A CASE STUDY OF DELAYING SCHOOL ENTRY ON THE EFFECTS OF STUDENT ACHIEVEMENT IN MATHEMATICS IN SEVENTH GRADE

A Doctoral Thesis Presented to the

Faculty of the College of Education

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

in Professional Leadership

by

Tracy A. McDaniel

May, 2012

A CASE STUDY OF DELAYING SCHOOL ENTRY ON THE EFFECTS OF STUDENT ACHIEVEMENT IN MATHEMATICS IN SEVENTH GRADE

An Abstract

of A Doctoral Thesis Presented to the

Faculty of the College of Education

University of Houston

In Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

in Professional Leadership

By

Tracy A. McDaniel

May, 2012

McDaniel, Tracy A. "A Case Study of Delaying School Entry on the Effects of Student Achievement in Mathematics in Seventh Grade" Unpublished Doctor of Education Doctoral Thesis, University of Houston, May, 2012.

ABSTRACT

The concept known as “red-shirting” in sports to provide an athletic advantage by delaying a child’s entry into sports is also prevalent among parents who perceive an academic advantage for delaying their children’s school entry. Interest exits among parents, teachers, administrators and medical professionals regarding the potential academic benefits and drawbacks of delaying kindergarten entrance for one additional year, even if students meet the state entrance requirement. The parents who wait to send their children to kindergarten normally cite one or two reasons for keeping their child back a year – either the child’s birthday occurs late in the year (July through December), making him or her younger than peers, or the child has exhibited less mature behavior (academic or social) than others of the equivalent age (Frey, 2005). This study examined if it is academically advantageous for students to be older than their peers in the seventh grade and if that advantage changes with a student’s gender or parents’ socioeconomic status. The study used the April 2011 Texas Assessment of Knowledge and Skills (TAKS) mathematics vertical scale scores as they relate to students’ chronological ages of approximately 1,300 students in seven middle schools in a northwest district of Houston, Texas. The students were broken into six cohort groups based on the date of their birth and the state of Texas’s public school enrollment of September first. Archival data was gathered from the TAKS data files to conduct a descriptive statistics study and ANOVA tests to answer the following research questions: Is it academically

advantageous to be older than your peers in the grade 7 cohort as indicated by the mathematics achievement scores in the state of Texas's TAKS tests? The results of this study displayed students with delayed entry perform similar to retained students than the traditional cohort or accelerated students. Does an advantage in chronological age at grade 7 differ in males and females? The study found gender does play a role in how the student will perform later in life. Delayed entry males tend to perform similarly to males in the traditional cohort, whereas females perform similarly to retained female students. Are there differences by socioeconomic status in relation to chronological age? The study found that delayed entry students on a free lunch plan perform similarly to students who have been retained. Through this study the researcher will add to the body of knowledge that exists regarding how a student's chronological age affects their achievement in mathematics.

Frey, N. (2005). Retention, social promotion, and academic redshirting: What do we know and need to know. *Remedial & Special Education, 26*(6), 332-346.

DEDICATION

I dedicate this thesis to my wonderful parents, George and Betty Keller, who instilled in me that I could accomplish anything and continuously supported me on my educational journey. Throughout my entire life they have given me the notion to keep striving for a higher goal and I have been able to with their love and inspiration.

Also I devote this writing to my husband, Brian McDaniel, who granted me the time and encouragement to follow my dreams and become a stronger person. Your support in my educational development has been continuous and steadfast.

To my children, James and Elizabeth, education is the key to the future. Continue to learn and focus on your goals. You will achieve them.

ACKNOWLEDGEMENT

I would like to acknowledge the advice and guidance of Dr. H. Jerome Freiberg, committee chair, whose constant support and knowledge has helped me develop this thesis and the ideas within. He is a teacher of teachers, who turns his students into citizens of the educational process.

I also thank the members of my committee for their guidance, suggestions and discussion related to the topic of academic redshirting students and the current trends we are witnessing in education today.

I acknowledge the University of Houston who created a program to support working professionals to achieve a doctoral degree while balancing work and home. The support of your professors is a credit to the university.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

Introduction

Every September parents of 5-year-old children across the country ask the same question… "Is my child ready for kindergarten?" Parents, teachers, administrators, and medical professionals have discussed the question of school readiness for decades. The answers vary depending on the child by examining their intelligence, emotional growth, social skills and physical development. Based on these factors, adults in the child's life decide if the child should start school that year, or wait another year in a private kindergarten. The parents who wait to send their children to kindergarten normally cite one or two reasons for keeping their child back a year – either the child's birthday occurs late in the year (July through December), making him or her younger than peers, or the child has exhibited less mature behavior (academic or social) than others of the equivalent age (Frey, 2005). In either case, the parents hope that their child will benefit from another year's growth prior to entering the school system. "A continuum of ages exists at school entry due to the use of a single school cutoff date – making the oldest children approximately 20 percent older than the youngest children" (Bedard & Dhuey, 2006). Gootman (2006) refers to parents' desire to not want his or her child to be the "runt of the class" as Darwinian. It is human nature to want to ensure your child is the most mature, not the least skilled, of the group. At younger grade levels, even a few months' difference in age can lead to substantial differences in cognitive and emotional development. This same correlation is not found as a child matures (Deming & Dynarski, 2008).

With high-stakes testing determining campus accountability, administrators have a vested interest in having strong learners at each grade level. Accountability programs and high-stakes testing are frequently blamed as a cause of increasing age at school entry (Stipek, 2002). In order to set the bar higher at third grade, the first year of school accountability, principals tend to increase the level of instruction at grades kindergarten through second (Deming & Dynarski, 2008). With all of the issues related to day of birth how does this affect achievement at older school levels?

Statement of the Problem

Why do some parents delay the entry of their child into formal schooling for a year? The process nicknamed “redshirting” originated from postponing a college athlete’s participation in regular season games for one year to give him an extra year of further growth and practice with the team in hopes of improving the athlete’s skills for future seasons. The term redshirting is used in American college athletics and derived from the red jersey commonly worn by players in practice scrimmages against the regular team players (Redshirt, 2011). Typically, a student-athlete has four years of eligibility in a given sport, to coincide with the standard four-year calendar for obtaining a bachelor’s degree in a college or university. Some student-athletes opt to not compete with the team for their first year attending a university, but to only attend classes and practices with the team giving their bodies time to mature. The student-athlete therefore does not use up one year of eligibility in that season. As a result of this practice a student athlete has up to five academic years to use the four years of eligibility. The maximum amount of time each student-athlete has is four years of actual competition with a varsity team. There is also a medical redshirt in sports. The college or university can grant a medical redshirt for a season lost completely or almost completely to injury. A medical redshirt can allow a student-athlete to gain additional eligibility beyond the standard five academic calendar years (Redshirt, 2011). In the higher education world when a student is redshirted in sports they are still participating with their peers in sports activities, they are just not playing league games. This differs to the redshirting we see in the elementary education field, where the child is completely left out of the public education setting. To illustrate the redshirting concept of sports to education, a kindergarten student would participate in class with his peers, but would not take the final test, just as a redshirted soccer player practices with the team, but does not compete in the soccer match. This is not the case of educational redshirting today.

Academic redshirting in relation to academics is the practice of postponing entrance into kindergarten age-eligible children in order to allow more time for socio-emotional, intellectual or physical growth. This policy leaves a large age range of students in one classroom. Educators and parents have delayed entry into kindergarten due to the belief that children who were chronologically older had an academic advantage (Katz, 2000). This academic redshirting occurs at the rate of 9 percent per year among kindergarten-aged students. According to the National Center for Education Statistics (2000), boys are more often redshirted than girls, and children born in the second half of the year are more likely to be redshirted than those born earlier (West, Meek, & Hurst, 2000). Dobkin and Ferreira (2007) found in California and Texas that there are striking differences between the children who are entering school as the youngest in their cohort and students who defer entry for a year. The study found younger students are disproportionately black and Hispanic, and they are also more likely to be female. The parents of the younger students have lower educational attainment, lower incomes and less valuable houses. White, non-Hispanic children are more than twice as likely as black, non-Hispanic children to have entered kindergarten later than their birthdays provide (West, Meek, & Hurst, 2000).

The first grade enrollment age has slowly progressed upward in the past 40 years. In the fall of 1968, 96 percent of 6-year-old children were enrolled in first grade or above nationally. By the year 2005, the proportion has decreased to 84 percent. The school attendance rate has held steady at 100 percent for decades, but the grade level of where the children are enrolled has changed. In 1968, most 6-year-old students were in first grade, whereas today a substantial share is instead in kindergarten. This trend follows in the later grade levels (Deming & Dynarski, 2008).

The major research issue in the study reflects the need to determine if delaying a child's entry into kindergarten has an effect on their mathematics achievement results in grade 7. Research related to redshirting has been conducted on gender, ethnicity, and economic status issues. The current unknown is how chronological age plays a determining factor in mathematical achievement. The study of this issue will inform education policy makers and school district leadership when determining policy for kindergarten admissions resulting in students of varying chronological ages in the same classes. The body of knowledge will help educate parents on making the right decisions for their own children on when to enroll students in the public education system. Additionally, the research will look into factors of school accountability as determined by the make-up of the students' chronological age range.

Purpose of the Study

This study focuses on the relationship between chronological school entry age and secondary mathematical achievement in students. This comparison of birth dates will determine the timeframe that is most beneficial to enroll a student into the school system and which students fall into the best timeframe for academic achievement. Elder and Lubotsky (2008) believed students who are older than their peers when they enter kindergarten score higher on achievement tests and are less likely to repeat grades than their younger classmates. This study also looks at the relationship of gender as it relates to mathematical achievement for boys and girls in the seventh grade. Does gender help or hurt later achievement for boys versus girls. Students' socioeconomic status is reviewed to see if chronological age along with socioeconomic status together affects student achievement in mathematics. The first year of the Texas state curriculum is planned for the child who has reached the chronological age of 5 years on or before the first day of September and is entitled to enroll as a kindergarten student (Texas Education Code - Section 25.001 Admission, 2007). This broad policy leaves a large age range of students in one classroom. This large gap in age levels is sometimes referred to as the 'graying of kindergarten.'

Significance of the Study

This study could prove to be important to policy makers if the need for amending kindergarten admission policy becomes evident. Zill, Loomis, and West (1997) indicated that instead of the amendment of school age, schools should reexamine curriculum standards to better meet the needs of different age groups of learners to ensure all a successful experience.

Elder and Lubotsky's (2008) estimates clearly indicate that children's reading and math abilities increase much more quickly once they begin kindergarten than they would have increased during the same time period if they delayed kindergarten entry. In the absence of future policy which dramatically increases the accumulation of skills prior to kindergarten entry, increases in kindergarten entrance ages have the primary effect of delaying the rapid learning that children experience once they begin school, especially among those from low-income households. (Elder & Lubotsky, 2008, p. 7)

In 1975, of the 30 states that established a cutoff date, nine (30 percent) required students to have turned 5 by a certain date in September or earlier. This rate was raised in 2005, when 45 states (77 percent) established a cutoff date, and 33 of those required that students must turn 5 years of age by a certain date in September or earlier. Since 1975, the state of Texas has retained the cutoff date for children to enter kindergarten to students who are age 5 by September 1 (Colasanti, 2007). If states were to set the kindergarten entrance age earlier, thus making students younger on arrival, would the impact on children and the system be negative or positive? This question is pondered by school districts across Texas. Deming & Dynarski (2008) stated that increasing the age of legal school entry would intensify the socioeconomic differences in educational attainment. Children in lower-income households are at a greater risk of dropping out of school when they reach the legal age of school exit (usually 18 years of age). As a result, increases in age at school entry therefore disproportionately decrease their completed education prior to drop out. Additionally, children who enter school later spend more time in unequal environments. These environments range from home to formal care and children who start school later linger in settings in which quality is directly correlated with their parents' human capital.

> [S]tudents born right before the cutoff date for school enrollment are significantly more likely to enroll in kindergarten a year earlier than similar students who were born right after the cutoff date. One third of these initial differences disappear by ninth grade since the youngest children in a cohort are held back more often than their older classmates. Minorities are more likely to comply with the law than whites and they are held back less frequently, therefore they are disproportionately bearing the burden of being the youngest student in the cohort. (Dobkin & Ferreira, 2007, p. 14)

Furthermore, the research found in this study could be important to parents of children approaching school age. Many parents may ask the question of whether they should give their child another year in preschool or private kindergarten prior to kindergarten entrance to provide socio-emotional, intellectual or physical growth if their child is young for their grade level. The delaying of entry is often the strategy of choice because it is seen as occurring before formal schooling starts; therefore it is not subject to the stigma normally attached to retention or transitional grades (Uphoff & Gillmore, 1986).

Fred Morrison, a developmental psychologist at the University of Michigan who has studied the impact of falling on one side or the other of the birthday cutoff concluded, “You couldn’t find a kid who skips a grade these days… We used to revere individual accomplishment. Now we revere self-esteem and the reverence has snowballed in unconscious ways” (Weil, 2007, p. 2). Parents want to protect their children and many find keeping them back will build stronger, more confident children as they enter kindergarten.

Literature is targeted to parents, giving recommendations about kindergarten entry. The American Academy of Pediatrics (Shelow, 1993) includes the following advice about kindergarten readiness:

> In most school systems, children are accepted for kindergarten based on their age, often with a very rigid cutoff date as a guideline. … While this approach works well for most children, it’s not perfect. Developmental rates vary so widely that one child may be prepared for school at four while another is not mature enough until late in his fifth year. For these reasons, if your child’s birthday falls between October and late December [for districts with January 1 cutoffs], you might consider keeping him in nursery school for another year. (pp. 368-369)

Regardless of a state specified enrollment age, some parents – up to 10 percent in the United States – voluntarily delay their children's primary school enrollment (Stipek, 2002). When a parent determines the age of entry for their child, they also may look at aspects other than educational achievement. There is evidence of a lasting competitive advantage in sports of older children. In Europe and the United States, children on elite youth soccer, hockey, swimming, and tennis teams are disproportionately born just after the age cutoff for those leagues—that is, they are the oldest of their peers (Deming & Dynarski, 2008). When one student moves up in the classroom rank, another student moves down. The phenomena called the 'graying of kindergarten' affects all the students in the class and can range the chronological age levels up to 25 percent. This changes the average 12-month kindergarten span to 15 months or more. Weil (2007) in her article in the *New York Times* described kindergarten teacher Jane Anderson's classroom of 22 students, some of which had been academically redshirted:

> After rug time, Anderson's kindergarteners walked single-file to P.E. class, where the children sat on the curb alongside the parking circle, taking turns running laps for the Presidential Fitness Test. By far the fastest runner was the girl in the class who had been redshirted. She strode confidently, with great form, while many of the smaller kids could barely run straight. One of the younger girls pointed out the best artist in the class, a freckly redhead. I'd already noted his beautiful penmanship. He had been redshirted as well. (Weil, 2007, p. 2)

When parents manipulate the age rank of their child in the classroom, schools may set off a cycle of social pressures that pushes up the age of children at the entry of school, to the detriment of social welfare (Deming & Dynarski, 2008). This practice by some parents disadvantages children who enter school on time. The most advantaged children in kindergarten are the oldest in the class, reinforcing socioeconomic gaps in school readiness:

> [C]hildren who may be at academic risk from factors associated with poverty face the additional hurdle of being compared to advantaged children 12 to 15 months older… the youngest child may appear to be immature and unready to tackle the tasks their significantly older classmates find challenging and intriguing. (Crosser, 1998, p. 2)

The socio-economic status of the surrounding area of a school has a large impact on the age range when students enter kindergarten. Students who are typically enrolled in school at a younger age are born to families who do not have alternatives for daily care for their child. The parent or parents need to work and a public education is a free education. The parents do not have the resources to provide care for their children another year, even if they feel that they are not ready for a structured education. In more affluent areas, parents might have the option of whether to enroll their child in a private kindergarten or to keep them in private home care an additional year.

In addition, local school districts could find this research useful since their accountability system is based on students' achievement scores. According to researchers Graue and DiPerna (2000), the act of delaying kindergarten entry was possibly due to the higher academic demands set forth by accountability assessments and increased standards. Some school districts have elected their age of entry with the goal of ensuring that children are ready for tasks formerly found in the first grade. As a result, the school districts and administrators hope to have more mature students at each grade thus reaching higher average achievement scores (Marshall, 2003). The No Child Left Behind Act (Pub. L. No. 107-110, 115 Stat. 1425, 2002) emphasizes the importance of frequent and early standardized assessment to ensure that all children meet academic expectations. This achievement must account for all demographic groups including ethnicity and socioeconomic status. The overall objective of these reforms is long-term academic success and high school completion rate; testing occurs as early as third grade to make sure students are on track with grade-level requirements (U.S. Department of Education, 2003). The belief is that mandatory testing in the third grade leads administrators and teachers to set a higher bar at kindergarten and first grade. With the increasing accountability pressures that schools are under, and a push for improved student performance demanded by today's society, educational systems are struggling to find ways to increase test scores (Marshall, 2003). This assessment is reflected now in a report card for the states; like the students, administrators received grades for how well their campuses and districts are performing. Just like parents, educators want the students and schools to be educated and stack up favorably against their peers (Weil, 2007).

Additionally, younger children in the classroom are more likely to be labeled as learning disabled (Elder & Lubotsky, 2008) and this is where class segregation begins in the public school system. Students in the high socioeconomic family status and students in the lowest socioeconomic status rarely share a classroom, so the scaffolding of the racial and socioeconomic segregation is softened. Regardless of classroom or age, the standardized test scores of children of the same grade are compared across districts and states, and the relative ages of these children will contribute to the gap between the scores of the rich and poor districts (Deming & Dynarski, 2008).

In the district of this study, for example, mathematical student ability has been the focus of instruction and curriculum development for many years. The students are excelling in reading and falling behind the state average in mathematics. This issue has been studied in many formats by the district including examining at the ethnicities and socioeconomic status make-up of the district. At this point research has not been conducted regarding a student's chronological age in relation to district mathematical achievement. As part of the Response to Intervention (RTI) program created through the Individuals with Disabilities Education Act (IDEA 2004) the study district identifies students early in the school year to determine if they need additional assistance obtaining their educational goals in mathematics. The implementation of activities in the RTI model focuses on (a) high-quality instruction and scientific, research-based, tiered intervention strategies aligned with individual student need; (b) frequent monitoring of student progress to make results-based academic decisions; (c) data-based school improvement; and (d) the application of student response data to important educational decisions (such as regarding student placement, intervention, curriculum and instructional goals.) Currently the study district gives students a beginning of the year assessment, middle of the year assessment, and uses the TAKS test at the end of the year to identify the students who are at risk of failing for the year. Gains are being made in the area of mathematics and by adding the chronological age element to the child's portfolio, critical determinations can be made regarding the placement and intervention level of the student.

The decision to start kindergarten or to delay entry for an additional year is a struggle many parents deal with for their children. Parents often look to pediatricians and schools to provide them guidance to lead their choice in the best situation. Parents must have the economic means to provide additional nonpublic schooling for their children. Districts and campuses must understand that parents bring them the best child they have and campuses must work with them to provide the best results which will in turn affect the campuses' and district's accountability on state and federal levels. State and federal officials need to ensure enrollment policy is up to date and they are doing what is best for children.

CHAPTER TWO

Review of Related Literature

Overview

For many years, education has pondered why some children seem to excel through their school careers, while others struggle from the beginning. In order to investigate one possible answer, this study examines the effects of school entry age on academic achievement in the study district within the state of Texas. This chapter will explore the research related to the different chronological ages that range in one school year including: academic redshirting, the family socioeconomic status and preschool, effects of delaying school entry, retention, gender as it relates to academic achievement, maturationist versus interactionist assumptions, maturity levels compared to success in school, school accountability and the background of achievement testing as a standard to progress to the next grade level.

