedule with students having six to eight classes a day and teachers having upwards of 125 or more students per day. This traditional schedule dates back to the 1920s (Carroll, 1989). Block scheduling has its origins in the Copernican Plan with its purpose to create large segments of instructional time and limiting the number of students for which teachers are responsible during a school day (Carroll, 1989). The most prevalent types of

block scheduling are the intensive block and the alternating block. On the intensive block, students attend four classes every day completing an entire Carnegie credit for each course in one semester and then take four more classes the next semester. On the alternating block, students most often take eight classes where students alternate meeting a group of four classes every other day for the entire year (Kramer, 1997a).

Research expounds advantages of the intensive block schedule; including fewer classes for students to manage and prepare for (i.e., four as opposed to six or seven) (Carroll, 1990), a rise in student satisfaction with a positive effect on school atmosphere, a change in student attitudes towards school (Carroll, 1990; Matarazzo, 1999), and a decrease in discipline referrals and dropout rates (Eineder & Bishop, 1997; Kramer, 1997a; Mistretta & Polansky, 1997). A study of Georgia schools revealed increases in attendance and GPAs (Georgia Department of Education, 1998). Hurley (1997a) reported advantages recognized by teachers as they had fewer preparations, more class time for in-class activities, more time at school for other duties, less students per semester, and less paper work. In the same study students acknowledged they liked the block schedule because they had less homework. Research on alternating block schedules, however, is very limited. In an analysis of research on block scheduling Zepeda and Mayers (2006) analyzed 58 different studies evaluating block schedules. Of these 58 studies, only one focused on schools using alternating block schedules.

Despite the advantages offered for intensive block schedules, early block scheduling research indicated mathematics teachers were most opposed to a block schedule implementation, preferring a 40- to 50-minute period (Usiskin, 1995). Due to the sequential nature of mathematics and the inevitability for some students not receiving mathematics instruction for an entire year, mathematics teachers are often less supportive of the intensive block schedule

(Kramer, 1997a). Math teachers are also concerned with not being able to cover the content comprehensively and effectively in a semester block schedule (Kramer, 1997b).

However, as a whole, teachers in general most often prefer the schedule. Fletcher (1997) declared more than 76% of the teachers in his study favored the intensive block schedule over the traditional, yearlong period schedules. Similarly, Evans, Tokarczyk, Rice, and McCray (2002) conducted teacher interviews and teacher focus groups in three school districts and noted approximately 80% of teachers would like to see block scheduling continue in their school. This was due to the ability to vary instructional practices such as spending more time on activities instead of lecturing, expanding on lessons, and using a variety of practices all in one class period; for example, teachers can present a lesson, show a movie, and review all in one day. Furthermore, teachers felt they knew their students better because they were able to spend more time working with individual students in class and they had fewer projects and papers to grade at one time because they had a lighter student load than under the traditional 50-minute class schedule. In addition, Wilson and Stokes (1999) commented teachers enjoy more planning time with fewer class preparations giving more time to perform their duties and prepare for their classes. An increase in planning time and a decrease in students allow teachers to concentrate more on instruction and less on paperwork. Preparing for a substitute and getting a student caught up after absences were expressed as difficulties associated with the block schedule, yet most teachers perceive the advantages of block scheduling outweigh the disadvantages (Hurley, 1997a). Administrators are also more favorable of a block schedule as Rettig and Canady (2003) cite school management problems are reduced because students spend less time in highly congested areas such as hallways and dressing rooms with reduced class tardiness.

Studies examining student attitudes regarding block scheduling offer mixed results.

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Ellerbrock and Kiefer (2013) examined students before and after the high school transition. The middle school the students left operated on a team focused "flexible" block schedule, whereas the high school ran an eight period traditional schedule. Students expressed having a hard time adjusting to having more classes and missed their middle school team. In another ninth grade study, Spencer and Lowe (1994) interjected block classes within a seven period day. Students in four mathematics classes served as an experimental group. Four mathematics teachers out of seven taught one or two block classes each, the time equivalent of two of their 50-minute periods. Both teachers and students addressed a time period of adjustment, but by the end of the school year, students expressed more favor toward the block class. In contrast, ninth grade students studied by Letrillo and Miles (2003) felt one of the most difficult aspects of transitioning to high school was getting accustomed to the block schedule. Other disadvantages to block scheduling include one class absence being comparable to missing two class periods of a traditional period day and less time for field trips (Hurley, 1997a; Hurley, 1997b). Also, for block scheduling to be most effective it is suggested schools provide sufficient professional development upon implementation, address any necessary changes in teacher evaluation practices, and the amount of instructional time utilized per block must be of concern (Howard, 1998; Kramer, 1997a; Shortt & Thayer, 1997).

The literature regarding the results on the impact of block scheduling on student achievement varies widely. Many studies have shown that block scheduling leads to an increase in student scores on achievement tests. One such study, conducted by Lewis, Dugan, Winokur, and Cobb (2005) compared the standardized testing results for ninth grade students and ACT results for eleventh grade students of three high schools—one on a traditional schedule, one an alternating block schedule, and one on an intensive block schedule. The results showed that

students on an intensive block schedule had greater gains in mathematics than did students in both traditional scheduling and alternating block scheduling. Evans et al. (2002) also found an increase in SAT scores and in the number of students completing advanced placement tests. Other studies have shown that under a block schedule, ACT scores increase (Khazzaka, 1998; Snyder, 1997), the percentage gain in mathematics is higher on standardized tests (Bateson, 1990; Shortt & Thayer, 1997; Veal & Schreiber, 1999), and students score higher on the SAT-II exam (Hess, Wronkovich, & Robinson, 1999).

However, not all studies point to higher standardized test achievement for students on a block schedule. When comparing 38,089 high school seniors in 568 public high schools in Iowa and Illinois that were either on a traditional schedule, an alternating block schedule, or an intensive block schedule, Pliska, Harmston, and Hackman (2001) found no significant difference among student ACT scores. After controlling for lifestyle factors, gender, school enrollment levels, number of examinees, and years under the scheduling model, the results indicated that the scheduling type used at a school was not a predictor of the ACT composite scores obtained by the students. In a similar study, Arnold (2002) studied the scores of eleventh grade students in Virginia on the Test of Achievement and Proficiency (TAP). The schedule types compared were a traditional schedule and an alternating block schedule. Student data were collected from the 1990-1991 school year through the 1995-1996 school year. According to the results of the study, no significant difference was found in students' test scores associated with the type of schedule. When investigating a block-scheduling program in a small, Midwestern city, Trenta and Newman (2002) compared 500 students and found no significant impact on the ACT scores of students based on the switch to a block schedule. Numerous other studies have shown that the schedule type has little to no impact on students' achievement on standardized tests such as the

SAT, ACT, or advanced placement exams (Salvaterra, Lare, Gnall, & Adams, 1999; Trenta & Newman, 2002; Carroll, 1989).

In some instances, a switch to a block-scheduling format for a traditional schedule has been shown to be detrimental to achievement on standardized tests. Harmston, Pliska, Ziomek, and Hackman (2003) compared data from 450 public high schools in Illinois and Iowa that employed a traditional schedule, intensive block schedule, or an alternating block schedule. Several years of data were available for block schools, which represented two years prior to implementation through four years after implementation. The traditional schools demonstrated a slight upward trend in mean ACT scores, the alternating block schools varied in their performance but increased very litter over time, and the intensive block schools showed a declined trend in scores. Comparing students' performance on the Georgia High School Graduation Test (GHSGT), Gruber and Onwuegbuzie (2001) compared scores from the 1996-1997 graduating class to those who graduated in 1999-2000. The high school moved from a traditional schedule to a block schedule in the 1997-1998 school year. Significant differences were found in mathematics and all students who received instruction on a traditional schedule received higher GHSTGT scores. The negative impact of block scheduling on student achievement standards was also supported by Brake (2000) when comparing ACT and SAT scores of students on a traditional schedule versus those on an alternating and intensive schedule.

A traditional schedule offers students continuous enrollment in their courses. Zelkowski (2010) determined a decline in mathematics achievement from a traditional schedule to an intensive block period declaring continuous mathematics enrollment (i.e., 50-minute periods) results in "nearly two-thirds of a year of academic ability in mathematics achievement" (p. 17) over intensive semester block schedules. Despite the advantage in mathematics achievement of

the traditional schedule and the discrepant achievement results of block schedule studies, intensive block schedules still remain in many high schools. Queen (2009) reported that by 2008, 72% of United States high schools used some form of block scheduling where about 30% utilized the intensive block schedule. All the aforementioned research compares one of the types of block scheduling to traditional scheduling. The first part of my study yields a comparison of mathematics achievement for students completing their Algebra courses as continuous enrollment (like traditional scheduling) versus completion with alternating block scheduling.

Theoretical Perspective Important for Understanding Mathematics Course Taking Progressions and Achievement

As defined earlier college- and career-readiness is "the acquisition of the knowledge and skills a student needs to enroll and succeed in credit-bearing, first-year courses at a postsecondary institution (such as a two- or four-year college, trade school, or technical school) without the need for remediation" (ACT, 2014, p. 1). The knowledge and skills obtained encompass students' achievement as students' progress through the mathematics courses they take. This definition is somewhat limited to a focus exclusively on academic preparation without any emphasis on other influences associated with success (Conley, 2012). Achievement in school has been shown to be multi-dimensional because it comprises a wide range of influences important for overall success (Conley, 2012; Mattern et al., 2014). This calls for examination of the interactions of achievement and course progressions in respect to student life course, the theoretical framework of this study.

A theory is a "set of interrelated constructs, definitions, and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining the phenomena" (Kerlinger, 1986, p. 9). Theories compatible with education aim to

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make sense of the complex nature of the environments students encounter (Benner, 2011). The four principles of life course theory stated in Chapter 1 (historical time and place, timing in lives, linked lives, and human agency) involve multiple, interlocking structures, such as family structure, social structure, and school structure (Elder, 1998). These structures provide an organizational framework for interpreting and connecting the diffuseness of students' mathematics trajectories and the many influences that affect their mathematics achievement. These influences continue to dynamically unfold and provide context to student mathematics achievement throughout the transition period and their mathematics course taking progression.

Family Structure

As students navigate the experience of the high school transition through their mathematical course taking progression, both add to their life course trajectory and are influenced by the family structures already in place in their lives. These family structures constitute the cultural capital students possess as they enter high school. According to Bourdieu (1986), capital is "accumulated labor … [which] enables [one] to appropriate social energy in the form of … living labor" (p. 83). Simply stated, it is the sum of experiences and/or objects one brings to a specific situation or circumstance from which to draw to accomplish a task. Bourdieu posits social position as being interdependent on one's accumulation of three forms of capital: economic, social, and cultural. His concept of cultural capital refers to the values, knowledge, attitudes, or ideas parents or family members can pass on to their children. Noyes (2004) describes a graphic illustration (See Figure ____) of Bourdieu's "representation of society on a Cartesian plane with axes of economic and cultural capital" (p. 95).

```
                          High Cultural
                            Capital
                               ↑
                               |
          First Quadrant       |      Second Quadrant
                               |
        Low Economic Capital   |   High Economic Capital
        but High Cultural Capital | and High Cultural Capital
                               |
  Low Economic                 |                  High Economic
   Capital   ←─────────────────┼─────────────────→    Capital
                               |
          Third Quadrant       |      Fourth Quadrant
                               |
        Low Economic Capital   |   High Economic Capital
        and Low Cultural Capital | but Low Cultural Capital
                               |
                               ↓
                          Low Cultural
                            Capital
```
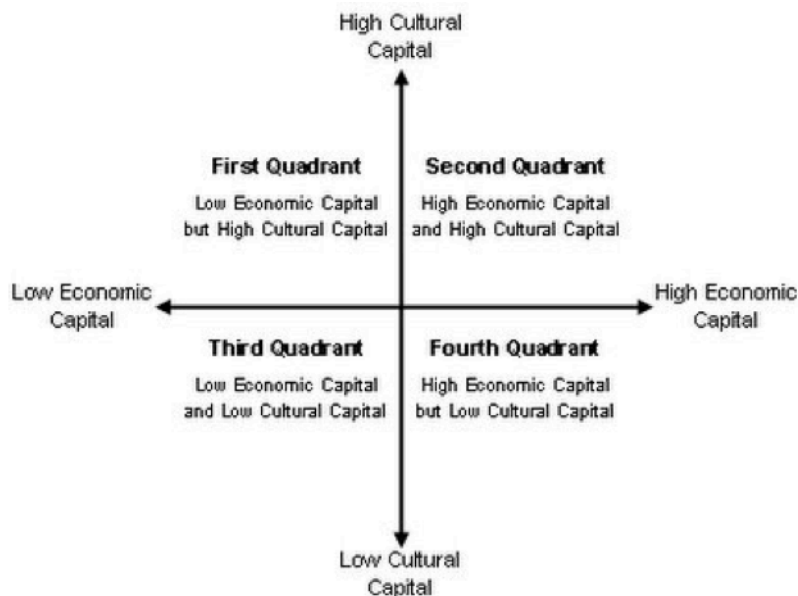
Figure 6. Bourdieu's economic and cultural capital (Noyes, 2004)

Cultural capital is most often transmitted to children through their experiences mostly guided by their parents and may include, but is not limited to, parent education level and family socioeconomic pressures, which cannot be controlled by education personnel (Bourdieu, 1986).

The amount of cultural capital students possess, evidenced in the family structure, determines their success rate in the educational system and often has an effect on students' successful negotiation of the high school transition and their mathematics achievement (Bourdieu, 1986). Parental attitudes regarding education have been found to outweigh all other factors affecting student achievement (McNeal, 1999; Melby & Conger, 1996; Owings & Magliaro, 1998). Furthermore, Ford (1993) affirmed demographic variables such as parents' education level, occupation, and employment status have had little relationship to students' commitment to academic achievement. But, that the family interpersonal experience involving attitudes, beliefs, and values about

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schooling have had a more direct effect on student perceptions regarding their achievement.

Parental support, a form of cultural capital, directly affects student adjustment to high school (Leonard, 2013). All families experience stressors such as family, work, and peer issues, as well as household concerns; these types of stressors are associated with students' increased perceptions of support. Parental support affects students' adjustment to school in that parents have more of an influence on student attitudes, behavior, and performance in school than their friends (Filer & Chang, 2008). In addition, students stay in school and achieve higher grades when there is evidence of support systems at home (Bornsheuer et al., 2011).

In a study by Newman, Myers, Newman, Lohman, and Smith (2000) examined parental support in high school through the effects of the Young Scholars Program (YSP) in Ohio consisting of 13 high performing (Grade Point Average [GPA] above 3.0) and nine low performing African American students from low-income families in nine different cities. Neither parent in the family had a college degree. Students were required to complete college preparatory classes, maintain a 3.0 or higher GPA, and participate in year-round YSP activities. Upon completion of the program, students were promised admission to The Ohio State University and a loan-free financial aid package. Interviews from all of the high performing students revealed that their mothers were supportive of their academic goals with only three of the low performing students thinking of their mother as supportive. Connell, Spencer, and Aber (1994), indicated cultural capital involving 10- to 16-year-old African American students had a profound effect on school performance and adjustment. Three independent samples of American youth were

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obtained from New York; Atlanta; and New York City, Baltimore, and Washington D.C., collectively. Data from questionnaires revealed family support, student resilience, self-esteem, and emotional security have more of an influence on school performance and adjustment than the influence of family or neighborhood economic conditions and a student's gender.

Another area of parental support with a high regard of influence is the participation in extracurricular activities. Many parents push their children to participate in these activities despite its possible hindrance to their achievement in school (Ashbourne & Andres, 2015). Middle-class parents in particular often seek out ways of distinguishing their children with involvement in extracurricular activities and displays of 'talent' and 'dedication' are viewed as important investments in their children (Shulruf, 2010). Numerous benefits have been associated with participation in extracurricular activities, including higher academic achievement, improved non-cognitive skills, greater life satisfaction and well-being, better career prospects, and lower instances of school dropout (Ashbourne & Andres, 2015).

Mathematics Achievement. Parental support has yielded strong positive effects on student mathematics achievement. Gutman (2006) found high-achieving high school seniors to have parents who emphasized and encouraged academic achievement. Levpuscek, Zupancic, and Socan (2013) surveyed middle school parents to assess their roles as motivators, providers, monitors, content advisers, and learning counselors with regard to their involvement in students' learning of mathematics and conducted regression analyses to examine how each of these roles contribute to students' mathematics success. All five parental roles as a whole significantly contributed to

predict students' mathematics achievement as measured by a proficiency test and performance-based assessment. O'Sullivan, Chen, and Fish (2014) report similar results and maintain the provision of structure by middle school parents is the most prevalent method of involvement in mathematics homework among low-income parents, regardless of achievement level. This provision contributes significantly to mathematics achievement whereas direct assistance and autonomy support did not predict student's grades. These findings suggest the importance of increasing parental support in helping their children succeed in school especially during the high school transition period. They also illustrate how students' achievement is dependent on the family structures that already exist in students' lives through their cultural capital. The degrees of cultural capital students possess help to shape their life course and determine their mathematics trajectory.

Social Structure

In addition to the family structures of life course theory, social structures students encounter also affect their high school transition and mathematics achievement throughout their mathematics course taking progression (Langenkamp, 2011). These social structures are formed by students' social capital, which refers to the various networks, both formal and informal, they encounter (Bourdieu, 1996). These networks are in addition to their families and can form around any number of supports such as peers, teachers, clubs, and athletics. Through social networks, students can obtain information, come to understand shared norms, and feel connections with others in the network; in essence, they form distinct communities of trust, which have an effect on their life course (Rosenfeld, Richman, & Bowen, 2000).

As students enter high school, social relationships can be difficult due to the loss of social support in school from teachers and peers often as a result from the change in the school context (Felner et al., 1982). Middle school often provides a more sheltered and structured environment than high school with support systems that may be different from or nonexistent in high school. Students may require a renegotiation of the school social context and a continuous improvisation of different skills to manage changing circumstances (Alshpaugh, 1998). As evident with the high school transition, these circumstances often pose uncertain, unpredictable, and stressful events. They often require a reliance on peer and teacher social support to realize acceptable courses of action dependent upon the situation.

Peer Social Support. When adolescents are faced with the stressors of high school, they will exhibit disturbing behavior, or they will use coping strategies showing constructive adaptation and gain an understanding of positive outcomes (success and adjustment) and negative outcomes (school failure) based on the adaptation utilized (Akos & Galassi, 2004; Cadwallader, Farmer, & Cairns, 2003; Letrillo & Miles, 2003; Little & Garber, 2004). Little and Garber (2004) affirmed students who displayed higher levels of interpersonal orientation were at greater risk of depressive symptoms following peer stressors during the ninth grade transition than those with low levels of interpersonal orientation.

Through interviews of 12 ninth grade students with and without learning disabilities, Letrillo and Miles (2003) explored student perceptions of the high school transition. This is one of the few qualitative studies of transition in the literature. Students with learning disabilities indicated they relied more on their peers and teachers to have a successful ninth grade year than the students without learning disabilities. Many students in both groups felt that just talking to older friends and siblings helped them understand life in high school. Benson (2009) also

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expressed this finding as a support in that students perceived the most help for their transition was from high school students rather than adults. Nevertheless, no matter what the status of a student upon the transition to high school, in their study of the effects of the high school transition, Cadwallader, Farmer, & Cairns (2003) found all students experienced increased difficulties in social adjustment during the high school transition. Using a prodigal analysis, a procedure specifically intended to identify developmental pathways of individuals whose social adaptations changed over time, the transition was found to be a challenge for all students and even a setback for some.

In their study of student, parent, and teacher perceptions of the high school transition, Akos and Galassi (2004) reported that students viewed social support as a major concern and all three groups felt making new friends was one of the top priorities when entering high school. Spending time with old and new friends was important to students to get adjusted to or to feel more comfortable in their new school, and teachers noted that students who adjust well to the transition have an active and balanced social life. Teachers suggest having social activities on campus the summer before the transition to aid in easing student fears of social support.

Teacher Social Support. Prevalent throughout research is the perceived lack of social support from high school teachers in comparison to middle school teachers (Croninger & Lee, 2001; Felner et al., 1982; Rosenfeld et al., 2000; Seidman et al., 1996). Teachers in high schools are considered less personal and more controlling (Barber & Olsen, 2004) whereas bonds formed with middle school teachers often serve as an important type of affective attachment for students (Croninger & Lee, 2001; Rosenfeld et al., 2000).

In light of trepidations students encounter as they transition to high school, teachers can display support for students by utilizing Freire's (1970) six elements he espouses shape teaching:

hope, love, faith, humility, mutual trust, and critical thinking. These elements have some relation to self-discovery and transformation, and when incorporated into lessons can play a vital role in helping students during the transitional time and throughout their mathematics course taking progressions. When students are offered opportunities in the classroom to engage in dialogue of communicative action, a transformative discourse, this allows them to learn by talking to others and often increases their social support (Morrow & Torres, 2002). Osterman (2000) posits the aforementioned can be accomplished using small group activities, team building, cooperative learning, and other small group environments to help foster students' need for a sense of community that is often less evident in high schools. Queen (2002) emphasized the importance of social support from high school teachers by advising they act as "agents of socialization" (p. 26) by developing strategies to meet students' socio-emotional needs which help to aid in their academic progress. Students from both uniform (single middle school to single high school) and mixed (multiple middle schools to a single high school) school district contexts with high levels of teacher bonding in middle school received higher grades in the first year of high school (Langenkamp, 2009).

Extracurricular Participation. Just as extracurricular participation is an area of parental support for students, it is also an area of social support. This participation has shown to promote more communicative action and provide social structure affecting the life course (Shulruf, 2010). Participation in extracurricular activities often gives students a sense of belonging that positively affects their motivation, effort, level of participation, and their achievement level (Crosnoe, Smith, & Leventhal, 2015). This feeling of belongingness may be the only source of attachment to school for academically weak students (Shulruf, 2010). In addition, participation in these activities may further develop other skills such as organization and time management, foster

attitudinal changes, or bring about social adaptations that might otherwise not take place if not involved in the activity. Otherwise, students not involved in extracurricular activities may often feel isolated, ostracized, and disconnected (Crosnoe et al., 2015; Styron & Peasant, 2010).

Additionally, social support evidenced from extracurricular participation increases academic efficacy expectations among students with this involvement yielding higher student achievement (Morris, 2016). Despite participation in sports being a positive aspect with regard to the transition (Akos & Galassi, 2004) a majority of ninth grade students are less involved in extracurricular activities in comparison to eighth grade (Crosnoe et al., 2015; Seidman, Allen, Aber, Mitchell, & Feinman, 1994).

Mathematics Achievement. Research demonstrates the relationship between these social structures of life course theory and mathematics achievement. In a foundational longitudinal study examining the transition to high school, Isakson and Jarvis (1999) assessed changes throughout the ninth grade year. Students identified the following stressors: concerns about extracurricular activities, peer conflicts, and problems with parents. These increased during the first semester of ninth grade and significantly decreased by the end of the year, but they did affect mathematics achievement resulting in a lower GPA. Social support from friends increased and was perceived to be due to the student's prior identification with the high school and the transition being from a K-8 to 9-12 grade school as opposed from a middle school to a high school. This type of transition where students from the same school all move to the same high school illustrates the positive relationship of social support from peers to an adjustment period. Students with a system of social support from peers are less likely to be depressed and anxious. Nevertheless, there can be a negative consequence associated with peer social support if the peer group does not recognize the importance of education and doing well academically (Isakson &

Jarvis, 1999). Thus peer influence is one of the principal reasons students give for dropping out of school (Catterall, 1998).

School Structure

The last structure of life course theory that interacts with the family and social structures of the theory is the structure of the high school. Characteristics of schools often contribute to the dissonance of the psychological stage and environment that impede the high school transition. Bornsheuer et al. (2011) emphasized the configuration of high schools often with no homeroom teachers and students' encounters with different sets of students in each class differ from their former school experiences. This structure can leave students feeling isolated and may establish a disconnect many students do not overcome throughout their life course in high school.

The Transition Project, a prevention strategy developed to reduce the change and complexity of the high school setting, examined the effects of school structure as students entered the high school transition period (Felner et al., 1982). Fifty-nine students from a freshman class of approximately 450 students were randomly selected and matched by sex, age, and ethnic background with a control group of 113 students. The experimental group was assigned exclusively to four homerooms where the homeroom teacher functioned as the primary administrative and counseling liaison between the students, parents, and the rest of the school. This teacher superseded the guidance counselor for his/her students by helping them choose classes, counseling them regarding school concerns, and contacting parents regarding absences. Also, before the school year began the teacher explained the project to parents and encouraged participation and contact with them throughout the school year. The other component of the project involved assigning all the experimental group of students so their four core academic classes were taken only with other students from the experimental group. This provided a high

degree of commonality and consistency among the students through a change in structure of the normative high school environment. The authors contend as a result of the structural change in the environment, the experimental group experienced significantly higher mathematics achievement, higher attendance, acquired more positive self-concepts, and exhibited attitudes of the school environment having clearer expectations and structure with higher levels of teacher support.

Such transition programs that are well planned reduce student apprehension and increase student belongingness to their new school. Simple requests such as a better understanding of the layout of the school were expressed as a concern from students (Benson, 2009) and could be easily addressed in transition programs. Akos and Galassi (2004) identified organizational changes such as riding the school bus and getting around the school as one of the most difficult aspects of being in high school for ninth graders.

High school students offered several suggestions that would help schools to ease the transition including providing more information and understanding about the high school, arranging better tours of the school, and sending high school students to middle schools to have conversation before the transition (Akos & Galassi, 2004; Benson, 2009). Parents also suggested better tours in addition to more middle school-high school collaboration and small group orientation. (Akos & Galassi, 2004). In their multi-site case study of a middle school and high school, Ellerbrock and Kiefer's (2013) primary goal was to explore student and school personnel voices of how the two schools were structured to support adolescents' needs. They studied controlled (scheduling, grouping of students and teachers, and the allocation of resources) and uncontrolled (nonacademic times of the school day) aspects of the school day in both the sending and receiving schools of the transition to examine their role in promoting responsive school

environments. Observations of students at both schools, as well as individual and focus group interviews with students and teachers, were utilized. At the sending middle school all teachers, students, and principal expressed the overall importance of interdisciplinary teaming and its corresponding components such as flexible block scheduling, homeroom, and extended teacher planning time. These aspects help to promote an intimate setting that support eighth grade students' needs. However, the absence of this teaming in high school, the absence of block scheduling, the number and nature of classes, and a lack of peer consistency in their classes was viewed by students as producing a sense of isolation when compared to middle school. Student schedules were a source of confusion for ninth grade students and teachers including how schedules were formed and changed. Thus, middle school structures had a positive impact as students transitioned to ninth grade, and they desired the personalization and connectedness they experienced at the middle school to be transferred at the high school.

Additionally, Neild (2009) contends administrative issues not resolved at the beginning of the school year hinder student adjustment to high school and have an adverse effect on student achievement. In his study of ninth graders, 40% reported a schedule change and 50% had a teacher change in at least one class. Mathematics achievement decreased for students who experienced such logistical and scheduling problems in the beginning of the school year.

The student transition to high school can serve as a turning point leading to the continuity or deflection of students' mathematics trajectory from their course progression (Elder, 1998). From the lens of life course theory, this study of mathematics course progressions provides an avenue for exploring mathematics achievement beyond the short-term investigations of the high school transition. In addition, this study provides insight and focus on student functioning past the immediate entrance to high school, as the life course is further shaped.

Interactions of Life Course, Mathematics Achievement, and Mathematics Course Taking

Progressions

Life course theory is embedded in relationships that constrain and support behavior (Elder, 1998). The many facets of both mathematics course taking progressions and mathematics achievement coincide with the individual life course and one's trajectories are interconnected with experiences encountered from each (Benner, 2011). The interrelation of all these experiences creates a dynamic collaborative process producing an outcome. The outcome in this study is student mathematics achievement (Langenkamp, 2011).

Life course theory is a way in which mathematics achievement can be observed through a marriage of sociological and demographical traditions within the environmental structures students encounter (Elder et al., 2003). Using the life course perspective to examine mathematics achievement throughout a student's high school transition period involves a view of this marriage as a tapestry of intertwined trajectories that come together and are influenced by different contexts (e.g., family, social, school) (Benner, 2011).

Students generally work out their life course in relation to the interlocking environmental structures of family, social, and school (Benner, 2011). Their navigation of these structures occur through established, institutionalized pathways, such as mathematics course taking progressions, students encounter throughout their high school transition period (Alabama State Department of Education, 2013a). Mathematics course progressions are determined as students are guided by the mathematics graduation requirements they must obtain, their prior mathematics achievement, and the school schedule imposed (Alabama State Department of Education, 2013b). All of these work in concert, and student achievement is constructed through the simultaneous contributions of all these combined (Benner, 2011; Elder et al., 2003).

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As student mathematics trajectories unfold, the transition to high school can serve as a turning point that leads to an increase or a decrease in achievement (Benner, 2011). Just as the aforementioned structures are interconnected and interdependent, so too are the individuals involved within the three structures (Benner, 2011; Elder, 1998). Students are surrounded by other people who contribute to and are affected by their educational experiences. The linked lives of family members, student, teachers, and peers within the social spaces encountered can be sources of support or strain which can promote an increase or a decrease in achievement levels (Benner, 2011).

Students shape and are shaped by their contextual environment. What happens to a student in their daily life, how they actively and passively interact with their environment, and what is going on in school and out of school, come together to constitute a complex attainment of mathematics achievement (Crosnoe, 2009). Because the life course perspective focuses attention on this interaction of individual people with their contextual environments, it provides a conceptual language to help describe the effect of mathematics course taking progressions on mathematics achievement throughout the high school transition period. Furthermore, it helps to expand the focus of educational research away from purely academic and institutional factors, statuses, and processes to consider the ways in which educational experiences are entangled with other life experiences (Crosnoe & Johnson, 2011).

Summary

According to researchers, as students enter high school and begin their mathematics course progression, the ninth grade year determines which students will prevail and which will fail to finish high school (Akos & Galassi, 2004; Alspaugh, 1998, 2000; Langenkamp, 2009; Rice, 2001; Smith, 2006)), particularly with respect to success in algebra (Clotfelter et al., 2015;

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Domina et al., 2014; Liang et al., 2012; Williams et al., 2011). Due to the increase of high school coursework so that students are college- and career-ready at graduation, it is necessary for schools to examine the transition to high school as a part of student mathematics course taking progression and the effect the transition will have on students' mathematics trajectories and achievement. According to the 2013 National Assessment of Educational Progress (U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, 2013), only 35% of students entered high school with adequate math proficiency.

Students with inadequate academic preparation face the greatest risk of course failure (Neild, 2009). This achievement concern is paramount but must be considered through all the structures of students' lives they bring to high school with them (Benner, 2011). The family, social, and school structures of a student's life course must be investigated in tandem with their transition to high school and the mathematics course taking progressions they follow to determine the potential impact on students' mathematics achievement. Furthermore, the manner with which students manage these structures and the high school transition can have lasting implications for their subsequent mathematics trajectory, whether they negotiate the transition with ease and accumulate advantage or whether it is a disruptive, accumulating disadvantage.

