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The Effect of Kindergarten Entry Age On Academic Achievement

Nicole A. Buten
Seton Hall University

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THE EFFECT OF KINDERGARTEN ENTRY AGE ON ACADEMIC ACHIEVEMENT

BY

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Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Education
Seton Hall University

2010
APPROVAL FOR SUCCESSFUL DEFENSE

Doctoral Candidate, Nicole Buten, has successfully defended and made the required modifications to the text of the doctoral dissertation for the Ed.D. during this Spring Semester 2010.

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Dedication

My deepest appreciation and love goes to my family. Thank you to my parents, Robert and Susan Joralemon, who taught me that I can do anything and to always finish what I start. Dad, you were not here to see this happen, but I know that you are proud of me. This dissertation was completed because of the unending support, encouragement, and sacrifice of David, my husband, and Steven and Jessie, my children. You have all helped me to stay focused on the big picture, and not to sweat the small stuff. Steven, it is from you that I have learned how to hang in there, believe in myself and fight through adversity. Never in my life have I met anyone with the ability to keep things in perspective as you can- on a daily basis, you are an inspiration to me. Jessie, you are a strong, determined girl who before my eyes is turning into a beautiful young woman. To you I devote this project. Please always know that, as a woman, you can have it all. David, everyday you encouraged me to do what was seemingly impossible. You have always been my best friend and most loyal supporter. For that, I am forever grateful. Easily, I am the luckiest woman in the world to be able to share my life with you.
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ABSTRACT

THE EFFECT OF KINDERGARTEN ENTRY AGE ON ACADEMIC ACHIEVEMENT

This study examined the effect of kindergarten entry age on the scores of the eighth grade Comprehensive Test of Basic Skills (CTBS) math and reading scores, while controlling for the demographic variables of gender and socioeconomic status. The subjects included 1,197 students who participated in the randomized, long-term STAR (Student-Teacher Achievement Ratio) experiment. One-way and Two-way ANOVAs, as well as an independent samples t-test, were conducted to test for significant differences between group means. Ten null hypotheses were tested at the .05 level of significance. Results of the study indicated that there was a significant difference in eighth grade CTBS math and reading scores based on SES. There was not a significant difference in the eighth grade CTBS math and reading scores based on gender or kindergarten entry age. There was also no significant difference in the eighth grade CTBS math and reading scores based on kindergarten entry age, SES and gender combined, or age and SES combined with kindergarten entry age.
Chapter One

Researchers, policymakers, school administrators, teachers, and parents alike have sought answers regarding the best age for children to begin school (e.g., Oshima & Domaleski, 2006; Stipek, 2002; Bickel, Zigmond, & Strayhorn, 1991; Cahan & Cohen, 1989; Lincove & Painter, 2006; Crosser, 1991). In the United States, kindergarten entrance age is generally around five years of age (60 months) and compulsory attendance age, state to state, ranges from age five to age eight (Vecchiotti, 2007). Policy makers debate the allowable age for school entry, as well as when school entry should be required. Most schools base eligibility for school enrollment on a child’s date of birth. Typically, parents send their children to school based on a chronological age that is determined by state legislators. The decision of when to send a child to school not only affects children and parents, but it also has an influence on the teachers, the other children in the classroom, and the educational system as a whole (Bush, 2007).

Today’s increasingly complex society places considerable importance on proficiency in reading and mathematics (Middleton & Spanias, 1999). Recent federal education policies, such as the No Child Left Behind Act of 2001, Public Law No. 107-110, § 115, Stat. 1425 (signed in 2002) highlight the fact that all children will be at a proficient level or higher in both reading and mathematics by 2013-2014. Now, more than ever, the assessment of whether children are meeting academic expectations emphasizes the importance of early and frequent standardized testing. Early testing occurs with these reforms to ensure that children are on track with meeting the goals and objectives of the curriculum in their grade level. Using early testing as an accountability tool puts pressure on educators to ensure that all third graders met national expectations.
(Lincove & Painter, 2006). As a result, early testing puts downward pressure on second
grade, first grade, and even kindergarten to meet high academic standards (Meisels,

The relationship between reading and mathematics achievement and kindergarten
entrance age has been of interest to researchers as well (Yesil-Dagli, 2006). A
considerable amount of research (e.g., Meisels, 1992; Morrison et al., 1997; Stipek &
Byler, 2001; Quinlan, 1996) has examined the relationship between age of entry into
kindergarten and academic performance in the areas of reading and mathematics.

Age is not the only factor to influence academic achievement. In order to
examine the relationship between age of entry and academic achievement, other factors
such as gender and socioeconomic status (SES) should be controlled or taken into
account. Gender is one variable that is examined in the present study because gender has
been documented to have an effect on academic achievement (Crosser, 1991; Warder,
1999; Zill et al., 2001). Previous studies have shown that socioeconomic status, or SES,
which describes the student’s economic environment, also influences readiness for
kindergarten and future measured educational achievement.

This researcher is investigating the effects of kindergarten entrance age on
children’s academic achievement in eighth grade. The analyses focus on the effects of
age of entry and a number of selected variables on children’s measured academic
achievement in reading and mathematics. Age of kindergarten entry was examined in
relation to the age of the children in the same class; in other words, this study considers
the age of a child relative to that of his or her classmates. Data for the study came from
Tennessee’s Student Teacher Achievement Ratio (STAR) randomized experiment. The
STAR experiment, initiated in 1985, was organized to conduct the legislated study of class size and student-assessed achievement scores in Tennessee. In STAR, kindergarten students and teachers in 79 Tennessee schools were randomly assigned to three different class types: small (with target enrollment of 13-17 students), regular (with target enrollment of 22-25 students), and a regular class with a full-time teacher’s aide. In the present study, students in classes of 22-25 were the target population. Students and teachers maintained their class types through third grade, after which all participants returned to regular-sized classes. Random assignment of children to class types took place within schools, providing experimental data that could be used to investigate other aspects of the education production function other than the effects of class size (Cascio & Schanzenbach, 2007). This data set therefore allows for a much-needed retrospective, explanatory research design (Johnson, 2001) for the topic of age of entry and long-term academic achievement.

**Statement of the Problem**

Many parents struggle with the question of whether they should send their children to school as soon as they are eligible or whether they should keep them out for another year to increase the likelihood of the child’s academic success. Likewise, school administrators search for answers to the many questions that surround this topic, both for student achievement and for budget issues. For most children, the question of when a child should begin his or her formal education in public school is easily answered by law, which sets a cutoff date based on chronological age. For example, in Tennessee, if a child turns 5 by September 30, the child may begin kindergarten that year. Therefore, a child who has a birthday a few weeks or a couple of months prior to the cutoff date may
elect to postpone school entrance for a year and be one of the older students in his or her class or the student may enter school as one of the youngest in his or her class. The question then becomes whether postponing school entrance for one year would be in the best interests of the child. Would children who are relatively young in their class fare as well academically as their older classmates? Are children who enter school at a relatively young age distinguishable from their older classmates in terms of academic achievement years later in middle school? To what degree do problems, if they exist, compound with age, or does a difference in age of a few months diminish in importance as children become older? Much of the previous research has been conducted to determine the effects of relative age status on children in the classroom. Most studies have focused on the academic status of children in elementary school who entered kindergarten as one of the youngest in their classes. Little empirical research has yet reported on the academic status of these children at the middle school levels of their education. Therefore, parents, school administrators, teachers, policy makers, and researchers are unclear about appropriate recommendations. Due to this lack of empirical data, to the legislative dispute over kindergarten entry age, and to a lack of clarity regarding the parental decisions to be made, a need exists for the study of kindergarten entrance age and subsequent academic achievement. The STAR randomized experimental database is available for such a study. Specifically, in this present study, the researcher identifies the effects of a child's gender, SES, and entry into kindergarten on reading and mathematics standardized test scores at the middle school level. This researcher will attempt to clarify the optimum school entry age to allow reexamination of state and local policies and their possible restatement so as to provide a significant narrowing of this age/achievement gap.
Purpose of the study

The purpose of this study is to compare students, gender, SES, and age at kindergarten entrance to the subsequent middle school standardized test scores in reading and math, with the aim of determining a causal relationship. This researcher seeks to determine the age at which it is most beneficial for students to start formal schooling by examining these relationships.

Due to the lack of empirical research, policymakers, parents, teachers and school administrators often find it difficult to reach consensus regarding the best age for a child to begin formal schooling. With the increasing accountability pressures that educators now face, and the push for improved student performance demanded by today's society, educators are, perhaps misguided, seeking ways to increase test scores. Parents sometimes decide voluntarily to delay kindergarten entry for their child, believing that delayed entry will lead to more success in school and that a more mature child will score better on achievement tests.

Significance of the Study

Not only is age of entry a focus of policies that pertain to children's access to education, but age of entry also figures prominently in teachers' and administrators' beliefs and decisions about children and their potential success in school. Teachers and administrators often search for guidance when evaluating whether a student is ready to begin kindergarten. Thus, the findings of this study could be of interest to teachers and education administrators of school districts. Education administrators can use this information to assist them in responsible decision-making. Accountability for student outcomes on standardized tests is currently the responsibility of schoolteachers and
administrators (Grissom, 2004). Therefore, if there is a more favorable age for a student to start school, administrators could benefit from this information. When analyzing teachers’ decisions to retain a child in grade, researchers have found that whether the child was young-for-grade is one of the most frequently identified reasons used to explain a child’s poor functioning and it is a factor that is considered when evaluating whether the child will fit into the cohort of children the subsequent year (Shepard & Smith, 1986). The present study will provide information that can assist teachers and administrators in assessments of accountability for student performance on standardized tests and for later student success.

This study should be important to policy makers because this researcher will obtain information that can be provided to legislators for legislating policy relative to effects of an appropriate kindergarten age. Recently, California changed its law legislating the age at which children could start school based partly on the argument that older children would be better prepared than younger children and would get the most from the increasingly academic curriculum in kindergarten (Vecchiotti, 2007).

According to Stipek (2002), the increasing emphasis on school accountability and thus on students’ performance on achievement tests will likely encourage more states and district leaders to at least consider increasing the age of school entry. Results from the present study will offer policy makers empirical findings that can be applied to determine the best timing for children’s’ entrance into kindergarten. This perhaps will help to end the guessing game of later attendance and test scores.