Weil (2007) described a child who, during an assessment, was asked to fold a piece of paper into a long triangle as his teacher demonstrated. Due to his lack of capability at his current chronological age he was unable to repeat the process the teacher showed. She continues to discuss:

> Depending on the boy’s family finances, circumstances, and mind-set, his parents may decide to hold him out a year so he’ll be one of the oldest and presumably, most confident. Or they may decide to enroll him in school

> as planned. He may go to college or he may not. He may be a leader or a follower. Those things will ultimately depend more on the education level achieved by his mother, whether he lives in a two-parent household and the other assets and obstacles he brings with him to school each day. Still, the last thing any child needs is to be outmaneuvered by other kids' parents as they cut to the back of the birthday line to manipulate age effects. (Weil, 2007, p. 11)

The idea that children have to compete in classrooms to gain the teachers' attention, to get the best scores and meet the expectations of their parents, may be compounded when a parent decides to give their child an extra year prior to kindergarten or during school to let them develop. At that point the classroom of a one-year difference in students changes into a classroom with a two-year difference. These weighted factors at an early age could navigate the educational path of the child.

Family Socioeconomic Status and Preschool

Family income has a great impact on how well a child does on readiness tests when entering kindergarten. The school readiness gap is steepest for children from families with the lowest incomes and continues through middle income families, gradually decreasing as income rises (Barnett et al., 2004). White, middle class, suburban communities contain the prevalence of academic redshirting. There is evidence that children from higher income households are more likely to experience delayed kindergarten entry (Cosden, Zimmer, & Tuss, 1993). The decision to delay school enrollment by a family can be burdensome since school attendance represents child care as well as education. When a child moves into the public realm of education the primary caregiver can return to paid employment or the cost of daycare is reduced. Keeping a child and a caregiver at home for an additional year may be prohibitive due to the financial impact, and therefore, lower income families are less likely to delay enrollment into public schools (Gredler, 1992). When an affluent family voluntarily delays the entry of their child into kindergarten, there is an indication that the educational and economic advantages that the child already enjoys are compounded by the child being older and more mature than those from a lower-socioeconomic status family (Zill et al., 1997). As a result, the educational gap, as well as the age gap, has already begun to develop prior to a child entering the classroom.

This gap continues in reading and math achievement in the early grades and throughout school and into the job market (Poppe & Clothier, 2005). A study of the Georgia Kindergarten Assessment Program (GKAP) discovered that students who had attended a preschool had higher scores on the instrument, regardless of the type of preschool program. An $F(1,169) = 4.03$, $p < .05$ was obtained, with the students who attended preschool having a mean of 4.88 ($SD = 0.56$) and the students who did not attend preschool having a mean of 4.63 ($SD = 0.95$) on the total GKAP (Taylor, Gibbs, & Slate, 2000). Dickinson and Sprague (2001) quoted a Children's Defense Fund study reporting that 65 percent of children whose parents earned more than $50,000 were enrolled in preschool, compared with only 42 percent of children from households with incomes under $15,000 annually. Table 1 displays the historical research related to socioeconomic status and student academic achievement.

Table 1

General Characteristics of Socioeconomic Status vs. Academic Achievement

Source	**Study/Purpose**	**Findings**
Buckles & Hungerman, 2010	Birth certificates of every child born in the United States from 1989 to 2001	Season of birth is slightly associated with adult achievement outcomes. Women giving birth in winter are more likely to be teenagers and less likely to be married or to have a high school degree.
Children's Defense Fund	2000 Census Bureau data, Social and Economic Characteristics of Students	42 percent of children with household incomes under $15,000 were enrolled in kindergarten compared to 65 percent of those with household incomes above $50,000
Cosden, Zimmer, & Tuss, 1993	1989-1990 kindergarten students in two school districts in Southern California and on all 1990-1991 kindergarten students in a third district.	Children from higher income households are more likely to experience delayed kindergarten.
Alexander, Daubner & Entwisle, 1993	728 inner-city students from Baltimore City Schools	African American boys living in poverty are more likely to be retained.
Gastright, 1989	Students from 33 member district of the Council of Great City Schools	Correlation between higher retention rates and lower SES
Gurewitz & Kramer, 1995	32 elementary schools in a Midwestern school district	Students attending middle-SES schools were most likely to be retained.
Meisels & Liaw, 1993	16,623 K-8 students from NELS:88 longitudinal study	33.9 percent of retained students from lowest income quartile; 8.6 percent from highest income quartile
Denton, 2001	Students from 16 member states	Students living in poverty are two to three times more likely to be retained.
Taylor, Gibbs, & Slate, 2000	171 kindergarten students (81 attended preschool; 90 did not)	Students who attended preschool scored higher on kindergarten readiness tests, regardless of program.

Table Literature Research Design by H. Jerome Freiberg (1989-2012)

Historical Trends in Federal Early Childhood Programs

In response to the economic gap and quality childcare, in 1965 as part of the War on Poverty, the Head Start program was created to promote school readiness and provide comprehensive child development services to low-income children, their families, and communities. The premise was that low-income children and their families need extra support to prepare them for the transition to school. In 1998 Congress reauthorized the Head Start Program with a mandate from the U. S. Department of Health and Human Services to determine the impact of the Head Start program on the children it serves. The 2010 report included the final randomized control sample of 23 states, 84 randomly selected/delegate agencies, 383 randomly selected Head Start centers, and a total of 4,667 newly entering children: 2,559 3-year-olds and 2,108 4-year-olds. The findings of this study showed providing access to Head Start has a positive impact on children's preschool experiences and positive impacts on several aspects of children's school readiness during their time in the program. The study researched four domains of child development: cognitive, social-emotional, health and parenting. In the 4-year-old group, the benefits at the conclusion of the Head Start year were focused in language and literacy elements of the cognitive domain, including impacts on vocabulary, letter-word identification, spelling, pre-academic skills, color identification, letter naming, and parent-reported emergent literacy. The 3-year-old group showed benefits in all four domains at the end of the Head Start and age of 4 years. However, when these children ended first grade, the advantages the children gained during their Head Start time yielded only a few statistically significant differences. In the cognitive outcome the Head Start children as a whole did significantly better on the PPVT (a vocabulary measure) for the

4-year-olds and on the Woodcock-Johnson III test of Oral Comprehension for the 3-year-olds (U.S. Department of Health and Human Services, 2010). The results of this study presented that when students were given a positive educational gain, the gain in education did not remain when they were mixed with the rest of the population. The strengths built within the Head Start program leveled out when mixed with the children from other daycare or alternative schooling situations. In a high quality program such as Head Start, children will excel. In the Head Start study, children who were disadvantaged were able to enter school on a level educational level with those children of more affluent families.

Additional information recently presented by Buckles and Hungerman (2008) reviews detailed data from the birth certificates of every child born in the United States from 1989 to 2001. They discovered slight differences in the seasons of the year in which wealthy and poor women give birth in every year of data collected. In this study it was not determined why this was the case. One hypothesis is that this could be a result of differing work and vacation schedules, so that more affluent mothers get pregnant over the Christmas holidays, while poorer women get pregnant in the late spring and summer. On the other hand, it could be a conscious decision of well-educated parents timing their births, either to ensure their child is older than their classmates, or to avoid caring for a newborn in the hot summer (Buckles & Hungerman, 2008).

Effects of Delaying School Entry

Frey (2005) states the term redshirting comes from “the practice of benching college athletes for a year to allow them additional time to refine their skills and build physical prowess” (p. 341). Academic redshirting is intended for the child to mature for a year to become more prepared for the rigorous curriculum of kindergarten. A key difference between academic redshirting and redshirted athletes is that athletes participate in practice and training, while redshirted kindergartners may receive no school service unless they are enrolled in an available preschool classroom (Lincove & Painter, 2006). Research on academic redshirting has so far failed to provide a strong picture of its short- and long-term effects on a student's education. Studies have examined the effects of redshirting that occur immediately or within the early elementary years (Bedard & Dhuey, 2006; Malone, West, Flanagan, & Park, 2006; McNamara, Scissons & Simonot, 2004; Offenberg & Holden, 1998; Oshima & Domaleski, 2006; Shepard, 1990; West, Denton, & Germino-Hausken, 2000; West, Meek, & Hurst, 2000; Zill et al., 1997). Other studies have looked at the long-term effects into college (Byrd et al., 1997; Deming & Dynarksi, 2008; Dhuey & Bedard, 2006: Dobkin & Ferreira, 2007; Lincove & Painter, 2006; Offenberg & Holden, 1998; Stipek, 2003). Proponents and opponents of redshirting often use the same data, but come to different conclusions. Therefore based on past research it is unclear whether redshirting solves the problem of academic school readiness.

Chronological Age Differences at the Primary Grade Levels

Research related to academic redshirting shows that in the short term, redshirting raises the child's academic achievement (math, reading, general knowledge) and conduct on par with or above that of a younger classmate (West, Denton, & Germino-Hausken, 2000) and may add to the normal mix of ages and abilities within the classroom. McNamara, Scissons, and Simonot (2004) studied phonological awareness and letter-sound understanding effects on chronological age which are predictors to a child's future reading success. The data showed younger children scored lower than their older-aged peers in letter-sound understanding, thus concluding that redshirting would not affect a child's phonological awareness, but would positively affect their letter-sound understanding. On the other side, children who have been redshirted may feel alienated from their younger classmates, and may have an unfair advantage over younger classmates in size in psychomotor and social skills. Shepard (1990) suggested that redshirting may have consequences for students who enter on time as well as those who were delayed entry:

> To the extent that 6-year-olds help to define kindergarten norms, meeting their needs moves the kindergarten curriculum further away from instruction attuned to the needs of children who have just turned 5 years old. Redshirting obviously increases the age heterogeneity of kindergarten classrooms. And to the extent that the middle class hypothesis is true, it increases the "disadvantage" of the normal 5-year-olds from poor families who come to school at 5 years 0 months and are asked to compete with children who are 6 years 3 months old, come from affluent homes, and have three years of Montessori preschool experience. (p. 163)

During the first three years of elementary school, West, Meek, and Hurst (2000) found student academic achievement is nearly equal to that of the other grade level peers in the class regardless of their chronological age. They also found redshirted children have a lower likelihood of obtaining negative feedback from teachers about their class conduct or academic performance in class (West, Meek, & Hurst, 2000).

In 1997, the National Center for Education Statistics found students with delayed kindergarten entry differed most dramatically from students who entered on time in the following areas: (a) First and second grade students in 1993 who had been kept out of kindergarten until they were older were less likely than other students to draw negative attention from teachers about their academic performance or conduct in class. (b) In 1995, the delayed entry students were less likely than students who started kindergarten on time to have repeated first or second grade. (c) First and second graders who were retained in kindergarten had more school performance problems than children who didn't repeat. (d) First and second graders in 1993 who repeated kindergarten were more likely than children who had not repeated to receive negative feedback from their teachers. (Zill et al., 1997)

McEwan and Shapiro (2008) studied the effect of delayed school enrollment on student academic outcomes by using eight annual surveys (1997-2004) of first graders, collected by the National School Assistance and Scholarship Board (JUNAEB) data on Chilean students including their exact birthdates. The regression-discontinuity estimates, based on enrollment cutoffs, show that a one-year delay in schooling decreases the probability of repeating first grade by 2 percentage points, and increases fourth grade test scores by more than 0.3 standard deviations, with a larger effect for boys than girls.

Economists Bedard and Dhuey (2006) looked at the relationship between scores on what is called the Trends in International Mathematics and Science Study, or TIMMS (math and science tests given every four years to children around the world), and month of birth. They found that among fourth graders, the oldest children score somewhere between 4 and 12 percentile points better than the youngest children. They described this further that if you take two intellectually equivalent fourth graders with birthdays at opposite ends of the cutoff date, the older student could score in the 80^{th} percentile, while the younger one could score in the 68^{th} percentile.

However, a study by the U.S. Department of Education (2006) found children at the end of first grade, who repeated kindergarten and experienced delayed entry have lower mathematics knowledge and skills than students who started on time (Malone, West, Flanagan, & Park, 2006). Offenberg and Holden's (1998) research found that students who were older than the conventional kindergarten age were less likely to attain second grade on time, and students who were more than 67 months old tended to be less likely to be on grade level. Then the scores of the older students decreased, until, in some socioeconomic groups, the scores of the older students were about the same as the youngest students' scores. Oshima and Domaleski (2006) reviewed test data from children with summer birthdays in comparison to children with fall birthdays. At first, older students in kindergarten scored better in reading, math, and general knowledge. This achievement gap decreased rapidly between the first and third grades, but still had tracings in fifth grade.

Chronological Age Differences in the Long Term

Deming & Dynarksi (2008) pointed out that an elementary-age child who starts school older than other children in the same cohort (unless he or she has a learning disability) may score higher than others in his grade level on tests, but this does not prove that starting school later has improved the child's learning. Rather, it shows only that he is older than his peers in his grade taking the test at the same time, at a point in his life when a few months of difference in age can translate into significant differences in experience and cognitive skills. They also note that their findings based on national statistics suggest that when the age of school entry rises, so does the high school dropout rate (Deming & Dynarksi, 2008). Over the long term of a child's 12-year academic career, there is no proven advantage to delaying the start of kindergarten (Lincove & Painter, 2006). Stipek agrees (2003) stating that the age differences, when found, were usually stronger at the beginning of school rather than in the later grades, indicating that the younger children tended to learn more, often catching up with their older peers after a few years of school. Offenberg and Holden (1998) disagree with Stipek's conclusion when they found that nearly half (46 percent) of the students who were in the "overage group," students who were 6 years or older when they began kindergarten, were labeled below grade or in ungraded classes. This suggests that they had serious academic difficulties. Offenberg and Holden (1998) also showed that on average, overage students earned lower report card grades than their peers.

Dhuey and Bedard (2006) studied the effects of the youngest group at four-year colleges in the United States. They found that students belonging to the relatively youngest group in their class are underrepresented by about 11.6 percent at postsecondary universities. Based on the findings above it seems that younger students do catch up to their peers regardless of age until we focus on students who continue into higher education through the college system. This reflection of college entrance may have a direct link to the emotional attachment students had to the formal school setting. When Muhlenweg & Puhani (2010) studied the tracking practices in Germany they found that entering school at age 7, rather than 6 raised the probability to attend the highest track secondary school by about 13 percentage points, which is a large effect, implying that young school entrants (age 6) are only two-thirds as likely to attend the highest track schools than old school entrants (age 7). In Germany the highest track students are sent to the universities to continue their educational attainment; the other tracks are trained for vocational work.

In looking at the emotional development of students, Byrd, Weitzman, & Auinger (1997) found that students whose school entry had been delayed exhibited more behavioral problems than their classmates in class regardless if the advanced age was from retention or redshirting. This thought process continues with a report published by the National Bureau of Economic Research (1990) which suggests the current trend of requiring an earlier cutoff date may have a negative consequence on the educational attainment of students. The possible scenario is pondered: if students are compared on their 16th birthdays, those who were born earlier in the year will have spent less time in school than students who were born later in the year. Assuming that a set fraction of students drop out of school upon reaching the legal dropout age, students born earlier in the year will, on average, have less education than students born later in the year. On the contrary, Dobkin & Ferreira (2007) studied the impact of early school entry law on labor market outcomes, and found no evidence in outcomes such as employment, wages, home ownership, or house prices for students later in life. The figures showed that in Texas, the chronological age gap in enrollment in one grade level for ninth graders is about two-thirds the size of enrollment age gap in kindergarten. The closing of the age gap is a result of the youngest students in each class is being held back at considerably higher rates than their older peers. A point to note is that 35 percent of the students born just prior to the cut off for school entry, who enroll in kindergarten as soon as they are legally allowed, are held back at some point between kindergarten and ninth grade while only 19 percent of the students born 180 days before the cutoff date are held back.

Table 2 looks at the historical research conducted regarding chronological age and academic achievement.

Table 2

General Characteristics of Age vs. Academic Achievement

Source	Study/Purpose	Findings
Bedard & Dhuey, 2006	228,629 students from 10 countries TIMSS longitudinal study	Older children score between 4-12 percent better than the younger children. Students belonging to the relatively youngest group in their class are underrepresented by about 11.6 percent at postsecondary universities.
Byrd, Weitzman & Auinger, 1997	Child Health Supplement to the 1988 National Health Interview Survey, 9,079 children ages 7 to 17	The Behavior Problem Index (BPI), children who were old for their grade, 19 percent of those grade-retained and 12 percent of those non-retained had extreme BPI scores, and for those not old for grade, 70 percent of grade retained and 7 percent of non-retained children had extreme BPI scores. Grade retention is associated with increased rates of behavior problem in children and adolescents, simply being older than others in one's class. Also being older and not retained has similar effects.
Deming & Dynarksi, 2008	October Current Population Surveys	Children who start school older may out perform their peers. That does not mean the child is more intelligent, they are just older.
Elder & Lubotsky, 2008	ECLS-K fall of 1998, 14,333 children with two different interviews with state data and the Educational Longitudinal Study of 1988, 24,599 eighth graders	The association between achievement test scores and entrance age appears during the first few months of kindergarten, declines sharply in subsequent years.
Gnezda, Garduque, & Schultz, 1991	National survey of state education officials	Officials estimate 10-15 percent of students experience delayed kindergarten.
Graue & DiPerna, 2000	8,000 Wisconsin students	7 percent of students experienced delayed enrollment; majority were boys with late birthdays
Lincove & Painter, 2006	National Education Longitudinal Survey, 42 students	Younger students who repeat had a higher rate of college attendance and higher wages.

Table 2 continues

Table 2 continued

General Characteristics of Age vs. Academic Achievement

Source	Study/Purpose	Findings
Malone, West, Flanagan, & Park, 2006	ECLS-K Class of 1998-99: 12,495 kindergarten students	Redshirted or retained students at the end of first grade have lower mathematics knowledge and skills.
McNamara, Scissons, & Simont, 2004	625 kindergarten children	Redshirting does not affect children's phonological awareness, but positively affects letter-sound understanding.
Muhlenweg & Puhani, 2010	Hessen administrative data, school years 2002/2003 through 2006/2007	In Germany due to tracking system, only two-thirds of sixth graders are likely to attend the highest track schools and older entrants (seventh graders). This raises the probability to attend the highest secondary track by 13 percentage points if you enter at age of 7.
Offenberg & Holden, 1998	Philadelphia schools, cohort of 1990-1991, 10,824 students, including 178 overage students	Found 46 percent of "overage" students who were 6 years or older when then began kindergarten were labeled below grade or in ungraded classes. On average the overage students earned lower report card marks than their peers. Multiple regressions revealed that age explains less than 3 percent variance in grade level in kindergarten; 67 months ideal for school entry.
Oshima & Domaleski, 2006	ECLS-K Class of 1998-99; 3,862 (June, July, & Aug. younger birthdays) & 2,693 (Sept., Oct., & Nov. older birthdays)	At first older students in kindergarten score better in math, but achievement gap decreases rapidly between first and third grade, but still has tracings in fifth grade.
West, Denton, & Germino-Hausken, 2000	NCES study of 22,000 kindergarteners through fifth grade	Short term, redshirting raises children's academic achievement in math on par with other peers.
West, Meek, & Hurst 2000	1993 and1995 National Household Education Surveys	First three years of elementary school, redshirted students' achievement nearly equal to peers.
Zill, Loomis, & West, 1997	1993 and 1995 National Household Education Surveys	Redshirted students in first and second grade less likely to gain negative attention; less likely to repeat a grade level. Retained students more school performance problems; more likely to receive negative feedback. A total of 9 percent of all first and second graders experienced delayed enrollment.