By employing an explanatory sequential mixed methods design, mathematics achievement will first be examined through standardized test performance. This will be followed by an examination of achievement concerns through student voices sharing their experiences of their high school transition period. This will address the lack of literature describing students' experiences of the high school transition period and the trajectory they followed throughout their high school mathematics course taking progression. Furthermore, it will add to block scheduling

literature by comparing mathematics achievement on an intensive and an alternating block schedule.

This study attempts to broaden the lens on the effects different mathematics course taking progressions have on student mathematics achievement throughout the high school transition period. Moreover, by recognizing the importance of students' experiences and how these experiences shape their mathematics trajectory, as well as how their support structures influence their mathematics achievement, the multi-dimensional construct of life course theory offers a different perspective of how students navigate the high school transition.

In the next chapter, a plan will be presented to explore the high school transition period through the mathematics course progression students followed at two different high schools and to determine if there is a difference in mathematics achievement between them. Briefly, the plan is to examine eighth grade ACT Explore Mathematics results and the ACT QualityCore Algebra 1 End of Course Test (EOCT) from both groups after successful completion of the high school algebra requirement and the eleventh grade administration of the ACT Mathematics Test. From this quantitative data, a purposive sample will be selected to interview students from both schools to gain the perspective of the experiences of students as they have transitioned through high school and their mathematics course progression.

CHAPTER THREE

METHODOLOGY

The purpose of this explanatory sequential mixed methods study was twofold. First, through the quantitative phase, the study examined mathematics achievement throughout the high school transition period at two different high schools employing different mathematics course progressions. Second, through the qualitative phase, the study investigated student reflections of their experiences as they transitioned to high school and their subsequent mathematics trajectory. The study offers insight into the relationship between mathematics course progressions and achievement with respect to the high school transition and beyond. This chapter has been divided into four parts. The first part provides the background of the researcher, the second section describes the mixed method design, which includes an in-depth discussion about the explanatory sequential design, the research questions comprise the third section, and the last section provides explicit details regarding the design of the study.

Background of Researcher

The genesis of this study originated five years ago with the onset of the Common Core State Standards for Mathematics (CCSS-M). These new standards spawned new graduation requirements in the state of Alabama. As the mathematics department chairperson and teacher in my school district's larger high school (School 1), I have taught Algebra A and Algebra B classes every day each semester for the past five years since this program's implementation. Previously at the same high school, I have taught Algebra A on a 50-minute, seven-period

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schedule as well as the Algebraic Connections course on the same schedule. Due to my prior experience and my current position, I have taught and am familiar with all mathematics courses in secondary education (7-12) through Calculus with the exception of a higher-level statistics course such as AP Statistics. In addition to my classroom responsibilities, I have also held many leadership positions within my school as well as throughout the school district.

After discovering our sister high school in the district chose a different mathematics progression for their Algebra A/B students, my interest was intrigued between the two approaches. Upon examination of literature regarding the high school transition and mathematics student achievement, I found a lack of literature regarding a relationship between the entities, especially a lack of qualitative studies in regard to the high school transition. Therefore, these circumstances facilitated my desire to conduct this research to benefit our school district while aiding the mathematics education research field.

Mixed Methods

The complexity of research problems often requires answers beyond what a single quantitative study reveals through numbers or what a single qualitative study reveals through words. Due to this complexity, research designs began to include mixed methods in the late 1980s to allow for "multiple forms of evidence to document and inform the research problems" especially for audiences in applied areas such as policy makers and practitioners (Creswell & Plano Clark, 2011, p. 21). Many definitions for mixed methods have emerged each with varying foci. Greene, Caracelli, and Graham (1989) emphasized methods and philosophy with one of the first definitions stating mixed methods designs are "those that include at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words), where neither type of method is inherently linked to any particular inquiry paradigm" (p. 256).

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Methodology was the focus of Tashakkori and Teddlie's definition in 1998. And in 2007, three more definitions emerged: a) Johnson, Onwuegbuzie, and Turner (2007) focused on qualitative and quantitative research and purpose; b) Greene (2007) on multiple ways of seeing, hearing, and making sense of the social world; and c) Creswell and Plano Clark retreating to the first focus of Greene et al. (1989), methods and philosophy. A more recent definition by Creswell and Plano Clark (2011) combine methods, philosophy, and design by emphasizing the key components they feel should be included in designing and conducting a mixed methods study:

- collects and analyzes persuasively and rigorously both qualitative and quantitative data (based on research questions);

- mixes (or integrates or links) the two forms of data concurrently by combining them (or merging them), sequentially by having one build on the other, or embedding one within the other;

- gives priority to one or to both forms of data (in terms of what the research emphasizes);

- uses these procedures in a single study or in multiple phases of a program of study;

- frames these procedures within philosophical worldviews and theoretical lenses; and

- combines the procedures into specific research designs that direct the plan for conducting the study (p. 5).

These definitions have materialized from five stages of development of the mixed methods research processes as declared by Creswell and Plano Clark (2011). The *formative period* for mixed methods began in the psychology field in the 1950s and continued up until the 1980s. In the 1980s and 1990s, researchers began the *paradigm debate period* with purists arguing qualitative and quantitative philosophical assumptions could not be combined, situationalists who adapted their methods to the situation, and pragmatists who used multiple

paradigms to address research problems. Continuing up to 2000, types of mixed methods designs began to surface in the *procedural developmental period* as specific methods of data collection, analysis, research designs, and the purposes for conducting a mixed methods study began to be provided. Throughout the early 2000s, a period of *advocacy and expansion* resulted in mixed methods research becoming a separate methodology and has extended to many disciplines and countries. Finally, in the early 2010s mixed methods researchers began a *reflective period*, assessing the field and providing constructive criticism regarding the emergence of mixed methods.

As with all research designs advantages and disadvantages occur in utilizing the different approaches. Before employing a mixed methods design the researcher must be skilled in both methods, make sure the approach is feasible with the time and resources available, and be able to convince others the value of the approach (Creswell & Plano Clark, 2011). Teddlie and Tashakkori (2009) proclaim a mixed methods study is *superior* to a single approach because using both approaches allows for addressing confirmatory and exploratory questions simultaneously, provides for stronger inferences, and gives a greater variety of differing views. Creswell and Plano Clark (2011) posit the most prominent advantage of utilizing mixed methods is that the use of both quantitative and qualitative methods often offset their weaknesses when used alone. Quantitative methods offer an elimination of bias often perceived in qualitative methods and qualitative methods offer an understanding of the context through the voices of the participants. When used in concert, quantitative and qualitative methods complement each other, allowing for a more robust analysis, taking advantage of the strengths of each which can yield richer, more valid, and more reliable results (Green, Caracelli, & Graham, 1989; Tashakkori & Teddlie, 1998; Creswell & Plano Clark, 2011).

Not all research problems fit a mixed methods design but when used it is suggested that justification be provided. Creswell and Plano Clark (2011) advocate for any research study, the methods used fit the research problem and thus provide six different research problems befit for mixed methods designs. Mixed methods was chosen for this study using the justification that a need exists to gain an enhanced understanding of mathematics student achievement (a quantitative measure) of different course progressions through the examination of student experiences (a qualitative measure) and the mathematics trajectory formed as a result.

Explanatory Sequential Design

Like qualitative and quantitative research approaches, mixed methods research encompasses many different designs classified by different disciplines (Creswell & Plano Clark, 2011). Tashakkori and Teddlie (1998) developed eight different mixed model designs useful in educational research. In 2003, Creswell, Plano Clark, Gutmann, and Hanson identified two categories of the most often used mixed educational research designs, which include three sequential and three concurrent designs and in 2011, Creswell and Plano Clark further refined these divisions into convergent, explanatory, exploratory, embedded, transformative, and multiphase designs. The mixed methods explanatory sequential design is one of these designs and has been used frequently by educational researchers. It begins with a strong quantitative orientation where quantitative data are collected and analyzed followed by qualitative data collection and analysis, representing two consecutive phases within one study. Thus, the qualitative results help to explain the initial quantitative results in more depth, hoping to associate the two different data sets.

The explanatory sequential design seems to be direct and straightforward; however, it is often not easy to implement. Certain methodological issues must be considered. Such issues

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include the often-lengthy amount of time required to execute both phases and the difficulty

obtaining institutional review board (IRB) approval because of a lack of specificity in how

participants will be selected for the qualitative phase. Issues regarding data and sampling involve

deciding which quantitative results need to be further explained, who to sample in the qualitative

phase, and the priority or weight to give to the quantitative and qualitative data collection and

analysis. Finally, it must be determined when and what stage or stages in the research process at

which the phases connect and when the results are integrated (Creswell et al., 2003; Creswell &

Plano Clark, 2011).

The purpose of an explanatory sequential design method is to use the quantitative data by

selecting significant results and strong predictors to decide what needs to be further explained.

This explanation can then be provided with the use of the qualitative data (Creswell & Plano

Clark, 2011). Such a purpose involves answering exploratory questions in the quantitative phase

and confirmatory questions in the qualitative phase (Teddlie & Tashakkori, 2009).

The quantitative and qualitative strands of an explanatory sequential mixed methods

design illustrate the meta-inferential nature of the process as shown in Figure 8 (Teddlie and

Tashakkori (2009). Each quantitative and qualitative strand contain the same stages but the

diagonal arrow from 'quantitative inferences' to the 'conceptualization stage' of the qualitative

strand displays how the results from the quantitative strand develop and plan the qualitative

strand of the study.
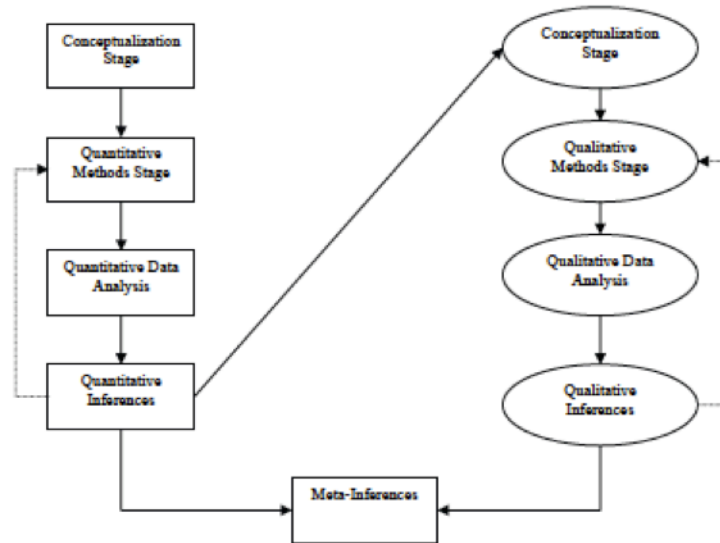
Figure 7. Explanatory mixed methods design. Teddlie and Tashakkori (2009)

This study was framed using an explanatory sequential mixed methods design. The quantitative, numeric data from three achievement tests was collected first. The goal of the quantitative phase was to determine if there was a difference in mathematics achievement between the two schools utilizing different mathematics progressions for Algebra A/B students and to allow for purposefully selecting informants for the second phase. In the second phase, a qualitative approach was used to collect text data through individual semi-structured interviews and documents to help explain what socio-ecological supports may be significant predictors of an increase in students' mathematics achievement. The rationale for this approach is that the quantitative data and results provide a general picture of the research problem, while the qualitative data and its analysis refine and explain those statistical results by exploring participants' experiences and views in more depth.

Research Questions

The quantitative phase of this mixed methods research included two research questions, one question for the qualitative phase, as well as a central question requiring a mixed methods design. They included the following:

Central Question

1. How does a different mathematics course progression impact students' high school transition and their subsequent mathematics achievement throughout high school?

Quantitative Research Questions

1. Is there a difference in mathematics achievement at the end of the Algebra A and Algebra B courses, as measured by test scores, for students who completed the courses every day in two semesters (one year) and students who completed the courses every other day in four semesters (two years)?

2. What effect did an extra mathematics course (Algebraic Connections) have on students' mathematics achievement as measured by the ACT?

Qualitative Research Question

1. What social-ecological supports might be leveraged to support an increase of students' mathematics achievement throughout the high school transition period?

Mixed Methods Research Question

1. In what ways do the qualitative interview data reporting the experiences of high school seniors about their high school transition and the mathematics trajectory the transition shaped, help to explain the quantitative results about mathematics achievement as reported from three achievement tests?

Quantitative Strand

The quantitative portion of this study focused on using district-level measures of student mathematics achievement in two high schools in an Alabama school district. The eighth grade ACT Explore Mathematics Test was used to examine students' prior achievement before entering high school. The ACT QualityCore Algebra 1 End of Course Test (EOCT) examined student achievement during the transition period. Long-term achievement was observed through the ACT Mathematics Test at the end of the eleventh grade.

Table 3

Achievement Test Administration - Comparison by School

Grade	School 1	School 2
8	ACT Explore Mathematics Test	ACT Explore Mathematics Test
9	ACT QualityCore Algebra 1 EOCT	
10		ACT QualityCore Algebra 1 EOCT
11	ACT Mathematics Test	ACT Mathematics Test

Participants

The setting for the study was a large public school district in Alabama; the school district is in a suburban city with a population of 55,683 according the 2010 census. Other 2010 estimates for the city included that 23.1% of the population held a bachelor's degree or higher and the median household income was $42,867. The 2010 demographic estimates for the city are reported in Table 4. The demographics for the school district and the schools used in the research for the 2015-2016 school year are reported in Table 5.

Table 4

City Population Demographics, 2010 Estimates

Demographic Category	Percentage of Total
African-American	21.7
Latino	12.4
White	62.9
Asian	0.9

Note. Estimated population 55,683

Table 5

District and School Statistics

Characteristic	District	School 1	School 2
Enrollment	8428	1438	978
Free and/or Reduced Lunch	55.5%	55.5%	55.8%
African-American	31.5%	37.0%	30.9%
Latino	24.0%	21.1%	18.6%
White	40.0%	39.2%	46.9%
Asian	1.3%	0.9%	0%
AP Enrollment	9.5%	8.0%	11.7%
Graduation Rate	86%	87%	86%

Note. Statistics for 2015-2016 school year.

The participants for the study included first-time ninth graders enrolled in Algebra A at the beginning of the 2012-2013 school year whose achievement data was available for all three quantitative measures described previously. School 1 had a total of 218 Algebra A students, which was about half of the total ninth grade population of 432. Due to retention, students leaving the school over the course of the three-year transition period, and EOCT scores missing for some students, data for all three achievement tests was only obtainable for 105 students. School 2 had a total of 88 Algebra A students, which was below half of the total ninth grade population of 254. Data was only obtainable for 48 of the School 2 students for the same reasons as School 1. These sample sizes (105 in School 1 and 48 in School 2) have been deemed sufficient according to Field (2013). He affirms a sample size of 30 is a widely accepted value

for the central limit theorem to effectively be applied to the data in which normality may be assumed. Furthermore, for a regression model, when fewer than 20 predictors are utilized, a smaller sample size is acceptable. Demographics for the participants in each school are reported in Table 6.

Table 6

Participant Demographics

Characteristic	School 1	School 2
Total Algebra A Student Population	218	88
No. of Participants	105	48
Free and/or Reduced Lunch	71.4%	71.5%
African-American	52.4%	50%
Latino	21.9%	20.8%
White	25.7%	29.2%
Asian	--	--

Upon comparison of the district and school demographics and the participant demographics, a noticed discrepancy exists. These data support research of the achievement gap that exists of students from socioeconomically disadvantaged backgrounds (National Research Council, 2009). Students from families with low socioeconomic status, on average, score about one half standard deviation below higher socioeconomic status students on standardized measures of academic achievement (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Crosnoe, 2009; Duncan & Magnuson, 2005). Because Algebra A and Algebra B courses are the lowest academic level mathematics courses offered at these high schools, it is at these low-level courses the achievement gap is most evident.

Data Collection

Before any data were collected, permission was obtained to conduct the study by the superintendent of the school district (Appendix C) and included with the application to the

Institutional Review Board (IRB). After permission was received from the IRB (Appendix D), data was collected from the district testing and data coordinator. Mathematics achievement tests scores were obtained from the ACT Explore Math Test, ACT QualityCore Algebra 1 End of Course Test (EOCT), and the ACT Mathematics Test.

The ACT Explore Math Test is a 30-minute, 30 question, multiple-choice test that measures mathematical reasoning, focusing on a student's ability to reason in math as opposed to only procedural skills. Questions cover pre-algebra, algebra, geometry, and statistics and probability. The ACT Explore (given in eighth grade) was designed as the starting point of a long-term assessment system culminating with the ACT (given in eleventh grade). This test shows students' strengths and weaknesses and compares students to others who have also taken the ACT Explore. Scores on the ACT Explore are based on the number of correct responses and converted to a score that ranges between 1 (the lowest score the student can receive) and 25 (the highest score a student can receive). This score also provides a predicted or estimated score range for the ACT to determine if students need to alter their coursework in order to obtain additional skills in preparation for college (ACT, 2015a). Both cohorts took the ACT Explore near the end of eighth grade. To date the ACT Explore has now been replaced by the ACT Aspire, which would prevent a full replication study with the quantitative instruments of this study.

The EOCT is a standards-based assessment constructed on the ACT QualityCore high school course standards, which are fairly well aligned with the CCSS-M and the ACT College- and Career-Readiness Standards (ACT, 2015b). Furthermore, it includes problem-based questions in academic and real-world contexts measuring learning outcomes students should acquire to become college- and career-ready (ACT, 2015c). The test items are distributed across

different mathematics categories and use Webb's (2002) depth-of-knowledge (DOK) levels to describe the thinking processes assessed by the test (ACT QualityCore, 2011). There are two modules of the EOCT, either two 35-38 item multiple-choice components or one 35-38 item multiple-choice component combined with a constructed-response component. Converting raw scores to scale scores with a range from 125 to 175 provides the EOCT score. Both cohorts took the two multiple-choice component assessments at the completion of the Algebra B portion of Algebra 1.

The ACT Mathematics Test is one subject area test in a national college admissions assessment evaluating mathematical skills from Pre-Algebra, Elementary Algebra, Intermediate Algebra, Coordinate Geometry, Plane Geometry, and Trigonometry. These are skills students have typically acquired in mathematics courses through twelfth grade. It is a 60-minute, 60 question multiple-choice test in which all questions necessitate reasoning skills to solve practical mathematics problems that span middle grades mathematics content through Algebra 2 with a small number of trigonometry questions. Twenty-three percent of the test is Pre-Algebra content, 17% Elementary Algebra, 15% Intermediate Algebra, 15% Coordinate Geometry, 23% Plane Geometry, and seven percent Trigonometry. Just as the ACT Explore, ACT scores are based on the number of correct responses and converted to a score that ranges from 1 to 36 (ACT, 2015d). All students in both cohorts took the ACT Mathematics Test in April of their junior year. This was the state board of education administration of the test taken during a school day on each school campus.

Data Analysis

Quantitative Research Question One. The first quantitative goal of the research study was to determine if a statistically significant difference existed between the mathematics

achievement of students in the two schools after completion of the Algebra A and Algebra B courses while controlling for prior achievement with the ACT Explore eighth grade assessment. To examine this, two statistical procedures were performed: independent samples *t*-test and regression analysis. Two independent samples *t*-tests were used, one to determine if group differences existed prior to the different course progressions and another to determine if group differences existed after the different course progressions. A regression analysis was performed to control for prior differences and determine the impact of the course progressions.

 Independent samples t-tests. First, two different independent samples *t*-tests were conducted to assess if differences existed on the ACT Explore Mathematics Test (at the end of eighth grade) and the ACT QualiyCore Algebra 1 EOCT (at the completion of the Algebra B course) by school. An independent samples *t*-test is the appropriate statistical test when the purpose of the research is to assess if differences occur on a continuous dependent variable by a dichotomous (two groups) independent variable (Field, 2013). The continuous dependent variables for each *t*-test are the Explore Test and the EOCT with the dichotomous independent variable being the school. The data was observed for bias by determining if outliers existed and the assumptions of normality and homogeneity of variance were assessed. Normality, for significance tests, assumes that the sampling distribution of means is normally distributed and was assessed using the Shapiro-Wilk's test and an examination of the quantiles on a Q-Q plot. Homogeneity of variance assumes that both groups have equal error variance and was assessed using Levene's Test for the Equality of Error Variances. The *t*-test was two-tailed with alpha levels set at $p < 0.05$. This ensures a 95% certainty that the relationships did not occur by chance (Field, 2013).

Simple linear regressions. Second, two simple linear regressions were conducted to investigate whether or not the ACT Explore Mathematics Test predicted the ACT QualityCore Algebra 1 EOCT at each school. A linear regression is an appropriate analysis when the goal of research is to assess the extent of a relationship between a dichotomous or interval/ratio predictor variable on an interval/ratio criterion variable (Field, 2013). For this regression, the predictor variable was the ACT Explore Mathematics Test and the criterion variable was the ACT QualityCore Algebra 1 EOCT. Linear regression fits a statistical model to the data in the form of a straight line and develops the equation of that line, which is the line that best summarizes the pattern of the data or the model (Field, 2013). The following regression equation (main effects model) was used:

$y_i = b_0 + b_1 X_i + \varepsilon_i$

(ACT QualityCore Algebra 1 EOCT)$_i = b_0 + b_1$(ACT Explore Mathematics Test)$_i + \varepsilon_i$

A quantity called R^2, the correlation coefficient of determination, was used to represent the amount of variance in the EOCT score explained by the model relative to how much variance occurred at the onset. The *F*-ratio was used to assess whether the Explore prior achievement scores are a good predictor of achievement on the EOCT at each school. The *t*-test was used to determine the significance of the ACT Explore, and beta coefficients were used to determine the magnitude and direction of the relationship. For statistically significant models, for every one-unit increase in the predictor variable, the criterion variable will increase or decrease by the number of unstandardized beta coefficients. The generalizability of the model was assessed by examining the standardized residuals and if any influential cases were evident.

The assumptions of a linear regression—linearity, homoscedasticity, independence, and normality—were also assessed. Linearity assumes a straight line relationship between the

predictor variable and the criterion variable, homoscedasticity assumes that scores are normally

distributed about the regression line; independence assumes that the errors in the model are not

related to each other, and normality assumes that the sampling distribution of means is normally

distributed. Linearity and homoscedasticity were assessed by examination of scatter plots of the

residuals, independence by the Durbin-Watson test, and normality by an examination of residuals

on a histogram and P-P plot.

 Multiple linear regression. A multiple linear regression analysis followed the simple

regressions to determine if the ACT Explore, school attended, race, and lunch status were

predictors of the EOCT score. A multiple linear regression assesses the relationship among a set

of dichotomous or interval/ratio predictor variables on an interval/ratio criterion variable. In this

analysis, the predictor variables included the ACT Explore test score, the school students

attended, race, and lunch status. While the criterion variable was the EOCT score, the following

regression equation (main effects model) was used:

 $y_i = b_0 + (b_1 X_i + b_2 X_{2i} + b_3 X_{3i} + b_4 X_{4i}) + \varepsilon_i$

 $(\text{ACT QualityCore Algebra 1 EOCT})_i = b_0 + b_1(\text{ACT Explore Mathematics Test})_i +$

 $b_2(\text{school attended})_{2i} + b_3(\text{race})_{3i} + b_4(\text{lunch status})_{4i} + \varepsilon_i$

 Standard multiple linear regression was used; which enters all independent variables

(predictors) simultaneously into the model. Variables were evaluated by what they add to the

prediction of the dependent variable (criterion), which is different from the predictability

afforded by the other predictors in the model. The *F*-ratio was used to assess whether the set of

independent variables collectively predicts the dependent variable. *R*-squared—the correlation

coefficient of determination—was reported and used to determine how much variance in the

dependent variable can be accounted for by the set of independent variables. The *t*-test tested the

null hypothesis and determined if the value of the beta coefficients was zero. Its significance gives confidence that the beta coefficients are significantly different from zero and that each predictor contributes significantly to the dependent variable. In addition, the beta coefficients evaluated the extent of prediction for each independent variable. For significant predictors, for every one-unit increase in the predictor variable, the criterion variable will increase or decrease by the number of unstandardized beta coefficients.

All assumptions from the previous regression were assessed—linearity, homoscedasticity, independence, and normality—with the addition of multicollinearity, which determines if the predictor variables are too correlated with each other. Multicollinearity was assessed using Variance Inflation Factors (VIF). If the largest VIF value is over 10 or the average VIF is considerably greater than one, multicollinearity may exist (Field, 2013).

The null research hypotheses for the first quantitative research question were the following:

$H_0 1$: There is no significant difference between School 1 and School 2 with respect to the eighth grade ACT Explore Mathematics Test.

$H_0 2$: There is no significant difference between School 1 and School 2 with respect to the ACT QualityCore Algebra 1 EOCT.

$H_0 3$: The ACT Explore Mathematics Test scores, at each school, do not predict the school's ACT QualityCore Algebra 1 EOCT.

$H_0 4$: The ACT Explore score, school attended, race, and lunch status do not predict the ACT QualityCore Algebra 1 EOCT.

Quantitative Research Question Two. The second quantitative goal of the research study was to determine if an extra mathematics course had an effect on student mathematics

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achievement at the end of eleventh grade measured by the ACT. This extra mathematics course was the Algebraic Connections course used in School 1 and not in School 2 accounting for the different mathematics course progressions between the schools along with the Algebra A/B course meeting every day as opposed to every other day in School 2. Many different statistical procedures were performed to make this determination.

Independent samples t-test. First, an independent samples *t*-test assessed if differences existed on the ACT Mathematics Test by school. All of the assumptions explained in question one for a *t*-test and regression were assessed.

One-way analysis of covariance (ANCOVA). Next, to investigate the effect of the treatment (extra Carnegie credit in Mathematics) in School 1 on student mathematics achievement, a one-way ANCOVA was conducted to evaluate differences between groups on a single dependent variable after controlling for the effects of a covariate. An ANCOVA is used to test the main effects of a categorical independent variable on a continuous dependent variable while controlling for the effect of other continuous variables, which co-vary with the dependent. For this ANCOVA, there is one independent variable with two groups (School 1 and School 2), the continuous dependent variable (ACT Mathematics Test score), and the control variable (prior achievement covariate), which is the eighth grade ACT Explore score. This covariate was chosen specifically because of its possible effects on the ACT. The purpose of the ANCOVA is to partial-out the effects of this variable on the dependent variable to determine if the effects are strictly due to the covariate or if the differences can be attributed to the treatment independent of the effects of the covariate. (Field, 2013).

The *F*-test was used to assess the main and interaction effects. The *F*-test is the between-groups variance (mean square) divided by the within-groups variance (mean square). When the *F*

value is greater than 1, more variation occurs between groups than within groups. When this occurs, the computed *p*-value is small and a significant relationship exists. If significance is found, comparison of the original and adjusted group means can provide information about the role of the covariate. Because predictable variances known to be associated with the dependent variable are removed from the error term, ANCOVA increases the power of the *F*-test for the main effect or interaction. Essentially, it removes the undesirable variance in the dependent variable. Besides examining the homogeneity of regression slopes to determine the relationship between the covariate and the dependent variable, which should be linear, the assumptions of ANCOVA are the same as the independent *t*-test (Field, 2013).

Analysis of variance. (ANOVA). Another way to consider the effect of the extra mathematics course in School 1 was to conduct another ANOVA to determine if there was a significant difference between the mean ACT mathematics scores based on the number of courses students took from ninth grade to eleventh grade. Sixty-percent of students in School 1 took four courses (Algebra A, Algebra B, Geometry, and Algebraic Connections). The remaining 40% earned credit in three or less courses due to failure of a course. At School 2, 96% of the students took three courses (Algebra A, Algebra B, and Geometry), thus four percent earned credit in two or less courses due to failure of a course.

Multiple linear regression. Lastly, a second multiple regression analysis was performed to determine if the ACT Explore, EOCT, the school students attended, the number of courses students took, race, and lunch status were predictors of the ACT Mathematics Test score. In this regression analysis, the predictor variables included the ACT Explore test, EOCT, the school students attended, the number of courses students took, race, and lunch status, while the criterion

variable was the ACT Mathematics Test. The following regression equation (main effects model):

$$y_i = b_0 + (b_1X_i + b_2X_{2i} + b_3X_{3i} + b_4X_{4i}) + \varepsilon_i$$

$$(\text{ACT Math Test})_i = b_0 + b_1(\text{ACT Explore})_i + b_2(\text{EOCT})_{2i} + b_3(\text{school})_{3i} + b_4(\text{no. of courses})_{4i} +$$

$$b_5(\text{race})_{5i} + b_6(\text{lunch status})_{6i} + \varepsilon_i$$

The same procedures were followed and all of the same assumptions assessed as with the previous multiple linear regression.

The null research hypotheses for the second quantitative research question were the following:

H_01: There is no significant difference between School 1 and School 2 with respect to the ACT Mathematics Test.

H_02: After controlling for the ACT Explore score, there are no differences on the ACT Mathematics score by school.

H_03: There is not a statistically significant difference in the means of the ACT Mathematics Test by the number of courses students took from ninth grade to eleventh grade.

H_04: The ACT Explore score, ACT QualityCore EOCT score, the school students attended, the number of courses students took, race, and lunch status do not predict the ACT Mathematics Test score.

The ACT suite of achievements tests provides the validity that is a concern in quantitative research. Creswell and Plano Clark (2011) emphasize two levels of validity: the validity of the instruments (content validity) and validity of the scores (criterion-related and construct validity). Content validity reviews items included in an instrument; criterion validity establishes if a data source relates to some external standard; and construct validity establishes whether a data source

measures what it is intended to measure. In regard to this validity, the test items in each of the ACT achievement tests are developed from the ACT College Readiness Standards (ACT, 2014). The mathematical domains from these standards thoroughly address all the six conceptual categories of the CCSS-M (ACT, 2010; National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010b). At the time of this study, mathematics teachers were under the mandate of the *2010 Alabama Course of Study Mathematics* (Alabama State Department of Education, 2010). The organization of this course of study was based upon the CCSS-M, hereunto; the mathematics classes at each school were to cover these standards.

Closely related to content, criterion, and construct validity is curricular and instructional validity. Curricular validity is a measure of how well test items represent the objectives of the curriculum (McClung, 1979) or how well test items reflect the actual curriculum. According to Madaus (2013), "curricular validity is evaluated by groups of curriculum/content experts who are asked to judge whether the content of the test is parallel to the curriculum objectives and whether the test and curricular emphases are in proper balance" (p. 16). While a measure of curricular validity is a measure of the theoretical validity of a test as an instrument to assess the achievement of students, instructional validity is an actual measure of whether schools are providing students with instruction in the knowledge and skills measured by the test (McClung, 1979). Due to the time required to verify curricular and instructional validity, as well as the availability of the researcher, data involving curricular and instructional validity were unobtainable.