Parents must make many decisions concerning their children. The age at which to send a child to school is an early, major decision made by a parent and one that could
have long-term, far-reaching consequences. Marshall (2003) stated that success or failure
in early elementary school could affect a child’s self-esteem and could be a good
predictor of future success for that child. Crosser (1998) stated that many families find
themselves in a dilemma regarding whether their child is prepared for kindergarten, even
though the child may be officially entitled to enroll. The results of the current study
could help the decision-making of parents of children approaching school age.

Research questions

1. How does kindergarten entry age affect eighth grade reading test scores, as
   measured by the Comprehensive Test of Basic Skills (CTBS)?

2. How does kindergarten entry age affect eighth grade math test scores, as
   measured by the CTBS?

3. How does gender affect the eighth grade CTBS reading scores of students?

4. How does gender affect the eighth grade CTBS math scores of students?

5. How do kindergarten entry age and gender affect the eighth grade CTBS reading
   scores of students?

6. How do kindergarten entry age and gender affect the eighth grade CTBS math
   scores of students?

7. How does socioeconomic status affect the eighth grade CTBS reading scores of
   students?

8. How does socioeconomic status affect the eighth grade CTBS math scores of
   students?

9. How do kindergarten entry age and socioeconomic status affect the eighth grade
   CTBS reading scores of students?
10. How do kindergarten entry age and socioeconomic status affect the eighth grade CTBS math scores of students?

11. What are the practical significant differences (effect size) in eighth grade math and reading CTBS scores based on their kindergarten entry age, gender and SES?

**Delimitations of the study**

1. This study was delimited to student CTBS scores achieved in eighth grade during the 1993-1994 school year.

2. This study was delimited to data collected from a norm-referenced test (NRT). The STAR study also has available achievement scores from criterion-referenced tests (CRT). Future analysis of CRT scores may produce significantly different results.

3. This study was limited to data collected from schools involved in the STAR experiment, which included 79 Tennessee school districts.

4. This study was limited to data collected over 25 years ago and that only represent the state of Tennessee; therefore, generalizations to the national population may be difficult.

**Definitions of terms**

**Age Eligible/ On Time Entrants** - Students who have reached a certain age when they are eligible to begin kindergarten at the start of the school year in September.

**Chronological Age** - The age of a person based on the number of years/months since birth.

**Comprehensive Test of Basic Skills/Terra Nova (CTBS)** - The standardized test administered to eighth grade students involved in Project STAR that provides a general
indication of student achievement. CTBS also assists in identifying general strengths and weaknesses. This Comprehensive Test of Basic Skills/Terra Nova covers language arts, math, science, and social studies, and many public schools use it. **Delayed Entrants**—Children who are 72 months of age or older at the time they enter kindergarten (also see Redshirting).

**Gender**—Sex of the children, indicating whether male or female.

**Kindergarten**—The beginning grade for students entering school, where the student is typically about age five.

**Kindergarten readiness**—The concept that children have developed social, physical, and cognitive skills necessary to learn in a structured environment (Malone, West, Flanagan, & Park, 2006).

**Project STAR**—The STAR (an acronym for Student Teacher Achievement Ratio) experiment was designed to study the effects of class size on student achievement and development. In the fall of 1985, this program randomly assigned a number of kindergarten students and teachers in 79 Tennessee schools into three different class types—small, regular and regular with a full-time teacher’s aide. The collection period for data on student achievement was four years.

**Redshirting**—The term redshirting originally referred to the practice of keeping students off of a varsity athletic team on the assumption that in the following year their more mature bodies and skills would enable them to be better athletes (Marshall, 2003). In the present research, the term redshirting indicates the practice of holding age eligible children out of kindergarten for an extra year (also known as the “gift of time”).

**Relative Age**—The age of a child relative to the class mean.
**Relatively Old for Class**- Children who are at the ages of 68, 69, 70 and 71 months at the time when they enter kindergarten.

**Relatively Young for Class**- Children who are at the ages of 60, 61, 62, and 63 months at the time when they enter kindergarten.

**Socioeconomic Status (SES)**- A child’s family socioeconomic status based on father’s education, mother’s education, father’s occupation, mother’s occupation, and household income.

**Standardized Assessment**- An evaluation that measures a student’s currently acquired comprehension and skills in one or more of the content areas common to most school curricula (such as reading and mathematics).
Chapter 2

Review of Research, Theory and Literature

This chapter provides an overview of kindergarten and the age of entry debate. The main purpose of this review is to present and critique relevant research, theory, and literature linked to kindergarten age of entry as it relates to future academic success. This review touches on a variety of areas, including legislation on school entry age, the history of kindergarten, increasing expectations of kindergartners, the impact of school entry age on academic achievement, readiness for school, comparison of delayed entrants and on-time students, comparison of the children in the same grade who have different birth dates, comparison of children in different grades who are the same age, and the variables of gender and SES.

The chapter introduces an important policy issue in the United States that has received much attention in recent years; namely, is the question of the optimal age for entry of a child into kindergarten. For many years, controversy and concern has existed regarding the appropriate age for school entrance. The reasons why some children seem to excel throughout school, while others struggle from the beginning, are not yet clear. The common goal of policy makers, school administrators, teachers, legislators, and parents alike is to ensure the academic success of all students. With the increased emphasis on teacher and administrator accountability and on high-stakes testing, a push to have a more academically challenging kindergarten has arisen in 2009-2010 compared to prior years.

In 1998, the National Research Council (NRC), released a report that called for widespread reforms "to ensure all children are equipped with the skills and instruction
they need to learn to read (NRC, 1998)." The National Education Goals Panel put school readiness in the national spotlight in 2000 when Goal One of the United States Secretary of Education Report titled "Goals 2000" stated that, "all children in America will start school ready to learn." The federal No Child Left Behind Act (NCLB) was signed into law in January 2002 and reauthorized the Elementary and Secondary Education Act of 1965 (ESEA). NCLB requires each state to establish its own academic content standards for what students in grades three through eight and in high school should know and be able to do in core content subjects. Most states now also have early learning standards that define expectations for what young children should know and be able to do before they enter kindergarten (Krauerz, 2005). According to NCLB, all students should be able to meet the high learning standards of the state in which they live. This federal requirement, which was designed to improve student achievement, emphasizes the importance of early and frequent standardized testing to ensure that children meet academic expectations. Under NCLB rules, schools can meet their adequate yearly progress (AYP) goals only if all subgroups meet state standards (or show adequate growth) in all subjects tested. Nationally, thousands of schools are under increasing sanctions because students in the school, or in one or more subgroups, are not making sufficient progress in math or reading. For this reason, educators should find the results of the present study to be of particular interest, as these findings may assist leaders in decision-making that can improve the achievement of all children.

Achievement in the areas of math and reading is improving in 2010, but still has a long way to go. The National Assessment of Education Progress (NAEP) shows that math and reading average scores have steadily increased since 2004 (NAEP, 2008). The
average math and reading scores of students aged 9, 13, and 17 have steadily improved since 2004 (NAEP, 2008). National and state NAEP assessments are conducted at least every two years in reading and mathematics at grades 4 and 8; national assessments in reading and math in grade 12 are conducted at regularly scheduled intervals. Even though performance in reading and math performance has grown slightly, achievement gaps by gender and varying levels of SES continue to exist (NAEP, 2008). Although NAEP reports about American children are, in fact, showing steady increases in academic growth and achievement, the education research community has an obligation to continue to examine factors that may have an effect upon academic achievement.

With changing education expectations and heightened requirements, researchers are investigating the factors that effect academic achievement. One such factor receiving attention is age of entry in kindergarten. Controversy about the appropriate age at which children should enter school abounds. Policy makers debate the age at which school entry should be allowed, when it should be required, and when it is late. Many parents struggle with the question of whether they should send their children to school as soon as the children are eligible, or whether to keep them out for another year to increase likelihood of academic success. Teachers and school administrators often experience confusion while determining when a child is ready to enter kindergarten. In the real-life kindergarten classroom, as much as a 15 month age span is possible between the oldest and youngest child. The youngest children may appear immature and unready for the tasks that their older classmates find challenging and intriguing (Crosser, 1998). As the curriculum and academic expectations increase to meet the needs of six-year-old children, there is a danger that the kindergarten program will become developmentally
inappropriate for the very young children it was meant to serve. The purpose of this review is to summarize and interpret evidence on age of entry studies to inform policies and practices designed to reduce achievement gaps and improve academic achievement outcomes of children.

**History of Kindergarten**

Kindergarten, once thought of as an innovative and revolutionary system of teaching young children (Meisels, 1992), was first pioneered by Friedrich Froebel, a 19th century German educator and scientist. He opened what he called his first “children’s garden” in 1836 (Krauerz, 2005) for children below the age of seven. Meisels (2002) indicated that the activities in Froebel’s garden were meant to promote creativity by encouraging playing with toys such as building blocks, and that children should develop freely according to their individual nature, using play as a tool.

Kindergarten was introduced in America before the Civil War, in the 1870s, and was institutionalized in the 1930s. Kindergartens were first introduced in this country as nurturing, play-based programs intended to enhance children’s cognitive, physical, and social development as a means of smoothing the transition into formal schooling (Krauerz, 2005). According to Lascarides and Hinitz (2000), the purpose for kindergarten in these early years was to provide opportunities for children disadvantaged by poverty, ignorance, and neglect; kindergarten provided a way to overcome the differences between children who lived in poverty and those whose families were more affluent, a task now continued in the present day with the Head Start program.

In current times, kindergarten is the typical starting point for a student in a public or private school system. Kindergarten used to be a place where children prepared for
elementary school. Swiss Psychologist Jean Piaget’s work launched a conceptual and research base whereby care and learning opportunities provided to children younger than age eight are different from, but important contributors to, later forms of education and school success (Krauerz, 2005). In spite of Piaget’s commonly understood and widely believed concepts regarding childhood development, in many cases, kindergarten has become elementary school. Due to this shift, coverage of material that historically was first grade curriculum now commences in kindergarten.

As kindergarten becomes the usual starting point for formal schooling, the age when children should enter kindergarten has attracted more attention than before. Typically, many children across the nation enter kindergarten at age five; however, the month that they should turn five varies greatly from state to state. In an attempt to determine the ages of kindergartners today, several researchers used a database that included a sample of kindergartners from across the United States. Upon examination of the ages of kindergartners upon entry to school, the age range was estimated at between four and a half to just over six and a half years, with the typical kindergartner beginning the year at an age of five and a half years old (Zill & West, 2001).