Table Literature Research Design by H. Jerome Freiberg (1989-2012)

Retention

Retention in kindergarten is a common strategy used in schools to allow students to mature to a more acceptable level for successful promotion to the first grade. Kindergarten retention is often the popular intervention that teachers choose for children who have difficulty acquiring basic academic skills or who are socially mature (Mantzicopoulos & Morrison, 1992). Through Mantzicopoulos and Morrison's (1992) study, students were reported by their teachers as being inattentive and immature during their primary year in kindergarten. In contrast, during the second year in kindergarten the teachers noted, "behaviors sharply declined [and] held through the end of the second grade" (Mantzicopoulos & Morrison, 1992). The researchers would not link this student behavior to retention due to the fact that it is impossible to know how the behavior would be if the student was not retained.

Elder and Lubotsky (2008) found being a year younger at entry raises the probability of repeating kindergarten, first, or second grade by 13.1 percentage points. Thomas believes (as cited in Magan, 2008) there have been various studies completed on comparing students who have been retained with their counterparts who were not retained, but it is impossible to compare retained and non-retained students due to the preexisting differences between the two groups. It would be impossible to equally match up two groups of identical students based on race, gender, and socioeconomic status for the comparison. Also, students cannot randomly be assigned into retention and non-retention groups; therefore, comparing variable studies is the best attempt at the rigorous research design.

Gender and Academic Achievement

Recent debates have sparked about gender equality in education. These debates focus on whether males or females are more "shortchanged" in the educational setting. The concern has traditionally focused on females in regards to mathematic achievement, but has traditional thinking clouded the judgment of mathematics and boys? Francis and Skelton (2005) discussed that generally girls are doing better than boys specifically in relationship to language and literary subjects. Their belief is due to the rise in girls' academic performance, not that the boys are doing worse on their performance. This can be found in the international Program for International Student Assessment (PISA) which is a worldwide evaluation coordinated by the Organization for Economic Cooperation and Development (OECD) measures 15-year old student scholastic performance in the 65 member nations. The OECD PISA study (2003) which showed that boys were doing slightly better than girls at mathematics in almost all the participating countries, and girls and boys were achieving to relatively equal standards at science. However, in all 43 countries involved in the PISA research, girls demonstrated greater proficiency than boys in the combined reading scale, with an average difference of 32 points across countries. The OECD PISA study repeated in 2009 continues to show in every one of the participating 65 countries and economies that girls have significantly higher average reading scores than boys. This report continues to point out that lower proficiency among boys has become a major concern in many education systems, and closing the gender gap will help improve reading performance overall. In mathematics boys outperform girls in 35 of the 65 countries and economies. In five countries, girls outperform boys, and in 25 countries there is no significant difference between the genders for mathematics. This gender gap is only one-third as large as that for reading, in which girls outperform boys. In the United States boys outperform girls in mathematics by more than 20 score points, close to one-third of a proficiency level.

According to the National Assessment of Educational Progress (NAEP) Long-Term Trend (LTT), in 1973, the gap in gender in 17-year-olds' math achievement was 8 points (0.3 standard deviations) with the males in the lead. Gender differences in high school course taking and related issues began to receive attention in the 1970s (Fennema & Hart, 1994), and the gap in high school narrowed over the next decade. Over the past decade, the results from the Main NAEP studies have shown small but persistent math gender disparities with males taking the rise in fourth, eighth, and 12th grades, with gaps of roughly 0.1 standard deviations or the equivalent of a few months of education. The TIMMS (Trends in International Mathematics and Science Study) and PISA (Program for International Student Achievement) data reveal that boys express a more positive attitude toward math in almost all participating countries (Else-Quest et al., 2010). These studies have focused on students in grades 4 and above, therefore the ECLS-K database has recently been used to examine gender-related issue in early achievement. Using the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K), researchers have found math gender gaps as early as kindergarten or the first grade. These math gaps, which favor males, have also been discovered to increase between kindergarten and the third grade (Rathbun, West, & Germino-Hauskin, 2004.) Penner and Paret (2008) examined the development of gender gaps in mathematic achievement from kindergarten through fifth grade. This study found that gender gaps begin as early as kindergarten in the top of the achievement distribution and then appear throughout the rest of the distribution by third grade.

Hyde, Lindberg, Linn, Ellis, and Williams (2008) discovered that gender gaps in math were not significant on NCLB tests given in second through 11th grades in 10 states. This study raised questions about whether there still is a gender gap in mathematical achievement. This study also attempted to study gaps on more challenging test items, given that males have been found to outperform females in the more challenging areas in math. Their conclusions found gaps favoring males at the upper end of the achievement distribution. According to the delayed entry of students and gender, Zill et al. (1997) indicated that male students usually do not start kindergarten as early as female students. They found a far stronger correlation to gender—11 percent of all boys experienced delayed enrollment, compared to 6 percent of girls, $\beta = .57$, $p < .01$, indicating that the overall academic performance of male students is less than that of female counterparts. According to Malone et al. (2006), children whose kindergarten entries are delayed are more likely than children who started on time to be male than female (60 versus 49 percent). This study has similar findings as Warder (1999) reported that female students accomplished more than male students in almost all grades and at almost all ages.

A study by Marshall (2003) found a slight academic advantage in the first three years of school for boys who delay the start of kindergarten. In kindergarten through second grade, children perform to their age, meaning that a 6-year-old kindergartener would perform the same as a 6-year-old first grader. Marshall (2003) found for girls in contrast, other factors such as family education and socio-economic status influence achievement much more than age. Katz (2001) showed the difference in achievement potential between male and female students has traditionally been prevalent in more affluent communities, but is more recently becoming common among the general public.

On the contrary, Graue and DiPerna's (2000) study found different results. As in Zill et al.'s study (1997), boys made up the majority of kindergarten redshirts; however, the likelihood of delaying entry for these students was more closely linked to summer birthdays that fell just before the cutoff date for enrollment (Graue & DiPerna, 2000).

Research including technology such as brain imagery has confirmed that sex differences in kids are quite pronounced. With boys' less-developed fine motor skills, boys at the age of 5 may have more difficulty than most girls holding a pencil or buttoning a coat. They usually need larger spaces to move around, require more breaks, and have shorter attention spans (normal for boys this age). Boys also learn differently from girls and do better when lessons use hands-on learning rather than verbal instructions, which girls are better at following (Hull, 2003).

Deming & Dynarski (2008) found gender differences in age at school entry partially explain the rising gap in the high school completion rates of males and females. The female advantage in school completion for 18-year-olds was about 10 percent for decades, but began to rise in the early 1990s and now is approximately 15 percentage points over the male counterparts. When the differing ages at school entry was adjusted, the male-female gap in high school graduation rates of 19-year-olds, who had time to finish high school even with delayed entry, was lower and there was no upward trend over time. When the completion of a bachelor's degree is examined, the gender difference in BA completion of 22-year-olds has been rising for over 20 years. The women studied were about 7 percentage points more likely to hold a BA degree.

Table 3 reviews the historical research presented regarding gender and academic achievement.

Table 3

General Characteristics of Gender vs. Academic Achievement

Source	**Study/Purpose**	**Findings**
Byrnes, 1989	71 retained elementary students	43 percent of girls and 19 percent of boys would not admit to researcher that they had been retained
Deming & Dynarski, 2008	October Current Population Surveys	Females have a 15 percentage point advantage in high school completion rates than males. This continues to the bachelor's degree at 1 percent.
Denton, 2001	Students from 16 member states	Boys twice likely to be retained as girls
Francis & Skelton, 2005	OECD PISA study (2003), 43 countries	Boys were doing slightly better in math, boys and girls were performing relative equal in science, but girls demonstrated greater proficiency than boys in combined reading scale, with an average difference of 32 points across countries.
Meisels & Liaw, 1993	16,623 K-8 students from NELS: 88 longitudinal study	Boys outnumbered girls 24 percent vs. 15.3 percent; found that girls were emotionally vulnerable to retention effects.

Table Literature Research Design by H. Jerome Freiberg (1989-2012)

Maturationist vs. Interactionist Assumptions

Many theories have been developed on when a child is ready to enter the world of public education. The maturationist theory believes that the cognitive, social and physical abilities of children develop according to a child's own time clock, not the stimulation from the outside environment. This theory asserts that the developmental process proceeds in a linear and automatic manner, therefore certain levels of maturity need to be reached prior to children succeeding in school. Maturationists believe that time will produce school readiness and the theory generally advises delaying school entry for some children whose birthdays occur near the cutoff date and those considered not ready for kindergarten by parents, teachers, and caregivers (Farlex, 2010). By following the thoughts of the maturationist theory, students who are chronologically older in the grade level will achieve higher academically and those who are retained or academically redshirted should produce at the top of their class.

The interactionist theory views age-related changes as resulting from the interactions among the individual characteristics of the person, the circumstances in society, and the history of social interaction patterns of the person contradicts the above theory (Farlex, 2010).

Constructivism learning theory argues that humans generate knowledge and meaning from an interaction between their experiences and their ideas (Farlex, 2010). These theorists believe children must reach a certain level of development before they are ready to learn new strategies or skills. Piaget believed that development must be stimulated by the interactions a child has with the world around them and the people with whom they come in contact. When a child handles an object in a different way, watches other children do something they had not thought of, or a peer asks a new question that stimulates new ways of thinking, they are making new discoveries that lead to higher levels of thinking (Marshall, 2003). To further this theory, Vygotsky (1978) thought through guidance and instruction, not just the passage of time, learning, developing, and readiness for a new learning is developed. Through this view, learning and teaching precede development, therefore schools need to be ready to support, guide and instruct each child by creating strong support and scaffolding structures of skills regardless of the knowledge a child brings into the classroom. Contradicting the maturationist theory, the constructivism learning theory would encourage children to be placed in the kindergarten classroom regardless of how mature they were. Through their interactions they would develop the maturity they lack and achieve at a higher level than the child who was left in an out-of-school setting.

Maturity vs. Success in School

The question of *do older students succeed at higher rates than younger students* remains inconclusive. Several researchers have indicated that there is later academic advantage for delaying school entry. A study by Grimes (1999) found that developmentally younger children have a more difficult time following class rules and routines. In this study teachers noted that developmentally younger students had more problems with their attention levels, staying seated, poor fine and gross motor skills, and had a more difficult time adapting behavior when transitioning from one activity to another.

The work of Cunha, Heckelman, Lochner, and Masterov, (2006) argues that skills accumulated in early childhood are complementary to later learning. Relative age differences at the start of formal schooling may therefore be long-lasting if relatively older students are better positioned to accumulate more skills in the early grades because their maturity advantage increases the likelihood that they are selected for more advanced curriculum groups or because they progress through a common curriculum at a faster rate.

Unger (1996) indicates “developmental age relates strictly to a person’s maturity as exhibited in his or her normal behavior” (p. 288). He shows that some children may behave in a way that is developmentally younger than their chronological age while developmentally older children may behave in a manner that is older than their chronological age. Schools currently look at a students’ developmental age instead of their chronological age for admittance into classes.

Kilpatrick (2002) researched middle school students’ Terra Nova reading and mathematics scores relating to their age when entering kindergarten for 389 sixth, seventh and eighth graders. Students were placed into two groups based on their entry date. Kilpatrick’s study revealed no significant difference between the older and younger students in terms of academic achievement at the middle school.

Greenberger (1982) studied whether children’s performance in schools, the education of their parents, or their scores on achievement tests would be associated with their level of maturity. Through a survey of 40,000 seventh, ninth and 11th graders she found that children who get good grades, who are more involved in extracurricular activities, and who are generally performing well in school tend to score higher on her maturity scales. These results suggest that things “inside” of the child such as educational aspirations and level of academic achievement are more closely linked with mature values than things “outside” the child, such as grades. She also found that girls develop higher levels of individual and social adequacy than boys. Girls are already ahead of boys in social adequacy and tend to stay that way.

Stipek (2003) believes that identifying the appropriate age for children to enter school is complicated due to the fact that children do not all develop at the same pace. A significant variation in school readiness will be found regardless of the age at which children are permitted to enter school. Stipek (2003) states children who have had experience in group day care or other early childhood education programs may be more adaptable and better prepared to handle the demands of school than their classmates with little or no experience in school settings, thus indicating that age will be a weak predictor of school readiness.

School Accountability

A school’s accountability rating can have real consequences; therefore administrators want the best and most able students at every grade level. Age at entry began to increase at least a decade before the incline of high-stakes testing in the 1980s. The trend continued in the 1990s and may be attributed to the introduction of high-stakes testing (Deming, 2008). This need for school achievement has pushed testing down to the lower grades starting in kindergarten. The ratings are published yearly and reported in print and by the media. The rating a school attains may affect how attractive it is perceived to be, which could affect its student population, property values, and local support for funding. Schools placed in the lowest ranking category undergo an evaluation process and may be reconstituted or otherwise sanctioned by the state. One of these sanctions includes students given the right to transfer to better-performing schools inside or outside of the district. Losing students means losing school funding. Schools with the highest ratings become magnets attracting the brightest and the best students. In some high performing schools, and schools with substantial growth, administrators and teachers receive financial awards based on student achievement (Cullen & Reback, 2006).

The History of Achievement Testing

Achievement testing is not a new creation; "examinations have been used throughout the history of public education to determine what a student knows and how they know it. It is the issue of testing, evaluation and assessment that appear to be the most important determiner of curriculum decision making, and the 'big test' reflects the standards that drive curricula today" (Price, 2006, p.10). Historically, the most significant achievement test program in the United States began in New York as the New York State Regents. In 1784, the Board of Regents was first established by the New York State Legislature as a 16-member committee responsible for the general supervision of the state's educational activities. In 1864 the Regents voted to require public examinations of all students who applied for admission to academies and high schools in order to maintain high standards for all secondary schools that sought public financial aid. In 1877 the Regents tests were given for high school graduation and college admission. Students who passed the tests were awarded Regents diplomas, from a catalogue of 68 different subject tests (Folts, 1996). Over the decades, until the present day, the Regents curriculum guidebooks and the nature and number of examinations have been changed to support the changing educational policies, practices and finances including a reduction of required exams due to deficit-reduction actions taken by the Regents in June 2010 (King, 2010).

In the 20th Century, U.S. school systems adopted standardized tests that were designed to measure students' competence in subject areas such as reading, language usage, mathematics, science, history, and geography. The results of those assessments are used to compare schools in terms of national norms as well as help colleges and universities decide which applicants to admit. The International Association for the Evaluation of Educational Achievement (IEA) was established in 1962 to conduct multinational research in education relating to student achievement in reading, mathematics, science, literature, civic education, French as a foreign language, English as a foreign language, and more (Postlethwaite, 1985). In the 1990s, Third International Mathematics and Science Study (TIMSS) ranked 41 countries on their mathematical and science knowledge in grades 4, 8, and 12. Results were published showing the United States outcomes in fourth grade were scoring above the international mean (500) in both math (545) and science (565) ranking above 26 nations. The study also showed that eighth grade students in the United States only scored average in math (500) and slightly better in science (534). The 12th grade results fell well below the international average of 500, with math (461) and science (480), which was a disappointment to the general public of the United States. This study confirmed that U.S. students' test scores in the upper grades were inferior to students in many other nations. "As pupils climbed the schooling ladder year by year, their performance—in comparison to that of students in other countries—appeared to grow worse" (Thomas, 2005, p.15).

In 1979 the Texas State Legislature passed a bill amending the Texas Education Code to require the Texas Education Agency (TEA) to adopt and administer a series of criterion-referenced assessments to assess basic competencies in mathematics, reading, and writing for students in grades 3, 5, and 9. The Texas Assessment of Basic Skills (TABS; 1980) was designed to link student assessment to the statewide curriculum in Texas. At that point the state of Texas did not have a mandated state curriculum; therefore the test was comprised of a small portion of the many skills students were expected to learn in Texas public schools. In 1983 the Legislature further amended the code to require ninth grade students who are failing to pass the TABS test to retake the exam each year thereafter even though students were not held accountable for graduation. This additional pressure on schools made districts provide remedial support for students falling below the minimum expectations. The state of Texas published the results of each campus and district to the public resulting in the beginning of high-stakes accountability for large-scale assessment in Texas (Cruse & Twing, 2000).

In 1984, the Legislature changed the wording of the Texas Education Code from "basic skills competencies" to "minimum" basic skills. The Texas Education Agency took this change of wording as a mandate to increase the rigor of the assessments and to add individual student sanctions for performance with reading, mathematics, and writing. The Texas Educational Assessment of Minimum Skills (TEAMS) test was developed for grades 1, 3, 5, 7, 9, and 11, with the grade 11 test developed as an exit-level assessment. Beginning with the graduating class of 1987 for the first time, students in grade 11 were required to pass the assessments based on the passing standard provided by the State Board of Education (Cruse & Twing, 2000).

In the late 1980s, the Texas Education Code and Texas Administrative Code rules were revised which prompted a new test from the State Board of Education. With the creation of the Texas Assessment of Academic Skills (TAAS), implemented in 1990, the following changes were made: an expansion of the content being measured, with more content directly linked to the core curriculum’s Essential Elements (EEs), and greater emphasis on the assessment of problem-solving skills. First grade testing was removed from the assessment system in this new design and the new subject content included a reading and mathematics test of multiple choice questions, a writing test comprised of a multiple-choice section, and a direct writing sample. The assessment was moved to the spring in 1993. In 1994 grades 3 through 8 were tested in reading and math, and writing was assessed in grades 4 and 8. The exit level assessments were moved to grade 10 to provide more opportunities to retest prior to graduation and end-of-course assessments in algebra I, biology, English II, and U.S. history were also added. As an alternative to the TAAS graduation requirements students were given the option of passing the algebra, English and either the biology or U.S. history tests (Cruse & Twing, 2000).

In 1999 the 76th Session of the Texas Legislature enacted Senate Bill 103, under chapter 39 of the Texas Education Code, mandating implementation of a new statewide assessment program named the Texas Assessment of Knowledge and Skills (TAKS) which started in spring 2003. This assessment included an accommodated, modified and linguistically accommodated version for students served by special education and limited English proficient students. This phased out end-of-course testing by the year 2002-2003 and required exit level assessment for graduation at grade 11 in English language arts, mathematics, social studies, and science. The TAKS mathematics exit level math assessment included at the minimum algebra I and geometry math Texas Essential Knowledge and Skills (TEKS) with the aid of technology embedded into the grade level tests. This assessment measured mastery of skills necessary for high school and readiness to enroll in higher education. Three additional open-ended items were added to the reading and English language arts sections in grades 9, 10 and 11.

In addition, the 76th Legislature also passed Senate Bill 4 (1999) that affected students by linking promotion at certain grade levels to TAKS and limiting social promotion. In order for a student to promote to the next grade level they must pass the following assessments: grade 3 must pass reading, grade 5 must pass reading and math, and grade 8 must pass reading and math. If students are not successful on their first attempt they are given two additional chances to test. Districts are required by the state through the Student Success Initiative to provide accelerated instruction to students who fail to perform satisfactorily at each attempt.

In 2001, high-stakes achievement testing reached its peak when the U.S. Congress authorized a revision of the 1965 Elementary and Secondary Education Act (ESEA). On January 8, 2002, President George W. Bush signed the revised act into law creating the motto, "*No Child Left Behind*." This mandated that 95 percent of the students must test and their scores be reported in reading and math in grades 3 through 8 and at least once during grades 10 through 12. Additionally, beginning in the 2002/2003 school year districts were obligated to test the English-language oral, reading, and writing skills of all students who were limited proficient in English. By 2007/2008, science is required to test at least once during grades 3-5, grades 6-9, and grades 10-12 (Thomas, 2005). The Texas accountability program created a blueprint for the No Child Left Behind Act, which required all states to adopt standardized testing for students in third to eighth grade and use student proficiency standards in order to rate schools (Cullen & Reback, 2006).