With the presence of content, criterion, and construct validity and despite the verification of curricular and instructional validity, the ACT suite of achievement tests utilized in the study allow for quantifiable, non-biased results. These results provide a comparison between the

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schools in which teachers and administrators can assess areas they need to improve on for the students based on the differences found. Also, because of the tests being administered throughout the high school transition period, educators can see the progress students have made. Students will either show a decline or improvement, giving teachers insight into how to respond to their educational needs. In this study, it was the students who showed improvement from the quantitative results who were interviewed in the qualitative phase.

Qualitative Strand

In an explanatory sequential mixed methods design, the qualitative phase follows the often stronger quantitative data collection and analysis (Creswell & Plano Clark, 2011). The qualitative component uses the quantitative results to support the subsequent qualitative data collection, thus the qualitative data provides more detail about the quantitative results (Creswell & Plano Clark, 2011). This qualitative strand in the research study utilized generic qualitative research epitomized by Merriam (2009); its basis is to "seek to discover and understand a phenomenon, a process, or the perspectives and worldviews of the people involved" (p. 11). Furthermore, it helps to "understand the meaning people have constructed, that is, how people make sense of their world and the experiences they have in the world" (p. 13). It is categorical, less abstract, and has as a goal to give a straight descriptive summary of the data. The focus is to understand the experience or event. Through this qualitative research strand, I sought to understand how students whose mathematics achievement increased over their high school transition period perceive this time in eighth through eleventh grade by allowing them to explain their experiences specifically regarding the structures that influenced their mathematics trajectory and the impact these had on their mathematics achievement.

Data and Sampling

Plans for qualitative data collection in an explanatory sequential design are tentative because they evolve from the results of the quantitative phase. Creswell and Plano Clark (2011) state qualitative decisions include: deciding who the participants should be, what sample size to use, what quantitative results need to be further explored through the qualitative data, and how to select the participants to be studied in the qualitative follow-up. Since the explanatory design seeks to explain the initial, quantitative results, interviews were conducted in the qualitative phase. Interviews in qualitative research are considered asymmetrical in that the interviewer controls the interview. An interview is a dialogue that is conducted one-way, providing information to the researcher, based on the research purpose, and leading to the researcher's interpretations (Creswell, 2013).

Interviewees were chosen purposively through the examination of individual mathematics trajectory achievement data. First, students were selected based on an increase of five points or more from the eighth grade ACT Explore score to the eleventh grade ACT Mathematics Test score. From School 1 only 20 from the 105 performed with such increase and at School 2, 11 out of the 48. Then from these groups, students were sampled using criterion sampling (Creswell, 2013). Student selection was excluded based on the following criteria:

- students who had been to credit recovery or summer school for any course over the three year period (eight in School 1 and three in School 2),
- students who did not attend credit recovery or summer school but made up a failed class the next year altering their course progression (one in School 1),

- special education students (six from School 1 – three of these students also went to credit recovery; one from School 2 – this student also went to credit recovery),

- students whose course progression changed from the group after successful completion of the Algebra A/B courses (two from School 1), and

- students who either left the school and never returned (three from School 1 and three from School 2).

This elimination process yielded only four students from each school meeting these criteria.

The researcher at School 1 contacted each student individually to explain the study and asked if he/she were willing to participate. Three students consented and one declined due to school and work responsibilities. Students at School 2 were initially contacted via their guidance counselor to determine their willingness to participate. Shortly following, the researcher met with each student individually. As followed from School 1, three students consented and one declined due to the same reason as the School 1 student. Interview appointments were then made; letters of consent for their parents (Appendix E) and letters of assent (Appendix F) were sent home for signatures. Six interviews were conducted and transcribed resulting in about 152 pages of data in all. This small sample size is considered sufficient by Creswell and Plano Clark's (2011) recommendation that the researcher use a much smaller sample size for the qualitative phase of the study. Specifically, in phenomenological studies, Creswell (2013) recommends a minimum sample size of less than or equal to ten interviews, whereas Morse (1994) recommends greater than or equal to six. Furthermore, due to practical issues such as time available and choosing parallel samples from both schools using the aforementioned criteria, (Baker & Edwards, 2012; Onwuegbuzie & Collins, 2007) sample size was also limited in order to effectively compare the

two schools by using the same criteria for each. This strategy coincided with the logic of the qualitative research question, the qualitative method, and the mixed method design chosen for the study.

Other qualitative data included documents or artifacts collected and examined by the researcher. These artifacts included archival and demographic data from the school district databases, as well as student transcripts of each participant, which were observed in great detail to examine students' eighth grade through eleventh grade academic behavior. Webb, Campbell, Schwartz, and Sechrest (1966) affirmed these non-obtrusive data help to highlight human behaviors and provide additional insight into the lived experiences of research participants. In addition, they allow the researcher to be informed about the subjects (Goetz & LeCompte, 1984) before the interview process.

Interview Protocol

In order to answer the qualitative research question: what social-ecological supports might be leveraged to support an increase of students' mathematics achievement throughout the high school transition period, the interview was the primary method of qualitative data collection. The interview was conducted as a standardized open-ended interview with questions worded in a completely open-ended format where the exact wording and sequence of questions were determined in advance, and all interviewees were asked the same basic questions in the same order (Patton, 2002).

An interview protocol was established (See Appendix G) which served an organizational purpose and provided a record of information in the event recording devices did not work (Creswell, 2013). The content of the interview protocol was informed by the theoretical framework of the study, life course theory, through examination of the structural elements

students encounter and how these interact with students' mathematics trajectories and achievement. This mathematical achievement was evident after the collection of the quantitative data and the results from the first phase of the study. These results facilitated the design of the interview protocol. Because the goal of the qualitative phase was to explore and elaborate on the results of the statistical tests (Creswell & Plano Clark, 2007), the researcher wanted to understand why certain predictor variables contributed differently to models produced from the tests. Furthermore, to also determine how the transition to high school and the trajectories that followed, formed by the different mathematics course progression each school employed, impacted student mathematics achievement.

The results of the three different independent samples t-tests yielded no achievement differences in variances for two tests and a difference in one test. Likewise, the results of the linear regressions produced differing results for one test but not the other. Due to the discrepancy in differences at different times in students' mathematics trajectory, the interview protocol included probing questions to discover if experiences by students in their personal lives or at school provided any explanation for the differences. Hereunto, the quantitative results, answered by the two quantitative research questions, are explained in more detail through the qualitative interview data allowing for a better understanding of how the personal experiences of students match up to the quantitative results (Creswell & Plano Clark, 2013; Teddlie & Tashakkori, 2009).

Five different categories of questions explored students' lived experiences throughout the formation of their mathematics trajectory over the high school transition. Another group of questions was specific to each school and asked questions regarding having math class every day as opposed to every other day, as well as mathematics achievement throughout high school.

Finally, School 1 students were asked about the extra course they took, Algebraic Connections (Ma & Wilkins, 2007; Nomi & Allensworth, 2009; Silva, 2007). The questions involving the transition categories addressed the different factors of the high school transition and their important role throughout the transition as reported by other researchers (Crosnoe, 2009; Kramer, 1997a; Seidman et al., 1996). Subsequently, the final group of questions employed provided clarity to the results found from both quantitative research questions. The categories of questions included the following: (a) culture (family/home life), (b) eighth grade school year, (c) eighth grade mathematics, (d) transition to ninth grade, (e) ninth grade school year, (f) ninth grade mathematics, (g) math class structure, (h) math achievement through high school, and (i) the Algebraic Connections course.

The collection of the qualitative data from the six interviews helped to accumulate and generate a descriptive body of information regarding the high school transition and students' trajectory as they experienced their mathematics course progression. The intent was to discover what perspectives each student holds in relation to their lived experience and the meaning attached to the experience in regard to their mathematics achievement, discovering how Elder's second and fourth principles (the timing of transitions and how individuals respond to life events) shaped their life course due to their different experiences.

Data Analysis

Interview data were examined to arrive at themes. I chose to employ two coding methods from Saldaña (2013): the descriptive coding method for first cycle coding, followed by the pattern coding method for second cycle coding. Saldaña (2013) describes coding as "essence-capturing and essential elements of the research story that, when clustered together according to similarity and regularity (a pattern), they actively facilitate the development of categories and

thus analysis of their connections" (p. 8). Descriptive coding develops a categorized inventory, summary, or index of the data's contents by dividing the data into smaller units and assigning labels or categories to the data (Saldaña, 2013). Description is the foundation for qualitative inquiry, and its primary goal is to assist the reader to see what the researcher saw and hear what the researcher heard in general. It is foundational for second cycle coding and further analysis and interpretation (Wolcott, 1994). Student interviews were transcribed and descriptive coding was applied using NVivo for Mac 11.2.2 computer software. Data was segregated, grouped and regrouped into codes which were placed into categories based on the factors which impact achievement (cultural, social, school/procedural, academic), as well as students' eighth grade and high school experiences in and out of school. Each transcribed interview was entered into the program and read several times. Responses from each student were analyzed and the researcher placed text segments from each interview in one of the aforementioned categories.

Pattern codes are "explanatory or inferential codes, ones that identify an emergent theme, configuration, or explanation" (Saldaña, 2013; p. 210). They are "regularities" which group the summaries or categories from the first cycle coding into smaller themes or constructs and come in several forms including similarity, difference, frequency, sequence, correspondence, and causation (Hatch, 2002). Upon completion of the descriptive coding process, pattern codes were established by hand. The researcher reread all of the data from each category in the descriptive coding process and wrote each student's individual responses from each category separately. This narrative data was then examined and reread again several times to facilitate comparisons for the development of four themes specified in Chapter Four. The coding process utilized is shown in Figure 8.

Figure 8. Coding Process

DeSantis and Ugarriza (2000) proposed a definition for a theme: "A theme is an abstract entity that brings meaning and identity to a recurrent [patterned] experience and its variant manifestations. As such, a theme captures and unifies the nature or basis of the experience into a meaningful whole" (p. 362). Themes served to interpret student experiences and provided perspective for the findings or results in Chapter Four that offered answers to the qualitative research question.

In qualitative research, "there is more of a focus on validity than reliability to determine whether the account provided by the researcher and the participants is accurate, can be trusted, and is credible" (Creswell & Plano Clark, 2011, p. 211). Often described as verification, trustworthiness, or authentic, Creswell (2013) suggests the term *validation* and offers specific strategies in which this validation can be documented in the research process. These include prolonged engagement and persistent observation in the field, mostly involving trust building with participants; triangulation, by providing combinations and comparisons of multiple data sources, data collection and analysis procedures, and research methods; using a peer reviewer; providing negative case analysis when the evidence does not fit the pattern of a code or a theme; clarifying researcher bias from the inception of the study; utilizing member checking by allowing participants to review the findings and interpretations; and allowing for an external audit from an external source with no connection to the study.

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It is advised by Creswell (2013) that at least two validation strategies be employed in any given study. For the purposes of this study, due to my position within my school and the district, prolonged engagement and persistent observation are evident. Triangulation is manifested through the research methods employed. The use of both quantitative and qualitative methods provided a corroboration of the findings. Member checking was also implemented giving participants the opportunity to read all interview transcripts to verify accuracy and provide any further clarification. The researcher segmented each interview transcription based on the categories of questions on the interview protocol, explained these different parts of the transcription to the participants, and directed them to read the transcription as parts instead of a whole document. They were encouraged to make notes on the document and asked to respond if the descriptions were accurate, and if not, why. A follow-up group interview was scheduled with participants in each school a week later to examine and discuss responses as well as to check on the accuracy of the themes, interpretations, and conclusions of the researcher.

Procedural Issues in the Explanatory Sequential Design

In implementing any mixed methods design, the issues of interaction, priority, sequencing, and integration of the quantitative and qualitative strands must be considered. It must be determined if the approaches, quantitative and qualitative, will be independent from the other or a direct interaction exists. Priority should be established about the relative importance of each strand within the design as well as the sequencing of the data collection and analysis of both types of data. Finally, decisions regarding where and how to mix or integrate the two approaches must be determined. It is also helpful to develop an efficient way to visually represent all the components of the study design for a better conceptual understanding of the entire process and to aid in comprehension. The addressing of these issues will be guided by the purpose of the study,

the research questions, and the methodological discussions in the literature (Creswell & Plano

Clark, 2011; Teddlie & Tashakkori, 2009).

Interaction

The level of interaction refers to the extent to which the two strands are kept independent

or interact with each other. Greene (2007) noted an independent level of interaction when the

two strands are distinct, where questions, data collection, and data analysis of each approach are

kept separate. The two strands are mixed only in the overall interpretation at the end of the study.

Conversely, an interactive level of interaction involves a direct interaction of the two strands that

can occur before the final interpretation at different stages of the research process and in

different ways. This type of interaction is illustrative of the explanatory sequential design that

describes this study with qualitative data from interviews and used to explain quantitative

significant and non-significant findings.

Priority

Priority refers to which approach, quantitative or qualitative (or both) is given more

weight or importance throughout the data collection and analysis process in the study (Creswell

& Plano Clark, 2011; Greene et al., 1989). This decision may depend on researcher interest,

audience, or the emphasis of the study. In the explanatory sequential design, priority is most

often given to the quantitative strand because the quantitative data collection occurs first and

often represents the major aspect of the mixed methods data collection process. The qualitative

strand most often follows the quantitative strand and is usually the smaller component. However,

there are variants to the explanatory design where the priority may be given to the qualitative

data such as the participant-selection variant and the follow-up explanations variant (Creswell &

Plano Clark, 2011). Decisions regarding priority can be made before the data collection begins or later during the data collection and analysis process.

From the onset of the study, priority was given to the quantitative data collection and analysis using achievement results to identify and explain the difference in the two mathematics course progressions. This was influenced by the purpose of the study to determine how the progression as part of the transition affects mathematics achievement. These achievement results were obtained from three data sources and various statistical techniques. The goal of the qualitative strand was to explore and help explain the statistical results obtained in the quantitative strand. Through the development of codes and themes the qualitative data collection and analysis was used to determine the students' lived experiences as influenced by the high school transition and their subsequent mathematics achievement.

Implementation

Implementation (also referred to as timing or pacing) refers to whether the qualitative or quantitative data collection and analysis comes first, second, or concurrently (Creswell & Plano Clark, 2011). In the explanatory sequential design, a researcher first collects and analyzes the quantitative data, and the qualitative data are collected in the second phase of the study with the intention of explaining the results from the quantitative strand.

In this study the quantitative data was collected first using standardized test scores. The goal was to determine if a difference in mathematics achievement exists between the two groups experiencing the different mathematics course progressions and to allow for purposefully selecting student participants for the second phase of the study. The quantitative data and statistical results seek to provide a general understanding of the mathematics achievement of

each group and between the groups. The intent of the qualitative data and its analysis was to help further expound any significance in the different course progressions.

Integration

Integration refers to the stage or stages in the research process where the mixing or integration of the quantitative and qualitative methods occurs – during the design phase of the study, data collection, data analysis, or during interpretation of the findings (Creswell & Plano Clark, 2011; Teddlie & Tashakkori, 2009). In the explanatory sequential design the first phase informs or guides the data collection in the second phase, the two phases are typically connected when selecting the participants for the qualitative follow-up analysis based on the quantitative results from the first phase. Another connecting point might be the development of the interview protocol and the interpretation of the findings (Creswell & Plano Clark, 2011). Connection between the quantitative and qualitative strands in this study occurred during the intermediate stage in the research process in selection of the participants for the qualitative interviews and in developing the interview questions for the qualitative data collection based on the results of the quantitative strand.

Visual Model

A multi-strand format of mixed methods research, often including two or more strands, is difficult to understand without graphically representing the mixed methods procedures used in the study. The value of providing a visual model of the procedures has been expressed in the mixed methods literature (Creswell & Plano Clark, 2011; Teddlie & Tashakkori, 2009). A graphical representation of the mixed methods procedures helps to visualize the study design by showing the sequence of the data collection, the priority of both methods, and the connection and integration of the two strands within the study. It helps the researcher organize all the

components of the study and understand where adjustments or additions might be made. In addition, it facilitates comprehension of a mixed methods design. The visual model for this study is illustrated in Figure 9.

Phase	Procedure	Product
Quantitative Data Collection	• ACT Explore Math Test • ACT Quality Core Algebra 1 End of Course Test • The ACT Mathematics Test • (N =153; 2 groups)	• Numeric
Quantitative Data Analysis	• Data screening • Univariate • SPSS quan. Software v.22	• Descriptive statistics, missing data, linearity, homoscedasticity, normality, outliers • Independent-samples *t*-test • Simple regression • ANOVA • ANCOVA • Multiple regression
Case Selection; Interview Plan	• Purposefully selecting 3 participants from each group (N = 6) • Interview questions	• Cases (N = 6) • Interview protocol
Qualitative Data Collection	• Individual in-depth personal interviews with 6 participants	• Text data (interview transcripts and documents)
Qualitative Data Analysis	• Manage data • Read and reread • Describe, classify, and interpret data • Represent and visualize data	• Organize data into files • Descriptive coding • Categories • Pattern coding • Themes
Integration of the Quantitative and Qualitative Results	• Interpretation and explanation of the quantitative and qualitative results	• Discussion • Implications • Future research

Figure 9. Visual model of explanatory sequential mixed methods design. (Adapted from Creswell & Plano Clark, 2011.)

Conclusion

This explanatory sequential mixed methods study used a quantitative data collection strand in which data was obtained from test scores followed by a qualitative data collection strand in which data was obtained from interviews. The quantitative data collected allowed for a broad understanding of mathematics achievement between both groups following different mathematics course progressions while the qualitative follow-up allowed for an in-depth exploration of the high school transition for six students and the mathematics trajectory established through the different mathematics course progressions. An explanatory sequential mixed methods study is the best design for this study because it is best able to answer the research questions.

CHAPTER FOUR

STATISTICAL AND QUALITATIVE RESULTS

Mathematics course progressions can become very complex as students enter high school. The first mathematics course taken in the ninth grade has an effect on students' mathematics achievement throughout the rest of high school (Alsapaugh, 1998, 2000; Langenkamp, 2009; Rice, 2001; Smith, 2006). The first class determines the course progression students will take for the remainder of high school (Ma & Wilkins, 2007). This study provides a comparative analysis of two high schools' mathematics achievement that resulted from different mathematics course progressions. This achievement began with the transition to high school and the mathematics trajectory that the transition formed as well as how student experiences relate to these course progressions.

The purpose of this mixed methods study was twofold and therefore conducted in two phases. First, the quantitative phase of the study was given priority and determined if significant differences existed between the two high school's student mathematics achievement as they entered high school and after they completed the Algebra A/B course as well as at the end of eleventh grade. Second, the qualitative phase of the study explored student life experiences throughout the attainment of their consequent mathematics achievement.

Chapter Four is organized according to the explanatory sequential mixed methods design with the quantitative phase findings presented first, followed by the qualitative findings. Independent t-tests, simple regression, one-way analysis of covariance (ANCOVA), one-way

analysis of variance (ANOVA), and multiple regression were performed to analyze the student mathematics achievement data. Next, qualitative data analysis involved two coding strategies. First, the data was organized by descriptive codes based on the interview protocol. Pattern coding followed with the development of themes. Data were analyzed primarily by hand, although NVivo qualitative data analysis software was used to supplement the organization and analysis of the data.

Quantitative Findings

Quantitative Research Question One

Is there a difference in mathematics achievement at the end of the Algebra A and Algebra B courses, as measured by test scores, for students who completed the courses every day in two semesters (one year) and students who completed the courses every other day for four semesters (two years)?

Independent samples t-tests. Following the careful collection and coding of transcript data, and the entry of those data into SPSS Statistics (v. 24), descriptive statistics were calculated comparing the Explore test scores and the Algebra 1 EOCT scores between schools. An independent samples t-test was conducted using the Explore test scores to determine if there were differences in achievement between schools before students enrolled in their beginning high school mathematics Algebra A and Algebra B courses. First, the Explore data sets for both schools were observed for bias. Upon examination of the boxplots for each set of scores there were four outliers in the School 1 data (scores of 2, 3, 4, and 4) and three outliers in the School 2 data (scores of 3, 4, and 4). For School 1 these outliers represent only 3.8% of their data set and for School 2, 6.3% of their set. When this occurs, Field (2013) gives four methods for correcting the data, two of which are trimming the data and winsorizing. Trimming the data is deleting

scores from the extremes based on percentage or standard deviation. *Winsorizing* is substituting

outliers with the next highest score that is not an outlier. Field (2013) states some may feel

uncomfortable of changing scores to different values and that it is like cheating, but if the

changed scores are

> unrepresentative of the sample as a whole and biases your statistical model then it's not
>
> cheating at all; it's improving your accuracy. What is cheating is not dealing with
>
> extreme cases that bias the results in favor of your hypothesis, or changing scores in a
>
> systematic way other than to reduce bias (p. 198).

Furthermore, because winsorized means have been found to be more stable than trimmed means

(Dixon, 1950, 1980; Hawkins, 1980), winsorizing was implemented in both data sets in which all

the outliers were substituted with a score of 5. Descriptive statistics after this correction are

shown in Table 7.

Table 7

ACT Explore Scores Descriptive Statistics

	School	N	M	SD	SE
ACT Explore Score	School 1	105	12.65	3.06	0.30
	School 2	48	11.75	3.01	0.44

Next, the data were observed for violation of assumptions. The Shapiro-Wilk's test of

normality indicated significance, both data sets being non-normal; however, Field (2013)

suggests in significance tests the "assumption of normality matters in small samples (<30), but

because of the central limit theorem we don't need to worry about this assumption in larger

samples (>30)" (p. 172), that the examination of Q-Q plots serves a better guide for normality if

both graphs are similar. Furthermore, he states the bias of outliers is much more vital to

significance tests than normality. Despite the Shapiro-Wilk's test being significant, the Q-Q plots

for each data set were very similar and showed the quantiles very close to the diagonal line.

Additionally, the assumption of homogeneity of variances was tested and satisfied via Levene's

F test, $F(151) = .06$, $p = .811$. There was no statistically significant difference in the variances of

the Explore scores between School 1 ($M = 12.65$, $SD = 3.06$) and School 2 ($M = 11.75$, $SD =$

3.01); $t(151) = 1.69$, $p = 0.093$. Cohen's *d* was estimated at 0.30, which is a small effect size.

These results suggest that no differences exist in the mathematics achievement in the two schools

at the end of eighth grade before the transition to high school. This statistically indicates students

at both schools were primarily at the same achievement level entering high school.

An independent samples *t*-test was also conducted using the Algebra 1 EOCT scores to

determine if there were differences in achievement between schools after students completed the

Algebra A and Algebra B courses. Only the School 1 EOCT scores showed outliers (scores of

149, 149, 149, 149, 152, 152). Winsorizing was applied again replacing these scores with 148.

Descriptive statistics after this correction are shown in Table 8. The Shapiro-Wilk's test of

normality showed significance for School 1 but non-significance for School 2; however, both Q-

Q plots are similar. The assumption of homogeneity of variances was violated as assessed by

Levene's *F* test, $F(151) = 6.72$, $p = .010$, so separate variances and the Welch-Satterthwaite

correction was used. After this correction, significant differences existed in the variances

between School 1 ($M = 142.84$, $SD = 2.65$) and School 2 ($M = 141.71$, $SD = 1.94$); $t(121.72) =$

2.97, $p = 0.004$. Cohen's *d* was estimated at 0.58, which is a medium effect size. These results

suggest that the different mathematics course progressions employed by School 1 and School 2

did have an effect on their mathematics achievement at the end of the Algebra A and Algebra B

courses, considering their achievement was not significantly different before entering high school.

Table 8

ACT QualityCore EOCT Scores Descriptive Statistics

	School	*N*	*M*	*SD*	*SE*
EOCT Score	School 1	105	142.84	2.65	0.26
	School 2	48	141.71	1.94	0.28

The Explore scores in the first *t*-test did not result in statistically significant differences, however, based on the effect size there was almost one-third of a standard deviation difference which implies School 1 students may have began the high school transition period at a higher achievement level than School 2 students. Because of the close significant value ($p = 0.093$), linear regression analyses were performed to ascertain if the achievement in both schools was not actually different at the beginning of the high school transition period and to determine what variables could be predictors of the achievement.

Simple linear regressions. First, simple linear regression analyses were performed using the Explore and EOCT scores to determine if prior achievement on the Explore score is a good predictor of future achievement on the EOCT score at each school. An examination of the standardized residuals and influential cases indicated both models were generalizable. Scatterplots indicated no curvilinear relationships existed between the Explore and the EOCT scores and there was no evidence of homoscedasticity in a plot of standardized residuals with standardized predicted values. Additionally, an examination of a histogram of residuals and a P-P plot revealed a relatively normal distribution with the data points all falling close to the diagonal line, and the Durbin-Watson value for both schools indicated that the residuals were independent.

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The model for School 1, $y = 138.33 + .37X$ was significant, $R^2 = .17$, adjusted $R^2 = .16$, p < .001, indicating that the Explore score was a good predictor of the EOCT score. Hence, the EOCT scores increased .37 units for every one-unit increase in the Explore score. The Explore score accounted for 17% of the variance in the EOCT score at School 1. The model for School 2, $y = 140.36 + .12X$ was not significant, $R^2 = .04$, adjusted $R^2 = .02$, $p = .190$, indicating that the Explore score was not a good predictor of the EOCT score (See Table 9) and the EOCT scores per unit increase was one-third less than School 1. These regression results confirm the t-test results in that there is a difference in mathematics achievement at the end of the Algebra A and Algebra B courses for students who took algebra every day for two semesters (School 1) and students who took algebra every other day for four semesters (School 2).

Table 9

Regression Results

	School	b	$SE\ b$	β	p	sr^2
Constant	School 1	138.33	1.05		< .001	
		(136.24, 140.42)				
	School 2	140.36	1.05		< .001	
		(138.24, 142.48)				
Explore Score	School 1	.37	0.08	.41	< .001	.166
		(.21, .53)				
	School 2	.12	0.09	.19	.190	.037
		(-.06, .29)				

School 1 Variability = 17%
School 2 Variablity = 4%

Multiple linear regression. A multiple linear regression was conducted to determine if there was an effect on achievement when controlling for potential confounding variables. The ACT Explore, school attended, race, and lunch status were used to determine if any were predictors of achievement on the EOCT. An examination of the standardized residuals and influential cases for each school indicated the model was generalizable. Scatterplots indicated no

curvilinear relationships existed between the predictors and the criterion variable and there was no evidence of homoscedasticity in a plot of standardized residuals with standardized predicted values. Additionally, an examination of a histogram of residuals revealed a relatively normal distribution, and the Durbin-Watson value of 2.11 indicated that the residuals were independent.

SPSS excluded two variables, White students and students not on free or reduced lunch, due to multicollinearity, meaning a strong correlation exists between these two predictors. All other predictors displayed no multicollinearity with VIF values no larger than 1.52 for any one predictor. Six variables remained for the analysis: the ACT Explore (X), school attended (X_2), African-American students (X_3), Latino students (X_4), reduced lunch students (X_5), and free lunch students (X_6). The model, $y = 139.63 + .27X + .90X_2 - .62X_3 - 1.18X_4 - .36X_5 - .69X_6$ was significant, $R^2 = .21$, adjusted $R^2 = .18$, $F(6, 146) = 6.628$, $p < .001$, which indicated that the linear combination of all six variables were predictors of the EOCT score. Further examination of the individual predictors suggested three variables were not good predictors of the EOCT score: African-American students, ($t = -1.39$, $p = .166$), reduced lunch students ($t = -.43$, $p = .671$), and free lunch students ($t = -1.61$, $p = .109$). This is likely due to the majority of the students being African-American and getting free or reduced lunch.

The regression coefficients for Explore scores ($B = .27$, $t = 4.38$, $p < .001$), the school attended ($B = .90$, $t = 2.25$, $p = .026$), and Latino students ($B = -1.18$, $t = -2.15$, $p = .033$) were significantly different from zero (see Table 10). These results suggest that Explore scores, the school attended, and if a student is Latino are the best predictors of the EOCT score. All of the variables account for 21% of the variance in the EOCT score. The squared semipartial correlation coefficients of the three significant predictors indicated that the Explore scores ($sr^2 = .1030$) contributed 10.30% of the unique variability, the school attended ($sr^2 = .0272$) contributed

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2.72% of the unique variability, and Latino students ($sr^2 = 0250$) contributed 2.50% of the

unique variability to the equation for a total of 15.52% unique variability from these three

variables. Therefore, 5.88% of variability can be attributed to the linear combination of all of the

variables.

Table 10

EOCT Multiple Linear Regression Results

	b	*SE b*	*β*	*p*	*sr²*
Constant	139.63	0.91		<.001	
	(137.84, 141.42				
Explore Score	0.27	0.06	.33	<.001	.1030
	(.15, .39)				
School	0.90	0.40	.17	.026	.0272
	(.11, 1.68)				
African-American	-0.62	0.45	-.12	.166	--
	(-1.50, .26)				
Latino	-1.18	0.55	-.19	.033	.0250
	(-2.26, -.09)				
Reduced Lunch	-.36	0.83	-.03	.671	--
	(-2.00, 1.29)				
Free Lunch	-.69	0.43	-.13	.109	--
	(-1.54, .16)				

Total Shared Variability = 5.88%, Total Unique Variability = 15.52%

Quantitative Research Question Two

What effect did an extra mathematics course (Algebraic Connections) have on students'

mathematics achievement as measured by the ACT?

Independent samples *t*-test. Descriptive statistics were calculated comparing the ACT

mathematics scores between the two schools. An independent samples t-test was conducted

using these scores to determine if there were differences in achievement between the schools at

the end of eleventh grade. First, the ACT data sets for both schools were observed for bias. Upon

examination of the boxplots for each set there were four outliers in the School 1 data (scores of

20, 20, 22, 26) and one outlier in the School 2 data (score of 21). Winsorizing was implemented

in both data sets; School 1 outliers were substituted with a score of 19 and the School 2 outlier was substituted with a score of 17. Descriptive statistics after this correction are shown in Table 11.

Table 11

ACT Mathematics Scores Descriptive Statistics

	School	*N*	*M*	*SD*	*SE*
ACT Score	School 1	105	14.99	1.71	0.17
	School 2	48	14.65	1.52	0.22

Next, the data were observed for violation of assumptions. The Shapiro-Wilk's test of normality indicated significance as with the previous *t*-tests, but the Q-Q plots for each data set were very similar. Additionally, the assumption of homogeneity of variances was tested and satisfied via Levene's *F* test, $F(151) = .10$, $p = .750$. There was no significant difference in the variances between School 1 ($M = 14.99$, $SD = 1.71$) and School 2 ($M = 14.65$, $SD = 1.52$); $t(151) = 1.20$, $p = .234$. Cohen's *d* was estimated at 0.22, which is a small effect size. These results suggest that no differences existed in the mathematics achievement in the two schools at the end of eleventh grade.