The cutoff dates for kindergarten entry are not uniform across the United States. The cutoff birth date for kindergarten entry is typically set by the state, although a few states give school districts discretion. Only five states (California, Connecticut, Hawaii, Michigan, Vermont), the District of Columbia, and the Virgin Islands have cutoff dates between December 1 and January 1 (Education Commission of the States, 2008). This practice leads to a robust mix of four year olds and five year olds enrolled in kindergarten. Recently, Hawaii passed legislation to change the cutoff date from
December 31 to August 1, beginning with the 2006-07 school year. Thirty-five states and Puerto Rico have kindergarten entrance cutoff dates between August 31 and October 16 (ECS, 2008). These policies lead to fewer four year olds entering kindergarten, but classrooms consist of a combination of four and five year olds entering each fall. Three states (Alaska, Indiana and Missouri) have cutoff dates on or before August 15 (ECS, 2008). While legislative intent cannot be determined without additional research, these states presumably would want to ensure that all children are five years old before they enter kindergarten. Another six states (Colorado, Massachusetts, New Hampshire, New Jersey, New York and Pennsylvania) leave the entrance-age question up to local district decision (ECS, 2008).

Although most school districts require that chronological age be used as the cutoff point for entry to school, they leave the decision up to parents as to whether the child is developmentally ready for school (Vecchiotti, 2003). This allows parents to enroll their children for one year after the compulsory age. Only eight states, the District of Columbia, Puerto Rico and the Virgin Islands, have a compulsory school age of five that effectively, if not explicitly, mandates kindergarten attendance for all children. Compulsory attendance ages in the other states range from ages six through eight. These laws allow parents and school administrators to delay a child’s entrance into kindergarten for a year. The reasons for delaying entry into kindergarten include research and theories that some children are not yet developmentally ready to succeed and that older children are able to adapt to the intellectual, social-emotional and academic demands of kindergarten. Therefore, the age at which children enter kindergarten varies from four years old to six years old or older, resulting in more confusion on the appropriate age to
enter kindergarten. Thus, the kindergarten entrance age has become an important issue for parents, policy makers, and educators.

In recent years, there has been a national trend toward raising the minimum entrance age for kindergarten. School entry age cutoff dates for many states have moved from the beginning of the calendar year to the beginning of the school year. Researchers reported that more than a third of reporting districts had raised their minimum entrance age three to four months over the period 1974-1997 (De Cos, 1997). Typically, one rationale for this change was to prepare children to handle a demanding academic kindergarten curriculum and to be able to compare kindergarten students in one state to students in another state based on scores of national achievement tests (Stipek, 2002). In part, as an effort to protect relatively young children from being disadvantaged by rigorous kindergarten standards (and in part in hopes of raising test scores by increasing the average age of children in each grade), the current trend is for states and school district leaders to require children to be older when they enter kindergarten (Meisels, 1992).

According to Stipek (2002), kindergarten entrance age policies may be a politically attractive strategy to state policymakers for achieving gains in test scores without any corresponding education investments. That is, a state can expect to boost its student test scores, at least for students in the first few years of school, by increasing the minimum entrance age for kindergarten. Such actions have been motivated by numerous studies that have suggested a positive correlation between entrance age and later school performance (Datar, 2004). State policy makers have interpreted this positive correlation as a causal link between entrance age and school performance and seek to raise children’s
achievement by raising the age at which they enter kindergarten. Datar (2006) noted that a motivation behind the trend of raising the minimum entrance age for kindergarten is that it allows children to enter school at a time when they are ready to learn. Since older children are usually more mature when they enter kindergarten, they are likely to perform better in school than are younger children. The current researcher seeks to study and understand this assertion.

**Increasing Expectations of Kindergartners**

Children's knowledge level is different today than it was 25 or so years ago for a number of reasons, including Head Start, increased participation in preschool, addition of educational electronic games, advances in technology, and exposure to many education television programs (Shepard, 1994). The increasing pressure for schools to be accountable and the implementation of “no social promotion” policies across the nation have put new demands on kindergarten and have increased the focus on assessment of basic skills by standardized achievement tests (Stipek & Byler, 2001). Moreover, the NCLB Act of 2001 (signed in January 2002) emphasized the importance of early and frequent standardized testing to ensure that children meet academic expectations. School leaders were required by this federal law to begin testing all students as early as third grade to make sure that children are progressing in their grade-level curriculum. Using early testing puts downward pressure on second graders, first graders, and even kindergarteners to meet high academic standards (Lincove & Painter, 2006). As a result, children in kindergarten are now expected to navigate through academic curricula that were once reserved for first and second graders (Vecchiotti, 2003). It is not uncommon for a kindergartner to have worksheets based on rigorous academic skills and an
environment that requires them to sit still for extended periods of time (Shepard, 1994). As a result of this shift in kindergarten requirements, some children, especially relatively young children, may appear less ready for school (Bickel, Zigmond, & Strayhorn, 1991) than they were in the 1990’s. Crosser (1998) indicated that in the real-life kindergarten class, the youngest children may appear to be immature and unready to undertake the tasks that considerably older classmates find challenging and stimulating. As the curriculum and academic expectations increase to meet the needs of the six-year-old children, there is a danger that the kindergarten curriculum will become developmentally inappropriate for the very young children it was meant to serve, thus greatly influencing academic achievement (Crosser, 1998). There is an effort by many to focus on preparing students entering kindergarten by having them exposed to a more rigorous academic curriculum during preschool and daycare (Cassidy, Mims, Rucker, & Boone, 2003).

Marshall (2003) noted that accountability pressures by the public have led some school district leaders to change the age of school entry, with the goal of ensuring that children are ready for tasks that were previously found in first grade curriculum. With older, supposedly more mature children at each grade, administrators in districts in which children enter at an older age hope for higher average achievement scores to meet accountability standards (Marshall, 2003). The current emphasis on school accountability based primarily on students’ performance on achievement tests is likely to encourage more states and district leaders to consider increasing the age of school entry (Stipek, 2002).
School Readiness and the Age of Entry Debate

In an effort to determine the factors that affect academic achievement, researchers have examined the effect of age of kindergarten entry. There is considerable debate in the research community regarding the age at which children are ready to enter school. For the most part, kindergarten is the typical starting point for formal schooling. Consequently, the age that children should enter kindergarten has attracted attention. Since it is widely believed that a good start for a child’s school experience is essential, the topic of when a child is most ready to enter school fuels much debate among researchers, parents, educators, and policy makers. Although there is a range of ages in every classroom, when the readiness factor is taken into consideration, there can be a large range of developmental ages within a small group of children (Crosser, 1998). This range in developmental age affects learning and in turn can impact test scores (Kilpatrick, 2002).

In a review of the literature of age of entry studies, Stipek (2002) noted the effects of entry age and the extensive research and debate on its effect on academic achievement. Stipek (2002) identified two different views of kindergarten readiness that shapes the age of entry debate as both a policy and a practice issue. The first is a maturational point of view that expects the child to be mature and ready for school, while the second perspective has a preference for experience gained in the school over maturation. The questions are whether younger children within a grade benefit less from the school experience than do older children (Stipek, 2002), and whether delaying the youngest children in their cohort would result in better or improved academic results (Gullo & Burton, 1992).
Those who hold this maturational perspective argue that school readiness is a threshold that the child should reach before starting school. From this perspective, a child considered ready to start school and the structured learning processes should show optimum development in affective, psychomotor, perceptual and cognitive behaviors (Krauerz, 2005). Merely reaching a fifth birthday does not insure that a child is ready for school nor does it guarantee a specific level of development (Crnic & Lamberty, 1994). Crnic & Lamberty (1994) noted that five years of age may not be the optimal age of readiness.

Proponents of the maturational view not only imply that older is better, but also claim that older is better until the children achieve the prerequisite level of development that is required for them to succeed in school (Stipek, 2002). Holders of this perspective propose a delay in entrance to kindergarten for a child who is not ready for school. Instead, they propose to give the child an extra year to become developmentally ready for the formal classroom structure and instruction (Grau & DiPerna, 2000). Based on this gift of time, the perspective of this school of thought is that the extra year of maturation will boost academic achievement. According to this perspective, chronological age is not an adequate criterion for deciding when to enter school. Instead, maturity should be the deciding factor used to determine the eligibility of the children to enter kindergarten.

Holders of the maturational view also highlight the gender differences in developmental readiness for kindergarten: there is dissimilarity in readiness for school between boys and girls. Boys are thought to mature later than do girls (Oshima & Domaleski, 2006). According to Graue & DiPerna (2000), boys are more likely to wait a year to begin school and are more likely as well to experience retention. Gredler (1992)
stated that regarding the decision to begin kindergarten, girls are usually ready at age five, whereas boys should be at least five and a half before entering kindergarten. Some studies have demonstrated the prevalence of this point of view in practice, as more boys than girls experienced delayed entry into kindergarten (Graue & DiPerna, 2000; Zill et al., 1998).

Holders of the maturational perspective propose that readiness tests should be used to determine the eligibility of children to enter kindergarten (Meisels, 1986). According to Gredler (1992), the Gesell school readiness test is the most frequently used screening measure in American schools. Shank (1990) also promoted the use of readiness assessment tests to determine readiness for school entry. With regard to readiness tests, Siegel and Hanson (1991) noted that if children are not ready based on the results of the test, they should be given an extra year to mature before they enter kindergarten.

Conversely, some individuals contend that readiness tests and readiness assessments are unreliable, misinterpreted, and incorrectly administered (Shepard, 1994). Graue (1993) maintained that readiness tests do not accurately predict later success in school. When students fail readiness tests, the reasons could stem from lack of experience, rather than a lack of ability (Shepard, 1994).

Persons holding another perspective believe that the only determining factor for entry into kindergarten should be chronological age. Supporters of the chronological age perspective believe that chronological age is the only common standard on which to base entry and is the only clear and equitable solution to the entry-age issue (Kagan, 1990). Brent, May and Kundert (1996) asserted that chronological age should be the deciding
factor in school entry. Stipek (2002) stated that age is equitable and less susceptible than other ways to cultural or social biases.

Regarding this perspective, Stipek (2002) stated that time in an instructional context is more valuable and will better promote academic success than will additional biological maturation or general out-of-school experience. Therefore, experience is preferred over maturation.

Educators and policy makers who favor the chronological age perspective criticize the practice of delaying children’s entrance to kindergarten and the use of readiness tests to determine the eligibility of children to enter kindergarten (Stipek, 2002; Graue, 2003). Advocates have proposed that it is the educational system’s responsibility to be ready to meet the individual child’s needs, not the child’s responsibility to be ready for school (Graue & DiPerna, 2000). Relying on readiness testing as the means of determining school entry places the responsibility on the parents rather than the school (Stipek, 2002).