As a result of the high accountability stakes districts and campuses are under, schools want to ensure their students are ready to excel at each grade level. Schools focus on students who need intervention to bring them educationally equal with their peers. This study reviewed the literature regarding the different chronological ages that range in one school year including: academic redshirting, the family socioeconomic status and preschool, effects of delaying school entry, retention, gender as it relates to academic achievement, maturationist versus interactionist assumptions, maturity levels compared to success in school, school accountability and the background of achievement testing as a standard to progress to the next grade level.

Conclusion

This chapter has explored the research related to the different chronological ages that range in one school year. The income a parent(s) makes during a child’s early years has a direct impact on the quality of education a child receives. If a child is young for their grade a parent may decide to give their child another year to grow and develop prior to enrolling them in the public school system. The parents without the financial means do not have the same options. As a result, the youngest students in a cohort tend to be from low-socioeconomic households, where students may be more than a year younger than their peers. Also, when school entry is delayed at the beginning of schooling the older children have a greater academic and behavioral advantage, though due to their physical maturity, they may feel alienated from their younger classmates. This advantage seems to decrease as children progress through elementary and middle school. In the long term being older in the cohort did not show an academic advantage, but did create a discipline and drop out issue. Older children have the ability to drop out earlier than their peers because they are a year older. Additionally, retention in kindergarten is a common strategy used when students do not seem ready to progress to the next grade level. This retention is often due to students being young for their grade level. In regards to gender, typically more boys are redshirted than girls and girls seem to have an early academic advantage over boys. In different points of view the maturationist believes that children develop according to their own time clock, and students who are older than their peers will naturally outperform their peers. The students who are more mature based on age in classrooms seem to out produce their peers. In contrast, the constructivism learning theorists believe through guidance and instruction, not just the passage of time, learning, and teaching precede development. This thought structure believes you can teach a child prior to the child being developmentally ready, through carefully calculated processes. Additionally, schools want the students able to handle the advanced curriculum due to the higher accountability rates and requirements for obtaining the next grade level by students.

Chapter two focused on the research surrounding students that have had their entry into the public school environment delayed by either parent's choice, school or physician's recommendation. That choice could be made based on a parent's socioeconomic status and perceived development of the child. Chapter three will delve into the steps the researcher will take to determine if delaying a child's entry into school is a solid idea based on research of how the study students do later in life in the seventh grade.

CHAPTER THREE

Research Methods

Overview

This study examined the relationship between school entry age and later academic achievement of students at grade 7 in the study district by determining the age of students in months by subtracting the birth month and year from the mathematics TAKS test month and year. Academic achievement of students was measured in the study grade level of seventh grade through the use of state achievement scores in mathematics. The data provides a foundation to determine if students who are chronologically older than their peers achieve more or less in the area of mathematics. This information coupled with the students' gender and socioeconomic status allowed the researcher to find correlations between age and academic achievement in mathematics at grade 7.

The Texas Assessment of Knowledge and Skills (TAKS) test was used to determine mathematical achievement for this cohort of students. The TAKS data was collected from the historical TAKS data file provided by Pearson Education, Inc. in the 2010/2011 academic year with permission of the district.

This study did not delve into information relating to the students' attendance in preschool. Since mandatory attendance begins at the age of 5 for the state of Texas, the research in this study begins after the preschool age and does not account for those additional years of schooling.

Research Questions

This study analyzed selected factors that affect the mathematic achievement of students based on their chronological age. The literature suggests that depending on the grade level of the student, chronological age may factor into mathematical achievement.

Research Question I. *Is it academically advantageous to be older than your peers in the grade 7 cohort as indicated by the mathematics achievement scores in the state of Texas's TAKS tests?*

In response to Research Question I, this study utilized archival historical TAKS assessment data for a suburban school district in the northwest Houston area to determine if older students have an advantage in seventh grade mathematical achievement over younger peers in the same grade level. Data was analyzed according to month of birth versus the mathematical vertical score on the TAKS test. As reviewed in the previous chapter, the literature finds that in the primary years of public school students who are older than the average child perform higher on mathematics. This trend does not follow in the middle school and high school years for students. This study focused on the students who were in the seventh grade and the literature indicates that chronological age does not make a difference in this age group.

Research Question II. *Does an advantage in chronological age at grade 7 differ in males and females as indicated by the mathematics achievement scores in the state TAKS tests?*

In response to Research Question II, this study used historical TAKS assessment data, month of birth, and gender to determine if mathematical achievement is greater for one gender based on chronological age. The literature shows that math attainment is higher for males than females. This study looked at gender as an indicator of mathematical performance.

Research Question III. *Are there differences by socioeconomic status in relation to chronological age as indicated by the mathematics achievement scores in the State TAKS tests at seventh grade?*

In response to Research Question III, this study used archival TAKS mathematical assessment data, economic disadvantaged status and month of birth to determine if mathematical achievement is greater for a student of higher socioeconomic status based on chronological age. The literature in the previous chapter indicates that students of higher economic status tend to outperform students at the lower socioeconomic levels. This issue was evaluated based on chronological age and if the socioeconomic status along with the chronological age creates a difference in the attainment of mathematics.

Table 4

Study Design

Research Questions	Variable Indicators	Data Source	Participants
Is it advantageous to be older than your peers in the grade 7 cohort in mathematics achievement?	Chronological Age versus Math Raw Score	April 2011 seventh grade Math TAKS data created by the Texas Education Agency: Student Assessment Division and scored by Pearson Education, Inc.	The participant group will consist of grade 7 students in the study district who have been enrolled in the district since the third grade.
Does this proposed advantage in chronological age at grade 7 differ in males and females in mathematic achievement?	Chronological Age versus Math Raw Score broken down by Gender	April 2011 seventh grade Math TAKS data created by the Texas Education Agency: Student Assessment Division and scored by Pearson Education, Inc.	The participant group will consist of grade 7 students in the study district who have been enrolled in the district since the third grade.
Are there differences by socioeconomic status in relation to chronological age in mathematics achievement at seventh grade?	Chronological Age versus Math Raw Score broken down by Socioeconomic Status.	April 2011 seventh grade Math TAKS data created by the Texas Education Agency: Student Assessment Division and scored by Pearson Education, Inc.	The participant group will consist of grade 7 students in the study district who have been enrolled in the district since the third grade.

Table Research design provided by H. J. Freiberg (1989-2012)

Population / Sample

The population of this study is the students enrolled in seventh grade in the research district located in Houston, Texas. According to the 2009-2010 Academic Excellence Indicator System developed by the Texas Division of Performance Reporting the study district serves 35,276 students, with 2,585 students in the seventh grade in seven middle schools. The website describes the district serves over 36,000 students in pre-kindergarten through 12th grade in a diverse and growing district. The district is located 20 miles northwest of Houston in an urban area that spans 57 square miles. The diverse district is made up of 39.5 percent Hispanic-Latino students, 40.1 percent Black-African American students, 15.7 percent White students, 0.2 percent Native American students, and 4.5 percent Asian-Pacific Islander students. The gender data for the study district is 51.44 percent male and 48.56 percent female. During the 2009-2010 school year 8 percent of students were identified Special Education, 17.3 percent Limited English Proficient and 45.7 percent At Risk. In the 1990 school year the research district had 14 percent low income students. In a 20 year time period the free and reduced lunch students escalated to 68.2 percent in the 2010 school year. Approximately 7.3 percent or 2,585 of the district's students are in seventh grade. The average class size ratio for seventh grade in 2011 is 25 students to one teacher. In the 2009-2010 school year the district's accountability rating was Academically Acceptable and the seven middle schools of which the seventh grade is a part all had accountability ratings of Academically Acceptable.

Instrumentation

Archival achievement data from the study district's TAKS results provided in the state of Texas data file was used for this research after permission was obtained from the study district. The school entry age variable was calculated to the nearest month and was considered to be a continuous variable.

The measure used for this study was the TAKS test. The TAKS test is the state of Texas's standardized achievement test that is given yearly and measures academic attainment per grade level. This assessment is developed and published by Pearson in the subjects of Reading, English Language Arts, Writing, Mathematics, Science and Social Studies. This study will focus on the subject of Mathematics. "The development of the TAKS program included extensive public scrutiny and input from Texas teachers, administrators, faculty and staff at Texas colleges and universities, and national content-area experts" (Grade 7 TAKS Information Booklet, p. 1).

The student's archival score code determined if the student's assessment was scored. Tests that were not scored were removed from this study. Students may have alternative score codes due to the following circumstances. The student was cheating therefore the score code was "othered" or not scored. The student was absent and the scantron was submitted for scoring in other subjects. These students were removed from the study group due to extenuating circumstances that invalidated their data.

The vertical scale score was used in this study to determine the student's mathematical achievement. The vertical scale score is a number that illustrates how well a student performed on the Texas Assessment of Knowledge and Skills (TAKS). This score is calculated from the number of questions a student answered correctly on TAKS. A vertical scale score was not developed for the TAKS modified version of the math test, therefore modified scores were not collected in this research. The current met standard vertical score for a seventh grade student in math is a 670. This is where the passing standard is set for the seventh grade level. This study evaluated the met standard based on this passing rate. The main advantage of having a vertical scale is that changes in the student's vertical scale scores show the academic progress the student has made from one year to the next. However, the amount of change a student needs to make depends on whether or not the student is currently passing the TAKS test. A student who is not passing needs to show more advancement than a student who is passing. Schools and parents use this data to determine whether a child is making sufficient academic progress (Student Assessment Division, 2011). A vertical scale score can be compared across different grades for the same subject.

Procedures

The researcher gained permission to study the district math TAKS data file for students in the seventh grade from the study district. This information was provided in electronic format for the researcher to use. A Human Subjects report was filed and approved to ensure that there were no risks to subjects in this study. Since this study was based on historical data already collected by the state of Texas, the researcher did not have to go out and seek the data from individuals. Information on individuals was masked in order to protect the rights and confidentiality of the seventh grade students in this study. This followed the compliance requirements to ensure that the risks are minimized by the subjects when compared to the benefits of the study. The data was secured on the district secured folder with only access to the researcher for data evaluation.

Only data from the 2010/2011-assessment year which will be relevant to the purpose of this study was gathered. Data consisted of TAKS test results from the most current year available. This current year is the last year the state of Texas administered TAKS to students in the state of Texas. Test results relevant to this study included the vertical math scores derived from the 2010/2011 academic school year.

To determine the chronological age groups of the students the researcher grouped students based on date of birth and created six groups illustrated in table 5. These groups contained students who were retained, delayed entry (redshirted), in a traditional cohort September to December, January to April, May to August, and accelerated (skipped a grade). The groups of September to December, January to April, and May to August make up students in the traditional cohort year. The first year of the Texas State curriculum is planned for the child who has reached the chronological age of 5 years on or before the first day of September and is entitled to enroll as a kindergarten student (Texas Education Code - Section 25.001 Admission, 2007). Based on the starting date of September first, the researcher designated students born within the time ranges of September 1, 1997 to August 31, 1998 as cohort students.

Table 5

Chronological Group Dissection

Chronological Age Group Name	Birth Date Range	Indicators
Retained	Prior to August 31, 1997	Retention on Student File
Delayed Entry (Redshirted)	Prior to August 31, 1997	No Retention on Student File
September to December	September 1, 1997 – December 31, 1997	Traditional Cohort
January to April	January 1, 1998 – April 30, 1998	Traditional Cohort
May to August	May 1, 1998 – August 31, 1998	Traditional Cohort
Accelerated	After August 31, 1998	Skipped a Grade

Other descriptive data that was collected includes gender and socioeconomic status. A student's gender is indicated in the TAKS data file as male and female. The gender was compared to the chronological age groups of the students to determine achievement in mathematics based on gender. The students' socioeconomic status was also collected in the TAKS data file that indicates one of four levels. These levels are as follows: students eligible for free meals under the National School Lunch and Child Nutrition Program, students eligible for reduced-price meals under the National School Lunch and Child Nutrition Program, students with other economic disadvantages, for example homeless students, and students who are not identified as economically disadvantaged. These two data pieces were gathered from the TAKS 2010/2011 data file. All gathered data was entered into the SPSS statistical analysis program. Descriptive and inferential tests were run to gather the statistical information that was required to run this study.

Achievement data was gathered by the researcher by reviewing students' TAKS mathematics results. These results were kept in a secure server provided by the district. The researcher identified the individuals who had repeated a grade level since third grade, by comparing their testing date in the student testing history. Any student who did not follow the typical one year per grade pattern was marked as a repeating student starting in the third grade.

Participant Limitations

All students who took an alternate assessment including TAKS Modified (TAKS-M), TAKS Alternate (TAKS-Alt), and TAKS Linguistically Accommodated Testing (LAT) were removed from this study (Student Education Agency, 2011) in order to not skew the data for assessments that rely on a different scoring system. The TAKS Modified is an alternate assessment based on modified academic achievement standards designed for students who meet participation requirements and who are receiving special education services. The test design covers the same grade-level content as TAKS, but TAKS-M tests have been changed in format (e.g., larger font, fewer items per page) and test design (e.g., fewer answer choices, simpler vocabulary and sentence structure). The TAKS Alternate assessment is another alternate assessment designed for the purpose of assessing students who have significant cognitive disabilities and are receiving special education services. The Linguistically Accommodated Testing (LAT) is a special administration of TAKS for LEP-exempt recent immigrants. Linguistic accommodations are made in order to assist students in overcoming language barriers and to provide a meaningful assessment of academic knowledge and skills not based on language acquisition (Student Education Agency, 2011). These assessments are based on a horizontal score of meeting standard at 2100 and cannot be compared to the vertical score for TAKS.

Students who were mobile during their academic careers from third grade to seventh grade school year were removed from the study. This study did not factor in students who had moved around to different school districts and academic growth may be hindered due to gaps in curriculum and educational alignment. The district information was found on the TAKS file and the student's third grade school district must match the seventh grade school district in order to qualify for this study.

Data Analysis

The design intent of this study was to be non-experimental quantitative due to the age a child entered third grade and their seventh grade test scores. Non-experimental quantitative research is defined by Wiersma and Jurs (2005) where no experimental variables are manipulated and variables are studied as they exist in the situation. This research is ex post facto where the variables of age, gender, socioeconomic status and vertical score will be studied in retrospect in a search for relationships between the variables. Descriptive statistics were run on the data set to determine a normal distribution.

Data analysis was conducted through an analysis of variance (ANOVA), an inferential statistic used to analyze data from an experiment that has either multiple factors or more than two levels of the independent variable. The vertical scale scores students achieve on the TAKS test were the dependent variable in this study. The independent variable used was the age range of students broken down into six groups based on chronological age. In this study the value of the score on a variable may be due to one or more of these factors: the independent variable, the individual differences of the subjects and experimental error. The first assumption was that of independence, in which one group of chronological age does not affect another group of chronological age. This was provided using the Levene's test, and inferential statistic used to assess the equality of variances in different samples. The second assumption of the ANOVA was normality where the distributions of one group of chronological age TAKS scores were not dissimilar from a normal bell curve. During the ANOVA test the researcher used an F-ratio to determine statistical significance of the results compared to the table of critical values to determine significance. The alpha level was set at .05 to determine data significance. The alpha level was based on the size of the sample with a large sample size needing the alpha level potentially being adjusted upward.

Scope and Limitations

Although this research was carefully prepared, study limitations may impact the ability to generalize the study. The enrollment count for the district in the seventh grade is 2,585 students in April 2011, due to the factors below including test type and district mobility, the study sample was reduced to 1,327 students for the study sample.

First, this study was limited to the reliability and validity of the Texas Assessment of Knowledge and Skills (TAKS) test created by the Texas Education Agency and published by Pearson Publishing, as well as this test's ability to measure student achievement.

Second, this study was limited only to students who had attended the study district in grade 7 and the results thereof may not accurately be generalized to the population of any other grade level of assessment.

Third, this study did not include students who were tested with modified assessments including TAKS Modified, TAKS LAT, and TAKS Alternate since they are derived on different horizontal scores that cannot be correlated to the TAKS mathematics vertical scale score. This assessment difference leaves out a portion of the population who are not represented in the study.

Fourth, since the district has a high mobility demographic, many students were lost in the study due to relocation of their parents. The students who moved from campus to campus were accounted for in this study, but the students who moved out of district from third to seventh grade were excluded.

Fifth, when a student registers for a new school district the information is hand-entered by registrars based off of paper copies provided by the prior school district or parent. Since this information is hand-entered into the computer, this study had the possibility of inaccurate data in the student's electronic record.

Summary

The research in this study focused on posing the question if chronological age affects mathematical achievement of students in the seventh grade. It also examined factors related to chronological age and mathematic attainment such as gender and a student's economic status. The study district comprised seven middle schools in a school district outside of the Houston area. The study was based on a student's TAKS vertical mathematics score at the seventh grade level and the information provided in the state of Texas' results data file provided to the district after students completed testing in April. The researcher ensured that the factors such as student mobility, alternate assessments, and second language acquisition did not affect the results by removing those students from the study sample as described in participant limitations. By examining the data gathered the researcher found trends in the above factors and was able to make recommendations on policy and student performance based on chronological age that could be used by the study district.

Chapter three focused on the steps required for the researcher to study the effects of delayed entry on students in the seventh grade. Chapter four will take those steps presented in chapter three and with the data gathered by the researcher determine the outcomes of students with delayed entry. This study will delve into how delayed entry will affect students based on their gender and socioeconomic status.

CHAPTER FOUR

Findings

Overview

The purpose of this study was to determine whether chronological age differences between students in the same grade level had an impact on their respective levels of performance in mathematics. The study analyzed the additional independent variables of gender and economic status to determine if these variables also contributed to differences in student performance. The study examined student performance on the TAKS test, specifically as it related to mathematics.

The study sample consisted of 1,327 male and female students in the seventh grade level in April 2011 in a selected Texas school district. The independent variables in the study included chronological age, gender and economic status. The dependent variable was student performance on the TAKS mathematics assessment.

Research Questions

The central research question for this study determined whether there was a significant difference in student performance on the standardized TAKS mathematics assessments, based on students' chronological ages within the seventh grade.

Research Question I. *Is it academically advantageous to be older than your peers in the grade 7 cohorts as indicated by the mathematics achievement scores in the state of Texas's TAKS tests?*

Research Question II. *Does an advantage in chronological age at grade 7 differ in males and females as indicated by the mathematics achievement scores in the state TAKS tests?*

Research Question III. *Are there differences by socioeconomic status in relation to chronological age as indicated by the mathematics achievement scores in the state TAKS tests at seventh grade?*

Birth month and year classified students in each of the six groups in the study. The first group of students contains students who have been retained sometime in their academic career. This retention could be due to a parent or the school determining the student was not academically or socially ready to progress to the next grade level. The second group of students consisted of the delayed entry or redshirted students with birthdays prior to the Texas September 1 cut-off date, but they did not attend school until the following school term, making them the oldest students in the class by parent choice. Students in groups one and two are the oldest students in the class. The third group comprised students with fall births from September to December. This group of students qualified for school entry based on the September 1 cut-off date. This group of students should be the oldest students in the grade level cohort if academic delayed entry or retentions did not occur. The fourth group contained the students with spring births from January to April. The fifth group comprised students who were born in the months of May to August. The sixth group consisted of the grade accelerated students, who at some point in their academic careers accelerated to a grade higher than their cohort group; these students due to their birth date should be one grade level lower than they are, or in the study year, these students should be in sixth grade instead of the current grade of seventh. These students were the youngest students in the seventh grade. The third through fifth groups all met the school entry date of September 1 and make up the traditional cohort group of students based on their birth date. Groups one, two and six do not fall within the traditional proposed cohort window.