ANCOVA. The ANCOVA extended the *t*-test by using the ACT Explore as a covariate to evaluate differences between School 1 and School 2 on the ACT Mathematics Test. All of the assumptions were met. A scatterplot of residuals against each level of the independent variable showed a random display of points around zero meeting the independence assumption. The assumption of normality was satisfied via examination of the residuals on a Q-Q plot and a review of the Shapiro-Wilk's test indicated no deviation from a normal distribution ($SW = .993$, $df = 153$, $p = .684$). An examination of the Levene's test indicated that the homogeneity of variance assumption was satisfied, $F(1, 151) = .01$, $p = .911$. A review of a scatterplot of the

ACT Mathematics score by the Explore score denoted a linear relationship thereby meeting the assumption of linearity. The assumption of independence of the covariate and the independent variable was determined satisfied through an examination of an ANOVA using the covariate as the dependent variable. There was no statistically significant difference in the covariate at different levels of the independent variable, $F(1, 151) = .01$, $p = .911$. Furthermore, an examination of the interaction effect of the independent variable with the covariate indicates that the assumption of homogeneity of regression slopes was met, $F(1, 149) = .649$, $p = .422$.

The ANCOVA results demonstrated a statistically significant covariate, $F(1, 150) = 14.424$, $p < .001$, indicating that the ACT Explore test can be used to control for error in the ACT Mathematics Test score. However, the school independent variable was not statistically significant, $F(1, 150) = .514$, $p = .475$. After controlling for the ACT Explore score, there were no significant differences on the ACT Mathematics score by school. Moreover, due to the ANCOVA results and because there were no significant differences in the ACT Explore scores by school as discovered in question one, the achievement levels for both schools in eighth and eleventh grade show no differences which imply that the additional instructional time in ninth grade which allowed for the extra mathematics course in School 1 did not have an effect on student's mathematics achievement on the ACT Mathematics Test.

ANOVA. A one-way ANOVA was conducted to determine if the means of the ACT mathematics scores differed by the number of courses students took from ninth grade to eleventh grade. Normality was shown as not significant by the Shapiro-Wilk's test ($SW = .993$, $df = 153$, $p = .684$); the boxplot suggested a relatively normal distributional shape of the residuals and the Q-Q plot showed reasonable normality. According to Levene's test, the homogeneity of variance assumption was satisfied $F(2, 150) = .709$, $p = .494$. A scatterplot of the residuals against the

levels of the independent variable was reviewed to assess the assumption of independence. A random display of points around zero provided evidence this assumption was met. The ANOVA was statistically significant, $F(3, 150) = 4463.26$, $p < .001$, the effect size is very large ($\eta^2 = .989$; suggesting 98.9% of the variance of the ACT scores is due to the number of courses students took from ninth to eleventh grade), and observed power is maximal for the independent variable, the number of courses (1.00). These results suggest there is a statistically significant difference in the means of the ACT Mathematics Test by the number of courses students took from ninth grade to eleventh grade.

Multiple regression. A multiple linear regression was the last statistical test conducted to determine the effects of the extra mathematics course on student mathematics achievement. The ACT Explore, EOCT, school attended, number of courses students took, race, and lunch status were used as predictors of the effects. An examination of the standardized residuals and influential cases for each school indicated the model was generalizable. Scatterplots indicated no curvilinear relationships existed between the predictors and the criterion variable and there was no evidence of homoscedasticity in a plot of standardized residuals with standardized predicted values. Additionally, an examination of a histogram of residuals revealed a relatively normal distribution, and the Durbin-Watson value of 2.01 indicated that the residuals were independent.

SPSS excluded two variables, White students and students not on free or reduced lunch, due to multicollinearity, meaning a strong correlation exists between these two predictors. All other predictors displayed no multicollinearity with VIF values no larger than 1.61 for any one predictor. Six variables remained for the analysis: the ACT Explore (X), the EOCT (X_2), school attended (X_3), the number of courses students took (X_4), African-American students (X_5), Latino students (X_6), reduced lunch students (X_7), and free lunch students (X_8). The model, $y = -13.16 +$

$.10X + .17X_2 - .39X_3 + .77X_4, - .32X_5 + .07X_6 + .48X_7 - .19X_8$ was significant, $R^2 = .24$, adjusted $R^2 = .20$, $F(8, 144) = 5.728$, $p < .001$, which indicated that the linear combination of all eight variables were predictors of the ACT Mathematics score. Further examination of the individual predictors suggested that five variables, the school a student attended ($t = -1.26$, $p = .211$), African-American students ($t = -1.09$, $p = .276$), Latino students ($t = .19$, $p = .849$), reduced lunch students ($t = .87$, $p = .385$), and free lunch students ($t = -.65$, $p = .515$), were not good predictors of the ACT score. The regression coefficients for Explore scores ($B = .10$, $t = 2.27$, $p = .024$), EOCT scores ($B = .17$, $t = 3.19$, $p = .002$), and number of courses ($B = .77$, $t = 2.69$, $p = .008$) were significantly different from zero (see Table 12). These results suggest that Explore scores, EOCT scores, and the number of courses students take are the best predictors of the ACT Mathematics score. All of the variables account for 24% of the variance in the ACT score. The squared semipartial correlation coefficients of the three significant predictors indicated that Explore scores ($sr^2 = .0272$) contributed 2.72% of the unique variability, EOCT scores ($sr^2 = .0533$) contributed 5.33% of the unique variability, and the number of courses students take ($sr^2 = .0380$) contributed 3.80% of the unique variability to the equation for a total of 11.85% unique variability from these three variables. Therefore, 12.26% of variability can be attributed to the linear combination of all of the variables.

Table 12

Multiple Regression Results

	b	$SE\ b$	β	p	sr^2
Constant	-13.16	7.62		.086	
	(-28.23, 1.90)				
Explore Score	0.10	0.04	.18	.024	.0272
	(.01, .18)				
EOCT Score	0.17	0.05	.26	.002	.0533
	(.07, .28)				
School	-0.39	0.31	-.11	.211	--

	(-1.01, .23)				
No of	0.77	0.29	.24	.008	.0380
Courses	(.21, 1.34)				
African-	-0.32	0.30	-.10	.276	--
American	(-.91, .26)				
Latino	0.07	0.37	.02	.849	--
	(-.66, .80)				
Reduced	0.48	0.55	.07	.385	--
Lunch	(-.61, 1.56)				
Free	-.19	0.29	-.05	.515	--
Lunch	(-.76, .38)				

Total Shared Variability = 12.26%, Total Unique Variability = 11.85%

Qualitative Findings

The purpose of the qualitative phase was to follow-up on the quantitative results and to explain them through generic qualitative research (Merriam, 2009). Questions for the interviews were initially developed as shown in Appendix G. Interview questions were intended to provide additional information about the findings in the quantitative data. Using the quantitative results, students were identified from each high school that exhibited the highest increase in mathematics achievement scores from the eighth grade (ACT Explore Math) to the eleventh grade (ACT Math). From this group three students from each high school were purposefully selected according to their increase in scores and whose mathematics course progressions were identical as detailed in Chapter Three. Table 13 displays the different course progressions for each school. Coincidentally, all students interviewed were girls, two seventeen-year olds and four eighteen-year olds. A summary of each participant's description is shown in Table 14 and test scores are shown in Table 15. The data collection consisted of one-on-one interviews from each student using the established interview protocol in Appendix G.

Table 13

High School Math Progression Comparison by School

Grade	School 1	School 2
9th	Algebra A & Algebra B	Algebra A
10th	Geometry	Algebra B
11th	Algebraic Connections	Geometry
12th	Algebra 2	Algebra 2

Table 14

Summary of Participants' Descriptions

Participant	School	Ethnicity	Family Background; free/reduced lunch	Extracurricular activities	Future Plans
Lauren	1	African American	Father, mother, three younger brothers; free (based on gov't assistance)	Band Cheerleading	Cosmetology school; if like it get business degree to own business
Debbie	1	White	Father, mother, older sister; pays	Chorus	Local community college – special needs teacher
Beth	1	African American	Father, mother, older brother; free	Chorus Band	Local university undecided
Keelie	2	African American	Step father, mother, older brother, younger sister; pays	Basketball Special needs volunteer	Maybe Air Force
Allison	2	African American	Mother, two older half-sisters, one older half-brother, two younger sisters; free (based on gov't assistance)	Volleyball Track	Work and get own Apartment and work first; then maybe nursing or Navy
Donna	2	White	Mother, younger brother; free (based on gov't	Robotics	Work first; then arts & sciences

assistance)				college; culinary or design

Table 15

Participants' Mathematics Test Scores

Participant	School	Eighth Grade ACT Explore Math Test	Ninth Grade ACT Quality Core EOCT	Eleventh Grade ACT Mathematics Test
Lauren	1	9	141	15
Debbie	1	10	144	16
Beth	1	10	143	15
Keelie	2	4	144	15
Allison	2	9	140	16
Donna	2	10	142	16

Qualitative Research Question

1. What social-ecological supports might be leveraged to support an increase of students' mathematics achievement throughout the high school transition period?

Upon examination of the interview data and after two-cycle coding, as each interviewee reflected on her transition to high school and her mathematics trajectory throughout high school, four themes emerged. They were early struggles in mathematics, meaningful relationships, involvement in school, and school mathematics schedule - Algebra A/B class structure.

Early struggles in mathematics. Most of the participants experienced failure in mathematics at some time in middle school (four out of six); however, none experienced failure in mathematics in high school. These students were able to learn from their prior experiences in mathematics and change their behavior in a positive direction as a result. They exemplified their agency through their cultural capital and opportunities given to them. They affirmed their role as

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an individual through the positive choices they made which affected their mathematics trajectory. For some students, these struggles were a result of an event that was going on in her life at that time. Keelie mentioned the biggest failure or frustration of her life was her "lifestyle with her dad." Her mom and dad divorced when she was in first grade and during her eighth grade school year she had a big "falling out" with her dad, which affected her schoolwork. In describing her eighth grade mathematics experience, she said, "it sucked," attributing her poor mathematics performance to the problems she was having with her dad. She could not focus on academics and if she could have changed anything about middle school it would be eighth grade because "[it] was just a big dump."

During middle school, Lauren's mom worked full-time as a nurse and went to graduate school. Her dad worked as a truck driver and was "gone most of the time," leaving her to keep up around the house and help take care of her three younger brothers. She explained she had to:

> Pick up a lot of the work and stuff my mom and dad can't do. So I try to help them as much as I can … when she's gone to work I have to clean her room for her … I'll pick it up a little bit and in the morning she'll be ready for work … so she don't have to be stressed out about [it] … I try to clean up the living room and the kitchen as much as I can because people pops up over there and I don't want it to be dirty.

For others these struggles were due to intrapersonal reasons. Debbie recognized a personal accountability for her middle school mathematics struggles especially in eighth grade. She did not do her homework or study for tests and would just "look over" the test material the day of the test. However, this behavior changed for her when she entered high school. When asked what she would change about middle school, she stated, "My grades, because I had Cs and Ds in middle school." She further declared this was one of the biggest frustrations in her life, that is not focusing on her grades and feeling she "should've pushed [herself] harder … I didn't know it would reflect on how it was not with college and stuff and it's reflected a lot."

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Beth and Donna mimicked Debbie's account of her middle school mathematics struggles in that neither ever studied for math tests and just "looked over" or "skim(med) through" notes or practice problems before a test. Beth stated if she could go back to middle school, "I would work harder on my math grade because then it maybe would have been looking better now." Allison attributed a bad seventh grade math experience for her struggles. She felt her seventh grade teacher did not adequately prepare her for eighth grade math. She stated the teacher "could have done better by explaining problems better and helping more" and "she was like rude and mean … she didn't want to help anybody … she didn't care." Similar to Beth, Allison further indicated that in middle school she, "would work harder and study for the tests I had to take."

Meaningful relationships. A supportive learning environment is primarily about relationships. Students need to know that they are with people they can trust, who will support their learning. The presence of meaningful relationships in someone's life informs how students experience their pedagogical relation to their environment. These relationships help to give a purpose in life or grounds for living. Most of the girls had meaningful relationships both at home and at school that helped guide and support them throughout middle school and throughout their high school trajectory. All but two girls live with two parents and all have at least one sibling. Of all the girls with two parents at home, both parents are employed except for one mother not working due to recently having a kidney transplant.

Keelie spoke of her mom helping to buy materials needed to build class Homecoming floats and:

> [Her parents are] very supportive and the first thing they look forward to asking me every day because they know that I have a big future ahead of me and they try to keep me on track. They know sometimes I'm not responsible-irresponsible. So, they're a big support of that.

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Debbie also mentioned her parents being supportive:

> They helped me out when I needed the help, and they've let me … I don't know how to explain it. They allow me to do my work and stuff, having to go home and do stuff, what I need to do around the house and stuff. They'll let me stay here and study if I have to, or do extra schoolwork.

Lauren stated that her mom always "got on my back" about her grades and she "took me off [cheerleading] because my grades were dropping … it was because of math." Her mom even bought the eighth grade mathematics textbook for her to use as reference in the ninth grade Algebra A course. Beth also said her parents:

> They stay on me about school. I had to … they just made me take the ACT. I didn't want to, because I've already been accepted into a school, but they made me do it anyways. I don't know why.

Not only was parental support evident but also teacher social support for most of the girls beginning in middle school. New teacher supports formed as the participants entered high school. All girls but two revealed at least one teacher from middle school as well as one from high school in which they developed a close, mutually respectful relationship.

Middle school teacher social support was evident with Keelie's eighth grade history teacher. She held him in high regard because:

> He was just straightforward with everything. He did what he said. I talked to him a lot just to talk because I know he liked to talk. So, that made me want to talk to him about life and school work, college early, we would talk about college.

No teacher in high school matched the relationship she had with this middle school teacher. She desired "that bond like I had with Mr. Smith [history teacher]. With most of my teachers, there are so many of us they don't get to talk to us like they can." Although she did not develop as close of a relationship with any of her high school teachers, her basketball coach and another

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teacher she talked to often in the hallway (whom she never had as a teacher in class) served as social supports in high school.

Debbie did not mention a specific teacher in middle school in which provided her support but stated:

> The teachers I had, they would talk to me as a friend and just try to get to know me and try to be one of my friends and not just stand here and teach and that's all they would do. They would actually get to know you and talk to you. Stuff about life, I guess.

She developed relationships with three teachers as she entered ninth grade, all of whom she is still close to now. She particularly likes her chorus teacher whom she described as "like my second mom" and she "love(s) her to death."

Allison had two middle school teachers with whom she developed relationships with, her English teacher who unfortunately passed away, and also a reading teacher she had every year of middle school. Furthermore, her English teacher in high school also formed a relationship with her in which she could "go and talk to her about anything that [she] need(ed) and she'll help."

Lauren said during middle school she would:

> Really have trouble trusting people but a teacher in particular, Mr. Green, I trusted him pretty well and he could tell when I was going through some things. He would just sit down and kind of talk to me and I appreciated it.

Her history teacher in ninth grade would become her support in high school. She held her in the highest regard:

> I loved her. I loved her so much. I still wish she was here. She retired and I was so upset. And I had her again, I think, my eleventh grade year. And I was so excited to be back in her class. She is still my favorite teacher at [School 1]. She really supported me in everything I did. If I needed anything, she helped me as much as she could and I really appreciated it… I always went to her class when I wasn't supposed to.

Donna's middle school math teacher would "talk individually with students." Donna said that she:

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> Felt like she [the math teacher] cared and I really felt like she wanted to help people … you could call her at home. I still have her personal number if I need help with math and I can still call her. I have called a few times.

She did not mention any of her high school teachers that provided social support for her and Beth supposed the only teacher/adult she was really close to in middle school or high school was her eighth grade basketball coach.

Involvement in school. All of the participants were involved in extracurricular activities in middle school and all but one was involved in high school at least during ninth grade at the beginning of the high school transition period. This involvement provided a sense of belonging that positively affected motivation, effort, level of participation, and achievement level.

Keelie discussed her involvement in basketball from sixth to twelfth grade as being the one thing in her life that she is most proud:

> I really think being in an activity at school that it kept me out of a lot of trouble. It had me thinking of the wrongs and rights with Coach Carter in my head all the time … I think being in basketball that has had a big impact on my life, from little until now … it probably made me noticed. I was noticed in basketball.

She was also involved in ninth through twelfth grade building class floats for the Homecoming Parade every year. Her mom would help purchase supplies they needed and she was also on the Homecoming Court as an attendant tenth through twelfth grade. She did not join clubs in middle school because she felt she was too shy and "didn't think [she] would fit in clubs." However, when she entered ninth grade she started building relationships with the developmentally delayed students on her own. (Her high school has an entire wing for the moderate to severe developmentally delayed.) She noticed them when they ate in the cafeteria during her lunchtime. She explained these relationships grew from when one of the students noticed and commented on her Spider-Man shirt, "How about you be my Spider-Woman and I'll be your Spider-Man? I will

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talk to you every day." From then on, "I just started talking to all of them every day … they are a big impact on my life." She would also visit them on days she did not have basketball practice and her senior year her basketball coach asked her to help with the Developmental Olympics in which she felt honored and happy to oblige.

Lauren was only involved in extracurricular activities in middle school and through the transition to high school only in ninth grade. Throughout middle school she was in band and "loved it." Then she was encouraged by her physical education teacher to try out in eighth grade for the ninth grade cheerleading squad. She felt flattered that her teacher:

> Saw something in me because she always said, 'you're so good at this, are you sure you haven't cheered before?' … I wasn't going to try out for ninth grade because I didn't feel comfortable enough … [but] she just kind of pushed me and she said, 'if you want to be on that team you have to work harder and you're going to have to work every day. And if this is something you really want, then you're going to have to go for it with all that you have. You can't go halfway.' And then once she said that, that's when I began, I started working really hard and I started coming to the practices here and I just got into it.

Her hard work paid off and she made the squad, which consequently made her have to quit band because she could not be in the band and cheer, too. Unfortunately, all of her involvement in cheering caused her grades to suffer and as aforementioned her mom made her quit cheerleading as a result. She expressed that she regrets not being involved in other clubs that took up less time after she quit cheerleading.

Donna was only involved in robotics in sixth grade and described it as "nice." She "was the only girl in it though so it like felt kind of weird … it was pretty fun, I liked it." However, she could not continue because of transportation problems to practice and competition. After this she would spend most of her time "hanging out" at a small video game store where she was their mascot.

Debbie began chorus in sixth grade and continued her involvement throughout high school. Just like Keelie, her extracurricular involvement is the one thing she mentioned that she is really proud of. She was able to perform at state competition one year and that really gave her a sense of accomplishment. Also, her highlight of high school was traveling with the chorus to Disney World, two different years, as a freshmen and a senior. She said she would never forget her time in chorus and the relationship she formed with her chorus teacher.

Beth was also involved in chorus in middle school. Despite the fact that she "really can't sing for real" and she "only did chorus to get out of the extra class" everyone else had to take, she really enjoyed it "it was fun" because "a whole lot of other friends did chorus too." She made the basketball team in seventh grade and continued to be on the team throughout high school. As Keelie and Debbie also commented, Beth's involvement in basketball is her most proud experience. During her eleventh grade year, her team was in the state semifinals and made it to the regional tournament in her senior year. Despite her participation in basketball, when asked if she could go back and change anything about high school, she responded, "probably get more involved, like do other stuff besides just come to school and basketball, because I don't really do too much, and I have a lot of free time."

When I began my interview with Allison and asked her to tell me about herself, after she mentioned her family she went directly to sports. She has been involved with volleyball from seventh to twelfth grade and track for eleventh and twelfth grades. She further described, "I'm just really athletic and I like playing sports. In my free time, I sleep a lot because I play sports a lot." She began volleyball after she did not make the cheerleading squad in sixth grade, "I liked it [volleyball] and I was good and I came farther and farther." She started track because, "I wanted

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to try something new because after volleyball, I had nothing to do. I was, like, I'm going to try track because I knew I could do it. I ended up liking it."

School mathematics schedule - Algebra A/B class structure. The structure of the environment students occupy also affects their life course. The participants at each school expressed they liked the mathematics schedule they were on in the ninth grade. At School 1 while taking Algebra A/B, students had mathematics every day in ninth grade and every other day each year following. Students at School 1 felt they performed better having mathematics every day with two actually liking it every day and one not liking it every day.

Beth felt it was more beneficial to have Algebra A/B every day in the ninth grade "because I wasn't too good at math, so that helps me get extra help on math and try to get better at it, and so I could make better grades." If Algebra A/B had been spread out meeting every other day for two years, she "probably would have done worse." She continued, "it would [have] help me more if I met every day" in my tenth through twelfth grade math classes, "especially geometry, because I was really not good at geometry." For her the day break in between each class with the alternating block schedule was a detriment:

> I feel like you kind of forget about it because you don't see it every day, so you don't focus on it as much. But when you have it every day, then you get to see it every day and remember it and focus on it every day.

She also stated having one teacher that she saw every day in ninth grade helped her:

> Because you get used to seeing them, and I think you can get closer to them and then get more comfortable, and then when y'all take notes and go over math, then you'll be more comfortable with asking questions, and all that.

If she had two teachers for Algebra A/B, "I probably wouldn't have actually got comfortable with my teacher, so most likely I wouldn't have asked questions."

Lauren echoed Beth's sentiments having Algebra A/B every day:

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It helped me a lot more because I would come in every day and it would be the same thing and she would review what we did for homework and then go to the next thing. But, if it was every other day, I wouldn't be as interested and I wouldn't pay that much attention. I would forget the stuff that she taught and then I would have to learn it all over again.

Also like Beth she felt she "probably would have done worse because it was, you know, too much" if Algebra A/B had been spread out over two years.

When I asked Debbie if it was more beneficial for her to have Algebra A/B every day she replied, "No, not really because then if we had homework that day it'd have to be done the next day. I wouldn't have time to do it. I'd do it in other classes" and she expressed it did not make a difference having it every day instead of every other day. Furthermore, she did not think it made a difference that she saw one teacher every day in the ninth grade whereas all of her other teachers she saw every other day. However, when I further explained to her that if the Algebra A/B courses had been taught every other day, they would have been spread out over two years instead of just concentrated in one year, she responded that she would have probably performed worse. Also, I told her she may have had two teachers for the courses instead of just one like she experienced and she modified her first response saying, "I think it should stay with the same teacher because she had taught it one way, and then you'd have to readjust to this other teacher teaching it another way." Moreover, she attributed her increase in mathematics achievement from eighth grade to ninth grade to the structure of the class, "because I was pushed more to do it." Also, of her remaining high school mathematics classes, "she liked [them] every other day, but I should've had [them] every day because every other day I forgot what we learned the two days before."

Students at School 2 had their Algebra A/B courses spread out over two years and all liked that structure; however, their only experience with taking mathematics every day had been

at the middle school taking it with six other subjects every day as opposed to three other subjects every day on the alternating block schedule like students at School 1. Keelie liked the structure of the alternating block schedule as opposed to middle school where she had every subject every day, "(In middle school) I had core classes every day … homework every day for each class and the teachers just acted like you don't have any other core class … the every day thing, it was tiring." She further stated having math every other day, "gave me more time to do my homework." Allison echoed Keelie's statements about homework, "I had time to do homework, like if I forgot, I could do it tomorrow." She also liked the structure of the alternating block describing it "goes by fast" and "it's pretty good." She added that "(with the alternating block) you've got to stay focused, you can't goof around."

Keelie and Donna would have liked the same teacher for their Algebra A/B courses; Keelie because of the way her Algebra B teacher taught and Donna because "I would have been used to their teaching methods and they would have already known me so it would have been easier." In contrast to Debbie's statement about having the same teacher, Allison didn't "think it would have made a difference because … it was kind of all the same … same techniques … they all did the same thing."

Conclusion

This chapter presented the statistical and qualitative results of the study. An overview of the methodology was presented along with information about the quantitative tests and qualitative interview data. The data analysis of the quantitative tests provided insight into the differences in each school's mathematics achievement after the Algebra B course and eleventh grade as well as revealed increases in test scores over the transition period. Whereas the data analysis of the interviews revealed the lived experiences of the Algebra A/B students at each

school throughout the high school transition and their consequent mathematics trajectory. Four themes were identified from this data analysis: early struggles in mathematics, meaningful relationships, involvement in school, and school mathematics schedule - Algebra A/B class structure. Chapter Five will interpret the results of the study and address the research questions as well as conclusions based on the results and possible future research needs based on the findings of the study or information not found within the study.

CHAPTER FIVE

INTERPRETATION OF RESULTS

This chapter includes 1) an overview of the research study; 2) a restatement of the research questions; and 3) quantitative, qualitative, and mixed methods findings. In addition, implications for practice and recommendations for future research are also presented.

Mathematics achievement is influenced by numerous factors. As students transition to high school they are placed in a mathematics course that will determine their mathematics course progression throughout the rest of high school. This transition is often considered short-term; occurring between the eighth to ninth grade years. However, this study examined the transition as a process occurring throughout high school. Additionally this study analyzed how mathematics achievement is potentially affected as a result of the mathematics progressions the participants followed throughout high school. Furthermore, this mathematics achievement was scrutinized by exploring the experiences of students who showed academic improvement throughout the transition.

School districts aim to provide students with the best mathematics progression with the goal of students achieving college- and-career readiness and perform well on college entrance tests such as the ACT. The findings of this study have implications for practice, as well as for future empirical studies designed to assess the effectiveness of mathematics course progressions on mathematics achievement and will also inform districts what best to offer students to become successful.

An explanatory sequential mixed methods design was employed consisting of two strands, a strong quantitative orientation followed by a qualitative strand to help explain the results from the quantitative strand. The initial two questions were addressed through non-experimental, descriptive, quantitative research, while the next question was answered through the qualitative strand. The final mixed methods question integrated the two strands and offered an avenue to make meta-inferences to determine if the follow-up qualitative data provided a better understanding of the problem than simply the quantitative results.

Research Questions

Central Question

How does a different mathematics course progression impact students' high school transition and their subsequent mathematics achievement throughout high school?

Quantitative Research Questions

1. Is there a difference in mathematics achievement at the end of the Algebra A and Algebra B courses, as measured by test scores, for students who completed the courses every day in two semesters (one year) and students who completed the courses every other day in four semesters (two years)?

2. What effect did an extra mathematics course (Algebraic Connections) have on students' mathematics achievement as measured by the ACT?

Qualitative Research Question

1. What social-ecological supports might be leveraged to support an increase of students' mathematics achievement throughout the high school transition period?

Mixed Methods Research Question

1. In what ways do the qualitative interview data reporting the experiences of high school seniors about their high school transition and the mathematics trajectory the transition shaped, help to explain the quantitative results about mathematics achievement reported from three achievement tests?

Quantitative Findings

Quantitative Research Question One

The first research question sought to compare mathematics achievement after the first required high school mathematics course was completed by determining the effect of students taking Algebra as an everyday course on students' mathematics achievement. The successful completion of Algebra A and Algebra B fulfills the Alabama graduation requirement of Algebra 1. Essentially, this study compared students taking Algebra A and Algebra B under a modified intensive block schedule format that required them to attend class daily for two consecutive semesters (School 1) versus students taking the courses under an alternating block schedule format that required them to attend class every other day for two years (School 2).

Before comparing mathematics achievement after Algebra A and Algebra B, an independent samples t-test using eighth grade ACT Explore data revealed no statistically significant difference in mathematics achievement between the sample from both schools before transitioning to high school. This test yielded an effect size of 0.30. The other independent samples t-test compared mathematics achievement after the completion of Algebra A and Algebra B using the ACT QualityCore EOCT data and a statistically significant difference in the two groups was determined with an effect size of 0.58. This was measured by Cohen's d, which evaluates the degree (measured in standard deviation units) that the mean scores on each

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individual test differ. If *d* is calculated as zero, this indicates there are no differences in the means of the two schools. As *d* deviates from zero, the effect size becomes larger. This provides a measure of the magnitude of difference expressed in standard deviation units in the original measurement, providing a measure of the practical importance of a significant finding.

It is important for stakeholders to understand the interpretation of the effect size to determine if the educational practice should continue. The Explore effect size of 0.30 indicates that students in School 1 with a mean score of 12.65 (the overall mean for the group) would be in the 50th percentile of School 1 while placing in the 62nd percentile at School 2. This is because students in School 2 who scored a 12.65 are at the 62nd percentile relative to other students at School 2. In concert with the *t*-test indicating a *p*-value not much above the significance level (*p* = 0.093), the Explore scores are probably more different than they are similar as indicated by the analysis of the effect size above.

However, upon comparison of this effect size with the EOCT effect size of 0.58, students who scored the mean score in School 1 would be in the 50th percentile at their school but the 72nd percentile at School 2; showing that the entire score distribution of the School 1 EOCT scores moved up relative to the score distribution of the School 2 scores. This shows that most students at School 1, no matter what their achievement test score was, performed better than if they had been enrolled at School 2. This larger effect size hereunto indicated more of a significant difference in achievement than seen in the Explore data.

The linear regression analyses helped to further explain and add credence to the *t*-test results through the examination of variables that could account for the pre-existing differences in the Explore scores. The simple linear regressions revealed a stronger predictive value of the EOCT scores at School 1. The models for each school showed the EOCT scores at School 1

increased at a higher rate than EOCT scores at School 2 when compared with each school's ACT Explore scores. The models also accounted for a much larger variance at School 1 than School 2. The multiple linear regression using the different predictors (i.e., Explore scores, school, race, and lunch status) helped to determine if a school effect existed when controlling for the confounding variables. These analyses did find that the school a student attended was a predictor of student achievement on the EOCT. These results suggest that the mathematics course progression utilized in School 1, taking Algebra A and Algebra B every day for two semesters, had an increased effect on students' mathematics achievement (after the end of Algebra B) as opposed to the course progression utilized in School 2 (i.e., taking Algebra A and Algebra B every other day for four semesters or two years).

Quantitative Research Question Two

The second question in this research investigated student mathematics achievement at the end of the eleventh grade. ACT mathematics scores were examined to determine if an extra mathematics course (Algebraic Connections) at School 1 had an effect on achievement. Students at School 1 had completed Algebra A, Algebra B, Geometry, and Algebraic Connections; students at School 2 had completed Algebra A, Algebra B, and Geometry. For this question four statistical analyses were performed: independent samples *t*-test, ANCOVA, ANOVA, and multiple regression.

As with the other achievement scores, an independent samples *t*-test was completed to compare the means of the ACT scores between School 1 and School 2 and revealed a small effect size of 0.22. As explained with the other *t*-tests, this effect size shows that students in School 1 with a mean score of 14.99 (the overall mean for the group) would be in the 50th

percentile of School 1 but only the 59th percentile at School 2. Therefore, no significant difference was found in the means of the ACT scores at the end of the eleventh grade with an even smaller effect size than the Explore. This disparity among test significance among these tests may be due to the different manner in which the ACT Explore and the ACT test are given as opposed to the EOCT. At the district studied, both the ACT Explore and the ACT test were given by grade level, where students are arranged in alphabetical order and distributed among the faculty of the school in charge of administering the test(s). In comparison, because the mathematics courses students take (in a certain grade) differ due to academic level when students transition to high school, (e.g. ninth grade students at either school could be in as many as four different mathematics subjects), EOCTs were administered in each individual mathematics teacher's classroom.