Followers of this view have also discussed concerns with socioeconomic status (SES) and kindergarten entry age. According to Lee and Burkham (2002), several differences exist between children of lower SES families and those of higher SES families. Before they even enter kindergarten, children in the highest SES group have cognitive scores that are 60% above the scores of students in the lowest SES group (Lee & Burkham, 2002).

Proponents of this perspective argue that delaying children’s entrance into kindergarten implies that children are deemed to fail before they begin (Siegel & Hanson, 1991). According to the maturational perspective, if a child is age-eligible, but not...
mature enough to handle kindergarten, the decision should be made to hold the child out for one more year. Supporters of the chronological age perspective have noted that this decision to stay home for an extra year comes with the assumption that at least one responsible adult is home all day to provide the child with necessary educational and social experiences to be successful in school (Siegel & Hanson, 1991) or that the additional cost of another year of day care or preschool will not be a burden to the family. Lower income families may not be able to afford the extra year of holding their children out of school, while middle income and high income families are more likely and better equipped to delay their children's entrance into kindergarten. Keeping children at home potentially increases the gap between children of low income and middle-high income families (Morrison et al., 1997; Stipek, 2002). Even though low-income families also voluntarily delay their children's entrance into kindergarten, middle-high income families would more than likely provide a better home environment than low-income families, which in turn puts children from low-income families at a greater disadvantage (Stipek, 2002).

In summary, school readiness is a relative definition that differs according to one's philosophical orientation (Brent et al., 1996). One school of thought, the maturational perspective, considers school readiness to reflect children's needs to be mature in all aspects of development in order to succeed in kindergarten. The assumption with this line of thinking is that as the child gets older, he or she will mature sufficiently to handle schoolwork and that age alone is not an adequate basis for determining the time of school entrance. Therefore, advocates have stated that readiness testing is the best way
to determine if a child is prepared to begin school. In the event that a child is not ready to begin school, entrance to school should be delayed.

In contrast, other educators and policymakers argue that the education system is responsible for accommodating children in different developmental steps and that it is not the child’s responsibility to be ready for school (Yesil-Dagli, 2006). Any intervention that would prohibit a child from beginning school when he/she is age-eligible is strongly opposed. Chronological-age supporters point out that not all children have the same positive and educational environment at home and that raising the entrance age widens the gap among the different SES families. Therefore, chronological age is the only criterion that gives an equal opportunity to all children.

**Focus of the Present Review**

This part of the review examines research on peer-reviewed, experimental, quasi-experimental, and nonexperimental studies that measure the effect of age of entry on academic achievement. The reviewer’s intention is to place age of entry studies and their results onto a common scale. With this information, educators, policymakers, and parents can make meaningful choices regarding this important decision. The present reviewer intended to analyze potential contributing factors that have proven in previous research to have a significant effect upon student achievement (i.e., gender and SES). For this reason, the review examines the three major strategies (Stipek, 2002) used previously to assess the effects of the age of school entry on children’s academic achievement.
The first strategy compares outcomes for children who have delayed by a year with outcomes for children who entered school when they were eligible. Bracey (1989) coined the phrase the “graying of kindergarten” when describing this trend. He noted that parents might believe that delaying kindergarten will provide an academic edge, by making their child the oldest student next year instead of the youngest student this year. This process has recently come to be known as “redshirting”. The term redshirting originally referred to postponement of a college athlete’s participation in regular season games for one year to give the athlete an extra year of further growth and practice with the team, in the hopes of improving the player’s skills for future seasons (Katz, 2000). In school, academic redshirting is delaying school entry an additional year in hopes of providing an extra year to mature cognitively, socially, and/or physically, so that there is a better chance of being successful in school. The National Center for Education Statistics (NCES) reported that academic redshirting occurs at the rate of about 9% per year among kindergarten age children (2000).

A second major strategy used to examine this issue is comparing children in the same grade who have different birth dates. In any one grade, there is at least a 12-month span in ages. This study approach uses variation in birth month of children within a class to estimate the age effect. Interpretation of findings of studies examining naturally occurring age variations is less problematic than it is for the redshirted studies because birth dates are presumably randomly distributed (Stipek, 2002). These studies are beneficial in providing information on whether older children perform better on average than do younger children.
The third strategy involves comparison of children who are the same age but in different grades, as well as children who are a year apart in age but in the same grade.

In summary: The first comparison provides information on the effect of a year of schooling, holding age constant. The second comparison provides information on the effect of chronological age, holding number of years of schooling constant. The third strategy provides information on the relative effects of an additional year of time (maturation and general, out-of-school experience) versus an additional year of schooling (Stipek, 2002). Categorization of the research by methodology should facilitate understanding of the many investigations conducted regarding the topic of school entry age. In this present review, the researcher examines available research in order to provide information to enhance decision-making concerning kindergarten entrance age.

While the core of the entrance-age topic concentrates on the young child, it is also important to consider the long-term educational consequences. Entry age could have an effect not only on kindergarten success, but also on success in later grades. Morrison et al., (1997) noted that the effects of entry age may not become evident until later years. Denton and West (2002) affirmed that early education sets the tone for later learning.

**Review Method**

Review of research studies of entrance age and its effect upon academic achievement allowed application of consistent, well-justified standards of evidence in order to draw conclusions about the age at which children should begin school. Synthesis of quantitative information from experimental, quasi-experimental, and nonexperimental studies would then provide unbiased, meaningful information. Details from the studies in
this literature review consist of identification of effect sizes (if included), a description of the context of the investigation, the research design used, and the findings of each study. This analysis characterizes the nature and quality of the contribution made by each study.

The purpose of this review is to examine the quantitative evidence on academic achievement as it relates to kindergarten entry age. As a result of this review, educators, policymakers and researchers will gain additional understanding about the current state of the evidence on this topic and will be able to identify gaps in the knowledge base that are in need of further scientific investigation.

**Limitations of the Review**

This literature review is a quantitative synthesis of academic achievement outcomes of age of entry research. It does not report on qualitative or descriptive evidence, attitudes, perceptions, or other nonachievement outcomes.

**Literature Search Procedures**

The aim of this broad literature search was to locate every study that could meet the inclusion requirements. This included obtaining all of the studies cited by Stipek’s (2002) summary of relevant age-of-entry research findings and by other reviews of age-of-entry studies. Electronic searches were made of educational databases (JSTOR, ERIC, EBSCO, PsycINFO, Dissertation Abstracts, NBER, Academic Search Premier, and Business Source Premier), and web-based search engines (Google, GoogleScholar). The review also included citations obtained from studies found in the initial phase of the search.
**Effect Sizes**

In statistics, effect size is a measure of the strength of the relationship between two variables. In scientific experiments, it is often useful to know not only whether an experiment has a statistically significant effect, but also the size of any observed effects. For practical reasons, effect sizes are helpful for making education decisions. This statistic allows readers to gauge the effects, or influences, of age of entry on academic achievement. Upon examination of the research articles that were compiled for this literature review, the researcher determined that few investigators reported the effect size. The lack of reporting on effect sizes suggests a need for clarification in interpreting findings. This current study will report effect sizes to provide practical evidence of any observed effects.

**Criteria for Inclusion in the Review**

Criteria for inclusion of studies in this review were:

1. The studies included experimental/quasi-experimental research on the issue of kindergarten entry age policies

2. Research examined the relationship between age of entry and academic achievement.

3. The research had no restriction on sample sizes.

4. Studies could have taken place in any geographic area, but the report had to be available in English.

5. Early studies, i.e. 1950s and 1960s, were not included due to the question of generalisability of findings from that time period to today's children.
6. Grade levels of the students studied range from kindergarten through post-high school.

7. Age ranges of the students studied varied from 4 years old to late twenties.

8. The dependent measures included quantitative measures of academic achievement.

9. Researchers must have reviewed the effect of age of entry on achievement to at least first grade.

Methodological Issues in Studies of Age of Entry

As noted, researchers who looked at the influence of school entrance age on children’s present and later academic achievement essentially used three study methods. All three types of studies suffer from different methodological problems. This first method provides information on the effect of a year of schooling. Studies comparing school outcomes of delayed entrant children with on-time and young entrants have yielded inconsistent findings (Datar, 2004). Thus, the findings of studies that compare delayed entrants with on-time students should be interpreted very cautiously (Stipek, 2002; Crosser, 1991; Oshima & Domaleski, 2006). First of all, children who are held out of school do not represent a random sample. In addition, the factors or child characteristics that originally influence parents’ decisions would possibly also affect the children’s school performance (Stipek, 2002). The findings of these types of studies are neither substantial nor consistent.

Another methodological concern for this first strategy is that many studies on this topic are limited in terms of control of other variables. Two variables in particular, SES and gender, have been found to have mediating effects on the relationship between age-
of-entry and achievement (Crosser 1991; Lincoe & Painter, 2006), but are not consistently examined as variables in delayed entry studies. According to the National Center for Education Statistics (NCES) report, academic redshiriting occurs at about 9% per year among kindergarten-age children (West et al., 2000) and has often been more common in affluent than in lower-SES communities (Brent et al., 1996). Furthermore, according to NCES, redshiriting occurs more frequently among boys than girls (West et al., 2000). Several studies have also supported the findings of the NCES report with regard to the holding out of economically advantaged children (e.g., Bellisimo et al., 1995; Graue & DiPerna, 2000; Stipek & Byler, 2001). Another methodological concern with studies of this kind is then the fact that if these delayed and economically advantaged children have higher achievement, age-of-entry would possibly only have a slight effect in comparison to the effect of SES on their academic achievement (Stipek, 2002).

Sample size of delayed entrants in the studies appears to be another concern. The number of delayed entrants is not sufficiently substantial for comparison with the other students, which reduces the power of statistical procedures (Yesil-Dagli, 2006). It becomes necessary to consider a finding of no difference from the perspective of what would have occurred had the children not been held out (Stipek, 2002). A finding of no difference is therefore difficult to interpret. Children who had been held out might have performed more poorly had they not been “redshirited”. Stipek (2002) noted that it cannot be determined whether the delayed children would have performed less well had they not been delayed.
Studies in this group have failed to control for sample size (e.g., the number of delayed entrants is less than the number of on-time students), SES, and gender (Yesil-Dagli, 2006). This issue of control is important because holding out is a common practice among high SES families, and for boys overall.