Findings

Descriptive statistics for grade 7, including, means, medians, modes and standard deviations for the independent variables, help frame the findings. Table 6 shows the mean, median, mode, and standard deviation of the vertical math scale scores. For the TAKS seventh grade April 2011 assessment the lowest vertical scale score possible is 302 and the highest is 997. In order for a student to meet standard on the TAKS math assessment they must achieve a vertical scale score of 670 or above. To meet the top commended performance level students will have to attain a vertical scale score of 823. The mean vertical math scale score for Grade 7 was 726.66. The median math score for Grade 7 was 718.00 and the mode was 742. The standard deviation was 78.271.

Table 6

Descriptive Statistics for Math Scores

N	Valid	1327
Mean		726.66
Median		718.00
Mode		742
Std. Deviation		78.271

Table 7 represents the frequencies for gender in grade. There were 674 females constituting 50.8 percent of the grade 7 populations. There were 653 males constituting 49.2 percent of the grade 7 populations. Overall, in Texas public schools, females make up 49.5 percent of the grade 7 population and males constitute 50.5 percent of the population (Texas Assessment, 2011).

Table 7

Frequencies for Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Female	674	50.8	50.8	50.8
Male	653	49.2	49.2	100.00
Total	1327	100.0	100.0	

Table 8 represents the frequencies of students considered economically disadvantaged. Of 1,327 students, there were 468 students not economically disadvantaged, consisting of 35.3 percent of the population. The additional 64.7 percent of the population were economically disadvantaged and are split between two types of economically disadvantaged status. The first group under the economically disadvantaged status is students who are eligible for free meals and the second group is students who are eligible for reduced-price meals under the National School Lunch and Child Nutrition Program. The number of students who qualify for free meals is 711 students who make up 53.6 percent of the population. The students qualifying for a reduced meal cost is 148 students or 11.2 percent. The overall percent of grade 7 students in Texas considered economically disadvantaged was 57.2 percent (Texas Assessment, 2011).

Table 8

Frequency of Economically Disadvantaged

Economically Disadvantaged Status	Frequency	Percent	Valid Percent	Cumulative Percent
Not	468	35.3	35.3	35.3
Free	711	53.6	53.6	88.8
Reduced	148	11.2	11.2	100.0
Total	1327	100.0	100.0	

Table 9 represents the frequencies of students by chronological age group. There were 139 students in the retained group, 81 in delayed entry group, 403 in September to December group, 357 in the January to April group, 220 in the May to August group, and 17 in the accelerated group. Percentages of each are 10.5, 6.1, 30.4, 26.9, 24.9, and 1.3 respectively.

Table 9

Frequencies of Students by Chronological Age Group

Group	Frequency	Percent	Valid Percent	Cumulative Percent
Retained	139	10.5	10.5	10.5
Delayed Entry	81	6.1	6.1	16.6
September to December	403	30.4	30.4	46.9
January to April	357	26.9	26.9	73.9
May to August	330	24.9	24.9	98.7
Accelerated	17	1.3	1.3	100.0
Total	1327	100.0	100.0	

In order to examine the math vertical scores, there was a determination of mean scores by group. The mean math scores by Group are in Table 10 and compared in Figure 1.

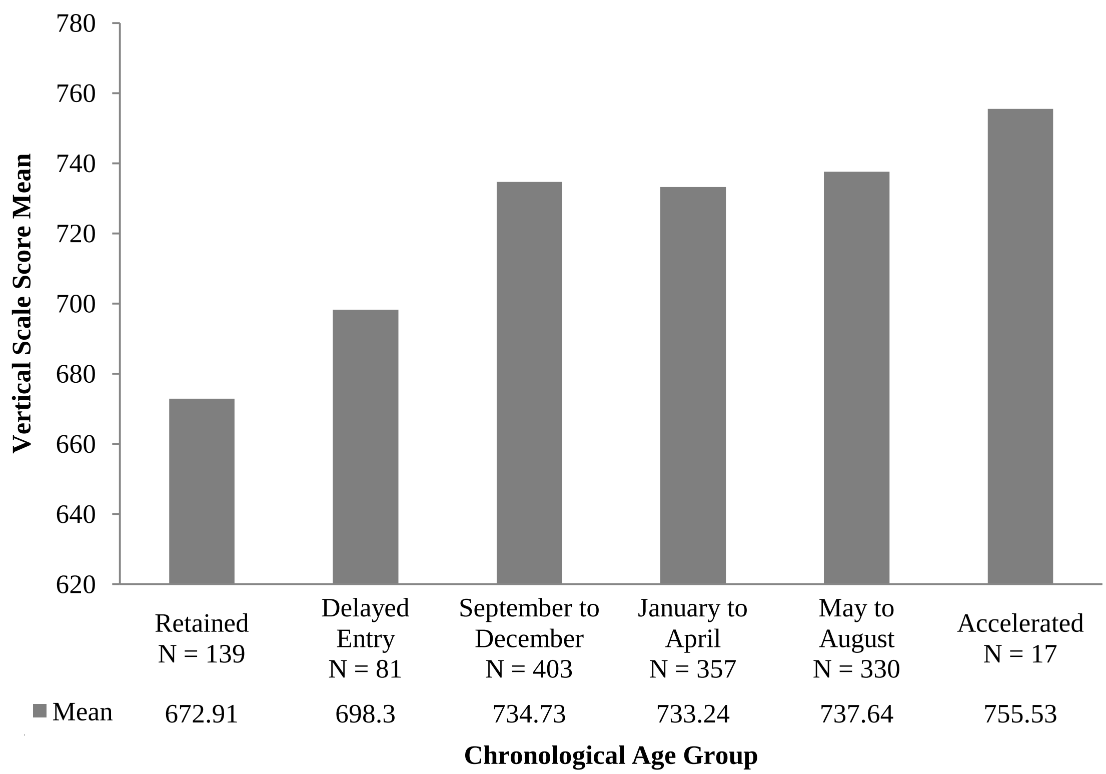
Table 10

Mean Math Scores by Chronological Age Group

Group	*N*	Mean	Std. Deviation
Retained	139	672.91	60.555
Delayed Entry	81	698.3	77.425
September to December	403	734.73	75.755
January to April	357	733.24	74.343
May to August	330	737.64	80.649
Accelerated	17	755.53	101.212
Total	1327	726.66	78.271

Figure 1

Mean Math Scores by Chronological Age Group



Research Question I. *Is it academically advantageous to be older than your peers in the grade 7 cohort as indicated by the mathematics achievement scores in the state of Texas's TAKS tests?*

A comparison of mean math scores by Group used an analysis of variance (ANOVA). There are underlying assumptions that needed addressing prior to running an ANOVA. According to SPSS v20.0, the variance of distribution of the dependent variable should be constant for all values of the independent variable (assumption of homogeneity of variance). In order to meet the assumptions of an ANOVA, it was necessary to conduct a test for homogeneity of variances for the math score. The results are in Table 11.

Table 11

Levene's Test of Equality of Error Variances for Chronological Age Group

F	*df1*	*df2*	Sig.
3.876	5	1321	.002

Levene's test of variance found a significant difference ($p < .002$) in variation on the math scores in grade 7. If the Levene's Test is significant, the two variances are significantly different. If it is not significant, the two variances are not significantly different; that is, the two variances are approximately equal (Archambault, 2000). Since the Levene's test is significant, we have not met our second assumption. One of the assumptions of the Analysis of Variance (ANOVA) is that the variances of the dependent variable are the same across the groups being studied. When this assumption is violated, the reported p-value from the significance test may be too liberal (yielding a higher than expected type I error rate) or too conservative (yielding a lower than expected type I error rate) (Introduction, 2012).

Without homogeneity of variance, the probability of a Type II error increases. That is, there is an increased chance of not finding a significant difference in math scores based on a difference in chronological age if one exists. Table 11 shows that the homogeneity of variance assumption is reasonably satisfied.

A one-way ANOVA compared chronological age group and math scores in grade 7. The results are displayed in table 12. A significant difference was present for Group, $F(5, 1321) = 19.541$, p =.000. The ANOVA table is in Table 12.

Table 12

ANOVA Grade 7 Math Scores vs. Group

Groups	Sum of Squares	*df*	Mean Square	*F*	Sig.
Between Groups	559461.738	5	111892.348	19.541	.000
Within Groups	7563986.937	1321	5725.955		
Total	8123448.675	1326			

Due to a significant *p* value for the ANOVA, a post-hoc Tukey's *HSD* determined the nature of the differences in math scores by age of the student in Grade 7. The Tukey's HSD revealed that students in grade 7 who were in the Delayed Entry Group (*m* = 698.3, *sd* = 77.43) scored significantly lower than the students in the September to December (*m* = 734.73, *sd* = 75.76), January to April (*m* = 733.24, *sd* = 74.34), and May to August (*m* = 737.64, *sd* = 80.65) groups. There were no significant differences in TAKS vertical scale scores between the Delayed Entry Group (*m* = 698.3, *sd* = 77.425) and the Retained Group (*m* = 672.91, *sd* = 60.56). Also, there was not a significant difference between the Delayed Entry Group (*m* = 698.3, *sd* = 77.425) and the Accelerated Group (*m* = 755.53, *sd* = 101.212). There was no significance between the traditional year cohorts September to December (*m* = 734.73, *sd* = 75.76), January to April (*m* = 733.24, *sd* = 74.34), and May to August (*m* = 737.64, *sd* = 80.65). Table 13 reflects the results of the Tukey HSD.

Table 13

Tukey HSD for Chronological Age vs. Math Score

Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Retained					
Delayed Entry	-26.012	10.578	.137	-56.20	4.18
September to December	-61.818*	7.443	.000	-83.06	-40.58
January to April	-60.324*	7.565	.000	-81.91	-38.73
May to August	-64.723*	7.651	.000	-86.56	-42.89
Accelerated	-82.616*	19.443	.000	-138.10	-27.13
Delayed Entry					
Retained	26.012	10.578	.137	-4.18	56.20
September to December	-35.806*	9.214	.001	-62.10	-9.51
January to April	-34.312*	9.313	.003	-60.89	-7.73
May to August	-38.710*	9.383	.001	-65.49	-11.93
Accelerated	-56.603	20.187	.057	-114.21	1.01
September to December					
Retained	61.818*	7.443	.000	40.58	83.06
Delayed Entry	35.806*	9.214	.001	9.51	62.10
January to April	1.494	5.500	1.000	-14.20	17.19
May to August	-2.904	5.618	.996	-18.94	13.13
Accelerated	-20.797	18.736	.877	-74.27	32.67
January to April					
Retained	60.324*	7.565	.000	38.73	81.91
Delayed Entry	34.312*	9.313	.003	7.73	60.89
September to December	-1.494	5.500	1.000	-17.19	14.20
May to August	-4.398	5.778	.974	-20.89	12.09
Accelerated	-22.291	18.785	.843	-75.90	31.32
May to August					
Retained	64.723*	7.651	.000	42.89	86.56
Delayed Entry	38.710*	9.383	.001	11.93	65.49
September to December	2.904	5.618	.996	-13.13	18.94
January to April	4.398	5.778	.974	-12.09	20.89
Accelerated	-17.893	18.819	.933	-71.60	35.82
Accelerated					
Retained	82.616*	19.443	.000	27.13	138.10
Delayed Entry	56.603	20.187	.057	-1.01	114.21
September to December	20.797	18.736	.877	-32.67	74.27
January to April	22.291	18.785	.843	-31.32	75.90
May to August	17.893	18.819	.933	-35.82	71.60

*$p < .05$.

Research Question II. *Does an advantage in chronological age at grade 7 differ in males and females as indicated by the mathematics achievement scores in the state TAKS tests?* In order to examine the math scores, it was necessary to examine the mean scores by gender and group. The mean math scores by gender and group is in Table 14.

Table 14

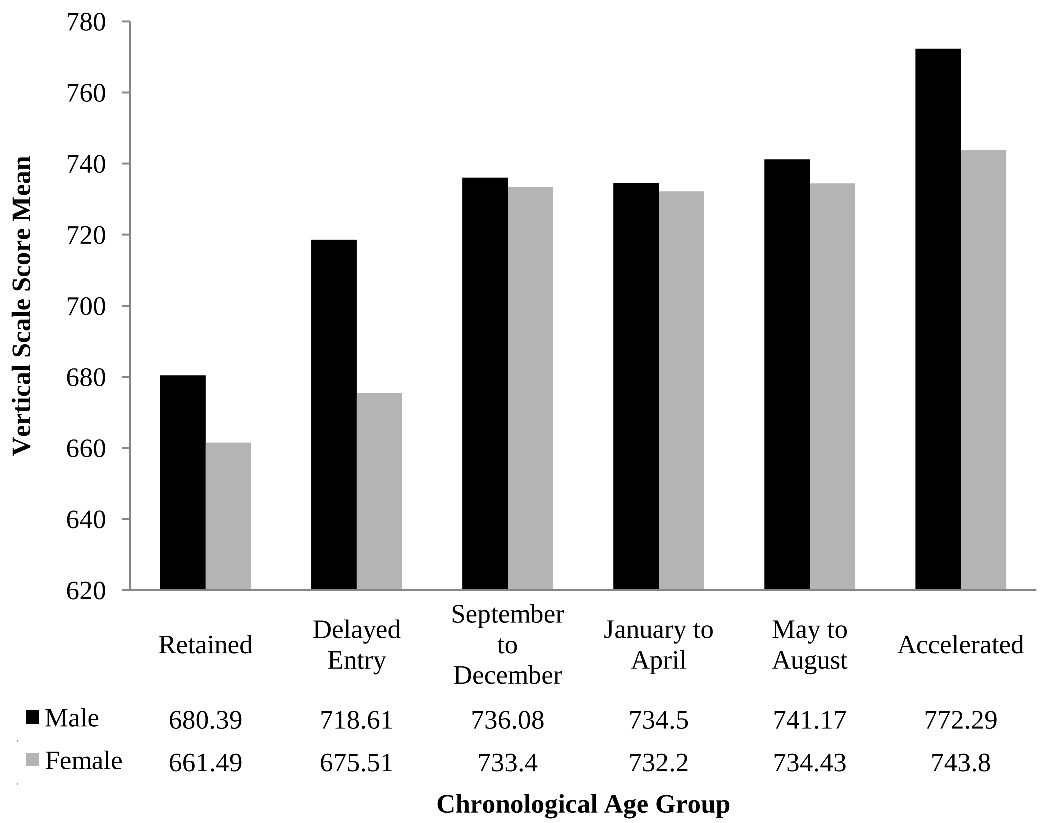
Mean Math Scores Gender vs. Chronological Age

	Female			Male			Total		
Group	*N*	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*
Retained	55	661.49	62.232	84	680.39	58.601	139	672.91	60.555
Delayed Entry	37	675.51	62.128	44	718.61	83.983	81	698.93	77.425
September to December	203	733.40	69.516	200	736.08	81.755	403	734.73	75.755
January to April	196	732.20	77.027	161	734.50	71.158	357	733.24	74.343
May to August	173	734.43	79.878	157	741.17	81.599	330	737.64	80.649
Accelerated	10	743.80	98.742	7	772.29	110.160	17	755.53	101.212
Total	674	724.42	77.307	653	728.96	79.247	1327	726.66	78.271

Note. Dependent Variable: Math Score

Figure 2

Mean Math Scores by Chronological Age Group and Gender



Levene's test (Table 15) of variance found a significant difference (p < .004) in variation on the math scores in grade 7. If the Levene's Test is significant, the two variances are significantly different. If it is not significant, the two variances are not significantly different; that is, the two variances are approximately equal (Archambault, 2000). Since the Levene's test is significant, we have not met our second assumption. One of the assumptions of the Analysis of Variance (ANOVA) is that the variances of the dependent variable are the same across the groups being studied. When this assumption is violated, the reported p-value from the significance test may be too liberal (yielding a higher than expected type I error rate) or too conservative (yielding a lower than expected type I error rate) (Introduction, 2012). Further research can be conducted to find out if chronological age group relates to a student's gender.

Table 15

Levene's Test of Equality of Error Variances for Gender

F	*df*1	*df*2	Sig.
2.510	11	1315	.004

Note. Design Intercept + Gender + Chronological Age Group + Gender*Chronological Age Group; Dependent Variable: Vertical Scale

A 2 (Gender) x 6 (Group) between-subjects factorial ANOVA compared math vertical scale score for participants by gender. A significant main effect for gender was found, $F(1, 1315) = 5.140$, $p < .05$. Males ($m = 728.96$, $sd = 79.247$) scored higher than females ($m = 724.42$, $sd = 77.307$). The interaction between Gender and Group at $F(5, 1315) = 1.272$, $p > .05$ was not significant. From the data presented it appeared that the interaction between Gender and Group did not have a significant effect on the TAKS mathematic scores. The results of this ANOVA are in Table 16.

Table 16

ANOVA Tests of Between Subjects Gender

Source	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.	Partial Eta Squared
Corrected Model	616948.402[a]	11	56086.218	9.825	.000	.076
Intercept	210799134.4	1	210799134.4	36928.109	.000	.966
Gender	29339.263	1	29339.263	5.140	.024	.004
Group	582393.183	5	116478.637	20.405	.000	.072
Gender * Group	36293.219	5	7258.644	1.272	.274	.005
Error	7506500.273	1315	5708.365			
Total	708821471.0	1327				
Corrected Total	8123448.675	1326				

a. R Squared = .076 (Adjusted R Squared = .068)

A Tukey's Post Hoc determined the nature of the differences between genders. The analysis revealed that female students who delayed entry (*m* = 675.51, *sd* = 62.128) and female students who were retained (*m* = 661.49, *sd* = 62.232) scored significantly lower than those born in September to December (*m* = 733.40, *sd* = 69.516), January to April (*m* = 732.20, *sd* = 77.027), May to August (*m* = 734.43, *sd* = 79.878) and Accelerated (*m* = 743.80, *sd* = 98.742). There was no significant difference between female students who were retained (*m* = 661.49, *sd* = 62.232) and delayed entry (*m* = 675.51, *sd* = 62.128). Also, there were no significant differences between females born from September to December (*m* = 733.40, *sd* = 69.516), January to April (*m* = 732.20, *sd* = 77.027) and May to August (*m* = 734.43, *sd* = 79.878). The analysis additionally showed that male students who were retained (*m* = 680.39, *sd* = 58.601) scored significantly lower than male students who had delayed entry (*m* = 718.61, *sd* = 83.983), students born September to December (*m* = 736.08, *sd* = 81.755), January to April (*m* = 734.50, *sd* = 71.158), May to August (*m* = 741.17, *sd* = 81.599), and accelerated (*m* = 772.29, *sd* = 110.160). In contrast to the females, the male students with delayed entry (*m*

= 718.61, *sd* = 83.983) did not show a significant difference between males born September to December (*m* = 736.08, *sd* = 81.755), January to April (*m* = 734.50, *sd* = 71.158), May to August (*m* = 741.17, *sd* = 81.599), and accelerated (*m* = 772.29, *sd* = 110.160). The results of the Tukey's Post Hoc are in Table 17.