Another explanation for the non-significant results could be the content of the test. The EOCT only covers Algebra 1 content while the ACT Mathematics Test covers content from four mathematics courses. Also, the EOCT was administered near the completion of the Algebra 1 course. Retention on the EOCT would not seem to be as big of a factor as retention on the ACT because it requires students to recall mathematics content from eighth grade through eleventh grade. This was one of the justifications for students in School 1 taking the extra mathematics course, Algebraic Connections, in the same school year as the ACT was administered. Because the course includes components to strengthen students algebra skills and 55% of the ACT assesses algebra content (ACT, 2014), it was the hope of School 1 this course would produce better ACT scores as well as prepare students for the Algebra 2 course they would take their senior year.

Additionally, using the independent *t*-test data, an ANCOVA was performed to determine whether the ACT Mathematics Test means differ significantly in each school after adjusting for possible differences in the ACT Explore means, used as a covariate. The ACT Explore was found to be statistically significant at the different schools indicating that the Explore can be used to control for error in the ACT Mathematics Test. However, the strength of the relationship between the school and the ACT score resulted in a very small effect size.

A follow-up ANOVA revealed very significant associations between the means of the ACT scores and the number of courses students took from ninth grade to eleventh grade with a very large effect size. Some of this effect is explained by the failure of courses requiring the repeating of a course, thus limiting some students taking the extra course. These findings are congruent with Zelkowski (2010) in that the number of credits a student obtains has significance on student performance on the ACT, as well as adding to Ma and Wilkins (2007) research on the effects of mathematics courses on the growth of mathematics achievement. These associations between achievement and the number of courses students take also contribute to the "double-dose" literature of Nomi and Allensworth (2009); Cortes, Goodman, and Nomi (2013); and the Southern Regional Education Board (SREB) (2002). Of these studies Nomi and Allensworth's research is more comparable to this study in that it did not include an additional component to its' "double-dose" intervention and did conclude an increase in algebra test scores but did not find as great of gains in achievement throughout the high school trajectory. However, the studies by Cortes, Goodman, and Nomi and the SREB had a component of English or reading concert with the "double-dose" of mathematics as well as some supplementary interventions for students.

Finally, a multiple regression analysis found scores on the Explore and EOCT, as well as the number of courses completed in high school, as significant predictors of the ACT

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mathematics score. The EOCT score was the most significant predictor, followed by the number of courses completed, and then the Explore score. Although the school students attended was not a significant predictor of the ACT score, the timing and circumstances of when students took the EOCT and how many courses they completed in high school was determined by which school students attended.

This quantitative phase of the study gives a holistic picture of student mathematics achievement throughout the mathematics trajectory during the transition period from the end of eighth grade to the end of eleventh grade. Its findings are based on data obtained from the ACT assessment suite. Some might argue these tests provide limited information regarding student achievement as a student's score summarizes student performance on a particular set of items on a particular day. If a student could take a test 50 or 100 times, his or her scores would vary (even if the student neither learned nor forgot anything between test administrations) (Kaestle, 2013). Utilizing multiple administrations of standardized tests are not feasible in today's education system because of the cost associated with them. Educators are forced to make decisions regarding student achievement based on these one-time administrations of tests beginning in kindergarten and continuing throughout high school and into college.

When resources are limited (e.g. time and money) standardized tests such as the ACT assessment suite provide a consistent assessment acting as somewhat of an equalizing force. They provide objective data with which to *compare* students and eliminate bias. In this study the quantitative data obtained allowed the researcher a means of *comparing* mathematics achievement between the two schools' mathematics course taking progressions. Through this means of comparison additional information regarding student achievement was obtainable in the qualitative phase. Without the quantitative achievement data the forces behind the

achievement would have been more difficult to obtain. As a high school mathematics teacher, I feel tests such as the ACT assessment suite provide important indicators of student achievement in which stakeholders can utilize to recognize students who may need additional academic intervention. Upon this recognition, factors that may be impacting the score can be determined. Therefore, when used in concert with other methods of evaluation these assessments can be a vital tool when evaluating student mathematics achievement.

The mixed methods design of the study, with a quantitative and a qualitative analysis, allowed for additional insight into student mathematics achievement based on the standardized test scores. The use of this design attempted to overcome the perceived limitations of standardized testing by understanding the context of each student's mathematics course progressions through the voices of the participants. Therefore, the choice component of Elder's fourth principle of life course theory, "individuals construct their own life course through the choices and actions they take" (p. 4), was examined in the qualitative phase through the responses students made as they traversed through their mathematics trajectory.

Qualitative Findings

Qualitative Research Question

The qualitative question asked what social-ecological supports might be leveraged to support an increase of students' mathematics achievement throughout the high school transition period. Upon completion of the quantitative strand, this qualitative strand is used to go beyond the quantitative discussion through the examination of student experiences as viewed by students. The exploration of student voices in this strand sheds light on why students experienced an increase of achievement throughout their high school transition period. By going beyond the statistical analysis of each school as a whole and examining individual experiences, the scores

come to life through an understanding of the meaning behind each of the student's scores on their individual tests.

The quantitative data revealed only 20 out of 105 (19.0%) students from School 1, and 11 out of 48 (22.9%) from School 2, increased their achievement score five points or more from the eighth grade ACT Explore Test to the eleventh grade ACT Mathematics Test. Six students were purposively selected to interview for this qualitative portion of the study based on their improvement and the sampling criterion delineated in Chapter Three. Three students from each high school participated in an approximately one-hour interview in an attempt to answer this research question. The following paragraphs provide the conclusions to that inquiry.

All six participants have been students in the school district from at least sixth through twelfth grades. Of the district's three middle schools, all are represented from the six participants: three from Valley Middle School, two from Maple Crest Middle School, and one from Pine Crest Middle School. Valley Middle School students feed into School 1 or School 2 depending on the student's home address. Two students from Valley attended School 2 and one attended School 1. All Maple Crest students attend School 1 and all Pine Crest students attend School 2.

Upon the initial descriptive coding of the six interviews, four categories that influences students' achievement were revealed: cultural, social, school/procedural, and academic factors. The second cycle of pattern coding resulted in four themes: early struggles in mathematics, meaningful relationships, involvement in school, and school mathematics schedule - Algebra A/B class structure (See Figure 10). These factors and themes mirrored the three interlocking structures of life course theory: family, social, and school structures. The Venn diagram in Figure 11 illustrates the interlocking nature of the factors, themes, and structures. These

collectively affect students' mathematics trajectory and achievement as they progress throughout high school.

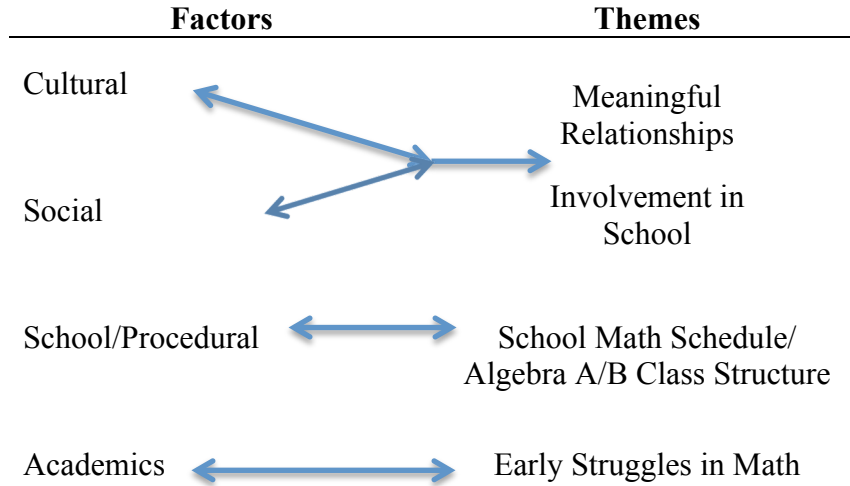| Factors	Themes
Cultural	Meaningful Relationships
Social	Involvement in School
School/Procedural	School Math Schedule/ Algebra A/B Class Structure
Academics	Early Struggles in Math

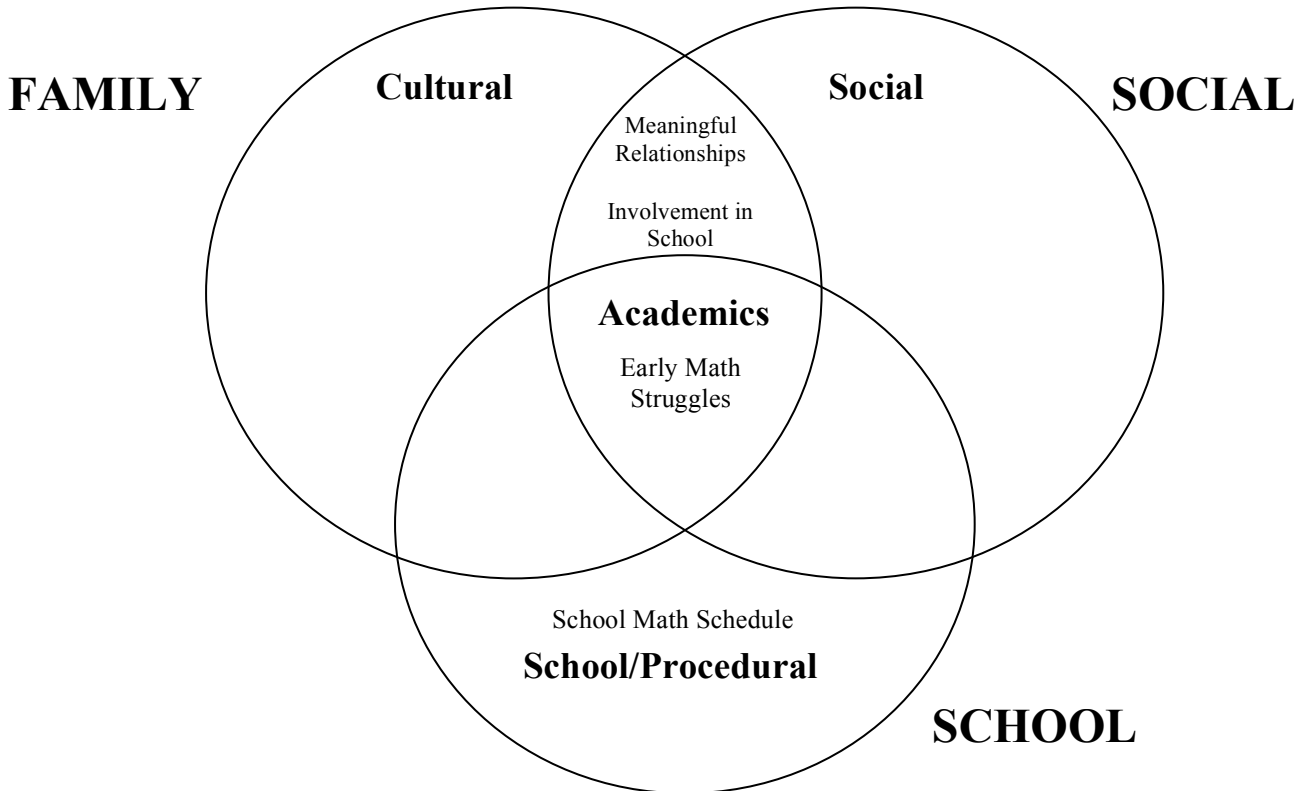*Figure* 10. Themes and factors from coding

Figure 11. Interlocking structures of Elder's life course theory

The realities of the more rigorous and focused curriculum of high school in comparison to middle school was found by Akos and Galassi (2004) as one of the most difficult to master soon after the high school transition. All of the participants navigated this part of the transition with apparent ease with all improving their mathematics grades from eighth grade to ninth grade despite their earlier struggles in mathematics. They also exhibited continual improvement throughout their mathematics trajectory. Specific courses designed to develop study skills have resulted in increased academic performance (Fulk, 2003; Kayler & Sherman, 2009). However, the participants' improvement occurred without any class in middle school or high school focused on study skills.

The transition into the large, anonymous, and complex setting of a high school makes the establishment of supportive relationships increasingly unlikely. Students often allege the prevalence of the lack of social support from high school teachers is more profound as opposed to middle school teachers. High school teachers are described as less personal and more controlling and students find it difficult to form bonds with them (Barber & Olsen, 2004: Croninger & Lee, 2001; Seidman et al., 1996). However, most all the participants formed a meaningful relationship with at least one of their high school teachers to replace the attachment they may have had with a middle school teacher, which increased their social capital. With the increase of their mathematics achievement in ninth grade, these findings are congruent with Langenkamp's (2009) research in that high levels of teacher bonding resulted in increased achievement in high school and were an essential social/emotional factor that contributed to their transition and trajectory.

The evidence of a supportive home environment during the transition time further helped to ease any disruption of social regularities. The third principle of Elder's (1998) life course

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theory illustrates this in that individual experiences are connected through the lives of family members. This is also consistent with research about the influence of positive parent-child relationships on student attitudes, behavior, and performance in school (Newman et al., 2000) and more specifically the effect these relationships impose on student mathematics achievement (O'Sullivan et al., 2014). The Carnegie Council on Adolescent Development (1990) considers such "relationships with adults … fundamental for intellectual development and personal growth" (p. 247).

This support from the home and school environments of each of these participants illustrated the high cultural and social capital discussed by Bourdieu (1986) that helped to establish the attitudes and knowledge necessary for them to have a successful transition and mathematics trajectory. Furthermore, since four of six participants were African-American, this confirmed Ford's (1993) research that demographic variables such as parents' education level, occupation, and employment status had little relationship to African-American students' commitment to academic achievement.

In addition to the cultural and social support provided by their teachers and parents that helped student academic performance, involvement in school and extracurricular activities further validates research on the impact these have to improve educational outcomes (Ashbourne & Andres, 2015; Shulruf, 2010). These activities allowed for increases in student social capital, and supported their social development. All of the students except Debbie mentioned some type of extracurricular activity as their highlight of high school or referenced an activity when asked to evaluate high school; responses included that it was "fun," "really enjoyed it," or "the best time of my life." Two stated they wished they could change high school and become even more involved by being in more clubs or other school activities. For most students their most valuable

experience in high school was involvement in an activity not directly related to academic areas. The research of Seidman et al. (1994) declared a majority of ninth grade students are less involved in extracurricular activities, but all participants except one were part of an extracurricular activity in ninth grade. It was apparent that these activities were very important to the students as well as their parents, were an integral part of their lives, and provided an additional avenue of support through a social structure.

Many schools and state sports associations have academic requirements for participation in extracurricular sports. In Alabama, the Alabama High School Athletic Association (2015) stipulates every tenth, eleventh, or twelfth grade student must pass a minimum of six units of work, including the four core courses, with a composite average of seventy for those six units during the two preceding semesters of enrollment. An eighth or ninth grade student must have passed a minimum of five new subjects with a composite average of seventy and must have been promoted to the next grade. None of the students in this study who participated in sports were ever in any danger of not satisfying this requirement. A few of them even discussed how when they were lower classmen the upper classmen on the team would offer to help them with their schoolwork and often encouraged them with their academics. Coaches at School 1 also offer tutoring sessions for their players to make sure they keep up with their studies. Despite the amount of time that extracurricular activity participation demands, the academic achievement of neither the athletes nor the other involved students suffered.

In addition to this requirement, these involved students were also subject to and must submit to random drug testing at any time while on school property or attending school-sponsored activities during regular school hours. This is in accordance with the decision of the

United States Supreme Court allowing this practice in public school districts (Pottawatomie County et al. v. Earls et al., 2002).

Lastly, the school/procedural factor associated in the transition literature addressed the school schedule and the Algebra A/B class structure at each school, the theme discovered in the interviews. All participants liked their mathematics schedule in ninth grade and the participants from School 1, having math every day, preferred that schedule for mathematics to the alternating block schedule. They were able to make the comparison of being on both schedules unlike the participants in School 2. School 1 participants maintained a higher grade point average (GPA) throughout their Algebra A/B course than their counterparts in School 2. This supports Pisapia and Westfall's (1997) study, which examined grade point averages of students enrolled in both schedules. It also supports the results of the first quantitative research question where a difference was found at the end of the course as seen by the EOCT scores in that School 1 participants increased their scores at a higher rate than School 2 participants.

Discussion regarding the results of the statistical analysis during the students' trajectory (after the Algebra A/B course) and the results of the statistical analysis towards the end of the students' trajectory (after the extra course) is warranted in comparison with the preceding qualitative results regarding student preference of schedules. It is interesting to note that the School 1 participants' GPA was higher and their mathematics achievement was significantly different from School 2 on the schedule they preferred, but after the extra course (with two years of math on the non-preferred schedule) their mathematics achievement was not significantly different from School 2. This preference by the students adds an additional perspective to the continuous enrollment research (Zelkowski, 2010) of a decrease in mathematics achievement when continuous enrollment is not evident.

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Mixed Methods Findings

A mixed methods design was chosen for this study to gain an enhanced understanding of student mathematics achievement (a quantitative measure) following different course progressions through the high school transition and the mathematics trajectory (qualitative measures) formed as a result. Through the use of both research methods, the weaknesses of each could be offset. The quantitative data offered a nonbiased explanation of the mathematics achievement attained at each school. The analysis of the student assessments and participant data confirmed that one school was significantly more successful at one time during students' mathematics trajectories and thus that there was something worth explaining. Despite the lack of data that attest to curricular and instructional validity, the qualitative analysis offered an understanding of why the participants exhibited an increase in their mathematics achievement. By examining the context of the participants' mathematics achievement throughout their trajectory, their lived experiences were explained through the exploration of their voices. This explanatory sequential mixed methods design provided the avenue, which analyzed quantitative data (mathematics test scores) and sought to explain these test scores through qualitative data (interviews).

Before transitioning to high school, all participants took the ACT Explore test at the end of eighth grade. The quantitative results of this test revealed no statistically significant difference in the test scores between the two schools with a small effect size. Moreover, all participants scored below the tenth national percentile rank in mathematics. As revealed in the interview process, this is most likely due to their attitudes regarding their achievement or what they were experiencing in their lives at that time. Keelie at School 2 encountered tumultuous times with her dad during this period, which possibly added to her low performance. She stated that if she could

change anything about middle school, she would change her entire eighth grade year, "that [it] was just a big dump." Three of the students, Debbie, Beth, and Allison, specified they would want to change their grades. Beth and Allison specifically mentioned math, "I would work harder on my math grade," and "I would work harder and study for the tests I had to take … and the math teacher I had."

After completion of the Algebra A/B courses, the EOCT scores revealed School 1 scores were significantly different than the School 2 scores. Considering the research of Allensworth and Easton (2005), Neild (2009), and SREB (2002) stating how crucial the transition from eight to ninth grade is to a student's ongoing trajectory, the practice of School 1 should be considered. The larger increase of the EOCT score distribution in School 1 over the score distribution in School 2 can be an indication the practice of School 1 was successful in increasing achievement, which would bode well for all stakeholders involved (i.e., schools, teachers, students, and parents).

Being a teacher at School 1 and teaching these students that were a part of this intervention, I identify with the advantages it employs. As previous research has proven continuous enrollment in mathematics courses is known to increase achievement (Zelkowski, 2010). The intervention at School 1 is a form of continuous enrollment. This is an advantage for all students but especially for lower socioeconomic students. First, it provides an academic advantage as indicated in the results and second, provides consistent structure for these students who often do not experience structure outside of school (Duncan & Magnuson, 2005: Moller, Mickelson, Stearns, Banerjee, & Bottia, 2013). In my experience, the everyday contact with students has been more profitable than seeing them every other day. This contact provides more consistent practice with the content by a daily assignment to be completed before the next day.

When the class meets every other day, students may go over 24 hours after class time before looking at the content again. This may not seem much, but for struggling learners (which most Algebra A/B students are) this is a lot of time. With the continuous enrollment, test scores increased which helps to alleviate some of the pressure teachers face in the area of high-stakes testing.

Upon examination of participants' individual data for the EOCT, all participants' percentile ranks increased significantly. As School 1 participants started high school with a slightly higher percentile ranks, based on the Explore, overall they continued to perform at a higher achievement level. This occurred despite the improved academic behavior all participants exhibited as they entered the high school transition period and continued throughout their mathematics trajectory. Also at this time in their trajectory, the mathematics GPA for School 1 participants was higher than the GPA of School 2 participants. These data may be explained by the responses of the School 1 participants regarding having math every day. All three of them mentioned they liked having math every day as opposed to every other day. Debbie even attributed the every day math class to her increase in scores from the Explore to the EOCT, "I think [my increase] was [due] to the structure of the class because I was pushed more to do it." Beth believed she "probably would have done worse" if she had taken math as the School 2 students (every other day) and that having math every day helps a person to stay more focused. These individual qualitative analyses help inform the overall quantitative data analysis by school in that there were differences in achievement between schools after students complete the Algebra A/B courses, which indicates the mathematics course progression at School 1 had a greater effect on mathematics achievement than did the progression at School 2 at this level.

Despite the difference in achievement, the change that occurred in all the participants' lives as a result of the high school transition illustrated Elder's (1998) description of the life course, "changing lives alter developmental trajectories" (p. 1). All the participants altered their mathematics trajectory as they improved from middle school and experienced a successful transition.

The participants in the study were purposively sampled based on an overall increase in their test scores from the Explore to the ACT (eighth grade to eleventh grade). However, as participants progressed from the end of the Algebra B course, achievement levels from the EOCT administration to the ACT in eleventh grade decreased for all participants at both schools with two exceptions. Lauren's achievement from School 1 remained constant and Allison from School 2 showed an increase. The decrease for School 1 participants occurred despite the extra course (Algebraic Connections) in their mathematics course progression. This also parallels the quantitative analysis that no differences existed in the mathematics achievement in the two schools at the end of eleventh grade. However, School 1 participants had an overall higher percentile rank on the ACT in comparison to School 2 participants. Debbie and Beth, from School 1, stated how they appreciated the extra course and did not think they would have scored as well on the ACT if they had not taken Algebraic Connections. Furthermore, Amber reflected if she had not had the Algebraic Connections course she would not have remembered content tested on the ACT. Keelie from School 2 mentioned a class to review algebra before taking the ACT would have been helpful for her. Only Allison from School 2 specified a teacher giving any type of review in preparation for the ACT. This was in the form of a "worksheet packet" which the students were expected to do individually and see the teacher individually if they had any questions. The packet was not assessed or taken for a grade.

For School 1 students, their decline in performance after ninth grade may stem from the structure of their math classes throughout the remainder of their trajectory. As stated previously, they all favored the continuous enrollment of the everyday math schedule. Then, in tenth grade when they started math every other day, Lauren thought, "once it started every other day, it was a lot harder for me." Beth would have liked to continued math every day, "especially with geometry, because I was really not good at geometry;" and that the day break in between [math classes] was not good for her. These comments support the quantitative findings that an intensive block schedule with a "double-dose" of math instruction (math class every day) has a greater effect on achievement than an alternating block schedule (math class every other day). The significant difference was found when students were on the different schedules with achievement being higher in School 1 after having math every day with the "double-dose" component. When students lost that "double-dose" component and went to the same schedule as School 2, despite taking the extra mathematics course in eleventh grade, the achievement between the schools was not significantly different any more. Theoretically, this can be explained through life course theory, in that a structural component of the school can influence student mathematics achievement.

The quantitative and qualitative findings from the study illustrate all of the forces that are interconnected and help determine students' mathematics success or failure. Cultural, social, school/procedural, and academic factors exemplify the multiple, interlocking structures present in the principles of life course theory: family, social, and school structures. All work together to determine individual responses to events that occur in their environment. These responses guide one's choice and initiative, which then shape the life course and affect students' mathematics trajectory, which produces achievement. Therefore, the findings suggest that mathematics course

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progressions alone do not determine student mathematics achievement nor do student experiences. Students navigate through the high school transition period and their mathematics courses based on the established, institutionalized pathways and constraints they encounter in concert with the social-ecological supports present in their lives: the family, social, and school structures. Moreover, the findings illustrate that results on standardized tests do not give the entire picture of student achievement. The results obtained from both methods show that high schools must consider the whole child as students transition through their mathematics trajectory.

Implications for Practice

The examination of student mathematics achievement through the lens of life course theory allowed for thought provoking implications for practice. When situated within the context of different mathematics course progressions, school districts need to account for how the different *developmental* needs of students are influenced by the different structures that support them. In addition, the influence of student agency should be accounted for and how all these elements intertwine to affect student mathematics achievement.

As students transition to high school each has varying *developmental needs*, but these needs are affected by the structures they encounter daily. These structures impact students in varying ways but all aspects of each structure need to occur for student development. Life course theory views lives as unfolding through these structures in transaction with the contexts encountered throughout transitions (Elder, 1998). Through its components it emphasizes the need for educators to study the context through which students progress throughout their high school transition.

This mixed methods study utilizing both quantitative and qualitative methods allowed for such an examination of student development on two levels: an understanding of mathematics

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achievement on a macro-level through educational practices and on a micro-level through student experiences within those practices. The quantitative findings in research question one yielded a significant difference in mathematics achievement for School 1 students. The School 1 course progression allowed students' trajectories to be enhanced and possibly change from the direction they were following before the start of ninth grade. The school structure of the mathematics course progression affected the *development* of School 1 students.

Although research by Zelkowski (2010), Kramer (1997a), and Zepeda and Mayers (2006) did not examine mathematics achievement at a specific grade level, all were concerned about different scheduling options and support these findings. Having a mathematics class every day for an entire year (School 1) is a form of continuous enrollment. Although Zelkowski studied continuous enrollment of a 50-minute class period every day an entire year as opposed to an intensive block period one semester, this study parallels his findings of a decrease in mathematics achievement when continuous enrollment was not evident. Kramer examined mathematics student achievement on the alternating block and intensive block schedule and revealed inconclusive results for each. Of the schools he studied only two out of four on alternating block schedule experienced in increase in mathematics achievement. Five out of nine on an intensive block schedule experienced an increase. Zepeda and Mayers did not examine mathematics achievement specifically, but found similar results from examination of achievement in general.

The qualitative findings mirrored these quantitative findings in that student experiences at home and school supported the academic *development* of each student. Most of the participants had meaningful relationships providing guidance and *support* both at home (parents) and school (teachers and peers). These relationships aided in student development by providing continuity

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and allowing students to proceed in a consistent direction. They provided a web of interpersonal relations and are evident in Elder's (1998) life course theory through the linked lives of individuals within their social spaces. These avenues of *support* promoted healthy *development* among all of the participants, which led to a successful transition period.

Due to both the quantitative and qualitative findings, I feel the everyday practice of the Algebra A/B course should continue at School 1 and should be implemented at School 2. This practice not only benefits students but also provides cohesion for ninth graders across the district. Based on my findings student *development* is enhanced through this practice. To implement a progression that includes additional instruction time one might think more teachers would be necessary. However, School 1 was able to implement this intervention without hiring additional mathematics teachers and since its inception, the number of teachers has actually decreased. No additional financial investment has played a role with this intervention.

Although schools have no control over relationships students have at home, aspects of the "double-dose" mathematics could help to circumvent the relationships students may lack at home. Based on the results from quantitative question one and with the Explore, EOCT, and number of high school courses being significant predictors of the ACT mathematics score, there seems to be credence to the School 1 mathematics course progression. The second quantitative research question found no significant differences in the means of the two schools' ACT scores in eleventh grade, based on the results of the independent samples *t*-test analysis. Despite these findings I feel the additional Algebraic Connections course utilized at School 1 should also continue as it did have an effect on student achievement. I base this recommendation on the overall outperformance of School 1 students over School 2 students.

The non-significant results on the ACT between the two schools might allude to School 2 students "catching-up" to School 1 students regarding achievement. However, despite these non-significant results, as mentioned earlier, School 1 students performed at a higher percentile rank on the ACT than School 2 students. Based on the effect size, they were in the 50th percentile at School 1, but would be in the 59th percentile at School 2. Howbeit, that is significantly down from EOCT scores where School 1 students would have been in the 72nd percentile at School 2, school and district leaders would have to determine if a nine percent difference in scores would justify the School 1 course progression including the Algebraic Connections course. In my experience, it would. In addition, consideration of the continuation of the progression is also justified through the ANOVA results, which revealed significant associations between the means of the ACT scores and the number of courses students took from ninth to eleventh grade. Furthermore, I feel the extra Algebraic Connections course is not only supported by the quantitative analysis, but also the qualitative analysis. All participants in School 1 felt the Algebraic Connections course was advantageous for them regarding their performance on the ACT.

While the achievement gains were not very large at School 1 at the end of eleventh grade, to further impact improvement of achievement, the district might give more consideration as to how standardized tests are administered. My speculation is that the different test administrations made a difference. Regretfully, I do not have any qualitative data regarding test administration. I came to this realization late in my data analysis with no more access to participants. In retrospect, I would have liked to have included questions regarding the different test administrations in my Interview Protocol. However, based on my experience with administering standardized tests to my own mathematics students, on average, my students generally perform

much better when I administer their test as opposed to another faculty member who may or may not be a mathematics teacher or one who knows the student individually. Schools might consider using a creative schedule to accommodate student testing where more students could be administered their standardized test by their content teacher to help promote possible increases in student achievement.

As mentioned in my limitations at the onset of this study, another avenue to explore when school districts are examining differences in achievement is the attitude of high school students with regards to testing. Most often do not try their best without an incentive or a grade. If scores on achievement tests were correlated somehow with specific classroom performance where a grade could be assigned or some incentive offered (or both), achievement gains might be more evident as well as more valid measures of increases or decreases in achievement. Also, in retrospect, for further insight, I wished I had asked participants how much effort they actually gave in taking the three standardized tests.

Another recommendation for practice includes adding components besides the prescribed course progression or to follow a specific model from research, which has been successful such as the Talent Development Model (Quint, 2006). This model includes not only the "double-dose" component of Algebra 1 and English 9 but also a freshman seminar course, a well-designed curriculum, lesson plans developed for the program, and professional development of ongoing coaching, support, and technical assistance to teachers. The freshman seminar course provides students an additional relationship of *support* through the building of a non-academic relationship between teacher-student. With the implementation of such interventions, Quint (2006) discovered achievement gains from ninth grade were not lost and continue throughout students' trajectory to the eleventh grade with continued improvements in math and reading test

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scores. Because of the exemplification of the impact of meaningful relationships in the qualitative data, by providing a course such as this the absence of meaningful relationships at home and school may be thwarted.

The last implication for practice entails student involvement in school including the influence of extracurricular participation and the support received within extracurricular participation. Involvement in extracurricular activities throughout high school contributed to the *development* of the participants by giving them a sense of belonging that has been proven in the literature to positively affect motivation, effort, and achievement level (Ashbourne & Andres, 2015; Crosnoe et al., 2015; Morris, 2016; Shulruf, 2010). Participation in these activities promote and help to improve organization and time management skills, foster positive attitudes, and support development of social adaptation skills that might not occur if they were not involved (Styron & Peasant, 2010). Because of their involvement in school activities, all of the participants, with the exception of maybe Donna, exhibited no signs of feeling ignored, excluded, or disconnected as they transitioned through high school.