Any kindergarten class always contains younger and older children with an age span of about one year (Crosser, 1991). This feature leads to the second strategy of examining the age-of-entry issue: comparing children in the same grade who have different birth dates. Stipek (2002) stated that interpretation of findings arising from examination of naturally occurring age variations is less problematic than it is for the delayed entry studies because birth dates are presumably randomly distributed. However, some methodological concerns exist with this approach as well. In this review, the researcher found that most studies do not examine associations between age-of-entry and other factors that influence student achievement. In one study that did examine these associations, researchers Jones and Mandeville (1990) found that the proportion of risk attributed to socioeconomic factors was 13 times larger than that contributed by age.

Another methodological concern regarding this second type of strategy is that much of the work in this area is cross-sectional and studies different children at the same time, for example first and fourth graders, rather than the same children over time (Vecchiotti, 2007). Consequently, these studies rarely assess changes in achievement over time. Therefore, the researchers cannot determine whether older children benefit relatively more from schooling (i.e., make greater gains) than do younger children (Stipek, 2003).
Studies conducted using national data sets (e.g., ECLS-K and NELS databases) have researched the effect of age of entry on academic achievement using the approach of comparing children in the same grade with different birth dates (Oshima & Domaleski, 2006; Datar, 2004; Linove & Painter, 2006). The determination of the cutoff date for kindergarten is a state function and varies widely across the United States. Some states (i.e., Pennsylvania and New Jersey) allow school district Boards of Education to set their own cutoff dates. Since entrance age policies differ among states, a young child in one state may be an older child in another state, making it difficult to draw conclusions about the appropriate age for children to enter kindergarten. Finally, few researchers using this second methodological strategy assess change in achievement over the school years.

In the third strategy, researchers compare the effects of a year of maturation and general experience (out-of-school) to a year of schooling. This analysis often compares children who are the same age but in different grades and children who are in the same grade but approximately a year apart in age (Stipek, 2002). A methodological concern with this approach includes the lack of control for socio-demographic variables (Bickel et al., 1991). Researchers have found that when children enter kindergarten their ability in reading and math is associated with age, gender, and family factors (Jones & Mandeville, 1990). When other variables are taken into account, the effect of entry age is often minimal (Bickel et al., 1991). Some studies (i.e., Breznitz & Teltsch, 1989) compared younger and older children who were given different types of tests, which made it difficult to identify the source of the differences in their performance, i.e., their age or the test. In this type of investigation, when comparing children who stayed out of school for a year versus those who started, researchers must factor into the analyses whether the
child who stayed out attended a preschool program, spent more time in maternal care, or may have had other experiences in that year out of school that may exert an independent effect on test scores (Datar, 2004).

A contribution that the current inquiry makes is that it incorporates a longitudinal investigation of children’s achievement trajectories from just after kindergarten entry through eighth grade. The study was designed to do this after taking into consideration (i.e., controlling for) attributes of children (i.e., gender) and of the family (i.e., SES). Few studies have included major socio-demographic variables in a single, retrospective, explanatory study. Disregarding variables such as gender and SES may yield group differences between younger versus older entrants that in turn may influence the direction and magnitude of the achievement differences (Morrison et al., 1997). Thus, not only does this research aim to illuminate cause and effect between age of entry and development over time, but does so after controlling for confounding factors that are known to effect academic achievement.

Studies of Age of Entry and its Effect on Academic Achievement

Upon reviewing the available literature of the relationship of school entry age to later academic achievement, Datar (2006) stated that it is clear that while there are different thoughts on the long-term effects of chronological age at school entrance, it does have an effect on school achievement. The question of the best age for children to begin school has long been a subject of debate. Although there are various ways to assess when a child is ready to go to school, age is most often used to determine eligibility. In fact, Marshall (2003) noted the only legally and ethically defensible criterion for determining school entry is whether the child has reached the legal
chronological age of school entry. Today, the majority of compulsory education laws for school entry fall between six years old (28 states) and seven years old (22 states). Nevertheless, most children enter school when they are five years old. With nearly 98% of youngsters attending kindergarten prior to first grade, at least a half-day of kindergarten is a near-universal experience for American children (NCES, 2000).

Kindergarten was designed to be a developmental year for children, with the understanding that the development of children at this age varies widely, as does their test-taking ability. Some children are beginning to learn to read and write, while others are just learning their letters. Whereas many children may have spent time in center-based early care and education programs, for others kindergarten is their first encounter with regular and prolonged peer-group interaction (NCES, 2000). This variation in experience and development makes decisions regarding kindergarten entrance age particularly challenging for policymakers. The common question for policy makers, parents, teachers, and administrators concerns the specific age at which to allow children to enter kindergarten (Stipek, 2002). The dilemma exists because compulsory education laws do not apply until at least a year after the age of eligibility and so the question arises regarding whether or not to send children to kindergarten as soon as they are eligible. Teachers, administrators, and parents alike ask if delaying relatively young children’s entry into kindergarten by a year past the time they are eligible to enter results in any increase in their chances for success in kindergarten and later grades.
Redshirting methodology results in researchers comparing children who have delayed entry by a year with children who entered school when they were eligible. Even with state deadlines or cutoffs, many parents continue to choose to delay the entry of their children who may be close to the cutoff date. Any kindergarten class will have a wide range of abilities and ages in the classroom (Carlton & Winsler, 1999). According to the National Center for Education Statistics (2000), when comparing older kindergartners with younger ones, older kindergartners demonstrate several differences in their knowledge, skills, and behavior and also have several characteristics in common. Older kindergartners are typically closer to being able to read, to do math, and to understand concepts of science and nature and they display advanced motor skills, are more socially adaptable, and have fewer behavioral problems than do younger kindergartners (NCES, 2000).

The choice to delay entry can be made exclusively by the parents or may be recommended by school personnel. Redshirting is referred to as the “gift of time” in education circles, reflecting a perception that children who have been allowed to mature for another year will benefit more from their schooling (Deming & Dynarski, 2008). Many experts, including teachers and administrators, advise parents to delay their “young” child’s entry into school, even without the knowledge of research (Crosser, 1991). The National Association for the Education of Young Children’s Position Statement on School Readiness (1995) stated that holding children out of kindergarten could prevent those who do not have access to a quality preschool program from
receiving the instruction and experience they need to eventually be successful in kindergarten and later grades (NAEYC, 1995).

Several studies have been conducted that focus on the practice of redshirting. Lincove and Painter (2006) studied the long-term effects of age at school entry on academic outcomes beyond high school, including graduation rates, college enrollment, and salaries in early adulthood, with special attention to those students who entered kindergarten a year later than their peers. This study used data from the National Educational Longitudinal Survey (NELS), which allowed the authors to draw from a national sample of 1,000 schools; totaling 25,000 nationally represented eighth-grade students. While controlling for SES and gender, Lincove and Painter (2006) determined that, with respect to long-term outcomes, young students have slightly better outcomes on average than do redshirted students, as long as there was no retention of the young students in any grade. They found that young students who started school “on time” were more likely than redshirted students to attend college, to graduate college, and to earn higher salaries at age 25. Similarly, the researchers found that redshirted students had slightly lower twelfth grade achievement scores and were twice as likely as young students to drop out of high school. While using a representative sample of Wisconsin school districts, Graue and Diperna (2000) examined the school records of more than 8,000 students to depict patterns of school entry, promotion, subsequent special services, and student achievement. The authors found that age had no statistically significant effect on achievement, even in early primary grades. However, they noted that children who delayed school entry by a year or more were more, not less, likely to receive special education services. A similar study by May, Kundert, and Brent (1995) examined the
effects of delayed entry in one suburban New York School District on later elementary school grade retention and referral for special education services for a population of a little over 3,000 students. The authors found that students who delayed school entry were most often male and were placed in special education programs in significantly higher proportions than were non-delayed entry students. Crosser (1998) analyzed data collected from seven public city school districts in Ohio. The purpose of the study was to examine the associations between age at school entry into kindergarten and academic performance through sixth grade. Results suggested that males with summer birth dates tended to be advantaged academically by postponing kindergarten entrance one year.

West, Denton, & Germino (2000) studied the effects of redshirting while analyzing the data from the 1993 and 1995 NHES surveys. In summary, when the authors controlled for socioeconomic and demographic factors, the differences in academic achievement through third grade between redshirted students and other students were small and insignificant. While differences did exist in first and second grade between redshirted students and other students, redshirted students and grade-level peers were nearly equal in their student performance by third grade. Several studies similar to West et al. (2000) have measured academic progress through achievement tests and have shown that older students have higher test scores during early elementary school, but that differences in achievement become insignificant by third or fourth grade.

Researchers have shown that redshirting has some disadvantages: It can deny the children opportunities for cognitive growth through social interaction with their age-mates and implies that children have failed at school even before they begin (Diamond, 2000). Another potential problem caused by delayed entry is that it raises the average
age of kindergartners. This can cause policymakers to expect more academically from the entire class and its teachers and may place too much emphasis on the academic achievements of kindergartners (Diamond, 2000).

Some researchers have found that age and delayed entry have no effect on academic achievement, even in early grades. Bickel, Zigmond, and Strayhorn (1991) examined scores on second, third, and fourth-grade reading and mathematics tests to determine the effects of beginning school age on later school success. The analysis involved 352 participants in one rural school district in Western New York divided into three groups: (a) age-appropriate for entrance to school, (b) young-for-entrance to school and (c) delayed from entrance to school. Investigation of differences among the age groups and between the genders indicated no statistically significant differences among the three age groups or between gender on either the reading or mathematics achievement measures.

Stipek (2002) and Datar (2004) both noted that these types of studies wherein researchers study students who began school “on-time” and those students who were redshirted need to be interpreted cautiously since children who are held out of school do not represent a random sample. It is also very likely that qualities that led parents to decide to delay their child’s entry into school contributed to differences found later between these children and the children who began school on time. In addition to these methodological problems, findings from research are neither substantial nor consistent. According to Stipek (2002), these studies are relevant to policy decisions about formal cutoff dates only inasmuch as they allow comparisons of children who are relatively old versus those who are relatively young at school entry (pg. 27).
Studies comparing delayed entrant children with on-time and younger entrant students have yielded mixed results (Yesil-Dagli, 2006). Some researchers reported that delayed entrants outperformed on-time students, while others suggested that redshirted students performed the same or worse than on-time or younger children. It appears that delayed entrants do not have any long-term advantage in terms of academic achievement. Research that studied children who have been redshirted and who began school one year later is difficult to interpret because the findings of the studies are within-grade comparisons of older and younger kindergarten entrants and are not consistent. Studies using this strategy have often failed to control for SES and gender, which are important variables to control because redshirting is a common practice among high SES families and for boys as well. The current review of literature clearly shows that findings are inconsistent. The present experimental study will therefore add to the body of knowledge regarding kindergarten age-of-entry, while controlling for gender and SES.