Table 17

Tukey's HSD for Gender vs. Chronological Age

Group	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Female					
Delayed Entry					
Retained	14.023	16.065	.383	-17.492	45.537
September to December	-57.890***	13.506	.000	-84.385	-31.396
January to April	-56.685***	13.543	.000	-83.253	-30.118
May to August	-58.914***	13.685	.000	-85.761	-32.068
Accelerated	-68.286*	26.928	.011	-121.113	-15.460
Male					
Delayed Entry					
Retained	38.221**	14.060	.007	10.638	65.804
September to December	-17.466	12.581	.165	-42.147	7.214
January to April	-15.889	12.853	.217	-41.103	9.325
May to August	-22.558	12.888	.080	-47.841	2.724
Accelerated	-53.672	30.744	.081	-113.985	6.641

Note. Based on estimated marginal means. The mean difference is significant at the .05 level.
[a]Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).
**p* < .05. ***p* < .01. ****p* < .001.

A 6 (Group) x 2 (Gender) pairwise comparison compared math vertical scale score for participants by gender. The analysis of the data showed that delayed entry male students (*m* = 718.61, *sd* = 83.983) had a significance difference (*p* = .011) to female students with delayed entry (*m* = 675.51, *sd* = 62.128). The results of the pairwise comparison are found in table 18.

Table 18

Pairwise Comparison for Chronological Age vs. Gender

Group		Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval Lower Bound	Upper Bound
Retained						
F	M	-18.902	13.105	.149	-44.611	6.807
M	F	18.902	13.105	.149	-6.807	44.611
Delayed Entry						
F	M	-43.100*	16.853	.011	-76.161	-10.039
M	F	43.100*	16.853	.011	10.039	76.161
September to December						
F	M	-2.676	7.527	.722	-17.443	12.091
M	F	2.676	7.527	.722	-12.091	17.443
January to April						
F	M	-2.304	8.036	.774	-18.069	13.461
M	F	2.304	8.036	.774	-13.461	18.069
May to August						
F	M	-6.744	8.328	.418	-23.082	9.593
M	F	6.744	8.328	.418	-9.593	23.082
Accelerated						
F	M	-28.486	37.233	.444	-101.529	44.557
M	F	28.486	37.233	.444	-44.557	101.529

Note. Based on estimated marginal means
[b]Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).
*p < .05.

Research Question III. *Are there differences by socioeconomic status in relation to chronological age as indicated by the mathematics achievement scores in the State TAKS tests at seventh grade?*

In order to examine the math vertical scale scores further, it was necessary to determine the mean scores by economically disadvantaged and Chronological Age Group. The students who are not economically disadvantaged (m = 747.50, sd = 80.410) scored higher than students who participated in the free lunch program (*m* = 761.50, *sd* = 115.980) or the reduced lunch program (*m* = 700.50, *sd* = 24.749). The mean math score by economically disadvantaged and Chronological Age Group is found in Table 19 and Figure 3.

Table 19

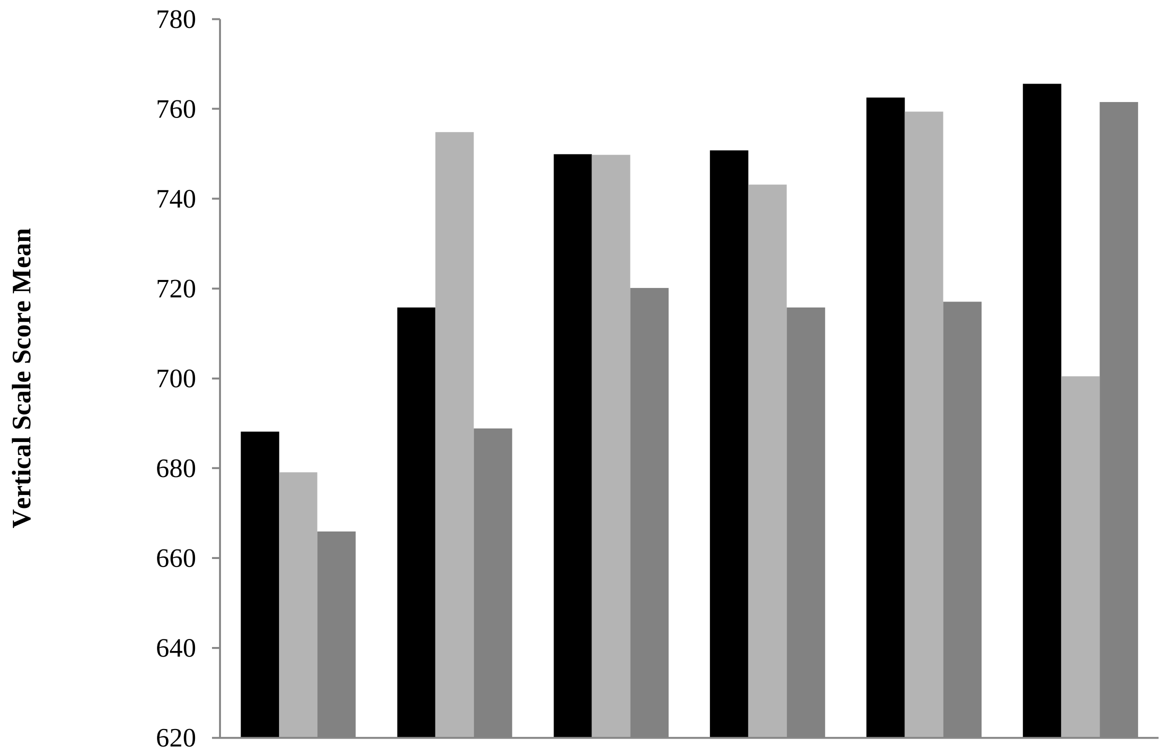
Mean Math Scores Chronological Age Group vs. Economically Disadvantaged

	Not Econ. Dis.			Reduced Lunch			Free Lunch		
Group	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*	*N*
Retained	688.11	61.043	35	679.07	69.914	15	665.90	58.181	89
Delayed Entry	715.78	88.813	18	754.80	45.257	5	688.88	73.832	58
September to December	749.92	80.373	147	749.76	81.039	51	720.10	68.104	205
January to April	750.79	76.638	149	743.11	72.362	37	715.81	68.956	171
May to August	762.52	80.904	114	759.42	99.425	38	717.05	70.127	178
Accelerated	765.60	93.951	5	700.50	24.749	2	761.50	115.980	10
Total	747.50	80.410	468	742.92	84.034	148	709.56	71.360	711

Note. Dependent Variable: Math Score.

Figure 3

Mean Math Score by Chronological Age Group and Economic Status



	Retained	Delayed Entry	September to December	January to April	May to August	Accelerated
Not Econ. Dis.	688.11	715.78	749.92	750.79	762.52	765.6
Reduced Lunch	679.07	754.8	749.76	743.11	759.42	700.5
Free Lunch	665.9	688.88	720.1	715.81	717.05	761.5

Chronological Age Group

Levene's test of variance (see Table 20) found a significant difference (*p* < .000) in variation on the math scores in grade 7. If the Levene's Test is significant, the two variances are significantly different. If it is not significant, the two variances are not significantly different; that is, the two variances are approximately equal (Archambault, 2000). Since the Levene's test is significant, we have not met our second assumption. One of the assumptions of the Analysis of Variance (ANOVA) is that the variances of the dependent variable are the same across the groups being studied. When this assumption is violated, the reported p-value from the significance test may be too liberal (yielding a higher than expected type I error rate) or too conservative (yielding a lower than expected type I error rate) (Introduction, 2012).

Table 20

Levene's Test of Equality of Error Variances for Economically Disadvantaged [a]

F	*df*1	*df*2	Sig.
2.672	17	1309	.000

[a.] Design Intercept + Economically Disadvantaged + Chronological Age Group + Economically Disadvantaged*Chronological Age Group; Dependent Variable: Vertical Scale.

A 6 (Chronological Age Group) x 3 (Economically Disadvantaged) between-subjects factorial ANOVA compared the math vertical score for participants who were in one of six chronological age groups, free lunch, reduced lunch and not economically disadvantaged. A significant main effect for economically disadvantaged was found, $F(2, 1309) = 5.823$, $p < .01$. Students who were not economically disadvantaged ($m = 747.50$, $sd = 80.410$) scored higher than students who qualified for free lunch ($m = 709.56$, $sd = 71.360$) and reduced lunch ($m = 742.92$, $sd = 84.034$). There was not a significant interaction between Chronological Age Group and economically disadvantaged, $F(10, 1309) = .749$, $p > .05$ which indicates that the relationship between students who are in the Chronological Age Groups does not reflect statistically to students who are economically disadvantaged. The results of the ANOVA are in Table 21.

Table 21

ANOVA Test of Between Subjects Economically Disadvantaged

Source	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.	Partial Eta Squared
Corrected Model	960807.775	17	56518.104	10.329	.000	.118
Intercept	132712332.835	1	132712332.835	24253.686	0.000	.949
Econ Dis.	63727.297	2	31863.649	5.823	.003	.009
Group	320651.019	5	64130.204	11.720	.000	.043
Econ Dis. * Group	41004.061	10	4100.406	.749	.678	.006
Error	7162640.901	1309	5471.842			
Total	708821471.000	1327				
Corrected Total	8123448.675	1326				

Note. R Squared = .118 (Adjusted R Squared = .107)

A Tukey's Post Hoc determined the nature of the differences between groups. The analysis revealed that the students who were not economically disadvantaged and retained (*m* = 688.11, *sd* = 61.043) scored significantly lower than those born in September to December (*m* = 749.92, *sd* = 80.373), January to April (*m* = 750.79, *sd* = 76.638), May to August (*m* = 762.52, *sd* = 80.904), and accelerated students (*m* = 765.60, *sd* = 93.951). Also, a significant difference is found in the delayed entry group (*m* = 715.78, *sd* = 88.813) and May to August group (*m* = 762.52, *sd* = 80.904). There was no significant difference between students who were delayed entry (*m* = 715.78, *sd* = 88.813) and retained (*m* = 688.11, *sd* = 61.043) in the not economically disadvantaged group.

As in the not economically disadvantaged group, the students with free lunch and retained (*m* = 665.90, *sd* = 58.181) and delayed entry (*m* = 688.88, *sd* = 73.832) scored significantly lower than September to December (*m* = 720.10, sd = 68.104), January to April (*m* = 715.81, *sd* = 68.956), May to August (*m* = 717.05, *sd* = 70.127) and accelerated (*m* = 761.50, *sd* = 115.980) groups. There were no significant differences between students who were delayed entry (*m* = 688.88, *sd* = 73.832) and retained (*m* = 665.90, *sd* = 58.181) in the free lunch group. In the reduced lunch category the analysis revealed that students in the retained group (*m* = 679.07, *sd* = 69.914) scored significantly lower than September to December (*m* = 749.76, *sd* = 81.039), January to April (*m* = 743.11, *sd* = 72.362), and May to August (*m* = 759.42, *sd* = 99.425) groups. The delayed entry group (*m* = 754.80, *sd* = 45.257) displayed a significant difference only to the retained group (*m* = 679.07, *sd* = 69.914). The retained group did not score a significant difference from the accelerated group (*m* = 700.50, *sd* = 24.749), but due to the low count in this group (*N* = 2), a chance of significance is low. The results of the Tukey's Post Hoc are in Table 22.

Table 22

Tukey HSD for Economically Disadvantaged vs. Chronological Age

Group	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference Lower Bound	Upper Bound
Not Economically Disadvantaged					
Delayed Entry					
Retained	27.663	21.455	.198	-14.427	69.754
September to December	-34.141	18.472	.065	-70.379	2.097
January to April	-35.014	18.458	.058	-71.226	1.197
May to August	-46.740*	18.761	.013	-83.545	-9.934
Accelerated	-49.822	37.395	.183	-123.182	23.538
Free Lunch					
Delayed Entry					
Retained	22.980	12.483	.066	-1.508	47.469
September to December	-31.223*	11.002	.005	-52.806	-9.641
January to April	-26.928*	11.240	.017	-48.978	-4.877
May to August	-28.171*	11.184	.012	-50.112	-6.231
Accelerated	-72.621*	25.328	.004	-122.309	-22.932
Reduced Lunch					
Delayed Entry					
Retained	75.733*	38.199	.048	.796	150.671
September to December	5.035	34.665	.885	-62.970	73.040
January to April	11.692	35.246	.740	-57.452	80.836
May to August	-4.621	35.190	.896	-73.657	64.415
Accelerated	54.300	61.889	.380	-67.113	175.713

Note. Based on estimated means.
[b]Adjusted for multiple comparisons: Least Significant Difference (equivalent no adjustments).
**p* < .05.

A 6 (Group) x 2 (Economically Disadvantaged) pairwise comparison compared math vertical scale score for participants by economic disadvantaged status. The analysis of the data showed that delayed entry free lunch students (*m* = 688.88, *sd* = 73.832) had a significant difference (*p* = .011) to reduced lunch students with delayed entry (*m* = 754.80, *sd* = 45.257). The results of the pairwise comparison are found in table 23.

Table 23

Pairwise Comparison for Chronological Age vs. Economically Disadvantaged

Group		Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference Lower Bound	95% Confidence Interval for Difference Upper Bound
Retained						
Not	Free	22.215	14.759	.133	-6.738	51.169
	Red.	9.048	22.828	.692	-35.736	53.832
Free	Not	-22.215	14.759	.133	-51.169	6.738
	Red.	-13.168	20.646	.524	-53.671	27.336
Red.	Not	-9.048	22.828	.692	-53.832	35.736
	Free	13.168	20.646	.524	-27.336	53.671
Delayed Entry						
Not	Free	26.898	19.958	.178	-12.255	66.052
	Red.	-39.022	37.395	.297	-112.382	34.338
Free	Not	-26.898	19.958	.178	-66.052	12.255
	Red.	-65.921	34.478	.056	-133.558	1.717
Red.	Not	39.022	37.395	.297	-34.338	112.382
	Free	65.921	34.478	.056	-1.717	133.558
September to December						
Not	Free	29.816***	7.995	.000	14.132	45.500
	Red.	.154	12.021	.990	-23.430	23.737
Free	Not	-29.816***	7.995	.000	-45.500	-14.132
	Red.	-29.662*	11.575	.011	-52.370	-6.954
Red.	Not	-.154	12.021	.990	-23.737	23.430
	Free	29.662*	11.575	.011	6.954	52.370
January to April						
Not	Free	34.985***	8.290	.000	18.722	51.248
	Red.	7.684	13.587	.572	-18.971	34.339
Free	Not	-34.985***	8.290	.000	-51.248	-18.722
	Red.	-27.301*	13.412	.042	-53.613	-.989
Red.	Not	-7.684	13.587	.572	-34.339	18.971
	Free	27.301*	13.412	.042	.989	53.613

Table 23 continues

Table 23 continued

Pairwise Comparison for Chronological Age vs. Economically Disadvantaged

Group			Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference Lower Bound	Upper Bound
May to August							
	Not	Free	45.467***	8.874	.000	28.059	62.875
		Red.	3.096	13.856	.823	-24.086	30.279
	Free	Not	-45.467***	8.874	.000	-62.875	-28.059
		Red.	-42.370***	13.219	.001	-68.303	-16.438
	Red.	Not	-3.096	13.856	.823	-30.279	24.086
		Free	42.370***	13.219	.001	16.438	68.303
Accelerated							
	Not	Free	4.100	40.516	.919	-75.384	83.584
		Red.	65.100	61.889	.293	-56.313	186.513
	Free	Not	-4.100	40.516	.919	-83.584	75.384
		Red.	61.000	57.298	.287	-51.407	173.407
	Red.	Not	-65.100	61.889	.293	-186.513	56.313
		Free	-61.000	57.298	.287	-173.407	51.407

Note. Based on estimated marginal means
[b]Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).
*p < .05. **p < .01. ***p < .001.

This chapter addressed the analysis of data to determine if there was a significant difference in vertical scores on the seventh grade math TAKS test, based on kindergarten entry age, gender and socioeconomic status. The following chapter, chapter five, will address the significance found as a result of the research and future implications for administrators who have schools with students who had delayed entry and the potential for discussions of policy that relates to “red-shirting.”

CHAPTER FIVE

Conclusions

This study described whether chronological age differences between students in the 7th grade level had an impact on their math TAKS vertical scale scores in the seventh grade. The study analyzed the additional independent variables of gender and economic status classification to determine if these variables made a difference in student performance.

The study sample was composed of 1,327 male and female students in the seventh grade from a northwest Houston school district. The independent variables in the study included chronological age, gender, and parent's socioeconomic status. The dependent variable was student performance on the TAKS mathematics assessment. In the final analysis, a significant difference existed in mathematics scores between groups based on chronological age.

Overview of the Findings

The central research question for this study determined whether there was a significant difference in student performance on the standardized TAKS mathematics assessments, based on student chronological ages within the seventh grade.

Research Question I. *Is it academically advantageous to be older than your peers in the grade 7 cohort as indicated by the mathematics achievement scores in the state of Texas's TAKS tests?* This quantitative design evaluated the data using an analysis of variance (ANOVA) and a post-hoc Tukey HSD to identify differences in student performance based on chronological age by group. The study found there were significant differences in mathematics performance between chronological age groups.

- One-way ANOVA calculated mean math scores of subjects with different birth dates.
- A significant difference was present for Group, $F(5, 1321) = 19.541$, p =.000.
- Tukey's HSD determined the nature of the differences between groups.
- The delayed entry group (*m* = 698.3, *sd* = 77.43) scored significantly lower than the students in the September to December (*m* = 734.73, *sd* = 75.76), January to April (*m* = 733.24, *sd* = 74.34), and May to August (*m* = 737.64, *sd* = 80.65) groups.
- There was no significance between the during the year cohort groups September to December (*m* = 734.73, *sd* = 75.76), January to April (*m* = 733.24, *sd* = 74.34), and May to August (*m* = 737.64, *sd* = 80.65).
- There was no significant difference with the retained group (*m* = 672.91, *sd* = 60.56) and delayed entry group (*m* = 698.3, *sd* = 77.425).
- There was not a significant difference between the delayed entry group (*m* = 698.3, *sd* = 77.425) and the accelerated group (*m* = 755.53, *sd* = 101.212).

The summary result determined the delayed entry group (redshirted students) scored significantly lower than the groups of September to December, January to April and May to August. There was no significant difference in scores of students who were in the delayed entry group and students who were in the retained group. Students in these two groups were the oldest students in the seventh grade level. As indicated previously, parents who choose to keep their children out of school for an extra year or more tend to do so to allow for greater levels of maturity, both mentally and physically. Due to the fact that the students in the delayed entry group are older, intuition suggests that these students would outperform the younger students, but statistical results indicate otherwise.

In addition to the central research question, this study investigated two related subordinate research questions since statistically significant differences in student performance on standardized mathematics tests based on chronological age existed in the seventh grade as determined by the ANOVA and the Tukey HSD.

Research Question II. *Does an advantage in chronological age at grade 7 differ in males and females as indicated by the mathematics achievement scores in the state TAKS tests?*

The ANOVA identified the significant interactions of the independent variables within grade. The study focused on identifying any significant differences in student performance on standardized mathematics assessments with grade levels based on gender. The study explored the significant interactions between group and gender within the seventh grade in analyzing student performance on the TAKS standardized mathematics assessment.

- A significant main effect for gender was found, $F(1, 1315) = 5.140$, $p < .05$. Males ($m = 728.96$, $sd = 79.247$) scored higher than females ($m = 724.42$, $sd = 77.307$).