Ninth grade students are the least involved students in high school (Seidman et al., 1994). Through the findings it seems extremely important that schools offer a variety of extracurricular activities beyond the traditional academic areas, including interest and service clubs. My recommendation would also include that schools offer an avenue for ninth grade students to be exposed to the different extracurricular opportunities beyond athletics. Such exposure might include a club fair to discover all of the opportunities available or an adjustment to the school schedule at the beginning of the year for all ninth graders to attend an abbreviated club meeting. This study showed through such activities that the participants' needs for social *development* were met by their added involvement in the total school environment. Furthermore, their

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involvement helped to spawn their trajectory throughout high school by providing opportunities outside the classroom to encourage confidence and self-efficacy inside the classroom.

Extracurricular participation in sports, as well as band and chorus, could also provide opportunities for students to receive the extra academic help that is often necessary for students in Algebra A/B courses. Keelie received this extra help in a non-structured fashion by the older girls on the basketball team helping her with her math work. Schools could implement a required tutoring component during their athletic periods at least once a week during their athletic season and maybe more often during the offseason. At both schools in the district, because of the alternating block schedule, most students in sports (and some in band and chorus) have two blocks of the activity; meaning five ninety-minute classes per week. This is in addition to after school practices. With a required academic component, students could take advantage of peer *support* to enhance their *development* in their mathematics class as was evident with Keelie.

Despite all the efforts schools might provide to adhere to the developmental needs of students in regards to their mathematics achievement ultimately students must be an agent of their own achievement. As a 24-year veteran in a mathematics classroom and a mathematics department head, I can attest teachers address with students how all the choices they make affect their achievement and future success academically, behaviorally, etc. This often occurs on a daily basis and mostly in an unstructured fashion; however, it is the decision of the student how they will internalize the message received. All participants determined of their own will to improve their study habits as they progressed throughout high school. This exemplified Elder's (1998) life course principle of human agency where "individuals construct their own life course through the choices and actions they take within the opportunities and constraints" (p. 4) of the environment they encounter. The participants came to understand their role in the construction of

their life course. They took an active, contributory role in shaping their mathematics trajectory and did not allow the stressors they faced to deflect their trajectory; instead they experienced relative continuity throughout.

However, the reality in most 9-12 schools is that most high school students lack intrinsic motivation and do not try their best on standardized tests without an incentive or given a grade. If districts want a true picture of student achievement, efforts must be made to provide motivation for students beyond intrinsic value. I speculate that the lack of significance found in the ACT test scores, indicating that the Algebraic Connections course may not have had an effect on achievement, was partially due to the lack of intrinsic motivation to do well on the test.

These implications for practice, guided by the data obtained from the study, further illustrate the structures that support students and how they are embedded within their social-ecological context. Student *development* is impacted by the academic and sociocultural contexts of which they are exposed throughout their transition period. As a whole, life course theory provides a perspective of student *development* that helps identify the structures influencing student *development*. It also provides an avenue in which educators can best help students navigate within the structures and produce a successful high school transition.

<center>**Unexpected Findings and Future Research**</center>

High Stakes Testing

Since the inception of *No Child Left Behind* (NCLB) in 2001, teacher effectiveness has been under scrutiny. It was required by this federal legislation that each state mandate standardized testing requiring all students to reach 100% proficiency within 12 years. In 2011, the U.S. government allowed flexibility from NCLB if states provided evidence of differentiated accountability systems and developed reforms to support effective classroom instruction and

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school leadership (The White House, Office of the Press Secretary, 2011). Most often these new accountability systems imply teacher evaluation models in which teachers might be evaluated based on one standardized test given at one time during a school year.

As of 2015, forty three states require objective measures of student growth and achievement to be included in teacher evaluation systems. In 18 of those states, teacher ratings involve student outcomes as a significant factor, and 17 states require student achievement as the prevailing standard for reviews of teacher effectiveness. Furthermore, some states have gone as far as directly tying teacher pay to teacher evaluation results (Doherty & Jacobs, 2015). The results from this study, through student interviews, inform the practice of this type of evaluation. Students come into classrooms from varied backgrounds and situations. Some are prepared academically but not emotionally, while others may be prepared emotionally but not academically. The preparedness of students also differs by location as well. A teacher in one area of a state may not have students as prepared as students in another part of the state. This can even occur in the same school.

Many factors influence student achievement on standardized tests, with teacher effectiveness being only one. Future research might involve a mixed methods longitudinal study following students from varied backgrounds with different cultural and social capital and examine their experiences across their entire educational trajectory. This type of study seems like a monumental task but would reveal differences among students and teachers as well as expose to legislatures the difficulty teachers face every year in providing the differentiation that is often required for students to perform on these standardized tests. Another study on a much smaller scale would be to choose one classroom to study for an entire year to examine the diversity of backgrounds in all areas of each student's life. This would examine the daily challenges teachers

face not only within the classroom with diverse students but also the daily challenges outside the classroom.

Despite arguments against high stakes testing, students continue to be evaluated on a single test score at various stages in elementary and secondary education as well as during their collegiate career. Most of the nation's postsecondary institutions rely on the ACT or SAT to help them make admission and placement decisions; especially in mathematics (Bettinger, Evans, & Pope, 2013). In some community colleges, if subject area scores on these tests are not high enough, placement tests may be administered to determine if remediation and/or non-credit bearing coursework are required. Moreover, many disciplines at the collegiate level require competency on a standardized test for degree completion. For example, in Alabama, many education collegiate curricular programs require passing the PRAXIS before student teaching and before obtaining a degree (Plash & Piotrowski, 2006). Several graduate school admissions require specific scores on the Graduate Record Examination (GRE) or the Miller Analogies Test (MAT). This exhibition of competency on standardized testing also extends to other professions such as nursing where each state board uses the National Council Licensure Examination (NCLEX) to determine whether or not a candidate is prepared for entry-level nursing practice (Trofino, 2013). This exam requires middle grades mathematics and very early algebra skills to pass the mathematics portion.

Due to these realities, another aspect of high stakes testing research this study could spawn would be to consider how standardized tests are given in middle school and high school (as discussed earlier). Throughout elementary school each student's daily classroom teacher gives most standardized tests. Students have become accustomed to this teacher and most students have been in the classroom with him or her all year. This most often is also the teacher

whom they may have practiced test-taking strategies. This practice is mostly abandoned when students enter middle school. For most standardized tests in middle school, as well as high school, students are placed alphabetically in classrooms where teachers (they may or may not be familiar with) administer and/or proctor the test. Often this is done out of convenience by placing all students who are testing in one area of the campus while the rest of the campus continues classes as usual. Of the three achievement tests examined in this study, student performance was the lowest on the two that were administered in this manner, Explore and ACT. However, the students' mathematics teacher administered the EOCT. This resulted in an increase in achievement for all six participants investigated. However, if tests were given by subject level and by the classroom teacher, this would make it easier for teachers to encourage and offer incentives or a grade for students to do their best. The examination of the test scores must take this into consideration.

Despite the limitations of high stakes testing and the lack of curricular and instructional validity in this study, the proven predictive validity of the ACT assessment suite (ACT, 2009; Lorah & Ndum, 2013; Radunzel & Noble, 2012a, 2012b) provides educators with valuable information that can adequately determine a student's present level of strengths and weaknesses. For both the ACT Explore and the ACT Mathematics Test, the philosophical basis for the tests are that (a) the tests measure the academic skills necessary for education and work after high school and (b) the content of the tests relate to the mathematics curriculum (ACT, 2015e; ACT, 2005). The Explore focuses on the knowledge and skills that are usually attained by eighth grade. The EOCT is course-specific to the Algebra 1 course that measures performance against the Algebra 1 CCSS-M (ACT, 2015b; ACT, 2015c). The ACT Mathematics Test focuses on the

knowledge and skills attained as the cumulative effect of a student's mathematics school experience (ACT, 2015d).

"Double-Dose"

Despite the "double-dose" component, the extra Algebraic Connections course at School 1, students at School 1 did not perform significantly different than School 2 students on the eleventh grade ACT exam. However, with this component not providing added value to ACT test scores based on the amount of resources committed, all the participants did graduate with some goals and ambitions that may not have been present before. If not for the intervention, they potentially could have been dropouts. In addition, the participants did not get close to the ACT mathematics college readiness benchmark score of 22.

Because of the results from quantitative question one which found the every day Algebra A/B course (School 1) to be significantly different from the every other day Algebra A/B course (School 2), future research should address the continuous enrollment of mathematics courses paired with the "double-dose." As for this study, it would be interesting to replicate if the School 1 students had continued to have math every day taking the same courses. For example, Geometry A/B in tenth grade, and Algebraic Connections A/B in the eleventh grade. This would determine if it was actually the "double-dose" that was not successful or the continuous enrollment that was successful.

Lack of Research

The lack of qualitative research in high school transition, the lack of research of the high school transition as a process, and the lack of research in mathematics achievement as it relates to the high school transition suggest there is a great need for more research regarding the relationship between these three entities. This research study was only concerned with the

mathematics achievement of students experiencing two different mathematics course progressions throughout their high school mathematics trajectory over the high school transition. Based on their lived experiences, they had a successful transition period and subsequent trajectory as related by their cultural, social, school/procedural, and academic factors present in each of their lives. The investigation of these experiences only included students who made an increase in their mathematics achievement from eighth to eleventh grade. This study could be extended by examining the experiences of all different levels of mathematics achievement over this trajectory including students whose achievement level decreased or stayed constant as well as those at each school who outperformed the group (e.g. the outlier scores on the EOCT and the ACT) to determine how or if their lived experiences differed. Due to time constraints and student graduation, these groups were not accessible for contact.

The lack of research of trajectories in different academic subjects suggests there is a great need for its examination in the high school transition literature. This research study examined the different factors of the transition and determined if students were able to manipulate the challenges of the high school transition and beyond while facing academic mathematical challenges. A retrospective design was employed where forgetting what they experienced throughout their trajectory could have influenced participants' recollections. A longitudinal design that assessed samples following adolescents' trajectories prior to the high school transition and beyond would minimize this. Utilizing a survey of all School 1 and School 2 students at the time of each test administration could have strengthened this study.

Closing Summary

This chapter provided an overview of the study, responses and conclusions to the research questions, implications for practice, and recommendations for future research. The explanatory sequential mixed methods design drove the development of the problem, purpose statements, research questions, and additional methodological decisions. Quantitative and qualitative research methods complimented each other and provided a comprehensive understanding of the effects of different mathematics course progressions on student mathematics achievement throughout the high school transition. Although this research consisted of two distinct phases, the two approaches were connected given that the quantitative data was used to determine qualitative participants.

The emphasis of this study was to examine mathematics achievement as a student transitions to high school and the mathematics trajectory that is established as a result of students' mathematics course progression. Furthermore, the many factors that are already established in many students' lives and the influences of these factors were explored by the investigation of the students' lived experiences throughout the transition period. The theoretical framework of life course theory provided a lens through which to study these educational occurrences, transition throughout high school and the mathematics achievement resulting from the students' mathematics trajectory. Within a life course theory framework, the research gave attention to the larger perspective of the high school transition as a process as opposed to a short-term event from eighth grade to ninth grade (Benner, 2011) and exposed the social-ecological supports that influence students' mathematics achievement. These supports of the multiple, interlocking structures, of family, social, and school, helped to interpret and connect the complexity of students' mathematics trajectories that affected their mathematics achievement.

Conducting this research study allowed me to gain a better understanding of students' mathematics trajectories as they transition throughout their mathematics courses in high school. One finding that I did not expect was the academic improvement of students over their trajectory. Most transition research posits a decline in achievement after the immediate transition to high school (Akos & Galassi, 2004; Alspaugh, 1998; Rice, 2001; Smith, 2006), but this was not evident in the six participants I examined. All the participants struggled before the transition but improved academically on mathematics achievement test scores as well as mathematics GPA throughout their mathematics trajectory. Also, their attitudes about mathematics improved which from my experience is not always the case as students get closer to high school graduation.

Evidence from this study suggests that high school students desire meaningful relationships in their lives not only at home but also at school. They seek teachers to build connections with and desire teachers to develop positive communication with them about their lives inside and outside the classroom. Students also enjoy being involved with school activities outside the classroom. It is through these activities students gain additional supports from other caring adults. These different caring teacher-student relationships were evident in the participants of this study in middle school and also established in high school, which seem to have had an effect on their academic trajectories and illustrated the social relations facet of life course theory and how these relations affected their sociocultural and psychological process of their trajectory (Elder, 1998).

Although the findings of this study are not conclusive, they provided insight into factors that can facilitate achievement and transition success throughout a student's mathematical trajectory. Moreover, by recognizing the importance of students' lived experiences as they obtained mathematics achievement helps to emphasize the need to further examine these factors

in students' high school experiences found in this study. These, in addition to other factors, could

possibly have long-term implications for the furtherance of students' trajectory and success

beyond high school.

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APPENDIX A

SAMPLE ALABAMA MATHEMATICS COURSE TAKING PROGRESSIONS

(List view)

POSSIBLE COURSE PATHWAYS

There are several pathways by which a student can meet the high school graduation requirements for earning four credits in mathematics in Grades 9-12. Local school systems may determine which pathways lead to completion of the requirements for a specific diploma, provided the minimum requirements set forth by the Alabama State Board of Education are followed. Some pathways in Grades 9-12 are indicated below.

Pathways for Students Who Begin Algebra I in Grade 9

Algebra I	Algebra I	Algebra I
Geometry	Geometry	Geometry
Algebra II With Trigonometry	Algebra II With Trigonometry	Algebra II With Trigonometry
Precalculus	Analytical Mathematics	Discrete Mathematics
Algebra I	Algebra I	Algebra IA
Geometry	Geometry	Algebra IB
Algebra II With Trigonometry	Algebraic Connections	Geometry
Mathematical Investigations	Algebra II With Trigonometry	Algebra II With Trigonometry
Algebra I	Algebra I	Algebra IA
Geometry A	Geometry	Algebra IB
Geometry B	Algebraic Connections	Geometry
Algebra II With Trigonometry	Algebra II	Algebra II
Algebra I		
Geometry A		
Geometry B		
Algebra II		

Some Pathways for Students Who Complete Algebra I in Grade 8

|		
Geometry	Geometry	Geometry
Algebra II With Trigonometry	Algebra II With Trigonometry	Algebra II With Trigonometry
Precalculus	Analytical Mathematics	Precalculus
Analytical Mathematics	Precalculus	Advanced Placement (AP) Mathematics Course
Geometry	Geometry	Geometry
Algebraic Connections	Algebra II With Trigonometry	Algebra II With Trigonometry
Algebra II With Trigonometry	Discrete Mathematics	Mathematical Investigations
Analytical Mathematics	Precalculus	Precalculus
Geometry	Geometry	Geometry
Algebra II With Trigonometry	Algebra II With Trigonometry	Algebraic Connections
Mathematical Investigations	Discrete Mathematics	Algebra II With Trigonometry
Discrete Mathematics	Mathematical Investigations	Precalculus
Geometry	Geometry	Geometry
Algebraic Connections	Algebraic Connections	Algebraic Connections
Algebra II With Trigonometry	Algebra II With Trigonometry	Algebra II With Trigonometry
Analytical Mathematics	Discrete Mathematics	Mathematical Investigations

APPENDIX B

SAMPLE ALABAMA MATHEMATICS COURSE TAKING PROGRESSIONS

(Graphical view)

High School Math Courses

(The number in the black oval is the recommended minimum grade for progressing from one course to the next. Honors level courses have thick borders around the course title, and AP courses have double borders.)
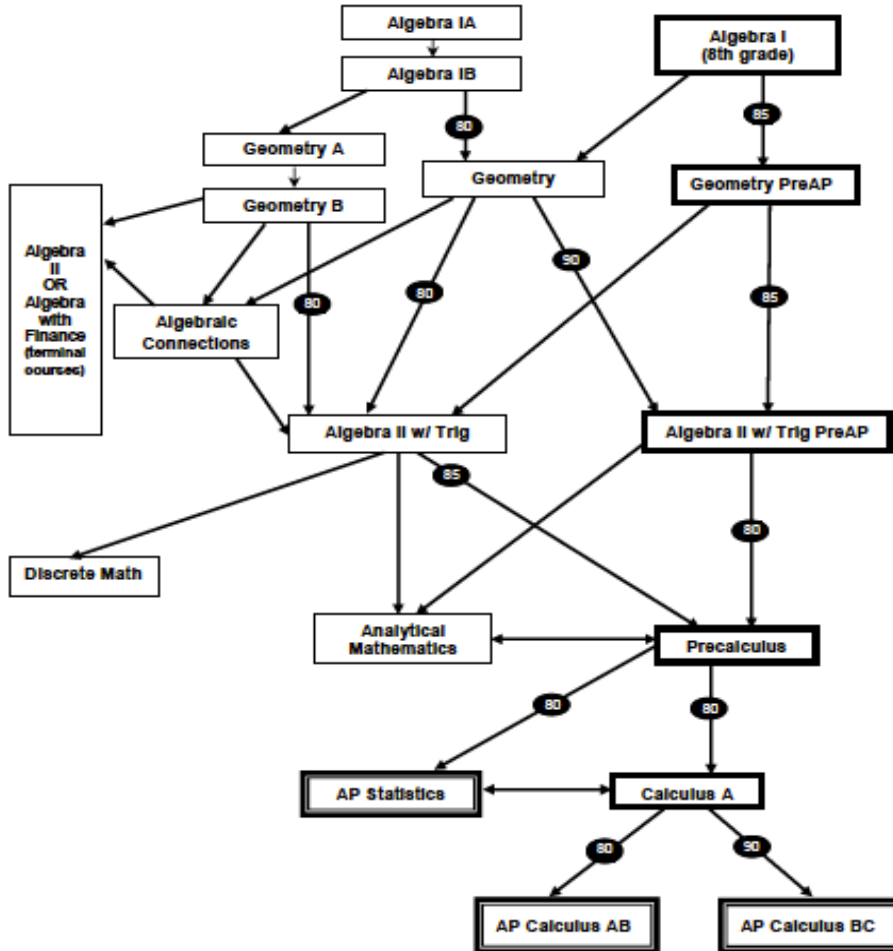
APPENDIX C

COOPERATING INSTITUTION APPROVAL

Office of the Superintendent

TELEPHONE
FAX
Email

January 26, 2016

Office for Research Compliance
The University of Alabama
358 Rose Administration Building
801 University Boulevard
Box 870127
Tuscaloosa, AL 35487

To whom it may concern:

I am writing on behalf of Ginger Richey's IRB Protocol 6028. Ginger is one of our mathematics teachers at ▮▮▮ and I am her superintendent. I am aware of her research regarding mathematics course progression and that she will be conducting it a ▮▮▮ and ▮▮▮ by obtaining mathematics test scores as well as interviewing three students at both schools. She has my permission to perform this research.

Sincerely,

Superintendent

APPENDIX D

IRB APPROVAL

February 12, 2016

Ginger Ellen Richey, NBCT, EdS
Department of Curriculum & Instruction
College of Education
University of Alabama
Box 870232

Re: IRB # 14-OR-371-R1 "High School Math Progression Evaluation"

Dear Ms. Richey:

The University of Alabama Institutional Review Board has reviewed the
revision to your previously approved expedited protocol. The board has
approved the change in your protocol.

Please remember that your approval period expires one year from the date of
your original approval, November 9, 2015, not the date of this revision
approval.

Should you need to submit any further correspondence regarding this
proposal, please include the assigned IRB application number. Changes in
this study cannot be initiated without IRB approval, except when necessary
to eliminate apparent immediate hazards to participants.

Good luck with your research.

Sincerely,

Carpantato T. Myles, MSM, CIM, CIP
Director & Research Compliance Officer
Office for Research Compliance

APPENDIX E

INFORMATION ABOUT THE STUDY/CONSENT FORMS

UNIVERSITY OF ALABAMA
HUMAN RESEARCH PROTECTION PROGRAM

Informed Consent for a Non-Medical Study

Study title: High School Math Progression Program Evaluation

Ginger Richey, Mathematics Department Head/Math Teacher at ███████
███████ **, UA Graduate Student**

Your child is being asked to take part in a research study.

You are being asked to give permission for your child to take part in a research study.

This study is called High School Math Progression Program Evaluation. The study is being done by Ginger Richey, who is a math teacher at ███████ and is a graduate student at the University of Alabama. Mrs. Richey is being supervised by Dr. Jeremy Zelkowski who is a professor of Mathematics Education at The University of Alabama.

What is this study about? What is the investigator trying to learn?
This study is being done to find out the effects of different mathematics courses taken in high school.

Why is this study important or useful?
This knowledge is important/useful because it will help teachers and administrators know the best mathematics courses for students to take to be most successful. The results of this study will help teachers and administrators understand better ways to help students.

Why has my child I been asked to be in this study?
Your child has been asked to be in this study because he/she has shown an increase in mathematics achievement from eighth grade through eleventh grade.

How many people will be in this study?
Five other people will be in this study.

What will my child be asked to do in this study?
If you meet the criteria and agree to be in this study, you will be asked to do these things:
Participate in one interview
Allow the interview to be transcribed

How much time will I spend being this study?
The interview should take about 45-60 minutes.

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CONSENT FORM APPROVED: 2-12-16
EXPIRATION DATE: 11-8-16

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Will being in this study cost my child anything?
The only cost from this study is your child's time.

Will my child be compensated for being in this study?
In appreciation for their time your child will receive a $25 Amazon gift card upon completion of the interview process. If they decide to quit during the interview, they will be given a prorated gift card (at a rate of $25 per hour).

Can the investigator take my child out of this study?
The investigator my take your child out of the study if she feels that the study is upsetting your child.

What are the risks (dangers or harms) to my child if I he/she is in this study?
There are no foreseeable risks for your child in this study, but there are reasons he/she may not want to participate. For example, he/she might not have the time to consent to an interview. His/her identity will be kept confidential by using a pseudonym of their choice. All data will be stored until no longer needed at which time they will be destroyed.

What are the benefits (good things) that may happen if my child is in this study?
Although your child will not benefit personally from being in the study, he/she may feel good about knowing that you have helped our teachers and administrators make decisions regarding future students taking mathematics courses.

What are the benefits to science or society?
This study will help high school teachers and administrators be more helpful to students.

How will my child's privacy be protected?
Participants will be interviewed in a private room or a site of their own choosing and will be told in advance what they will be asked about. Sample questions will be as follows:
Describe your ninth grade math class. (teacher, instruction, assignments, etc.).
How do you think your ninth grade math class, meeting every day, prepared you for the rest of your high school math classes?

How will my child's confidentiality be protected?
Participants' identity will be kept confidential by using a pseudonym of their choice. All data will be stored until no longer needed at which time they will be destroyed.

What are the alternatives to being in this study? Does my child have other choices?
The alternative to being in this study is not to participate.

What are my child's rights as a participant in this study?

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Taking part in this study is voluntary. It is their free choice. He/she can refuse to be in it at all. If you start the study, you can stop at any time. There will be no effect on your relations with the school, Mrs. Richey, or The University of Alabama. There will be no repercussions/bad treatment for non-participation or for dropping out of participation.

The University of Alabama Institutional Review Board ("the IRB") is the committee that protects the rights of people in research studies. The IRB may review study records from time to time to be sure that people in research studies are being treated fairly and that the study is being carried out as planned.

Who do I call if I have questions or problems?
If you have questions, concerns, or complaints about the study right now, please ask them. If you have questions, concerns, or complaints about the study later on, please call the investigator Ginger Richey at ▇▇▇▇▇▇▇
If you have questions about your child's rights as a person in a research study, call Ms. Tanta Myles, the Research Compliance Officer of the University, at 205-348-8461 or toll-free at 1-877-820-3066.

You may also ask questions, make suggestions, or file complaints and concerns through the IRB Outreach website at http://osp.ua.edu/site/PRCO_Welcome.html or email the Research Compliance office at participantoutreach@bama.ua.edu.

After your child participates, you are encouraged to complete the survey for research participants that is online at the outreach website or you may ask the investigator for a copy of it and mail it to the University Office for Research Compliance, Box 870127, 358 Rose Administration Building, Tuscaloosa, AL 35487-0127.

I have read this consent form. I have had a chance to ask questions. I agree for my child to take part in it.
I will receive a copy of this consent form to keep.

_____   _____
Signature of Parent   Date

_____   _____
Signature of Investigator   Date

UNIVERSITY OF ALABAMA IRB 2-12-16
CONSENT FORM APPROVED:
EXPIRATION DATE: 11-8-16

APPENDIX F

INFORMATION ABOUT THE STUDY/ASSENT FORM

UNIVERSITY OF ALABAMA

Informed Assent for a Research Study

Dear Student,
I am mathematics teacher at ▮▮▮▮▮▮ and a student at The University of
Alabama. I am doing a study to find out how student mathematics achievement is different
for students experiencing different mathematics course progressions throughout high
school. This study is important because I will learn which mathematics course progressions
are best for better mathematics achievement.

You are being asked to participate in this study because your mathematics achievement
increased from ninth grade to eleventh grade. Your parents know that I am asking you to be
in this study. It is OK with them.

If you decide to be in this study, you will be asked to answer interview questions. I will
digitally record your interview and make a typed record. The recording will be destroyed as
soon as the typed record is made. If you do not want to be interviewed, you should not be in
this study.

In appreciation for your time you will receive a $25 Amazon gift card upon completion of
the interview process. If you decide to quit during the interview, you will be given a prorated
gift card (at a rate of $25 per hour). You are helping me but you do not have to unless you
want to. This is your free choice.

I do not think there are any risks or harm to you in this study.

If you have any questions, please feel free to contact me, Ginger Richey at ▮▮▮▮
▮▮. If you have questions or complaints about your rights as a research participant, call
Ms. Tanta Myles, the Research Compliance Officer of the University at 205-348-8461 or toll-
free at 1-877-820-3066. You may also ask questions, make a suggestion, or file complaints
and concerns through the IRB Outreach Website at
http://osp.ua.edu/site/PRCO_Welcome.html. After you participate, you are encouraged to
complete the survey for research participants that is online there, or you may ask me for a
copy of it. You may also e-mail us at participantoutreach@bama.ua.edu

If you agree to be in this study, please sign your name on this letter below. You can have a
copy of the letter to keep.

Thank you very much for your interest.

Sincerely,

Ginger Richey

_____   _____
Name of Participant   Date

_____   _____
Person Obtaining Consent   Date

UA IRB Approved Document
Approval date: 2-12-16
Expiration date: 11-8-16

APPENDIX G

INTERVIEW PROTOCOL

Thank you for giving me the opportunity to interview you today. I am going to ask you questions about your 8th – 12th grade school years involving your transition to high school and your math classes that shaped your mathematics achievement. I will be recording our discussion and transcribing your responses after we have finished. Your responses are valuable to me as I want to discover your experiences regarding transitioning to high school and mathematics.

I.   Culture – Family/Home Life
    A. Tell me about yourself.
    B. What are your strengths? What are your weaknesses?
    C. What have been the biggest failures or frustrations in your life?
    D. Describe your family/home life.
    E. Who do you live with? Mom/dad, grandparents, brothers/sisters, etc. Who is primarily responsible for you?
    F. How would you describe your relationship with your parents or grandparents (depending on answer to question above)?
    G. How supportive is your family in regards to your schoolwork/academics?
    H. Can you tell me any more about your family background?
       (e.g. Who supports your family? Where do your parents work? Do you work? Has anyone in your family graduated from high school and/or college?)
    I. Have any of your family members been involved at any of the schools you have attended?
    J. Do you have a specific place at home where you always work on schoolwork?
    K. If you had a free day with no responsibilities what would you do?
    L. Is there anything you have done or experienced of which you are most proud

II.   Eighth Grade School Year
    A. Describe your eighth grade school year.
        1. What were your favorite classes? Favorite subjects? Worst subject?
        2. Did you like eighth grade? Why or why not?
        3. What was a highlight of your middle school experience? Is there something that you remember about middle school that stands out; something that you will always remember?
        4. What would you say were the strengths of your middle school? Weaknesses?
        5. What is your overall evaluation of your middle school experience?
        6. If you could go back and change anything about middle school, what changes would you make? Why?
    B. Academically: teachers, grades, etc.
        1. Tell me about your eighth grade teachers.
        2. How well did you do in your eighth grade classes? What were your grades like?
    C. Socially: relationships with peers and teachers

1. Were you involved in any extracurricular activities (i.e. sports, clubs, etc.)
D. School Procedures
    1. In eighth grade your were segregated from other grade levels most of the school day, do you think that helped or hurt you academically and/or socially?
    2. What kind of relationships did you have with your eighth grade teachers, counselor, and principal?
    3. How often did you see or visit the counselor? Daily/weekly/monthly or less?
    4. What about the principal?
    5. Describe a typical school day as an eighth grader (e.g. your schedule and activities of the day).
    6. Do you think the structure of the school and the school day helped or hurt you academically and socially?

III.   Mathematics: Describe your eighth grade math class (teacher, instruction, assignments, etc.).
A. Who was your eighth grade/Pre-Algebra math teacher?
B. Can you remember how he/she taught? How was the class structured?
C. Did you always complete your assignments in this class?
D. Can you remember an event, activity, or lesson from Pre-Algebra that stands out?
E. Was there a project, assignment, or specific grade from Pre-Algebra that you were especially proud of when you completed it?
F. How well do you feel your eighth grade math class, Pre-Algebra, prepared you for your ninth grade math class, Algebra A?
G. How did you prepare for math tests in eighth grade? How did you study? Just in class with the teacher or individually outside of class, as well?
H. What is your overall evaluation of your eighth grade math experience?

So, now I am going to ask you questions about your transition to ninth grade.
IV.   Do you remember how the middle school began preparing you for your transition to ninth grade?
A. Did teachers, counselors, coaches, etc. talk much about ninth grade and what to expect?
B. Did anyone give you any advice about the transition to high school?
C. Do you feel the middle school did a good job of preparing you for high school?
D. What do you feel could have been done differently, either at the middle school or the high school, to better prepare you for success in high school?

V.   Ninth Grade School Year
A. Describe your ninth grade school year.
    1. What were your favorite classes? Favorite subjects? Worst subject?
    2. Did you like ninth grade? Why or why not?
    3. What has been a highlight of your high school experience? Is there something that you remember about high school that stands out; something that you will always remember?
    4. What would you say were the strengths of your high school? Weaknesses?

5. What is your overall evaluation of your high school experience?
6. If you could go back and change anything about high school, what changes would you make? Why?

B. Academically: teachers, grades, etc.
    1. Tell me about your ninth grade teachers.
    2. How well did you do in your ninth grade classes? What were your grades like?

B. Socially: relationships with peers and teachers
    1. Were you involved in any extracurricular activities (i.e. sports, clubs, etc.)

C. School Procedures
    1. In ninth grade your were not separated from the other grade levels during the school day, do you think that helped or hurt you academically and/or socially?
    2. What kind of relationship did you have with your ninth grade teachers, counselor, and principal?
    3. How often did you see or visit the counselor? Daily/weekly/monthly or less?
    4. What about the principal?
    5. Describe a typical school day as a ninth grader (e.g. your schedule and activities of the day).
    6. Do you think the structure of the school and the school day helped or hurt you academically and socially?