**Age Differences**

The second methodological strategy for analyzing age-of-entry is for researchers to compare children in the same grade with different birth dates. A kindergarten class will contain younger and older children with an age span of up to one year. Zill and West (2001) reported that in 1998, 9% of the kindergartners were not yet 5 years-old, almost 64% were between 5 years and 5 years 8 months, about 23% were between 5 years, 8 months and 5 years, 11 months, and 4% were already 6 years of age. Morrison et al., 1997, noted that when considering only age differences, it was likely that older students would know more than younger students when they enter school. Research has supported that notion (West et al., 2000; Zill & West, 2001; Morrison et al., 1997).
Breznitz and Teltsch (1989) reported that older children in kindergarten surpassed their younger peers in reading and mathematics. Morrison et al. (1997) reported that older children were more likely than younger children to read, to do arithmetic, and to demonstrate a more positive approach to learning. Crosser (1991) reported that girls seemed to be more advanced in both reading and math than were boys, while Campbell (1985) reported the opposite to be true.

Studies examining the age-of-entry effect on children's academic achievement in later years have yielded inconsistent and contradictory findings. While some studies have found no significant effect of age differences in academic tests (Graue & DiPerna, 2000; Stipek & Byler, 2001), other researchers have found that younger children (relative to the class mean age) did not perform academically as well as did older children (Breznitz & Teltsch, 1989; Campbell, 1985; West et al., 2000; Zill & West, 2001). Stipek (2002) reported that although the findings of age-of-entry studies on later school achievement varied across studies, the pattern was clear. The oldest children performed better than the youngest children in kindergarten, in first grade, in second grade, and in fourth grade (Stipek, 2002). Bickel et al., (1991) reported that differences between younger and older children decline and disappear in later elementary school years.

Oshima and Domaleski (2006) divided entering kindergarten students into two groups. The first group included students with summer birthdays (June, July, and August) who were less than 67 months of age. The second group consisted of students with fall birthdays (September, October, and November) who were more than 67 months of age. Oshima and Domaleski (2006) concluded that although the fall birthday group (the older students) had a higher initial academic performance, this advantage decreased
through the third grade. The gap continued through the fifth grade and then leveled off during middle school. Kilpatrick (2002) studied the academic achievement of kindergarten students in later grades. In this study, the kindergarten students also consisted of two groups. The early-entry group was comprised of students less than 66 months old, and the regular entry group consisted of students 66 months or older. In comparing these groups and their academic performance in middle grades, Kilpatrick found that academic achievement by middle school age was unaffected by kindergarten entry age. Kurdek and Sinclair (2001) examined the effect of entry age on students’ fourth grade achievement scores in mathematics and reading. Results indicated that while girls scored higher in both math and reading in kindergarten readiness tests, no significant difference existed between males and females by the fourth grade. Older children (birth dates between September 1 and December 31) scored higher, on average, than did younger children (birth dates between May 1 and August 31) in reading domains, but all examined differences dissipated by fourth grade.

This second methodological strategy has researchers comparing children born in the same calendar year but in different months, and then categorizing them into groups according to their birth month. Most researchers have reported improved academic achievement at the beginning of the school year or in early grades, yet many of the same studies also showed that these differences dissipated in later elementary grades. In sum, studies have demonstrated that a comparison of children who were born in the same year, but in a different quarter of the year, support the notion that the advantage of being older at entry is not long lasting.
Schooling versus Age

The basis of many age-of-entry debates is a comparison of the advantages of being in school or being more mature out of school. Schooling versus age studies compare the effects of a year of maturation and general experience (out of school) to a year of schooling (Stipek, 2002). This analysis compares children who are the same age but in different grades and children who are in the same grade but approximately one year apart in age. Studies have shown that younger first graders outperform their age-mates who are a year behind them in school. This indicates that entrance age alone is not a risk factor; rather, schooling effects are larger than age effects (Graue & DiPerna, 2000).

Stipek & Byler (2001) found that children who enter kindergarten relatively young initially perform less well academically than do their older peers. However, they found that the age-of-entry effects on achievement disappeared within a few years of elementary school (by third grade). Morrison et al., (1997) found that older first graders, young first graders, and older kindergartners obtained almost the same grade equivalent scores in reading and math. However, they found that by the end of the school year, young and old first graders improved by 1.0 grade-equivalent score, while older kindergartners demonstrated only a .33 improvement. Morrison et al., (1997), noted that one possible explanation for the difference in achievement was the curriculum, as kindergarten may be more play-oriented whereas first grade activities involve more formal instruction. Accordingly, it is possible to claim that children at the same age, but at different grades, perform differently because of instructional and curricular differences. A study completed by Datar (2006) determined that a delay in kindergarten entrance was
associated with a significant increase in math and reading scores at kindergarten entry, and this difference endured throughout the first two years of school. Datar was cautious to note that while results from the research show that there are sizeable benefits during the first two years in school resulting from delaying kindergarten entrance, whether these benefits persist in the long run was unknown. Crone & Whitehurst (1999) conducted similar research comparing age and schooling as predictors of cognitive outcomes. They found that older kindergarten students outperformed younger students, but these differences disappeared by second grade.

Findings from researchers using the third methodological strategy have shown that schooling is a potent variable in most of the cognitive skills measured. In math and most aspects of reading and literacy, children who were in school gained more in a year than did children the same age who were not in school. These comparisons support the idea that both schooling and age have some impact on achievement; however, overall, schooling seems to be relatively more effective than age. The evidence also shows that age is not a factor in how much children benefit from a year of schooling.

**Gender and School Entry**

The variable of gender can make a difference in achievement in school (Crosser, 1998; Warder, 1999; Zill et al., 1998). Crosser (1998) found, after reviewing the intelligence level of kindergarten entrants with birth dates falling throughout the calendar year, that boys with summer birth dates demonstrated an academic advantage over girls when the boys postponed their kindergarten entrance by one year. Warder (1999) reported that, when analyzed by gender, female students exceeded expected grade level performances in both reading and math, as opposed to males who simply accomplished
expected grade levels through third grade. In a review of the U.S. Department of Education’s Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ELCS-K), Zill and West (2001) reported that females have a slight academic edge when they enter kindergarten and male students usually do not start kindergarten as early as do female students. Male students were more likely than female students to have been retained in kindergarten, thereby leading the authors to the conclusion that the academic performance of male students is less than that of female students at kindergarten age. Malone et al. (2006) noted recently that children whose kindergarten entry was delayed were more likely to be male than female and also that females were more likely than males to be promoted to first grade after only one year of kindergarten (Malone et al., 2006). Much research has been done on the effect gender has on academic achievement. Gender will be a variable examined in this study, as gender has been documented to have a potential effect on academic achievement.

**Socioeconomic Status and School Entry**

Recent years have shown a rise in the trend for minimum entrance age requirements. The primary motivation behind this trend seems to be to allow children to enter school at a time when they are ready for school (Datar, 2004). These changes in policies are ultimately seeking to improve children’s performance in school.

Researchers have reported that affluent parents tend to hold their summer-born children out of school more often than do low SES parents (Meisels, 1992). If that is the case, then children who may be at academic risk from factors associated with poverty face the additional hurdle of being compared to advantaged children who are 12 to 15 months older. Little research exists regarding the consequence of raising the minimum
entrance age and the imposition of additional childcare costs on families whose children are forced to stay out of school for an additional year, or on the families who believe that their child would benefit from waiting an extra year to begin school.

When some children are held out, they are not always given the benefit of access to quality childcare. There is evidence that disadvantaged children at preschool ages are less likely to be in high-quality care when compared to advantaged children (Federal Interagency Forum on Child and Family Statistics, 2001). This differential access to high-quality care may widen disparities in school readiness and achievement between advantaged and disadvantaged children when children are forced by policy, or by their parents' choice, to stay out of school for an additional year (Datar, 2006).

Age of entry could make a particularly significant difference for disadvantaged children, who, if not enrolled in school, may not be able to attend a high quality preschool or day care. This current research may guide state policy makers in designing better entrance-age policies that will take into account the effect of entrance-age and its impact upon the achievement gap between advantaged and disadvantaged children.

Summary

Policy makers and educators have long debated the best age for school entrance. Studies concerning the effect of age-of-entry on academic achievement typically are one of three types. The first two types provide information about the common practice of delaying children’s entrance and having an advantage or disadvantage of being in the older or younger sides of the age distribution based on a cutoff date. The third type of study provides information about the comparison of children who are at the same grade but who differ in age, with an age span of one year.
In sum, the findings of the studies have not clearly indicated one preferable age over any other. The literature review has yielded inconsistent findings. Comparisons of delayed-entry children with on-time children do not suggest that delayed entry is advantageous. Researchers have found that delayed entrants perform the same or, in some cases, worse than on-time students. Holding a student out is more prevalent among high SES families and delaying children’s entry does not appear to enhance the possibility of increased achievement. However, as previously mentioned, it is difficult to determine from the published research whether these students would be more at advantage or disadvantage had they not been delayed.

The second type of studies involves children who have a birthday in the same year, but who are relatively older or younger than their peers when they start kindergarten. In these studies, the question was whether or not the youngest students in the class are at an academic disadvantage. These results of these studies have been inconsistent. Some investigations found no entry-age effect on children’s academic achievement, while others found achievement differences between younger and older children at the beginning of the school year or during early elementary years. It was also documented, however, that any differences vanished by the later elementary years.

The third type of studies targeted the concept of schooling versus maturation. In these studies, researchers made two comparisons. The first comparison was with children who were at the same age in different grades, keeping age constant. The second comparison was children at the same grade level but in different age groups, keeping schooling constant. The researchers found that, on average, the effect of schooling is larger than the effect of age.
Some methodological concerns were evident in the studies. In the studies reviewing redshirted students, researchers noted that children who were held out of school do not represent a random sample. The factors that influence parents' decisions or the qualities of the individual child would probably affect the children's school performance. With regard to all three types of methodologies, only a limited number of age-of-entry studies have controlled other highly prominent variables, such as SES and gender, which has resulted in the lack of knowledge of whether these variables can explain achievement differences more than kindergarten entrance age can. Sample sizes and comparisons are also concerns. An issue with current studies regarding age-of-entry to kindergarten is that few report effect sizes. Even when reported, the magnitude of the differences favoring older children is very small.