- In the seventh grade, males outperformed females in each of the six chronological age groups including retained, delayed entry, accelerated, September to December, and January to April, May to August.
- The interaction between Gender and Group at *F*(5 ,1315) = 1.272, p > .05 was not significant. From the data presented it appeared that the interaction between Gender and Chronological Age Group did not have a significant effect on the TAKS mathematic scores.
- Delayed entry males *(m* = 718.61, *sd* = 83.983) had a significance difference (*p* = .011) to female with delayed entry (*m* = 675.51, *sd* = 62.128).
- Female students who had delayed entry (*m* = 675.51, *sd* = 62.128) or were retained (*m* =661.49, *sd* = 62.232) scored significantly lower than those born in September to December (*m* = 733.40, *sd* = 69.516), January to April (*m* = 732.20, *sd* = 77.027), May to August (*m* = 734.43, *sd* = 79.878) and the Accelerated group (*m* = 743.80, *sd* = 98.742).
- There was no significant difference between female students who were retained (*m* = 661.49, *sd* = 62.232) and delayed entry (*m* = 675.51, *sd* = 62.128).
- There were no significant differences in scores between females born from September to December (*m* = 733.40, *sd* = 69.516), January to April (*m* = 732.20, *sd* = 77.027) and May to August (*m* = 734.43, *sd* = 79.878).
- Male Retained students (*m* = 680.39, *sd* = 58.601) scored significantly lower than male students who had delayed entry (*m* = 718.61, *sd* = 83.983), students born September to December (*m* = 736.08, *sd* = 81.755), January to April (*m* = 734.50,

sd = 71.158), May to August (*m* = 741.17, *sd* = 81.599), and accelerated (*m* = 772.29, *sd* = 110.160).

- Male students with delayed entry (*m* = 718.61, *sd* = 83.983) did not show a significant difference between September to December (*m* = 736.08, *sd* = 81.755), January to April (*m* = 734.50, *sd* = 71.158), May to August (*m* = 741.17, *sd* = 81.599), and accelerated (*m* = 772.29, *sd* = 110.160).

In summary, the male students outperformed the female students in all groups in mathematics TAKS scores in 7^{th} grade. From the data presented it appeared that the interaction between Gender and Chronological Age Group did not have a statistically significant effect on the TAKS mathematic scores. Female students who had delayed entry and/or were retained scored significantly lower than all other female groups, but similar to each other. In contrast, male students with delayed entry did not show a significant difference with the other groups other than the males who were retained. Even though the males who had Delayed Entry scored lower than the other groups (excluding the retained males) there was not a statistical difference in scores. This finding solidifies redshirting a female in kindergarten to increase achievement at the seventh grade is not statistically sound, but in contrast, redshirting a male in kindergarten may have statistical merit for mathematics achievement in vertical score on the TAKS seventh grade math test.

Research Question III. *Are there differences by socioeconomic status in relation to chronological age as indicated by the mathematics achievement scores in the State TAKS tests at seventh grade?*

The ANOVA identified the significant interactions of the independent variables within grade. The study focused on identifying any significant differences in student performance on standardized mathematics assessments with grade levels based on socioeconomic status. The study explored the significant interactions between group and socioeconomic status within the seventh grade in analyzing student performance on the TAKS standardized mathematics assessment.

A significant main effect for economically disadvantaged was found, $F(2, 1309) = 5.823$, $p < .01$. Students who were not economically disadvantaged ($m = 747.50$, $sd = 80.410$) scored higher than students who qualified for free lunch ($m = 709.56$, $sd = 71.360$) and reduced lunch ($m = 742.92$, $sd = 84.034$).

- There was not a significant interaction between Chronological Age Group and economically disadvantaged status, $F(10, 1309) = .749$, $p > .05$.
- The Not Economically Disadvantaged category analysis revealed:
    - A significant difference is found in the delayed entry group ($m = 715.78$, $sd = 88.813$) who had a lower mean score than the May to August group ($m = 762.52$, $sd = 80.904$).
    - There was no significant difference between the delayed entry group ($m = 715.78$, $sd = 88.813$) and retained group ($m = 688.11$, $sd = 61.043$).
    - The retained group ($m = 688.11$, $sd = 61.043$) scored significantly lower than those born in September to December ($m = 749.92$, $sd = 80.373$), January to April ($m = 750.79$, $sd = 76.638$), May to August ($m = 762.52$, $sd = 80.904$), and Accelerated ($m = 765.60$, $sd = 93.951$) groups.

- The Free Lunch category analysis revealed:
    - The delayed entry group (*m* = 688.88, *sd* = 73.832) and retained group (*m* = 665.90, *sd* = 58.181) scored significantly lower than September to December (*m* = 720.10, sd = 68.104), January to April (*m* = 715.81, *sd* = 68.956), May to August (*m* = 717.05, *sd* = 70.127) and accelerated (*m* = 761.50, *sd* = 115.980) groups.
    - There were no significant differences between students who were delayed entry (*m* = 688.88, *sd* = 73.832) and retained (*m* = 665.90, *sd* = 58.181) in the free lunch group.
- The Reduced Lunch category analysis revealed:
    - The delayed entry group (*m* = 754.80, sd = 45.257) displayed a significant difference only to the retained group (*m* = 679.07, *sd* = 69.914).
    - The retained group (*m* = 679.07, *sd* = 69.914) scored significantly lower than September to December (*m* = 749.76, *sd* = 81.039), January to April (*m* = 743.11, *sd* = 72.362), and May to August (*m* = 759.42, *sd* = 99.425) groups.
    - The retained group (*m* = 679.07, *sd* = 69.914) did not score a significant difference from the accelerated group (*m* = 700.50, *sd* = 24.749), but due to the low count in the accelerated group (*N* = 2), a chance of significance is low.

The findings found that overall the students who were not economically disadvantaged group achieved a higher mean score than those in the free lunch and reduced lunch groups. A significant main effect for chronological age group was found, but when a comparison between group and economically disadvantaged status was performed there was no significance in the difference of seventh grade mathematics scores (Table 18, Figure 3). The delayed entry group did find significance in the reduced lunch category, but it did not find significance to the retained group in the not economically disadvantaged and free lunch categories. A significant difference was found between the delayed entry group and the May to August group.

Summary of Findings

The research conducted in this study found significant implications in regard to chronological age. A summary of the findings is found in Table 24.

Table 24

Results and Implications of Research Questions

Research Question	ANOVA Result	Between Subjects Effects	Tukey's HSD	Implications
Is it academically advantageous to be older than your peers in the grade 7 cohort as indicated by the mathematics achievement scores in the state of Texas's TAKS tests?	Significant at $p < 0.001$ alpha level	Significant at $p < 0.05$ alpha level for the Delayed Entry Group. The Delayed Entry mean was greater than the Retained mean, but less than the other groups of September to December, January to April, May to August and Accelerated.	The Delayed Entry mean is less than the September to December, January to April, May to August means at the $p < .05$ alpha level.	The students who had Delayed Entry performed significantly lower than the traditional cohort groups (September to December, January to April, and May to August) on the seventh grade TAKS math test. There was no significant difference between the mean scores of the Delayed Entry group and the Retained group, therefore students who had their entry delayed perform more closely to the lower level of math achievement of a student who was retained than the higher level of traditional and accelerated cohort groups. The findings suggest that students with the delayed entry perform similarly to students who were retained.

Table 24 continues

Table 24 continued

Results and Implications of Research Questions

Research Question	ANOVA Result	Between Subjects Effects	Tukey's HSD	Implications
Does an advantage in chronological age at grade 7 differ in males and females as indicated by the mathematics achievement scores in the state TAKS tests?	Significant at $p < 0.05$ alpha level.	Not significant for Chronological Age Group crossed with Gender at $p > .05$ alpha level. Significant for gender at $p < .05$ alpha level. The male mean was greater than the female mean in every Chronological Age cohort group.	The Male Delayed Entry mean is greater than the retained group mean at the $p < .05$ alpha level. The Female Delayed Entry mean is less than the Accelerated and traditional cohort groups (September to December, January to April, and May to August) mean at the $p < .05$ level.	The Male students outperformed the female students in all chronological age groups. Delayed Entry Male students perform more on level with the male students in the traditional and accelerated groups rather than the retained groups. In contrast the Delayed Entry Female students perform more on level with the female retained students. The findings suggest that the gender of the student has limited effects on if a student should be redshirted in Kindergarten.
Are there differences by socioeconomic status in relation to chronological age as indicated by the mathematics achievement scores in the State TAKS tests at seventh grade?	Significant at $p < 0.05$ alpha level.	Not significant for Chronological Age Group crossed with Economic Disadvantaged Status at $p > .05$. Significant for Economic Disadvantaged Status at $p < .05$. Students who were not Economically Disadvantaged scored highest mean, than students who had Reduced lunch mean, and the Free Lunch mean was the lowest.	The Not Disadvantaged Delayed Entry mean is lower than the May to August mean at the $p < .05$ alpha level. The Reduced Lunch Delayed Entry mean is higher than the Retained mean at the $p < .05$ alpha level. The Free Lunch Delayed Entry mean is lower than the Accelerated and traditional cohort groups (September to December, January to April, and May to August) mean at the $p < .05$ level.	The students who were not economically disadvantaged outperformed the students in the reduced lunch group and the free lunch group at every chronological age group. The findings suggest that Delayed Entry Not Economically Disadvantaged students perform similar to the whole chronological age groups. Delayed Entry Reduced Lunch students perform similar to students in the Accelerated and traditional cohort groups (September to December, January to April, and May to August). Delayed Entry Free Lunch students perform similarly to the students who have been retained.

Table Results and Implications Design by H. Jerome Freiberg (2012)

Based on the analysis of the data, chronological age is a contributing factor that affects student mathematic performance. When examining the performance of the chronological age groups in the seventh grade, data suggests that the delayed entry (Academically Redshirted) group achieved a mean slightly higher than the retained group (held-back), but a mean significantly lower than the other three traditional age school groups of September to December, January to April, and May to August. Additionally, the group of students who were in an accelerated grade level outperformed all of the other chronological age groups even though they were the youngest students to test in this cohort. Students are accelerated based on private school attendance or by testing out (skipping) of a grade level.

These findings seem to refute the research conducted by Hickman (2006) who reported that “by the third grade, children who had entered kindergarten early were performing significantly worse in their academics” (p.145). This study found the youngest students in the accelerated group outperformed all the other groups. This research also reached different findings than the research by Kilpatrick (2002) that studied the impact of kindergarten entry age on middle school achievement. The study indicated that there was no significant difference in the academic performance of middle school students, based on kindergarten entry age.

The data from this study also suggested that there was a significant main effect for all independent variables including gender and economically disadvantaged. The data from this study also indicates that males significantly outperform females in grade 7 mathematics based on scores on the TAKS math assessment. Female students who were delayed entry and/or retained did not have a significant difference from one another, but they both scored significantly lower than all the other September to December, January to April, May to August, and accelerated female groups. In contrast, male students with delayed entry displayed significantly higher mean scores (*m* = 718.61) than the males who were retained (*m* = 680.39). Male delayed entry students did not show a significant difference with the other four groups, but scored lower on the math assessment when compared to the accelerated and traditional cohorts. These findings are also in contrast with research conducted by Stipek (2002), who reported that age and gender had no impact on achievement test scores.

Additional findings showed that students who are not at-risk scored higher than students in the free and reduced lunch groups. A significant main effect for economically disadvantaged was found. Overall the students who were not economically disadvantaged achieved a higher mean score than those in the free lunch and reduced lunch groups. The delayed entry group did find significance in the reduced lunch category, but it did not find significance to the retained group in the not economically disadvantaged and free lunch categories. A significant difference was found between the delayed entry group and the May to August group. The interaction between Gender and Group or Economic Status and Group was not found significant in this study.

Limitations of the Study

This study utilized Texas school district data obtained from the data file provided by Pearson with the help of the Texas Education Agency to determine whether chronological age differences among students in the seventh grade had an impact on their respective vertical scale score on the Texas Assessment of Knowledge and Skills mathematics assessment (TAKS).

Another limitation of the study is the definition of student performance as a single score on a single measure. As such, student performance, for the purposes of this study, has a finite meaning, which limits the comparability of the findings to all Texas schools. The study, because of its sample size, may have the ability to generalize with some limitations to students in the seventh grade; however, there must be accommodation for a single measure of mathematics performance.

Theoretical Implications

A classroom represents a vast amount of human diversity that makes up the learning environment for students. All students do not fall into the same traditional birth year pattern. For some students entry was delayed (redshirted) or they were retained in a grade level due to maturity or academics. These students are the oldest students in the classroom. The next group is students who were born within the traditional school year time restraints from September 1 to August 31 of the following school year. These include the students born from September to December, January to April, and May to August. The youngest groups of students are students who are Accelerated (skipped a grade).

The maturationist theory believes that development is a biological process that occurs automatically in predictable, sequential stages over time (Hunt, 1969). The maturationist theory of Arnold Gessell (1925) continues to affect the processes in schools, particularly in the early childhood classrooms. Gesell based his theory on three major assumptions: (a) development has a biological basis, (b) good and bad years alternate, and (c) body types (endomorph, etcomorph, and mesomorph) are correlated with personality development (Thomas, 1992). Maturationists believe that time will produce school readiness and the theory generally advises delaying school entry for some children whose birthdays occur near the cutoff date and those considered not ready for kindergarten by parents, teachers, and caregivers (Farlex, 2010). By following the logic of the maturationist theory, students who are chronologically older in the grade level will achieve higher academically and those who are retained or academically redshirted should produce at the top of their class. The research in this study does not support the maturationist theory of development at an older grade level since the students who had delayed entry underperformed their peers who were placed in the traditional school year time restraints.

Piaget (1952) believed that development must be stimulated by the interactions a child has with the world around them and the people with whom they come in contact. When a child handles an object in a different way, watches other children do something they had not thought of, or a peer asks a new question that stimulates new ways of thinking, they are making new discoveries that lead to higher levels of thinking (Marshall, 2003). The constructivism learning theory argues that humans generate knowledge and meaning from an interaction between their experiences and their ideas. This theory relies heavily on logical-mathematical knowledge and universal invariant stages of development to the neglect of other forms of knowledge and the vast importance of context in a child’s development (Aldridge & Goodman, 2007). These thoughts believe children must reach a certain level of development before they are ready to learn new strategies or skills. To continue this theory, Vygotsky (1978) believed through guidance and instruction, not just the passage of time, learning, developing, and readiness for a new learning is developed. Through this theory, learning and teaching precede development, therefore schools need to be ready to support, guide and instruct each child by creating strong support and scaffolding structures of skills regardless of the knowledge a child brings into the classroom. Contradicting the maturationist theory, the constructivism learning theory would encourage children to be placed in the kindergarten classroom regardless of how mature they were. Through their interactions they would develop the maturity they lack and achieve at a higher level than the child who was left in an out-of-school setting. The research presented in this study supports the constructivism learning theory. The students in this study group who had delayed entry generally underperformed when compared to students in the other groups. Students in the delayed entry often performed more consistently with students who had been retained.

Practical Implications

The purpose of this study was to determine if there was a significant difference in scores on the seventh grade TAKS test based on kindergarten entry age, gender and socioeconomic status. Data from the TAKS data file for the 2010-2011 school years was analyzed. There are several conclusions that can be made based on this research.

Individual scores on the TAKS provide a means of categorizing students as not met standard, met standard, and commended performance. Beyond that, there is no practical application for the individual vertical scale score. However, districts receive a breakdown that details each student's performance divided by objectives designated by the state. Using these additional objective data pieces, district and campus personnel can identify the strengths and weaknesses of a student based on the Texas essential elements within the state standards. This more sophisticated look at a student's scores provides the means to examine individual students, specific groups of students, or entire classes. The implications for these analyses address interventions for individual students, targeted professional development for teachers, or curriculum realignment.

Even though state met standard scores change from year to year on the TAKS, the level of rigor of the test remains the same. That is, the objectives that are tested remain the same, and test items reflect a consistent measure of the essential content as identified by the Texas Education Agency. Although the rigor of the assessment remains the same the state requirement for the percentage of students who must score at the met standard level or above increases every year. This escalating accountability is in direct response to No Child Left Behind, which has targeted a steady increase in students who meet standard that reaches 100 percent by the year 2014. Results of this study can support districts in identifying subgroups of students who would benefit from additional opportunities for student remediation or enrichment.

Findings point toward several practical implications for districts and schools. Delayed entry (redshirted) students typically underperform all other students in a grade level (excluding retained students) in mathematics, which points toward a more critical factor in providing supports and interventions for this group of students. Policies must be set to discourage parents from delaying student's entry into school given the need to provide additional support for these students and reduced funding. These redshirted students are currently not identified in the district's student services records software therefore, teachers do not know about this identifying factor in the classroom. Early and sustained intervention seems critical for many students who make up this group. This adds another burden on the schools based on some misconceptions by parents. Figure 1 illustrated the mean score for students who had delayed entry into the public school system. The delayed entry students (m = 698.3) achieved a vertical scale mean score just above students that were retained (m = 672.91). Many schools support retained students with additional tutoring, etc. Based on the data, schools should also potentially support students with delayed entry for intervention and early remediation. The mean scores of the delayed entry students (m = 698.3) displayed a significant difference from the students in the traditional cohort of September to August where all the means ranged from 734 to 737.

Findings of this study also suggest that districts and schools look closely at age within sub-groupings of students in categories of gender and economically disadvantaged. Currently schools typically develop programs and interventions to support students in these demographic groups, but a more refined look for academic remediation to a more specific level including chronological age within each grade level may be needed.

Additionally, the findings from the study propose a difference in mathematics performance between males and females. This disparity is exaggerated when adding age as a variable. In most cases, research on the differences in mathematics performance between genders has been mixed. However, the data in this study indicates that males perform at a higher rate, and schools cannot discount this finding when grouping and creating other strategies that support female achievement in the field of mathematics. Chronological age can be a consideration in these placements. In the area of mathematics, schools can create courses that interest females into the field of mathematics. Classes need to focus on strategies to raise the math achievement of girls by using dialogue, group work and collaboration to explore mathematical concepts. Strong, positive role models should be provided to display a woman's ability to succeed in mathematical fields. It would be of interest to create all girl math classes to determine if the social dynamic issues could be mediated to reduce the math gap seen in this study.

Finally, parents and schools often have conflicting viewpoints on when a child is ready for kindergarten. There are numerous considerations to examine including: social adjustment, skills, attitudes, family issues, knowledge and environment. Preschool experience can also impact a child's readiness for kindergarten. Schools and communities have tried to make the transition easier for kindergarten students. Many school districts have created connections between schools, homes and daycares. Schools have strived to become ready for the children, instead of the children being ready for school. Even with all these considerations, chronological age is a factor that most parents use when determining when a child is ready to enter kindergarten. Parents may decide to keep their child out for an extra year, for the fear that their child will not be able to keep up, or will lack the maturation advantages that the older children in the class seem to exhibit.

The research from this study indicates that in the seventh grade, students who entered kindergarten in the traditional cohort performed generally at a significantly higher level on the TAKS mathematics assessment than students who delayed entry or were retained even though traditional students were younger. This can be a critical factor when parents are deciding if they should enroll their child in kindergarten or keep them at home or in private schooling for an additional year.

Redshirted students tend to be relatively young boys. Across studies many parents have noted that they decided to redshirt at the child's birth because they believed it was important for boys to be the oldest in the group (Graue & DiPerna, 2000). Therefore, many teachers and parents feel that older boys would do better in kindergarten, and this benefit would continue throughout their school career. The research of this study supports this claim. Males who delayed entry perform on similar mathematics level with the other boys who fall into the traditional year, and higher than the students who were retained (held back). In contrast the females who had their entry delayed by their parents align their scores more to the students who were retained and not the students who entered kindergarten in the traditional year. Therefore this research does not support delaying entry for females.