VI.   Mathematics: Describe your ninth grade math class. (teacher, instruction, assignments, etc.).

A. Who was your Algebra A/B teacher?
B. Can you remember how he/she taught? How was the class structured?
C. Did you always complete your assignments in this class?
D. Can you remember an event, activity, or lesson from Algebra A/B that stands out?
E. Was there a project, assignment, or specific grade from Algebra A/B that you were especially proud of when you completed it?
F. How did you prepare for math tests in Algebra A/B? How did you study? Just in class with the teacher or individually outside of class, as well?
G. Has your preparation for math tests changed since you were in Algebra A/B?
H. What is your overall evaluation of your ninth grade math experience?

For School 1 Students Only:

A. When you entered high school, all of your classes, except for math, met every other day. Do you think it was more beneficial for you to have math every day, unlike your other courses?

B. How do you think your ninth grade math class, meeting every day, prepared you for the rest of your high school math classes?

C. Did seeing one teacher **every day** help as you transitioned to high school?   How?

D. Do you think you would have performed better, worse, or the same in Algebra A & B (your ninth grade math class) if it had been spread out over two years, taking math every other day as opposed to every day in one year? Why?

E. If you had taken Algebra A & B over two years instead of one, you probably would have had two teachers instead of one; do you think having a different teacher for Algebra A then Algebra B would have made a difference in your performance/achievement? Why or why not?

F. Your math scores (ACT Explore & EOCT) increased from eighth to ninth grade. Do you think this was due to the structure of your ninth grade math class (e.g. taking the course every day), a choice you made, or did something else occur in your life (at home or school) that might account for the improvement?

G. After ninth grade your math courses (Geometry, Algebraic Connections, and now Algebra 2) met every other day like all your other courses. Did you like that or do you prefer having math every day? Why or why not?

H. After ninth grade your math scores, continued to improve, can you think of anything that may have caused this (a specific occurrence, choice, etc.)?

I. Upon taking the ACT last year (as a junior) you had four math classes: Algebra A, Algebra B, Geometry, and Algebraic Connections. Do you think you would have scored as well had you not taken Algebraic Connections last year and had taken the ACT directly after Geometry? Why or why not?

J. How do you feel Algebraic Connections prepared you for your current Algebra 2 class?

G. How well are you doing in your current Algebra 2 class?

K. How do you feel your 9th – 11th grade math classes prepared you for the ACT Mathematics Test?

A. How do you think your ninth and tenth grade math classes, Algebra A & B, prepared you for the rest of your high school math classes?

B. Do you think you would have performed better, worse, or the same in Algebra A & B if you had taken the two courses in one year meeting the class every day, instead of over two years, meeting every other day? Why or why not?

C. Did you have the same or different teachers for Algebra A & B? Do you think having the same teacher for Algebra A & B would have made a difference in your performance/achievement? Why or why not?

D. Your math scores (ACT Explore & EOCT) increased from eighth to tenth grade. To what do you attribute your increase? Could it have been the teacher, a choice you made, or did something else occur in your life (at home or school) that might account for the improvement?

E. Your math scores continued to improve after taking the ACT last year, can you think of anything that may have caused this?

F. Upon taking the ACT last year (as a junior) you had three math classes: Algebra A, Algebra B, and Geometry. Do you think you would have scored even better had you taken Algebraic Connections (a class intended to expand your algebra knowledge) before taking the ACT? Why or why not?

G. How well are you doing in your current Algebra 2 class?

H. How do you feel your 9th – 11th grade math classes prepared you for the ACT Mathematics Test?

APPENDIX H

KEELIE INTERVIEW TRANSCRIPT

Mrs. Richey: Tell me about yourself. Tell me some things about you, what you like, whatever you want to tell me about.

Keelie: I play basketball for Decatur High, or I used to. I usually help Developmental sometimes. I don't work down there but I go down there and work with them.

Mrs. Richey: Do you like doing that?

Keelie: Yes. I guess I got so used to them during lunch that I got close to a few of them. So, I just go down there and communicate with them. At home, all the time doing something. I always help my mom out too. She has this little business that she is trying to get – I don't know how to say it. She is trying to get a business going.

Mrs. Richey: What kind of business?

Keelie: She likes decorating baby showers, weddings and all that kind of stuff. So, we're doing that this weekend. Helping her out still. So, that's my little job right there.

Mrs. Richey: Do you get paid?

Keelie: Yes, I mean, I don't want a lot. I don't ask for a lot.

Mrs. Richey: Well, what about – could you tell me about some strengths that you have?

Keelie: What kind of strengths?

Mrs. Richey: Well, just what are you good at? What are some things that would be a strength, that either your personality or something in school or whatever.

Keelie: It would definitely have to be personality and communication, because I think I talk a lot.

Mrs. Richey: What about weakness? What would be something that you have to work at, that you're not so good at?

Keelie: Sometimes being responsible because when I'm doing stuff I'll just set something down or I'll forget a lot. And I try to working on it. That's my big weakness right there.

Mrs. Richey: Good. Okay. It's good that you recognize it. Weaknesses are always hard for me because they'll ask you that kind of stuff when you go for a job. Maybe you've never been to a job interview or anything. I hate trying to think what I am weak at. So, thinking about your life so far, what has been the biggest failure or frustration that you've had in your life?

Keelie: Biggest frustration, probably, I guess my lifestyle with my dad. That's like the biggest frustration. If I have a problem with him doing something that we don't like at home, I think it really reflects outside the home. Like, school, basketball and all that kind of stuff.

Mrs. Richey: This is the relationship with your father?

Keelie: With my dad.

Mrs. Richey: Do you live with your dad?

Keelie: No.

Mrs. Richey: Does he live here in town?

Keelie: He lives in Meridianville or Hazel Green.

Mrs. Richey: How often do you see him?

Keelie: I can't say the last time I've seen him – it was Christmas Eve and before Christmas Eve I hadn't seen him in two years.

Mrs. Richey: Do you ever talk to him on the phone?

Keelie: I don't think he wants to talk to me.

Mrs. Richey: I'm sorry.

Keelie: Oh, it's good.

Mrs. Richey: So, you told me about your dad. Can you tell me more about your family, your home, what you do at home?

Keelie: Well, I mean we all have a rough road ahead from past. I guess we don't see our family as much as we used to now. Because there was something that had went on related to my little sister. So, they kind of separated us from my dad's side and my mom's side. Of course, on my dad's side we don't see him and on my mom's side there was a problem that went on and they kind of split me up. We have my mom, my sister and my stepdad.

Mrs. Richey: So you don't see grandparents or any of that?

Keelie: No.

Mrs. Richey: I meant to tell you at the beginning too, that if there is anything you don't feel comfortable answering, you can just tell me.

Keelie: It's okay, it just slides right off my shoulders.

Mrs. Richey: So, you just have one sister? Do you have any other siblings?

Keelie: I have my brother – my oldest brother too.

Mrs. Richey: He doesn't live with you?

Keelie: Yeah, he's 22 now. So, he's on his own.

Mrs. Richey: Did he live with your mom before he was on his own?

Keelie: Yes, he did.

Mrs. Richey: He's not in your home anymore?

Keelie: We see him every once in a while.

Mrs. Richey: But he lives here in Decatur?

Keelie: Yes, ma'am.

Mrs. Richey: So, it's just you and your sister at home? Your younger sister, you said, with your mom and stepdad?

Keelie: Yes.

Mrs. Richey: So, how long have you not had this relationship with your dad?

Keelie: It's on and off with him.

Mrs. Richey: Did your mom and dad ever live in the same house together? Were they married?

Keelie: Yeah. I think they broke up during, like, the first grade.

Mrs. Richey: So, they were married and divorced when you were in first grade?

Keelie: Yes.

Mrs. Richey: So, how old is your sister?

Keelie: She was born in first grade in 2004. On December 16th.

Mrs. Richey: So, it's just your mom and your stepdad that take care of you, right?

Keelie: Yes.

Mrs. Richey: Do you have a good relationship with your mom then?

Keelie: Yes.

Mrs. Richey: So, what about – how supportive is your mom and stepdad to your school work, your academics and things at school.

Keelie: They're very supportive and the first thing they look forward to asking me every day because they know that I have a big future ahead of me and they try to keep me on track. They know sometimes I'm not responsible – irresponsible. So, they're a big support of that.

Mrs. Richey: How do you get home from school?

Keelie: Sometimes I'll ride the bus home or I'll get my stepdad to come get me.

Mrs. Richey: So, when you get home is your mom or stepdad at home when you get there or are they still at work?

Keelie: They're still at work.

Mrs. Richey: You said your mom is doing the business, but did she have another job that she works?

Keelie: Yes. She works at Madison Walmart.

Mrs. Richey: Okay. What about your stepdad? What does he do?

Keelie: He works at the – he works at a plant somewhere in Huntsville but I don't know which one.

Mrs. Richey: So, they get home around?

Keelie: Mark, he gets home around 7:00 or 6:00 and my mom, she gets off at 3:30. It depends on the traffic when she gets home.

Mrs. Richey: So, she's home not long after you get home from school?

Keelie: Yes.

Mrs. Richey: So, you just help your mom? You don't have any kind of other job? You don't work anywhere else or do anything?

Keelie: No, ma'am, not until after graduation. When I'll be looking.

Mrs. Richey: So, has anyone in your family graduated from high school? Did your mom graduate from high school?

Keelie: I don't think my mom or dad graduated from high school.

Mrs. Richey: Were they from Decatur? Did they grow up in Decatur?

Keelie: My mom's from Decatur, my dad is from Huntsville.

Mrs. Richey: Okay. Did your mom go to Decatur or Austin?

Keelie: She went to Austin.

Mrs. Richey: She went here but didn't graduate? What about your stepdad? Do you know if he graduated?

Keelie: He graduated from Buckhorn.

Mrs. Richey: Buckhorn. Did he go to college?

Keelie: No, ma'am.

Mrs. Richey: Just high school?

Keelie: Yes.

Mrs. Richey: As you have grown up in school, was your mom involved in school?

Keelie: Oh, yeah.

Mrs. Richey: Did she help at school or do anything like that?

Keelie: As far as PTA, she wasn't in anything like that. But she did help out when I was in events, because I always stayed in events at school.

Mrs. Richey: Did she do anything at Decatur?

Keelie: Yes.

Mrs. Richey: What was she involved in at Decatur?

Keelie: I've been on homecoming since 10th grade and we'll do like the floats and all that kind of stuff.

Mrs. Richey: So, she helps with the Homecoming Parade?

Keelie: Like if she has to buy anything, I bring it. Anything like that.

Mrs. Richey: Awesome. What about – so she did help when you were in middle school as well then?

Keelie: Yes.

Mrs. Richey: So, when you get home and you have school work to do, do you have a specific place at home where you always work on your school work? Is there some specific place or does it just vary?

Keelie: The den. Like, I've got to have that TV in front of me, I've got to have something entertaining me while I'm doing my work.

Mrs. Richey: It can't be quiet?

Keelie: No, and I'll sit on my bean bag.

Mrs. Richey: So, even if you are studying?

Keelie: I'll go to my room for that because my sister, she just likes to talk.

Mrs. Richey: So, if you're studying for a test you go to your room? But if you're doing just homework, you stay in the den and watch TV while you are doing it?

Keelie: Yes.

Mrs. Richey: That's what I used to do too when I was in school. So, if you had a free day and you had no responsibilities and you could do anything you wanted to do, what would you do?

Keelie: Hang out with my friends.

Mrs. Richey: What would y'all do?

Keelie: Probably – we really don't do anything. We really just stay at the house or if we're hungry, we try to scrap our change up and go out to eat. I like McDonald's or we might go to Applebee's or something like that. That's all we ever do.

Mrs. Richey: Just hang out, you don't do anything specific?

Keelie: Yes. We don't party. I don't party at all.

Mrs. Richey: Well, that's good. That will keep you out of trouble. Is there anything that you have done or experienced of which you are most proud? Anything in your whole life? You're just very, very proud of that you have done? Or accomplished?

Keelie: Um.

Mrs. Richey: Anything in school or out of school.

Keelie: I would say, basketball. I really think being in an activity at school, that it kept me out of a lot of trouble. It had me thinking of the wrongs and rights with Coach Boy on my head all the time.

Mrs. Richey: Coach Boy? B-O-Y?

Keelie: Yes.

Mrs. Richey: That's the head coach at Decatur?

Keelie: Yes, ma'am.

Mrs. Richey: Go ahead, I didn't mean to interrupt you.

Keelie: Yeah, I think being in basketball that has had a big impact on my life, from little until now.

Mrs. Richey: So, did you play basketball at Brookhaven?

Keelie: Yes, ma'am.

Mrs. Richey: 6th, 7th, 8th? You played all the way through?

Keelie: Yes.

Mrs. Richey: Okay. So, now I want to start to talk about – I'm going to get you to think back to 8th grade. Brookhaven 8th grade. What can you remember about your 8th grade? If you had to describe your 8th grade year, how would you describe it? If you can remember.

Keelie: I would have to say my dad and my grades. Like, those two were the only things that was 8th grade besides basketball.

Mrs. Richey: What do you mean your dad?

Keelie: Yeah, he kind of – I guess since we argue a lot from things he didn't want me to do or something like that, I think I brought it to school. And then it reacted on my grades, and my grades just fell. That was really the whole 8th grade and then that's when I went to summer school and I knew I could do better. The way everything was outside of school, I just brought it inside.

Mrs. Richey: So, 8th grade was the big year that your relationship with your dad kind of went -- flared up, so to speak?

Keelie: Yes.

Mrs. Richey: You said your dad and your grades. Because of the relationship with your dad that year, your grades slipped.

Keelie: Yes.

Mrs. Richey: So, in 8th grade, did you have any favorite classes? Do you remember any classes that you thought were your favorite?

Keelie: I didn't like Spanish, but I liked it that year.

Mrs. Richey: You don't like Spanish, but you liked it that year?

Keelie: I don't like it at all but I liked that class for some reason and I don't know why.

Mrs. Richey: You don't remember why?

Keelie: I guess, it was all my friends in there and usually when you have all your friends in there, you do your work better or something like that. You concentrate better -- when you don't know anybody, you're all shy and don't speak. That's how I was.

Mrs. Richey: So, you would say Spanish was your favorite class but not really your favorite subject?

Keelie: No.

Mrs. Richey: Not your favorite subject but just your favorite class?

Keelie: Yes.

Mrs. Richey: So, do you have a favorite subject? You really like the subject material?

Keelie: I don't know about that. Not really.

Mrs. Richey: Not really. What about your worst subject? Did you have a subject that you did not like at all?

Keelie: Math. I don't know if it was the way she explained it to me or what. I just did not like it.

Mrs. Richey: We're going to get more specific about math in a minute. We'll get more specific about that – I have questions about that. So, we'll come back to math being your worse subject. I probably know the answer to this one because of what you said before: Did you like 8th grade?

Keelie: No.

Mrs. Richey: Because of your dad and what happened during that year?

Keelie: Yes.

Mrs. Richey: Well, what about middle school in general, 6th, 7th and 8th grade, can you remember any kind of highlight? Was there anything that stood out or was spectacular about middle school? Something that you will always remember or that stands out from 6th, 7th or 8th grade?

Keelie: I have no idea.

Mrs. Richey: You can't really remember anything?

Keelie: No.

Mrs. Richey: Wasn't anything spectacular, huh?

Keelie: No.

Mrs. Richey: So, you went to Brookhaven. Thinking back to Brookhaven, the school, what would you say were the strengths of Brookhaven Middle School? Was there something about the school that they did really, really well that you remember?

Keelie: When I went to Brookhaven, I was a little wimp. I guess when I went to Brookhaven in to there I was, you know, shy. I didn't want to speak. I think I was just a little weird, like, three percent weird. But I think it gave me tough skin. They go out of elementary school and go into Brookhaven and I think the teachers gave me tough skin. I think there were just not putting up with it. And I started talking more, I made a lot of friends even though I had a lot of friends before. I think that's just tough skin at Brookhaven. It made me open up before high school.

Mrs. Richey: So – you already answered this, but what is your overall evaluation of your middle school experience? You just said it kind of made you tougher.

Keelie: Yes.

Mrs. Richey: Was that because of the students there?

Keelie: Probably. Of course, when you enter a school you're not going to know anybody and they are going to treat you some kind of way. But I wasn't with it so I started opening up my mouth, and when I started opening up that's when everybody started giving me respect. Because I was not going to let anybody talk to me any kind of way. And especially if you go in there with older kids, then you're going to leave. Built myself up.

Mrs. Richey: Did you ever get in any kind of trouble?

Keelie: No, only one time. Because mom actually called me on my flip phone and I had ISS. I was so mad that day because we had a little science project.

Mrs. Richey: What grade were you in?

Keelie: I think it was 6th or 7th grade.

Mrs. Richey: And she caught you on your phone?

Keelie: When I got home she told me she was sorry and I told her you caused me to get ISS. She called me on my phone and I thought it was off.

Mrs. Richey: She called you on your phone?

Keelie: She called me by accident.

Mrs. Richey: Oh, no.

Keelie: And I thought I had my phone off. But it wasn't off and I said, "You just caused me ISS."

Mrs. Richey: Oh, no. So that was the only time you got in trouble?

Keelie: Yes. It wasn't big, but I have to turn this in.

Mrs. Richey: So, if you could go back and change anything about middle school, is there any kind of change you would make?

Keelie: No, I wouldn't change anything. Well, 8th grade, that was just a big dump. If I could change my 8th grade year I would, but I can't.

Mrs. Richey: Because of everything going on with your dad?

Keelie: Yes.

Mrs. Richey: Okay, what about your 8th grade teachers? Can you remember anything about your teachers?

Keelie: Do I remember any of them?

Mrs. Richey: Yes.

Keelie: I had Mr. Hartselle, I loved Mr. Hartselle.

Mrs. Richey: What did he teach?

Keelie: History.

Mrs. Richey: Why did you love him, what was it about him that you liked?

Keelie: He was just straight up.

Mrs. Richey: I guess, straight up you mean –

Keelie: He was just straightforward with everything. He did what he said. I talked to him a lot just to talk because I know he liked to talk. So, that made me want to talk to him about life and school work, college early, we would talk about college.

Mrs. Richey: Did you talk to him about your dad?

Keelie: No, I didn't feel comfortable talking to him about it. But I guess now that I am grown up a bit, it's nothing to me.

Mrs. Richey: So you talked to him more about school things and preparing for high school?

Keelie: Yes, and all that stuff like that. We talked about his "boy band." And Mrs. Clout, she was another one that taught Spanish and she was a lot of fun. I did not take Spanish in 6th grade because I was like everybody else and I didn't know anything. When I got in there, I had fun.

Mrs. Richey: Do you remember any other teachers?

Keelie: Mrs. Huff and Mr. Stephenson. I didn't have Mr. Stephenson but I just knew him in the hallway, and he would give me a high five but I was short, so I had to jump. And Mrs. Huff, she always made funny jokes. Yeah, I liked Mrs. Huff.

Mrs. Richey: So, Mr. Stephenson you didn't even have, but you just saw him. Did he teach something or was he like a principal?

Keelie: I think he taught History and he was the 8th grade boys coach, I think. But every time he did see me, he said I was so short and little. And I had to show him I wasn't short and little. And he just picked on me and we became friends, I guess.

Mrs. Richey: And this was in 8th grade?

Keelie: Yes.

Mrs. Richey: Okay. So, in just a minute we're going to talk about your grades, but I think we have already talked about your grades in 8th grade because you said it was a bad year and that's when you grades did go down.

Keelie: Yes.

Mrs. Richey: I'm looking at your grades here and we can kind of see that from 7th grade into 8th grade and then in 9th grade, they went back up. We've already talked about how that was because of what you had to go through with your dad that year. Right?

Keelie: Yes.

Mrs. Richey: So, you were involved in extracurricular activities? You said you played basketball in middle school? Did you do any other kind of clubs? Was there any other kind of sport or any other kind of activity in middle school?

Keelie: I didn't do any kind of clubs because I was so shy. I didn't think I would fit in at the time. All I knew was my friends from basketball and my classes, I didn't think I would fit in in clubs.

Mrs. Richey: So, the only thing you did extra was basketball?

Keelie: Yes, and it probably made me noticed. I was noticed in basketball. When I left, I guess I should have been involved in clubs but I didn't.

Mrs. Richey: Okay. So, at Brookhaven in 8ᵗʰ grade, you were segregated from other grade levels? You didn't really see much of 6ᵗʰ graders and 7ᵗʰ graders? You were with 8ᵗʰ graders all day long?

Keelie: Yes.

Mrs. Richey: So, do you think that helped you or hurt you to be with the same people? The same grade level? Where it is different from high school where you are intermixed with everybody.

Keelie: Yeah.

Mrs. Richey: Do you think that was a good thing or a bad thing being with just 8ᵗʰ graders?

Keelie: I didn't. Now since I'm in high school, I don't like it at all. Like, being with older people, I need someone to tell me from right and wrong. You know, getting examples from them. But in 8ᵗʰ grade, I did not like it.

Mrs. Richey: So, you didn't like it because you were the oldest?

Keelie: You were separate from the 6ᵗʰ grade and 7ᵗʰ grade and you were always with the 8ᵗʰ graders. They were becoming lame while I was in it and I was like I need some older people around me because they act a little bit more mature. I tried to get mature.

Mrs. Richey: So, you liked having that older influence? In 8ᵗʰ grade because you were just with the 8ᵗʰ graders, you didn't have any other influences, is that what you're talking about? You didn't have any older influences?

Keelie: Yes.

Mrs. Richey: So, you talked about your relationship with some of your 8ᵗʰ grade teachers. Did you have any kind of relationship with a counselor in 8ᵗʰ grade? Do you remember?

Keelie: I don't even know who the counselor was.

Mrs. Richey: So, you didn't have any kind of relationship?

Keelie: My counselor was Mr. Hartselle.

Mrs. Richey: Even though he didn't have that title? What about the principal?

Keelie: Only – I think it was Mrs. Jackson and Mrs. Renick.   I think it was the other one. I really had a connection between those two, I guess, because they were females.

Mrs. Richey: The principal – so you didn't know the principal, you knew the assistant principals?

Keelie: Yeah.

Mrs. Richey: How did you come to make a relationship with them?

Keelie: Mrs. Jackson, my mom had said she was our cousin so I just walked up to her and said, "Hi, I'm Keelie," and all that stuff.   "Who's your granddaddy?" And I was like Leo Gray and she was like, "Oh, baby, I know you."

Mrs. Richey: So, you've got a good memory if you remember that. So, you started to talk to her after that?

Keelie: Yes, she started talking about how I was doing in school and my grades and all that kind of stuff.

Mrs. Richey: And the other principal or assistant principal as well?

Keelie: Mrs. Renick. I guess when I got assigned to ISS and I had to go to her office, she knew that I was innocent but she said the same thing; that I had to go. She couldn't change anything or she would get in trouble. Yeah, that's how I met her.

Mrs. Richey: She had to follow the rules.

Keelie: Yes.

Mrs. Richey: Do you remember what a typical day was like in 8ᵗʰ grade? Do you remember your schedule or what you did in a day?

Keelie: I had to wake up at like 5:00 in the morning to go to my aunt's house, so that my mom could go to work in Madison and I walked to school. Go to the lunch room and eat but we had to be quiet in the lunch room. Stay in there and after that, the bell would ring and I would go to class and then I would do a regular day every day.

Mrs. Richey: The same thing every day?

Keelie: Yeah.

Mrs. Richey: So, the way the school was structured about you doing the same thing every day and no varying – you did the same thing every day. You did the same thing all year long, right?

Keelie: Yes.

Mrs. Richey: Do you think that helped you or hurt you with your grades, or your friends socially or anything?

Keelie: It hurt, I don't know if it helped? I think it hurt me because, you know, I had core classes every day and so therefore you had homework every day for each class and the teachers just acted like you don't have any other core class. And you had to stay up all night long doing it. That made me angry because it kept me up all night long knowing I had to get up early in the morning. And I guess doing that   every day thing, it was tiring, it was hurting me. Now we have different schedules and it's kind of fun. But in middle school, it was like a prison.

Mrs. Richey: Okay.   So, let's talk about math in 8ᵗʰ grade. We know you had Mrs. Huff and this was Pre-Algebra. Can you remember how she taught math?

Keelie: She taught fast.

Mrs. Richey: She talked fast or she taught fast?

Keelie: She taught fast. Yes, everything she did was just so fast and she thought you could get it immediately and I couldn't. And I knew every time I asked a question, I was getting on her nerves but I just did not get it.

Mrs. Richey: But you did ask questions?

Keelie: Yes.

Mrs. Richey: How was her class structure? Was it the same thing every day? Did she vary any? Do you remember how it was?

Keelie: It was taught mostly the same every day. I guess towards the end of the year we started doing projects. I was like why would you do projects at the end of the year? I'm already struggling. And she just had homework on top of homework. And I already didn't know math at the time, so it made it worse.

Mrs. Richey: So you asked her in class for help and questions. Did you ever stay after school or get extra help from her at other times?

Keelie: Well, I went to the tutoring class or something like that. My mom had signed me up for that and I started going after school to that. And other teachers that were there that knew math, would help me and others in 8ᵗʰ grade or any other grade. And then sometimes I would go over to my friend's house – I think it was Lakesha, she goes here. I would go over there and get some help or she would teach me at the Aquadome or something like that.

Mrs. Richey: Did that help? The tutoring or getting help from your friend?

Keelie: It helped a little.

Mrs. Richey: Okay. Can you remember an event or activity or a lesson from Mrs. Huff's Pre-Algebra class that stands out that you liked or didn't like? That you can remember?

Keelie: The notebooks, you made little flaps in the notebooks to show us how to do it. But I still didn't know how to do it. It kind of helped. I say the notebooks helped me a lot and I've still got that notebook, I think.

Mrs. Richey: Do you?

Keelie: Yes, but I don't need it anymore because I finished my math, I think it was 1st and 2nd semester.

Mrs. Richey: Are you going to school? College?

Keelie: I was thinking about it. I was trying to get into the Air Force for that.

Mrs. Richey: You never know. Let me tell you about notebooks. You've got your notebook from 8th grade – so just from personal experience. I used to keep everything when I was in high school. I had graduated college and I still had my notebooks from high school. Okay. I started out in elementary school, I was an elementary teacher. That's what I got my degree in at first. And I couldn't get a job teaching elementary school. So this private school, which is Decatur Heritage, way back when, a long time ago, they needed a math teacher. I didn't go to school for math but I always loved math. And they were like, "Can you teach Algebra I?" And I was like, "Yeah, I can do that." Because I loved math. Well, I don't remember how long it was before that, but I had thrown all of those math notebooks away before I got that job. It wasn't long after I threw all that away before I got that job teaching math and I could just kick myself for throwing all that stuff away. I really loved my high school math teacher. He was from Turkey and he was just good. I really liked the way he taught. I threw all that away and to this day, I can never forget that and wished I had that. Of course, I went back to school and got my degree and I am still teaching math. Don't throw that notebook away because you never know. But that's good. That's interesting that you would say that, because I use notebooks like the composition notebooks.

Keelie: I use the foldables and stuff like that.

Mrs. Richey: That is very interesting. Well, was there a project or an assignment or a specific grade from Pre-Algebra that you remember that you were especially proud of? Do you remember doing anything really well that you had to do that you were proud of or liked above anything else?

Keelie: I can think of one test that I appreciated so much. I was praying that I got a good grade on that and I had studied with Lakesha and all that and my friend Jacquis the day before the test. And I got in there, you know, and we got huddled up – I will never forget this day. We got huddled up and were praying that I got a good grade on it and I did. I got like an 85.

Mrs. Richey: Do you remember what it was on?

Keelie: No, there was so much math, I don't know.

Mrs. Richey: But you remember that one specific test? Okay, we know you didn't do well in Pre-Algebra because of the things going on -- and you did say you had to go to summer school?

Keelie: Yes.

Mrs. Richey: How was that? Did it help you get over what happened in 8th grade?

Keelie: Yeah, I guess the summer of 8th grade I was like, I just need to grow up. Stop being a cry baby, I need to toughen up and when my mom sees me down, she will always talk to me and she will build me back up. I guess during the summer I went there, Mrs. Sutherlin was our teacher – I think she was our teacher at Cedar Ridge, in summer school she would come over there and she would tell me what to do and all that stuff. And I just got math after a while at that point.

Mrs. Richey: Was that the only time you had to go to summer school?

Keelie: Yes. That's the only time I ever went.

Mrs. Richey: Okay. So, thinking about – even though you didn't do so well in Pre-Algebra, do you think your 8th grade math class prepared you for your 9th grade math class? You took Algebra A in 9th grade. Even though you didn't do well, do you think it – and I guess you can say summer school and put that in together, do you think it helped to prepare you for your 9th grade math, Algebra A?

Keelie: Yes, because I think that the first or second day of school in 9th grade, we had a little quiz on everything that we had learned from 8th grade and think it helped me out a little bit. In summer school we did it on the computer and it had every example and I remembered every example and it helped me out on that quiz. And I started off good.

Mrs. Richey: You did. You had an 86, which is a B, your first semester – first grading period of Algebra A. So, you mentioned earlier about that one test where your friend, Lakesha, helped you. Did you normally prepare that way for your tests in 8th grade? Or was that just one instance?

Keelie: It was sometimes. When she had time and when I had time, because we didn't have no cars back then and we had to go on our mama's schedule. But after school every day, we went to the Aquadome to go play or something like that. We would be in the bleachers and we would make our own sloppy notecards and she would like flash it in my face and I would tell her what it is or I would have to write it down. Then she would check it.

Mrs. Richey: This was your friend Lakesha?

Keelie: Yes, and at the same time she would be, "Nope, you got that wrong because you missed this number and you got the whole problem wrong."

Mrs. Richey: She was a good tutor. So did you study for most tests?

Keelie: Yeah, a little. Sometimes I just gave up. At that point, I had just gave up studying. I was making 50's so I was going to go with the flow.

Mrs. Richey: So, if Lakesha didn't help you, you pretty much didn't study for a test?

Keelie: Yes. And my other friend, Kenya, she had helped me the same way Lakesha did, because she stayed right around the corner.

Mrs. Richey: Okay. So we have talked all about this 8th grade math. So, if you had to evaluate your entire 8th grade math experience – you've already said some of this but you can say it again. If you had to evaluate 8th grade math, your overall evaluation of it. What would you say about your entire 8th grade math experience?

Keelie: It sucked.

Mrs. Richey: Just because of you struggling?

Keelie: Yes.

Mrs. Richey: And your experience with your dad? That had a lot to do with it? Do you think if you didn't have those problems with your dad, that it would have been better?

Keelie: It would have been better.

Mrs. Richey: It would have been better, you just had that on your mind?

Keelie: Yes.

Mrs. Richey: You couldn't focus as much as you needed to?

Keelie: Yeah.