**Conclusion**

Whether children are ready for schooling at a certain age has been a dominant concern for a long time. The research on the relationship between kindergarten entry-age and academic achievement has been plentiful, but the results are contradictory. Each study reviewed in this literature review has its own strengths and weaknesses. However, in putting them all together, and after reviewing the various and conflicting studies and theories, the reviewer determined that it was necessary to conduct a more systematic and closer examination of the findings. The existing research, theories, and literature have provided little insight into what is the optimal age for a student to begin school. Age is not the only factor that affects achievement; therefore, gender and SES were controlled in this present study. Because the majority of studies indicated differences in the early grades, the focus of the present examination was to review studies with findings beyond
the first years of school, through middle school. Finally, the study used data from an experiment where children were randomly assigned to different class conditions at the start of school. In the present study the researcher will seek to determine if there are advantages or disadvantages to being the youngest or oldest in a class and if age-of-entry can predict future success in school.
Chapter III

Design and Methods

The purpose of this study was to examine, through quantitative methods, the relationship between kindergarten entrance age and school achievement as determined by test scores. This chapter presents the design and methods used to investigate the cause and effect relationships between age-of-entry in kindergarten and later academic achievement. Sections in this chapter include design of the study and the methods used, including population, instrumentation, design, data analysis, and hypotheses.

The ages of entering kindergarten students vary greatly within classes and school districts. There is a need to determine the cause and effect relationship between kindergarten entry age of students and achievement in reading and math as measured by standardized test scores. The factors of gender and socioeconomic status (SES) of parents and family are also part of the study. Due to the lack of empirical data and legislative disputes over kindergarten entry age, the present study focuses on the effect of a child's age when entering into kindergarten and the students' subsequent reading and mathematics standardized test scores at the middle school level.

Design

The researcher examined the kindergarten entry age of students and their scores on eighth grade standardized assessments, while also investigating the effect of the independent variables of gender and SES (of the family). This investigation is a nonexperimental, retrospective, explanatory design (Johnson, 2001).

The study uses nonexperimental, quantitative research. Kerlinger (1986) defines nonexperimental research as:
A systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable. Inferences about relations among variables are made, without direct intervention, from concomitant variation of independent variables and dependent variables (p. 348).

In nonexperimental research, random assignment to groups is missing. This means that nonexperimental researchers must study the world as it naturally occurs. It has been noted (Kerlinger, 1986; Johnson, 2008) that because nonexperimental researchers cannot randomly assign research participants to experimental and control groups, a red flag should pop up that nonexperimental research cannot provide evidence for causality that is as strong as evidence obtained in experimental research. Random assignment is a procedure that makes assignments to conditions on the basis of chance (Johnson, 2008). Thus, random assignment maximizes the probability that potentially confounding extraneous variables, known and unknown, will not systematically bias results of the analyses. Random assignment provides the ability to control for both known and unknown potentially confounding extraneous variables and is the scientific procedure that should be used whenever and wherever possible (Johnson, 2008).

A typical major weakness and threat to internal validity of nonexperimental studies is the lack of randomization; however, it is not an issue for this nonexperimental investigation because STAR was a large-scale randomized experiment that provided data from a random population. Therefore, this current study used the STAR randomized database in an effort to strengthen the results of the investigation. Thus, the data used for this study come from a randomized data base. Evidence for causality is much stronger than for a typical nonexperimental study in this investigation, since the STAR study was a randomized experiment.
According to Johnson (2001), it is helpful to classify nonexperimental quantitative research by the primary objective or research purpose, as well as classifying by the time dimension. This present study is classified as explanatory (primary objective), retrospective (time dimension) research. In explanatory research, researchers are interested in testing hypotheses and theories that explain how and why a phenomenon operates as it does (Pedhazur, 1997). According to Johnson (2008), the researchers’ goal in explanatory research is to understand the phenomenon being studied and to establish evidence for cause-and-effect relationships. When studying cause and effect, the time dimension for researchers is a concern. In other words, it is a necessary condition for establishing cause and effect only if variable A affects variable B whereas variable A occurred before variable B. Johnson (2008) noted that in retrospective research, the researcher typically starts with the dependent variable (i.e., the observed outcome of academic achievement) and then moves backward in time, locating information on variables (i.e., age, gender, SES) that help to explain individuals’ statuses on the dependent variable.

This study asks the question of whether age, gender, and SES have effects on academic achievement. This is a retrospective, explanatory research study because the purpose is explanation (examining the possible causes of academic achievement) and the data were retrospective (based on past data collected for an experimental study).

Participants

The participants were from the population of students who were part of the STAR (Student-Teacher Achievement Ratio) randomized, long-term experiment. The STAR experiment, initiated in Tennessee in the fall of 1985, was a large-scale, four-year
experiment, with follow-up. Although the original purpose of STAR was to study the effects of reduced class size, because of the longitudinal scientific data rich with information, the STAR database is ideal for the present study. STAR included a total of 79 participating schools in 42 school systems throughout Tennessee. According to the STAR fact sheet, schools from inner city, rural, urban, and suburban locations were included in the experiment. For each participating class, STAR researchers randomly assigned students to classes, thereby making classmates’ ages unpredictable on the basis of their own characteristics and thus generating exogenous variation in relative age (Cascio & Schazenbach, 2007). In addition to randomly assigning students, teachers were randomly assigned to three different class types: small (with a target enrollment of 13-17 students), regular (with target enrollment of 22-25 students), and regular classes with a full-time teacher’s aide. Randomization rarely happens in practice since school administrators may match incoming kindergartners and teachers to classes based on maturity or because parents may lobby to have their children placed in classes where they are among the eldest students (Cascio & Schanzenbach, 2007). STAR was categorized as a randomized experiment employing post-test analysis only (Campbell & Stanley, 1963). Use of this type of control-group design is only feasible in experiments where true randomization is possible. The STAR experiment meets the decisive factors of experimental Design 6, as written in Campbell and Stanley (1963). Data are available for students participating in STAR on achievement tests in kindergarten through eighth grade. The experiment ended in 1989; however, student achievement data collection continued through high school and beyond.


**Instrumentation**

The present study analyzed the various factors of kindergarten entry age, gender, and socioeconomic status in order to determine their impact on the Grade 8 Comprehensive Test of Basic Skills (CTBS) reading and math scores. CTB/McGraw Hill publishing company develops the CTBS. CTBS is a norm-referenced achievement test that provides achievement scores that are valid for most types of education decision-making (CTB/McGraw Hill, 2000). Primarily, inferences from test results include measurement of achievement of individual students relative to a current nationwide norm group and relative program effectiveness based on the results of groups of students. According to the publishing company, the purpose of the CTBS is to assess student achievement in the areas of reading and mathematics. It is a group-administered subtest for students in grades k-12. Administration time ranges from two hours to six hours for the entire battery. It is a multiple-choice, timed standardized test with math and reading components. The CTBS was standardized on a nationally representative, stratified random sample based on geographic region, school size, SES, race/ethnicity, within public, parochial and private schools (CTB/McGraw Hill, 2000). The sampling techniques used for this standardized assessment ensure that any group of students represents the same proportion of the norm sample as is represented in the national student population as a whole.

**Data Analyses**

The data used in this study are characterized as existing data. The archived research data were originally used for investigative purposes. The variables in this study are not manipulated and the groups studied are randomly distributed. From the data
gathered, the relationships between the independent variables of age of entry, gender, and SES and the dependent variable of student achievement could be explored using two primary procedures. The first procedure involved gathering data on student achievement from the STAR database. The second procedure involved statistical analyses conducted to determine the relationship among the independent variables of entry age and SES and the dependent variable of eighth grade academic achievement. Analysis of data is gender specific. The male and female gender data were compared separately to determine the difference among gender, age of entry into kindergarten and academic achievement in later grades.

The study sample consisted of three groups. For the purpose of this study, the students were assigned to categories based on their ages on September 30 in months. This date was used since a Project STAR kindergartner whose birthday was on September 30 should have started school just before turning age five, while his/her counterpart born on October 1 should have been one full year older. At the time of data collection, Tennessee implemented a statewide cutoff date of September 30 for all incoming kindergartners. The students therefore fell into one of three age groups. The youngest group of children, group 1, included students who were 5 years of age to 5 years 3 months of age (60-63 months old). The next group of students was the middle entry-age group and included students who were 5 years 4 months old to 5 years 7 months old (64-67 months old). The third group was the oldest group reviewed and included students who were 5 years 8 months old to 5 years 11 months old+ (68-71+ months old). This oldest group also included students who were age-eligible to start school, but who had delayed entrance to kindergarten by a year.
The study used inferential statistics because parametrics will allow extension beyond the data to use the laws of probability to make inferences about populations based on a randomized sample. Data including CTBS scores, birth dates, gender, and SES classification were gathered from the STAR database. SES was determined by the students’ eligibility to receive free or reduced-cost meals, which was determined by the family income.

Data obtained from the Project STAR database were entered into a computer using the SPSS statistical software program. Independent samples t-tests were used to compare the mean scores of two groups on a given variable. For instance, an independent samples t-test was used to compare the means on a dependent variable (e.g., CTBS achievement score) for two independent groups (e.g., boys and girls). An independent samples t-test was performed to test the hypothesis for significant difference in the CTBS math and reading scores based on gender. Analysis of variance (ANOVA) permits comparison of two or more populations when interval or ratio variables are available for the population. ANOVA allows the researcher to compare the dispersion of samples in order to make inferences about their means. A one-way ANOVA compares the means of more than two populations based on a single treatment factor. In this study, a one-way ANOVA was performed to determine if there were statistically significant differences among the CTBS scores based on entry age. A two-way ANOVA for repeated measures was used when the subjects were subjected to repeated measures, or when the same subjects were used for each treatment. A two-way ANOVA was performed to determine the statistically significant differences among the CTBS scores based on SES, as well as the interactions between gender and entry age, and between SES
and entry age. All tests were performed at the .05 significance level or the 95% confidence level.

Because the study involved analysis of data found on a public database and there was no direct contact with any STAR students, there was no risk to the students. As a result, an Institutional Review Board (IRB) waiver was sought and obtained. Only data pertinent to this study were analyzed. These data included gender, kindergarten entry age in months, and the eighth grade standardized assessment scores. In addition, the SES of students was recorded in the STAR database by noting which students received free or reduced-cost lunches.