Recommendations for Future Research

This study focused on chronological age as it affected student math performance in the seventh grade. Further research could be conducted to expand the knowledge of chronological age issues:

1. Future research could expand this study to other subject areas including reading, science and social studies, which could further validate the findings of this study that chronological age is a factor in student performance.
2. Future research on the delayed entry (academic redshirted) group could investigate the type of experience the delayed entry students had during the year they were held out of school. This research could specify whether students were exposed to pre-school structured academic experiences, such as Early Start, academic day care or lack thereof, and thus help clarify the delayed entry students' level of academic performance.
3. As indicated in the review of prior literature, although many studies have been completed that consider age as a factor in student performance, findings have been wide-ranging. A final proposal for future research would be to conduct a meta-analysis of the existing research to collectively inspect all of the research that has been completed to date.

Summary

The findings of this study produced new research on the effects of chronological age on math achievement scores in the seventh grade. The study showed significant influences on gender and economically disadvantaged status. The students who had Delayed Entry performed significantly lower than the traditional cohort groups (September to December, January to April, and May to August) on the 7^{th} grade TAKS math test. There was no significant difference between the mean scores of the Delayed Entry group and the Retained group, therefore students who had their entry delayed performed more closely to the lower level in math achievement of a student who was retained than the higher level of traditional and accelerated cohort groups. The findings suggest that students with the delayed entry perform similar to students who were retained. The male students outperformed the female students in all chronological age groups. Delayed Entry Male students perform more on level with the male students in the traditional and accelerated groups rather than the retained groups. In contrast the Delayed Entry Female students perform more on level with the female retained students. The findings suggest that the gender of the student has significant effects on if a student should be redshirted in Kindergarten. The students who were not economically disadvantaged outperformed the students in the reduced lunch group and the free lunch group at every chronological age group. The findings suggest that Delayed Entry Not Economically Disadvantaged students perform similarly to the whole chronological age groups. Delayed Entry Reduced Lunch students perform similar to students in the Accelerated and traditional cohort groups (September to December, January to April, and May to August). Delayed Entry Free Lunch students perform similar to the students who have been retained.

In conclusion, school readiness is an issue with many layers. Parents, pediatricians, teachers and school administrators must consider those factors. When this decision is made, the needs of the individual child needs must play a role. Parents should be provided adequate information to make the decision by administrators and physicians. A parent’s guide based on research regarding the chronological age and school achievement later in life would be informative to all parties. Communities must be sure that not only are the children ready for schools, but the schools are ready to support the students as well regardless of age diversity. Unless the district, school, community, and parents work together, a child's entrance into kindergarten can be the beginning of a lifetime of successful learning experiences as well as a bridge into their academic careers.

REFERENCES

Alexander, K. L., Daubner, S. L., & Entwisle, D. R. (1993). First-grade classroom behavior: Its short and long-term consequences for school performance. *Child Development, 64*, 801-814.

Archambault, Susan. (2000). One-way ANOVA. Pysch 205 review site. Retrieved on April 20, 2012 from http://www.wellesley.edu/Psychology/Psych205/anova.html

Angrist, J. D., & Krueger, A. B. (1990). *The effect of age at school entry on educational attainment: An application [sic] of instrumental variables with moments from two samples*. Cambridge, MA: Harvard Institute of Economic Research, Harvard University.

Barnett, W. S., Brown, K., & Shore, R. (2004, April). *Preschool policy matters*. National Institute for Early Education Research (Issue 6). Retrieved January 15, 2011 from http://nieer.org/docs/index.php?DocID=101

Bedard, K., & Dhey, E. (2006). The persistence of early childhood maturity: International evidence of long-run age effects. *The Quarterly Journal of Economics, 121*(4), 1437-1472.

Buckles, K., & Hungerman, D. M. (2008). *Season of birth and later outcomes: Old questions, new answers*. The National Bureau of Economic Research. Working Paper No. 14573.

Byrd, R. S., Weitzman, M., & Auinger, P. (1997). Increased behavior problems associated with delayed school entry and delayed school progress. *Pediatrics, 100*(4), 654-661.

Colasanti, M. C. (2007, March). Kindergarten entrance ages: A 30 year trend analysis. *ECS State Notes Kindergarten.* Retrieved on January 24, 2011 from http://inpathways.net/kindergarten_trend_analyses.pdf

Cosden, M., Zimmer, J., & Tuss, P. (1993). The impact of age, sex, and ethnicity on kindergarten entry and retention decisions. *Educational Evaluation and Policy Analysis, 15,* 209–222.

Crosser, S. 1998. “He has a summer birthday: The kindergarten entrance age dilemma.” ERIC Digest ED423079 1998-09-00.

Cruse, K. L., & Twing, J. S. (2000). The history of statewide achievement testing in Texas. *Applied Measurement in Education, 13*(4), 327-331.

Cullen, J. B., & Reback, R. (2006). Tinkering toward accolades: School gaming under a performance accountability system. *Advances in Applied Microeconomics, 14*, 1-34.

Cunha, F., Heckman, J., Lochner, L., & Masterov, D. (2006). Interpreting the evidence on life cycle skill formation. In E. Hanushek & F. Welch (Eds.). *A Handbook of the Economics of Education, 1*, 698-805. doi:10.1016/S1574-0692(06)01012-9

Deming, D., & Dynarski, S. (2008). The lengthening of childhood. *Journal of Economic Perspectives, 22*(3), 71-92.

Denton, D. R. (2001). Finding alternatives to failure: Can states end social promotion and reduce retention rates? Southern Regional Education Board. Retrieved from: http://www.eric.ed.gov/PDFS/ED451268.pdf

Dickinson, D. K., & Sprague, K. E. (2001). The nature and impact of early childhood care environments on the language and literacy development of children from low-income families. In S. B. Neuman & D. K. Dickinson (Eds.), *Handbook of early literacy research* (pp. 263–280). New York: Guilford.

Dobkin, C., & Ferreira, F. 2007. “Do school entry laws affect educational attainment and labor market Outcomes?” Retrieved March 14, 2011, from http://people.ucsc.edu/~cdobkin/Papers/School_Entry.pdf

Elder, T. E., & Lubotsky, D. H. (2008). Kindergarten entrance age and children’s achievement; Impacts of state policies, family background, and peers. *The Journal of Human Resources*, *44*(3), 641-683. Retrieved January 19, 2011 from http://www.ler.illinois.edu/lubotsky/Elder%20Lubotsky%20June%202008.pdf

Else-Quest, N. M. Hyde, J. S., & Linn, M. C. (2010). Cross-national patterns of gender differences in mathematics: A meta-analysis. *Psychological Bulletin*, *136*(1), 101-127.

Farlex Inc. (2010). Constructivism. In *The Free Dictionary online dictionary*. Retrieved from http://encyclopedia.thefreedictionary.com/Constructivist+theory

Farlex, Inc. (2010). Interactionist theory. In *The Free Dictionary online dictionary*. Retrieved from http://medical-dictionary.thefreedictionary.com/interactionist+theory

Fennema, E., & Hart, L. E. (1994). Gender and the JRME. *Journal for Research in Mathematics Education*, *25*(6), 648-659.

Folts, James D. (1996). *History of the University of the State of New York and the State Education Department, 1784-1996.* Retrieved December 27, 2010, from http://www.nysl.nysed.gov/edocs/education/sedhist.htm

Francis, B., & Skelton, C. (2005). *Reassessing gender and achievement: Questioning contemporary key debates*. New York, New York: Routledge.

Frey, N. (2005). Retention, social promotion, and academic redshirting: What do we know and need to know. *Remedial & Special Education, 26*(6), 332-346.

Gastright, J. F. (1989, March). *The nation reacts: A survey of promotion/retention rates in 40 urban school district.* Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Gnezda, M. T., Garduque, L., & Schultz, T. (Eds.). (1991). *Improving instruction and assessment in early childhood education: Summary of a workshop series*. Washing, DC: National Academy Press.

Gootman, E. (2006). Preschoolers grow older as parents seek an edge. *The New York Times.* Retrieved January 17, 2011 from http://www.nytimes.com

Graue, M. E., & DiPerna, J. (2000). Redshirting and early retention: Who gets the "gift of time" and what are its outcomes? *American Educational Research Journal, 37*(2): 509-34.

Gredler, G. (1992). *School readiness: Assessment and educational issues*. Brandon, VT: Clinical Psychology.

Greenberger, E. (1982). Education and the acquisition of psychosocial maturity. In McClelland, David. (Series Ed.), *The development of social maturity* (pp. 155-189). New York, NY: Irvington Publishers, Inc.

Grimes, J. (1999). School entrance age, modern America 1914- present. University of North Carolina at Pembroke. Retrieved December 29, 2010, from http://www.uncp.edu/home/canada/work/allam/edit/entrance.htm

Gurewitz, S. & Kramer, J. (1995). Retention across elementary schools in a Midwestern school district. *Research in the Schools*, *2*(2), 15-21.

Hyde, J. S., Lindberg, S. M., Linn, M. C., Ellis, A. B., & Williams, C. C. (2008). Gender similarities characterize performance. *Science, 321*(5888), 494-495.

Hickman, L. N. (2006). *Entry into kindergarten: Educational stratification at the beginning school experience* (Doctoral dissertation, Ohio State University). Retrieved from http://etd.ohiolink.edu/view.cgi/Hickman%20Lisa%20N.pdf?osu1150314337

Hull, J. (2003). The lost boys. *Parenting, 17*(8), 144. Retrieved January 17, 2011 from EBSCO *host.*

Hunt, J.M. (1969). The impact and limitations of the gain of developmental psychology. In Elkind & J. Flavell (Eds.), *Studies in cognitive development: Essays in honor of Jean Piaget.* New York: Oxford University Press.

Individuals with Disabilities Education Act, 20 U.S.C. §1401 et seq. (2004).

Introduction to SAS. (2012).UCLA: Academic technology services, Statistical Consulting Group. Retrieved on April 18, 2012 from http://www.ats.ucla.edu/stat/sas/notes2/

Katz, L. J. (2001). *Academic redshirting and young children*. KidSource On Line Inc. Retrieved from http://www.kidsource.com/education/red.shirting.html

Kilpatrick, T. H. (2002). A study of how kindergarten entry-age and gender affects middle school achievement. *ProQuest Information and Learning Company.* (UMI Microform 3061768)

King, J. B. (2010, August 2). *Changes in regents exams for 2011*. Retrieved from http://www.nysut.org/files/January_Regents_Notice.pdf

Lincove, J. A., & Painter, G. (2006, Summer). Does the age that children start kindergarten matter? Evidence of long-term educational and social outcomes. *Educational Evaluation and Policy Analysis, 28*(2), 153-179.

Magan, S. (2008). Successful interventions for the prevention of retention (Doctoral dissertation, New Jersey Rowan University). Retrieved from http://proquest.umi.com.ezproxy.lib.uh.edu

Malone, L. M., West, J., Flanagan, K. D., & Park, J. (2006). The early reading and mathematics achievement of children who repeated kindergarten or who began school a year late. *Statistics in Brief* (NCES 2006-064). Retrieved December 21, 2010, from http://www.eric.ed.gov/PDFS/ED491697.pdf

Mantzicopoulos, P., & Morrison, D. (1992). Kindergarten retention: Academic and behavioral outcomes through the end of second grade. *American Educational Research Journal*, *29*(2), 182-198.

Marshall, H. H. (2003). Opportunity deferred or opportunity taken? An updated look at delaying kindergarten entry. *Beyond the Journal. Young Children on the Web.* September. Retrieved December 29, 2010, from http://www.naeyc.org/resources/journal

McEwan, P. J., & Shapiro, J. S. (2008). The benefits of delayed primary school enrollment: Discontinuity estimates using exact birth dates. *Journal of Human Resources. 43*(1), 1-29.

McNamara, J. K., Scissons, M., & Simonot, S. (2004). Should we “redshirt” in kindergarten? A study of the effects of age on kindergarteners’ reading readiness. *The Alberta Journal of Educational Research, 50*(2), 128-140.

Meisels, S. J., & Liaw, F. R. (1993). Failure in grade: Do retained students catch up? *Journal of Educational Research*, 87(2), 69-77.

Muhlenweg, A. M. & Puhani, P. A. (2010). The evolution of the school-entry age effect in a school tracking system. *Journal of Human Resources, 45*(2), 407-438.

No Child Left Behind Act of 2002, Pub.L. No. 107-110, 115 Stat. 1425 (2002).

OECD (2003). *PISA 2003 learning for tomorrow’s world*, OECD Publishing. Retrieved December 29, 2010 from http://www.oecd.org/dataoecd/1/60/34002216.pdf

OECD (2010). *PISA 2009 at a Glance,* OECD Publishing. Retrieved December 29, 2010, from http://www.pisa.oecd.org/dataoecd/31/28/46660259.pdf

Offenberg, R. M., & Holden, B. (1998). *Kindergarten enrollment age and achievement: Overage enrollment.* Presented at the annual meeting of the American Psychological Association, San Francisco, CA.

Oshima, T. C., & Domaleski, C. S. (2006). Academic performance gap between summer-birthday and fall-birthday children in grades k-8. *The Journal of Educational Research, 99*(4), 212-217.

Penner, A. M., & Paret, M. (2008). Gender differences in mathematics achievement: Exploring the early grades and the extremes. *Social Science Research, 37*(1), 239-253.

Poppe, J. & Clothier, S. (2005). The preschool promise. *State Legislatures, 31*(6), 26-28. Retrieved January 15, 2011, from EBSCO *host*.

Postlethwaite, T. N. (1985*).* International Association for the Evaluation of Educational Achievement. In T. Husen & T. N. Postlethwaite (Eds.), *The international encyclopedia of education* (Vol. 5, pp. 2645-2646). Oxford: Pergamon.

Price, T. (2006, Fall). Public education and the history of testing. *Common Concern, 2*, 29-31.

Rathbun, A. H., West, J., & Germino-Hausken, E. (2004) *From kindergarten through third grade: Children's beginning school experiences* (NCES 2004-007). Washington, DC: National Center for Education Statistics.

Redshirt. (n.d.). *Dictionary.com unabridged*. Retrieved March 16, 2011, from Dictionary.com website: http://dictionary.reference.com/browse/redshirt

Redshirt. (n.d.) *Wikipedia the free encyclopedia*. Retrieved March 16, 2011, from Wikipedia.com website: http://en.wikipedia.org/wiki/Redshirt_freshman

S. Bill 103, 76th Legislature, §101.3001. Implementation of Assessment Instruments (1999). Retrieved December 27, 2010 from http://ritter.tea.state.tx.us/rules/tac/chapter101/ch101cc.html

Shelow, S. P. (Ed.). (1993). *Caring for your baby and young child: Birth through age 5: The complete and authoritative guide*. New York: Bantam Books.

Shepard, L. A. (1990). Readiness testing in local school districts: An analysis of back-door policies. *Politics of Education Association Yearbook*, *5*(5) 159-179. doi:10.1080/02680939008549070

Spring ISD No Child Left Behind Report Card. http://ritter.tea.state.tx.us/perfreport/nclb/2010/district.srch.html

Stipek, D. J. (2002). At what age should children enter kindergarten? A question for policy makers and parents. *Social Policy Report, 16*(2), 3-16.

Stipek, D. J. (2003). School entry age. Center of excellence for early childhood development. Encyclopedia of Early Childhood Development. Retrieved December 19, 2010, from http://www.child-encyclopedia.com/documents/StipekANGxp.pdf

Student Assessment Division. (2011). A guide to the TAKS vertical scale used in Texas. *Texas Education Agency*. Retrieved October 3, 2011, from http://www.tea.state.tx.us

Student Assessment Division. (2011). Linguistically accommodated testing resources. *Texas Education Agency*. Retrieved October 3, 2011 from http://www.tea.state.tx.us/student.assessment/ell/lat/

Student Assessment Division. (2011). TAKS-M resources. *Texas Education Agency*. Retrieved October 3, 2011 from http://www.tea.state.tx.us/student.assessment/special-ed/taksm/

Student Assessment Division. (2011). TAKS-Alternate resources. *Texas Education Agency*. Retrieved October 3, 2011 from http://www.tea.state.tx.us/student.assessment/special-ed/taksalt/

Spring ISD. (2011) 75 Years of Education, 1935-2010. Retrieved April 11, 2011 from http://www.springisd.org/default.aspx?name=75th.demographic

Taylor, K. K., Gibbs, A. S., & Slate, J. R. (2000). Preschool attendance and kindergarten readiness. *Early Childhood Education Journal*, *27*, 191–195.

Texas Assessment. (2011). *Assessment summary results: April TAKS 3-11 and Exit Level*. Retrieved from https://www.pearsonaccess.com

Thomas, R. (2005). *High-stakes testing: Coping with collateral damage*. New Jersey: Lawrence Erlbaum Associates.

Thomas, R. M. (1992). *Intelligence and experience*. New York: Ronald Press.

Unger, H. G. (1996). "Developmental age." *Encyclopedia of American Education*. New York: Facts on File.

Uphoff, J. K., & Gilmore, J. E. (1986). *Summer children: Ready or not for school*. Middletown, OH: J&J.

U.S. Department of Education (2003). No Child Left Behind Act. Retrieved from http://www.ed.gov/nclb/landing.html

U.S. Department of Health and Human Services (2010). Administration for Children and Families. Head Start impact study: Final report. Washington, DC. Retrieved from http://eric.ed.gov/PDFS/ED507845.pdf

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*, M. Cole, V. John-Steiner, S. Scribner, & E. Souberman (Eds.). Cambridge, MA: Harvard University Press.

Warder, K. (1999). *Born in December: Ready for school?* (Report No. 439815). Retrieved from Education Resources Information Center website: http://eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED439815&ERICExtSearch_SearchType_0=no&accno=ED439815

West, J., Denton, K., & Germino-Hausken, E. (2000). *America's kindergarteners*. (NCES No. 2000-070). Washington, DC: U.S. Department of Education.

West, J., Meek, A., & Hurst, D. (2000). *Children who enter kindergarten late or repeat kindergarten: Their characteristics and later school performance*. (NCES No. 2000-039). Washington, DC: U.S. Department of Education.

Wiersma, W. & Jurs, S. G. (2005). *Research methods in education: An introduction*. Boston, Massachusetts: Pearson.

Zill, N., Loomis, L. S., & West, J. (1997). *The elementary school performance and adjustment of children who enter kindergarten: Findings from national surveys* (NCES 98-097). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

APPENDIX A

HUMAN SUBJECTS APPROVAL

UNIVERSITY of **HOUSTON**

DIVISION OF RESEARCH

January 19, 2012

Ms. Tracy McDaniel
c/o Dr. H. Jerome Freiberg
Curriculum and Instruction

Dear Ms. Tracy McDaniel,

Based upon your request for exempt status, an administrative review of your research proposal entitled "A CASE STUDY OF DELAYING SCHOOL ENTRY ON THE EFFECTS OF STUDENT ACHIEVEMENT IN MATHEMATICS IN SEVENTH GRADE" was conducted on January 11, 2012.

At that time, your request for exemption under **Category 4** was approved pending modification of your proposed procedures/documents.

The changes you have made adequately respond to the identified contingencies. As long as you continue using procedures described in this project, you do not have to reapply for review. * Any modification of this approved protocol will require review and further approval. Please contact me to ascertain the appropriate mechanism.

If you have any questions, please contact Alicia Vargas at (713) 743-9215.

Sincerely yours,

Kirstin M. Rochford, MPH, CIP, CPIA
Director, Research Compliance

*Approvals for exempt protocols will be valid for 5 years beyond the approval date. Approval for this project will expire **December 1, 2016**. If the project is completed prior to this date, a final report should be filed to close the protocol. If the project will continue after this date, you will need to reapply for approval if you wish to avoid an interruption of your data collection.

Protocol Number: 12223-EX

316 E. Cullen Building   Houston, TX 77204-2015   (713) 743-9204   Fax: (713) 743-9577
COMMITTEES FOR THE PROTECTION OF HUMAN SUBJECTS