Mrs. Richey: Okay. Now we're going to transition to 9ᵗʰ grade. So you went to Brookhaven in 8ᵗʰ grade. Before you went to 9ᵗʰ grade, do you remember if Brookhaven prepared you in any way for transitioning to 9ᵗʰ grade? Do you remember anything that they did to help prepare you for going into 9ᵗʰ grade?

Keelie: All they said was in 8ᵗʰ grade to prepare us for 9ᵗʰ grade was, "Stop talking," and all that kind of stuff. I don't think really that they prepared us enough to go to 9ᵗʰ grade. Anybody that transitioned from Brookhaven to Decatur High, I don't think they prepared us enough.

Mrs. Richey: So, did anybody – the teachers, counselors, coaches, did they talk to you any about what to expect in 9ᵗʰ grade?

Keelie: Well, Mr. Hartselle, he did. He was about the only teacher that ever said anything about high school; that talked to me about it. He was like we need to be responsible and not talk. He always talked about the restrooms because everybody tried to use the restroom. He talked about the late work how you don't get a grade for late work and all that kind of stuff. Mr. Hartselle was the only teacher that ever talked about all this stuff, our other teachers did not.

Mrs. Richey: So he just talked to y'all about it in your class.

Keelie: Yes, everybody took a -- and he hit me in the face – not really hit me. It didn't do much to me.

Mrs. Richey: So he's the only one that you can remember that gave you any advice about transitioning to high school?

Keelie: Yes, him and Mr. Stephenson.

Mrs. Richey: Mr. Stephenson was the one that you saw in the hall that gave you the high five?

Keelie: Yes.

Mrs. Richey: How did he talk to you if you didn't have his class?

Keelie: He would talk to me in the hallway. He and Mr. Hartselle were real cool, because they teach history and he would come in there sometime for a few minutes. And then he would just talk to us or me, and then walk back out.

Mrs. Richey: So he would just talk to you about high school and what to expect in high school?

Keelie: Yes.

Mrs. Richey: So, you've already answered this question: Do you feel the middle school did a good job preparing you for high school?

Keelie: No.

Mrs. Richey: So, what do you think they could have done differently? How could they have better prepared you for high school?

Keelie: Well, that's the way it goes. I mean, as far as the work, that's the same as high school but I guess discipline and all that stuff.

Mrs. Richey: What do you mean by discipline? Do you mean they weren't strict enough?

Keelie: No, they tried. Like, they took our pep rallies away. That's the only thing they ever did. But they kind of let us run around Brookhaven at the time. Probably not now, but at the time they probably just let us run that school.

Mrs. Richey: So, Decatur was much more strict than Brookhaven?

Keelie: Yes. But I have a lot of home training so I didn't get in trouble.

Mrs. Richey: You were prepared more because of your home life? But still, they didn't as a whole they didn't really prepare you as well as you thought they could have? You did visit the high school, right?

Keelie: Yes, I visited Decatur.

Mrs. Richey: They transport you at the end of 8ᵗʰ grade to Decatur but they didn't really talk to you much about what to expect? How it's different or anything like that?

Keelie: No.

Mrs. Richey: No kind of special class or program or anything like that?

Keelie: No.

Mrs. Richey: Okay. So, 9ᵗʰ grade, let's talk about 9ᵗʰ grade. In 9ᵗʰ grade, you were coming off your bad 8ᵗʰ grade experience. You went to summer school and then into 9ᵗʰ grade. What were your favorite classes in 9ᵗʰ grade? Can you remember? Did you have any favorite classes in 9ᵗʰ grade?

Keelie: I can't think of any, it's been a long time.

Mrs. Richey: Well, you took your core classes: you had Algebra A and Algebra B – not in 9ᵗʰ grade, you just had Algebra A. Biology, English, Family & Consumer Science and Intro to English?

Keelie: Engineering. That – I thought that was another English class and the teachers at Brookhaven told me it was another English class. But it wasn't, it was engineering. When I was there the first day I said, "What did I get myself into? Those teachers lied to me."

Mrs. Richey: Oh, no. So you didn't like that one?

Keelie: No, and I was the only girl in that class.

Mrs. Richey: So, you didn't like that? You had basketball?

Keelie: Yes.

Mrs. Richey: So, was any of those your favorite? Did you have a favorite class that you liked? Like you had a favorite class in middle school but you didn't like the subject. You didn't like Spanish, but you liked the class. You didn't like the subject. Did you have a favorite class or subject in 9ᵗʰ grade?

Keelie: Yes, history.

Mrs. Richey: The class or the subject?

Keelie: The class.

Mrs. Richey: So you just liked going in there?

Keelie: Yeah, and the teacher.

Mrs. Richey: So, you did like the teacher? What was her name?

Keelie: Mrs. Brannon,

Mrs. Richey: Mrs. Brannon. Mrs. Cates – I don't think she's there anymore or she retired.

Mrs. Richey: What did she teach?

Keelie: English. I liked Family & Consumer Science. But our teacher wasn't there much of the time because I think two days before the start of school, she got in a bad wreck and she wasn't there a whole year. So we had subs. But it was fun.

Mrs. Richey: The class was?

Keelie: Yes.

Mrs. Richey: So do you have a favorite subject that you just like? You like the subject material?

Keelie: I'd say English at the time. I like English.

Mrs. Richey: Still didn't like math?

Keelie: No.

Mrs. Richey: So, was math your worst subject, still? Looks like science was.

Keelie: Yeah and science was too. Oh, yeah, science was the worst one. I forgot all about that class. I struggled in that class.

Mrs. Richey: The content was hard?

Keelie: Yeah.

Mrs. Richey: What about the teacher? How was the teacher?

Keelie: She was nice. She was just as regular as everybody else. I guess the thing that really we were taught. I didn't get the germs and bacteria, there were a lot of big words.

Mrs. Richey: But you remember some of the stuff, though. So, you're about to finish high school. Did you like 9th grade?

Keelie: Yeah, 9th grade was pretty fun.

Mrs. Richey: Why?

Keelie: I got to meet a lot of new people that was like me. There was really nobody like – nobody had the same personality as me at Brookhaven. When I went to Decatur High, there were so many Oak Park kids there and I kind of attached to them like the third day. Because I just sit there, you know, on the first day and I would just go up to them and talk to them. And they just came to me and I was like, oh, I feel cool. And then from there I was just – made a lot of friends. I made a lot of friends that were just like me.

Mrs. Richey: So, you liked 9th grade mostly because of the friends you made?

Keelie: Yes.

Mrs. Richey: And the different people that you met?

Keelie: Yes.

Mrs. Richey: Did you keep any friends from Brookhaven? Did you keep Lakesha? Is she still your friend?

Keelie: Yes, I kept a lot of them but I can't remember their names. But since my name was so simple -- in my mind and I would be like, "Hey, how are you doing?" And I that would bring all kinds of memories back because all of them were really over here.

Mrs. Richey: It was like from Brookhaven, most of them? Most of your friends from Brookhaven came over here instead of going to Decatur High?

Keelie: It was only like a few of us that went to together. But everybody came here. When they see me they be all, "Hey, how are you? How you doing?"

Mrs. Richey: So, now I'll get to what I was going to a minute ago. So, you're a 12th grader about to graduate. What would you say has been a highlight of your high school experience? What sticks out?

Keelie: I had to answer that question today and it's so hard – what was the biggest highlight?

Mrs. Richey: Something that you will always remember about high school? 9th, 10th, 11th or 12th, anything in high school that you remember that sticks out.

Keelie: This may sound dumb but the biggest highlight was walking through the hallway seeing everybody that you liked and you just approached them for like 30 seconds and you went to your class. I guess because you see them every day, it's not going to be like that when we leave high school. So, I really take advantage of that every day.

Mrs. Richey: That is neat. You just like seeing – the experience of seeing your friends every day?

Keelie: Yes.

Mrs. Richey: That is neat. So, thinking of Decatur High as a whole, the school and the things that the school does, the things that they offer and that kind of thing, what would you say were the strengths of Decatur High School? What did they do really well?

Keelie: I guess, my work because like – you know how teachers are, you're a teacher. Like if I have homework and it's due the next day, teachers at Decatur High did not play. They will say as soon as you walk through the door to turn your work in. That is your grade and you don't even get five minutes to do your work from last night. You have to turn it in immediately or they will not take it. I guess that strengthened me by being a little responsible about my work. Because I know I got to do it the night before because they're not going to give me a chance to do it. And I think my coach, Coach Christopher, he helped me a lot on that. "You know you got practice at 4:00 and it's two-something, you better do your work right now. You know they're not going to let you turn your work in late," and I was like, "Yes, sir." He would make me sit by him. Well, he would make all of us sit by him and do our work. So I guess that strengthened me a lot by making me responsible to do something without being told.

Mrs. Richey: So, Decatur High helped you to become more responsible because you know you've got to do your work?

Keelie: Yes.

Mrs. Richey: So, that's a strength of Decatur High? Well what would you say was a weakness of Decatur High? What's something that you think they could do better?

Keelie: Sometimes you feel like the teachers helping you – I mean they do help us, but I want that bond like I had with Mr. Hartselle. With most of my teachers, there are so many of us they don't get to talk to us like they can.

Mrs. Richey: So, like a personal relationship?

Keelie: Yes.

Mrs. Richey: Like, the Mr. Stephenson that would see you out in the hall? That kind of stuff? One thing that I do to try to, it doesn't take a lot of time but I get to see students that I normally don't get to see, but I try to be out in the hallway in between classes and I'll see students that I've had before and that kind of thing. I'll say, "Hi, how are you doing?" Do any of your teachers do that? Stand out in the hallway?

Keelie: Yes, I've never had Mrs. Jones – I think she's over the nursing and all that stuff. I don't have her as a teacher but I've talked to her so much. I guess she's like the favorite teacher out of the whole school. Nobody has her as a teacher but she talks to everybody. I guess the way she comes out where her personality and her respect and all that kind of stuff.

Mrs. Richey: Okay. So, I asked you this about middle school: What is your overall evaluation of your high school experience? What would you say if somebody asked you, "How was high school?" What would you say about it? Was it good? Bad? Could have been better because of this? What would you say if you had to evaluate your high school experience? 9th through 12th.

Keelie: It was the best time of my life. I think being very adventurous with this school. Being in culinary and going out and cooking for churches and stuff like that. Volunteering for all the little camps and walks and that kind of stuff. We just did a lot. Before pep rallies the students, not teachers, would do something. Like we would have hillbilly day and we'd go out muddin' at 5:00 in the morning. All the students would go out in mud to get their cars really dirty for the pep rally and anything else. There would always be something else the student body – I guess that just got everybody a little bit closer. And they were like, "I want to do that but I don't know so and so." But if you just go do it. I would never just go do something at Brookhaven. You would learn – well, not learn, but you would know a lot of people and have a bond with everybody in the school. So it's not just like – I don't know how to say it. Everybody had their little clique. Everybody's clique was joined together.

Mrs. Richey: So, we talked already about your 9th grade teachers, you already mentioned those and about how well you did in your classes and what your grades were like. So, your basketball in high school continued. Any other extracurricular activities you've done in high school besides sports? Any kind of clubs?

Keelie: Only culinary because I was in there. We just cooked and cooked, and go out to churches and all that kind of stuff.

Mrs. Richey: So that's volunteer stuff you do?

Keelie: Yes.

Mrs. Richey: What kind of things did you cook for churches?

Keelie: We did desserts and – I don't know what they're called, it's a big word for desserts. We cooked desserts, chicken breasts. Anything that Mrs. Yates found on YouTube or Google. We'd prepare for it one day and then just cook it.

Mrs. Richey: So, you mentioned earlier about Developmental and helping with that. How did you get involved with that?

Keelie: It really started in 9th grade. Developmental would come in there and eat with us.

Mrs. Richey: At lunch?

Keelie: Yes. And you know some of them would walk around, so I guess, the one boy that stood out, his name was Will and he would talk to everybody. But for some reason, he seen my Spider-Man shirt that I had on and he was, "You like Spider-Man?" And I was like, "Yeah, I like Spider-Man." And he was like, "How about you be my Spider-Woman and I'll be your Spider-Man. I will talk to you every day." I was like, "Okay, I will talk to you every day." And then, I guess, the next day he went to everybody – like all the kids in Developmental and he told them about me. And they were just rushing to the table. And my friends were like, "Keelie, what's going on?" And I was like, "I don't know what's going on." And then I just knew everybody. I just started talking to all of them every day. If I didn't talk to them, they were – I don't know.

Mrs. Richey: So you talked to them during lunch and now you say you go down there?

Keelie: Like, when we don't have basketball practice or something like that, I'll just go down there. And the girl that plays on our team, her name is Amblin, she works down there. So that was a big reason to go down there and talk to them, see them and ask them how they are doing. At first, they didn't know my name and they kept asking my name. I guess I feel special they know my name now.

Mrs. Richey: That's good.

Keelie: They are a big impact on my life. And then Coach Boy, he said, "Keelie, I've got a job for you." He said that three weeks ago. "I want you to work in Developmental Olympics." And I was like, "Oh, my gosh, for real?" And he said, "I told Mrs. Laughlin about it and I think you'll be a good representative for that." I was like, "Thank you." And he said, "You're so happy." I said, "I don't think you understand." He said, "Well, what's the reason?" I said, "Will is the reason why, because Will -- he just came to me and started talking about my shirt."

Mrs. Richey: The Spider-Man?

Keelie: Yes.

Mrs. Richey: That is awesome. Okay. So, we talked earlier about your 8th grade, and in 8th grade you were just with 8th graders.

Keelie: Yes.

Mrs. Richey: But in 9th grade, you may have had classes with mainly 9th grade, but you had 10th, 11th, and 12th, you could communicate with. You could communicate with other grade levels. You said in 8th grade you didn't like being with just your 8th graders. But in 9th grade you could mingle with everybody else. So, do you think that helped you?

Keelie: Yes.

Mrs. Richey: Being with the older?

Keelie: Yes, like it really helped. My brother went there and I think he graduated in 2011, I think, and so all those kids that knew him, they knew me. So, as soon as I walked in there, "Keelie, you're here." And I was like, "Yeah." I was here. And then I would hang out with them in the courtyard during lunch. I would be the only 9th grader over there just chilling, eating.

Mrs. Richey: Do you think that had any kind of impact on your grades or just more social?

Keelie: It was grades and social because I knew in my grade some of them didn't know how to do the work. And in 12th grade, especially the people that played basketball on varsity and they would see me over there struggling and they'd come over and help me if they had a chance to. So, I guess that was a good advantage.

Mrs. Richey: Well, good. We kind of talked about this earlier, but I'm going to go ahead and mention it again to make sure I covered it. So, your 9th grade teachers: Can you remember any good relationships or the relationships with your 9th grade teachers?

Keelie: I had good 9th grade relationships with all of them.

Mrs. Richey: Did anyone stand out?

Keelie: Mrs. Cates, because she was a little older. And she retired the next year.

Mrs. Richey: She taught what?

Keelie: English.

Mrs. Richey: That's the one you said you liked the class the most.

Keelie: And subject at the time.

Mrs. Richey: Yes. Did you have any kind of relationship with a counselor? Any counselor in 9th grade? Do you remember anything about the counselors?

Keelie: I forgot her name, but I did have one and she moved to a college to teach. I forgot her name but I had a good relationship with her.

Mrs. Richey: How did that come to be? Do you remember?

Keelie: Well, she came like in the middle of my practice to play defense. She used to play but we didn't know and when I went for a shot, she blocked my shot. And then after that, we started talking and I was like, "You're the counselor, aren't you?" And then she was like, "Yeah." And she was like, "If you ever need anything, just come on in there." And half of 9th grade, I'd be going in there talking to her.

Mrs. Richey: Did you talk to her any about your dad or anything like that? Or just mainly school work?

Keelie: Mainly school work. Credits and all that kind of stuff. Graduating and all that stuff.

Mrs. Richey: What about the principal? Did you have any kind of relationship with him? I know y'all have had a new principal in the last couple of years. But with the one before or this one, did you have any kind of relationship with Mr. Moore or Dr. Schrimsher?

Keelie: I did have a relationship with Mr. Moore because of my brother and my mom. They used to communicate with him all the time. So, I guess he kind of knew who I was. And Dr. Schrimsher, we don't call him that. We call him Schrimp Daddy. He's the type that would walk through the hall and say, "Hey, how you doing?" And then he would start a conversation. So, you know, we ever since he came, see him like a father or dad. And that's when we started calling him Schrimp Daddy.

Mrs. Richey: Have you ever talked to him one on one? Or just casually?

Keelie: Sometimes. I think there were only two times I talked to him one on one.

Mrs. Richey: What was that about? Do you remember?

Keelie: Just about how things were going.

Mrs. Richey: Did you ever talk to Mr. Moore, like, go to his office and talk to him or was it mainly just out with everybody?

Keelie: It was just out with everybody. You could never catch him because he was always busy. Dr. Schrimsher is too.

Mrs. Richey: Okay. 9th grade, a typical day. Do you remember a typical day in 9th grade? What you would do? You said in 8th grade you would get up and go to your aunt's house, what about 9th grade? Did you keep the same routine or what did you do in 9th grade?

Keelie: That was a time when we did go to our grandma's house. I would get ready, take the bus to school and I would go in the large gym. I guess since we were basketball we were like going in the lunchroom and we would just sit down and mingle until the bell rung. I went to my classes and everyday was different. We had A day and B day. So it was different. Everything was a little more adventurous.

Mrs. Richey: How was it more adventurous?

Keelie: Sometimes we would never stay in one class. We would have to go to the computer lab and do some work. And I liked going to the computer lab because I would get done real quick with my typing. And then after that, we would go back to the class and talk until the bell rung. It was just something different every day with the block schedule.

Mrs. Richey: Did you like the A, B? Every other day?

Keelie: Yes, because we had core classes everyday but on different days because of how our schedule was. I guess it gave me more time to do my homework. I would push that math homework to the side, rest my brain and then get back to it. I liked that, but we couldn't do that this year because we had to go every day, same class like 8th grade.

Mrs. Richey: So, you liked the every other day better?

Keelie: Yes, I think everybody liked that better because you have more time to do your work.

Mrs. Richey: In 9th grade you're saying that structure, did that help you or hurt you?

Keelie: It helped, when you've got that subject that you just don't get, that's going to hurt you regardless sometimes. But it really helped me.

Mrs. Richey: Because of having that extra day?

Keelie: And it was different from 8th grade.

Mrs. Richey: So now we're going to talk about – we're getting close to being done. So now we're going to talk about your 9th grade math. So you had – is it Mr. or Mrs. Reeves for 9th grade Algebra A?

Keelie: It was Mrs. Reeves.

Mrs. Richey: You had Mrs. Reeves for Algebra A and you had Mrs. Givens for Algebra B. So, let's talk about Algebra A, Mrs. Reeves. Can you remember how she taught? What her class was like? How it was structured with Mrs. Reeves?

Keelie: It was always noisy in there. Like, nobody could ever be quiet. I can't remember her and she retired after 9th grade. I can't remember how she taught.

Mrs. Richey: You just remember that it was loud?

Keelie: Yeah. Everybody was just so noisy.

Mrs. Richey: Well, did you always complete your assignments for her?

Keelie: Sometimes I did and sometimes I didn't because she gave so much work. She acted like we were going to get done with a stack of work in one or two days but we couldn't. I never got done with my work but it was just to pass the grade. That was the worst math class that I ever took in my life besides 8th grade.

Mrs. Richey: Next to 8th grade, it was the worst one?

Keelie: Yes.

Mrs. Richey: Well, you did well your first semester, you made an 86. But then your grade dropped to a 65 the second semester. Do you remember why you may have done better before Christmas than after Christmas?

Keelie: Yes, because I guess after Christmas was when she started pushing the work. Because she said we needed to get the done because we were behind. And that's when all the work came and that's when I was just struggling.

Mrs. Richey: So, do you remember – these are the same kind of questions I asked you for 8th grade math. Do you remember any event, activity or lesson from her class that stands out? Was there anything?

Keelie: We wrote in the notebook constantly. We didn't have folders or anything like that, we just wrote in the notebook.

Mrs. Richey: Was it a composition notebook or just a binder where you take your own notes?

Keelie: Yes, it was a binder. I was worried it was going to get lost or tear out by itself. It was stuff like that, it was horrible.

Mrs. Richey: You liked the notebook of Mrs. Huff better than you did the binder?

Keelie: Yes.

Mrs. Richey: So, you had that test in 8th grade that you remember that stood out. Was there any kind of project or assignment or specific grade in Mrs. Reeves' class that you were especially proud of? Do you remember anything from her class?

Keelie: The only thing I remember doing was when we had to do group projects and I hated that.

Mrs. Richey: You would rather do it yourself?

Keelie: I would rather do it by myself and get help from my mama even though she didn't know about it she still helped. But I guess the group thing in class and especially in her class, it was horrible. Nobody could get anything right.

Mrs. Richey: So you didn't like the group thing. There was not anything that stood out that you were proud of in her class?

Keelie: No.

Mrs. Richey: No special grade or anything like that?

Keelie: No.

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Mrs. Richey: So, how did you prepare for tests in her class? Do you remember? Did you have Lakesha helping you?

Keelie: No, she went here. I just prepared for the test, I didn't have anybody in there to really help me. I couldn't take any of them serious in there at the time.

Mrs. Richey: So how did you study for your test? Do you remember?

Keelie: Yeah, at that time I was in my room. I didn't have my door shut at the time when I was studying in 9th grade. Just study, that's all I can say.

Mrs. Richey: Did you work problems or did you just look over problems?

Keelie: Yes, I looked over problems constantly and sometimes I would go to something that I didn't do right and try to do it again. And if I kept getting it wrong, that's when I would go to Coach Christopher because he was a math teacher. I would get some help from him.

Mrs. Richey: So, you did study for your tests?

Keelie: Yes.

Mrs. Richey: So, since you've been in Algebra A, have you prepared any differently for your tests in your later math classes? Geometry and Algebra II? Or did you still prepare the same way that you did in Algebra A?

Keelie: The same way. Because I can't have noise around me when I'm studying.

Mrs. Richey: What is your overall evaluation of your 9th grade math class with Mrs. Reeves?

Keelie: Reckless. Well, not the first semester but the second semester. It got really bad.

Mrs. Richey: So, in 10th grade you took Algebra B and we're still in the alternating schedule, every other day. And you had Mrs. Givens. Do you remember how she taught?

Keelie: She taught the same way as Mrs. Huff did but she wasn't really fast with it.   She did notebooks.

Mrs. Richey: Composition notebooks?

Keelie: Yes, from that grade up they started when every teacher did composition notebooks and the folders and stuff.

Mrs. Richey: 10th grade.

Keelie: And up.

Mrs. Richey: So did you always complete your assignments in Mrs. Givens class?

Keelie: Yeah, I think I did. There was some that I didn't complete but – because there was one that I did not complete. Every time she gave us that worksheet, I'd complete it. It was one certain worksheet but I don't know what it was.

Mrs. Richey: Can you remember anything from her class that stands out? An event or activity that she did or a lesson or anything?

Keelie: Yes.

Mrs. Richey: What do you remember?

Keelie: At the time we were making the examples into a rap song. Everybody thought they were a rapper, including myself. I don't know why.

Mrs. Richey: Do you remember what the rap was about?

Keelie: I forgot. It was something about width. Wide width or something.

Mrs. Richey: Was it the quadratic formula?

Keelie: Yeah, it was something like that. It was so much that I forgot. But we used to rap it out.

Mrs. Richey: You did more than one rap?

Keelie: Yes.

Mrs. Richey: So she used music a lot to help you remember things?

Keelie: We sort of forced her to do it. We thought we could learn better and we kind of did. We remembered the song that we did and it helped us remember all the examples and that kind of stuff.

Mrs. Richey: So, y'all didn't make up your own kind of raps. There were raps that she showed you?

Keelie: Yeah, we made up our own raps.

Mrs. Richey: Oh, you made up your own raps to remember?

Keelie: Yes. She was like well you've got to put this in there. So we made up our own rap.

Mrs. Richey: So, did you prepare for your tests the same way in Algebra B as you did in Algebra A?

Keelie: That was in 10th grade – yeah, I liked the kids in that class and we would get together. It was like six of us in that class, so we would get together and study together. And she would come in and she would pop something up on the board and she would like show us how to do it. Then she would give us another one to do by our self. That was how I studied for her test. It was kind of easy.

Mrs. Richey: So, was there just six of you – people in the whole class?

Keelie: Yeah, between six and eight people.

Mrs. Richey: That's all it was?

Keelie: Yes, and we loved it.

Mrs. Riche: I guess so, being a small class. That's odd that it was so small. Okay. We talked about Algebra A and Algebra B, 9th and 10th grade. So, how do you think those classes in 9th and 10th grade prepared you for the rest of your high school math classes? You've taken Geometry and you've taken Algebra II. How do you think those Algebra A and B classes prepared you for your classes in 11th and 12th grade?

Keelie: Well, Algebra B because I said I keep notebooks. The 9th grade notebooks, it was boring so I was like, I'm not going to remember this. It was just sloppy.

Mrs. Richey: That was the binder?

Keelie: Yes, the binder and that's why I just had to throw it away. But as far as the composition notebook for 10th grade, that's when I had Mrs. Godwin in 11th grade.

Mrs. Richey: That's when you had Geometry and she used the composition notebook too?

Keelie: Yes, it was like every year they asked us if we wanted do the notebooks because it was way easier to check the grades better. Skimming through it instead of looking for the pages. Less pages in the book bag and everything like that.

Mrs. Richey: That's what I use in my class too. So, in Algebra A and B you had different teachers?

Keelie: Yes.

Mrs. Richey: Do you think having the same teacher for Algebra A and B would have made a difference in your performance?

Keelie: Yes.

Mrs. Richey: Why?

Keelie: I would have chosen Mrs. Givens, she was very outspoken and she helped us a lot more and she just got involved.

Mrs. Richey: So, it would have made a difference if just had her for both classes? Just had one teacher for that whole Algebra experience? Is that what you're saying? Just because of the way she taught?

Keelie: Yes.

Mrs. Richey: Okay. So, one of the reasons why I chose you for this is because in 8th grade – we talked about what happened in 8th grade. Your math scores on your standardized test – you took a test called an EXPLORE test. I don't know if you remember that but it was at the end of 8th grade probably in the spring, about this time in the spring. Do you remember taking an EXPLORE test?

Keelie: Yes.

Mrs. Richey: It's kind of like a mini ACT. It had reading, math, science and English.

Keelie: It was long.

Mrs. Richey: And you didn't do very well. You made – it's on the same scale as what the ACT scores are. So you made a 4 on that ACT – that EXPLORE test in 8th grade. But after 10th grade, I don't know if you remember in 10th grade, you took an end of the course test. It was like a big test at the end. It was not like the ACT, it was just math. You took a test that was just about math at the end of that. It's a standardized test in a booklet. I don't know if you remember that. Do you remember that in Mrs. Givens' class at the end of the year?

Keelie: I think I did.

Mrs. Richey: So, from 8th grade to 10th grade, you went from a 4 in 8th grade to a 16 in 10th grade. So I think I know the answer to this, but I want you to tell me. So, what do you think made you jump so high from a 4 in 8th grade to a 16 in 10th grade in math on your standardized test?

Keelie: My lifestyle, summer school, studying a lot and probably the teachers and the people that helped me.

Mrs. Richey: Because that 4 was when you were going through all that stuff with your dad?

Keelie: Yes.

Mrs. Richey: So, we talked about that and how that affected everything. That has gone away in 10th grade and you don't have all those struggles with your dad, right?

Keelie: Yes.

Mrs. Richey: You did mention the teacher, when you had Mrs. Givens. But you did say Mrs. Huff – she used the notebooks too that you liked. But with the stuff going on outside your life, that's probably why you were so low. So, you took the ACT last year? You made a 15 on the ACT. Have you taken it since then? Since your junior year have you taken it again?

Keelie: No, because I've been pre-recruited by the Air Force and Army and all them. I've been going to see them for the information night and all that kind of stuff. And I'm setting all that stuff up and I wanted to go travel and all that.

Mrs. Richey: You're going a different route instead of college. You're looking at the armed forces? You took the ACT last year as a junior. And as a junior, your math classes were Algebra A 9th grade, Algebra B 10th grade and Geometry and then you took the ACT. Do you know about the class called Algebraic Connections? Have you had any friends that took that class? Do you know anything about that class?

Keelie: No.

Mrs. Richey: Okay. What Algebraic Connections is -- it's just a class to extend your Algebra knowledge. You had that year in 11th grade where you had Geometry and that was a break before you took Algebra II. You took Algebra and Algebra 9th and 10th, Geometry and then Algebra II. Do you think you may have scored better on the ACT if you had had a class and reviewed your Algebra?

Keelie: I think that would have helped.

Mrs. Riche: Why do you think that?

Keelie: Because, when I hit Geometry, I guess some of the Algebra and math had went away and we're still doing Geometry and whatever else we were doing. And then we took the ACT and I guess all the stuff from the past that was on there, I knew some of it but I didn't know a lot. And then that was going all out with the other math that I haven't done and that kind of stuff that was on there. And I didn't know it and I was looking so dumbfounded. Oh, my gosh. And then you know, we had that little break and everybody asked, oh good, I'm not the only one that went through it.

Mrs. Richey: That was hard to remember, wasn't it? Algebra from 9th and 10th grade? You did pretty well in Algebra II. You made C's in Algebra II. How did you like Algebra II?

Keelie: It was good. I think my grades could have been way more -- better because the schedule that we got, I think they got in the way of all the core classes and homework. I could study, but not as much.

Mrs. Richey: So, you think you did better on the alternating schedule?

Keelie: Yes. I did way better. I was trying to go with all A's during the first semester, but with all the core classes, it was all in the way.

Mrs. Richey: You had three core classes. If they could have split it up better, it would have been better?

Keelie: I tried but it would have been too many people in the classes.

Mrs. Richey: Yeah, it's hard when it ends up being like that.

Keelie: It just messed up my whole goal. But I'm still striving for all A's before I graduate.

Mrs. Richey: Okay, last question. You kind of already answered this, but I'll just go over it again. We talked about math classes up to the ACT; your 9th grade class Algebra A, your 10th grade class Algebra B, and then your 11th grade class Geometry. How do you feel those math classes prepared you for that ACT math test?

Keelie: Probably, some of the foldables that we used, that's mainly all I studied. The foldables helped me and it had all the steps on there.

Mrs. Richey: But that was 8th grade, right?

Keelie: Yes.

Mrs. Richey: You didn't do any foldables in 9th, 10th or 11th?

Keelie: Only 10th and 11th but not 9th grade.

Mrs. Richey: You did some foldables in 10th and 11th?

Keelie: Yes.

Mrs. Richey: So, do you feel like your 9th grade class –

Keelie: It kind of cut me off because of the class that we had.

Mrs. Richey: Because of the people that were in it and the way she taught was just not your style?

Keelie: No.

Mrs. Richey: Not your learning style? But 10th and 11th better prepared you for the ACT than your 9th grade year? Okay, well that is all. I know it was a lot. It has been really nice talking to you and very interesting.