Table 1. Research Matrix

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Statistical Method</th>
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<tbody>
<tr>
<td>Impact of gender on academic achievement (reading and math)</td>
<td>Independent samples t-test</td>
</tr>
<tr>
<td>Impact of socioeconomic status on academic achievement (reading and math)</td>
<td>One-way ANOVA</td>
</tr>
<tr>
<td>Impact of age of entry and gender on academic achievement (reading and math)</td>
<td>Two-way ANOVA</td>
</tr>
<tr>
<td>Impact of age of entry and SES on academic achievement</td>
<td>Two-way ANOVA</td>
</tr>
</tbody>
</table>

The following null hypotheses were tested:

Ho1: There is no difference in eighth grade CTBS reading test scores based on students’ kindergarten entry age.

Ho2: There is no difference in eighth grade CTBS math test scores based on students’ kindergarten entry age.

Ho3: There is no difference in the eighth grade CTBS reading scores of students based on their gender.
Ho4: There is no difference in the eighth grade CTBS math scores of students based on their gender.

Ho5: There is no difference in the eighth grade CTBS reading test scores of students based on their kindergarten entry age and their gender.

Ho6: There is no difference in the eighth grade CTBS math scores of students based on their kindergarten entry age and their gender.

Ho7: There is no difference in the eighth grade CTBS reading scores of students based on their socioeconomic status as determined by eligibility for free or reduced price lunch.

Ho8: There is no difference in the eighth grade CTBS math scores of students based on their socioeconomic status as determined by eligibility for free or reduced price lunch.

Ho9: There is no difference in the eighth grade CTBS reading scores of students based on their kindergarten entry age and their socioeconomic status as determined by eligibility for free or reduced price lunch.

Ho10: There is no difference in the eighth grade CTBS math scores of students based on their kindergarten entry age and their socioeconomic status as determined by eligibility for free or reduced price lunch.
Chapter IV

Analysis of Data

This chapter presents the results of statistical analyses completed by the researcher to determine the effects of kindergarten entry age on reading achievement and math achievement in eighth grade. Reading and math achievement were determined using the Comprehensive Tests of Basic Skills (CTBS) reading scores and math scores. Findings are shown regarding gender and SES analyses.

The SPSS statistical software was used to analyze the data retrieved from the STAR database. All data were analyzed using a .05 level of significance. Data for the dependent variables were drawn from reading and math scores provided by the assessments administered in the spring of 1994. Additional information obtained from the STAR database included the following variables:

1. Student ID- participants were from 79 Tennessee schools in 42 districts. Student names were not identified. Students who participated in the regular class type (22-25 students) were selected for this study. Only students in the regular class type whose information also contained eighth grade reading and math CTBS scores were included in analyses.

2. Gender- participants were identified as male or female.

3. Entry age- participants were grouped into three categories according to their kindergarten entry age and birth month and birth year.

4. Socioeconomic status (SES) was determined by those students who qualified for free or reduced-price school meals and those who paid.
A total of 1,197 records were studied. As a requirement of STAR, schools from inner city, suburban, urban, and rural areas were included (Finn et al., 2007). Of the 1,197 students, 520 were male and 677 were female.

Table 2. Descriptive Statistics for Gender in STAR Database

<table>
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<th>Cumulative Percent</th>
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</tbody>
</table>

Students who were selected for this study were required to be at least five years old by September 30 in order to enter kindergarten in the STAR experiment. The following tables demonstrate kindergarten entry ages by month group (Table 3), followed by a crosstabulation of gender and month group (Table 4). The younger group includes students who were 60-63 months upon the start of kindergarten, the average group includes students who were 64-67 months upon the start of kindergarten, and the older group includes students who were 68 months or older when they began kindergarten.

Table 3. Descriptive Statistics of Entry Age by Month Groups

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>younger</td>
<td>365</td>
<td>30.5</td>
<td>30.5</td>
</tr>
<tr>
<td></td>
<td>average</td>
<td>436</td>
<td>36.4</td>
<td>66.9</td>
</tr>
<tr>
<td></td>
<td>older</td>
<td>396</td>
<td>33.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1197</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Descriptive statistics for Kindergarten Entry Age Groups by Gender

<table>
<thead>
<tr>
<th>STUDENT GENDER</th>
<th>monthgrp</th>
<th>younger</th>
<th>average</th>
<th>older</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>MALE</td>
<td>Count</td>
<td>150</td>
<td>186</td>
<td>184</td>
<td>520</td>
</tr>
<tr>
<td></td>
<td>% within STUDENT GENDER</td>
<td>28.8%</td>
<td>35.8%</td>
<td>35.4%</td>
<td>100.0%</td>
</tr>
<tr>
<td>FEMALE</td>
<td>Count</td>
<td>215</td>
<td>250</td>
<td>212</td>
<td>677</td>
</tr>
<tr>
<td></td>
<td>% within STUDENT GENDER</td>
<td>31.8%</td>
<td>36.9%</td>
<td>31.3%</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Count</td>
<td>365</td>
<td>436</td>
<td>396</td>
<td>1197</td>
</tr>
<tr>
<td></td>
<td>% within STUDENT GENDER</td>
<td>30.5%</td>
<td>36.4%</td>
<td>33.1%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

A total of 150 males were in the younger group, 186 males in the average age group and 184 in the older group. The female group consisted of 215 students in the younger group, 250 in the average group and 212 in the older group. The mean age for the male group was 66.01 months and the female group was 65.5 months (see Table 5).

Table 5. Descriptive Statistics of Kindergarten Entry Age in Months by Gender

<table>
<thead>
<tr>
<th>STUDENT GENDER</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MALE</td>
<td>66.0192</td>
<td>520</td>
<td>4.04879</td>
</tr>
<tr>
<td>FEMALE</td>
<td>65.4549</td>
<td>677</td>
<td>3.68948</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>65.7001</td>
<td>1197</td>
<td>3.85820</td>
</tr>
</tbody>
</table>

The measurements of achievement for this study were the scores of eighth grade CTBS reading and math. SPSS indicated a high score of 892 in reading, with a low score of 588. Table 6 shows descriptive statistics of reading and math scores, broken down by gender and month group. The means of the average and older groups of males scored similarly, in the 765 range, whereas the younger male group mean was slightly lower, at
The younger and older female groups had mean reading scores in the 765 range, while the average month group mean for the females was slightly higher at 766. In math, SPSS indicated a high score of 920 and a low score of 606. The younger and average age male groups means were in the same range at 790, but the older male group mean fell below that mean to a score of 785. The younger and average month group females scored in the 793 range for math, whereas the older group mean fell slightly below at 792. The bottom of Table 6 is an analysis of reading and math scores by month group. The means for reading of the average age month group were the highest, followed by the means of the older age month group, and then followed by the means of the younger age month group. For math, the means of the younger age group outscored the other two groups, with average group means slightly higher than the older group means.

Table 6. Descriptive Statistics for Eighth Grade Reading and Math CTBS Scores

<table>
<thead>
<tr>
<th>STUDENT GENDER Month Group</th>
<th>TOTAL MATH SCALE SCORE CTBS GRADE GRADE 8</th>
<th>TOTAL READING SCALE SCORE CTBS GRADE 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>MALE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>younger</td>
<td>Mean 790.26 149 45.827</td>
<td>Mean 763.97 150 40.859</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std. Deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>average</td>
<td>Mean 790.09 186 45.103</td>
<td>Mean 765.38 186 41.826</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std. Deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>older</td>
<td>Mean 785.64 184 51.819</td>
<td>Mean 765.49 184 49.269</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std. Deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Mean 788.56</td>
<td>Mean 765.01</td>
</tr>
</tbody>
</table>

(Table 6 continues)
In addition to age and gender, the demographic variable of SES was included, as determined by the eligibility for free or reduced lunch meals in the public school system.

Table 7 shows the percentage of male students and female students who received free or reduced lunch status. In total, 42.3% of the males received free/reduced lunch, and 57.7% of the females received free/reduced lunch.
In this study, 1,197 students took the eighth grade CTBS math and reading assessments. The descriptive statistics indicated that the mean reading score for the free/reduced lunch group was 750.21, and the mean reading score for the non-free lunch group was 775.03. The descriptive statistics further indicated that the mean math score for the free/reduced lunch group was 776.42, and the mean math score for the non-free lunch group was 800.45 (see Table 8).
Table 8. Descriptive Statistics for Reading and Math Scores Based on SES

<table>
<thead>
<tr>
<th>FREE/REDUCED LUNCH STATUS</th>
<th>TOTAL MATH SCALE SCORE CTBS</th>
<th>TOTAL READING SCALE SCORE CTBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>KINDERGARTEN</td>
<td>TOTAL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATH</td>
<td>READING</td>
</tr>
<tr>
<td></td>
<td>SCALE</td>
<td>SCALE</td>
</tr>
<tr>
<td></td>
<td>SCORE</td>
<td>SCORE</td>
</tr>
<tr>
<td></td>
<td>CTBS</td>
<td>CTBS</td>
</tr>
<tr>
<td></td>
<td>GRADE 8</td>
<td>GRADE 8</td>
</tr>
<tr>
<td>FREE LUNCH</td>
<td>Mean</td>
<td>776.42</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>463</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>45.950</td>
</tr>
<tr>
<td>NON-FREE LUNCH</td>
<td>Mean</td>
<td>800.45</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>734</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>42.354</td>
</tr>
<tr>
<td>Total</td>
<td>Mean</td>
<td>791.15</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>1196</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>45.301</td>
</tr>
</tbody>
</table>

The descriptive statistics for the reading and math scores of students in all three age groups with SES is shown in Table 9. In both reading and math, the younger students who received free/reduced lunch scored higher than the average and older age groups who received free/reduced lunch. The non-free lunch students outscored their free/reduced counterparts in all age groups for both reading and math.
Table 9. Descriptive Statistics for Reading and Math Scores Based on SES and Age by Month Groups

<table>
<thead>
<tr>
<th>FREE/REDUCED LUNCH STATUS KINDERGARTEN</th>
<th>monthgrp</th>
<th>TOTAL MATH SCALE</th>
<th>TOTAL READING SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREE LUNCH younger Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>154</td>
<td>154</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>42.825</td>
<td>34.807</td>
</tr>
<tr>
<td>average Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>156</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>46.866</td>
<td>41.858</td>
</tr>
<tr>
<td>older Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>153</td>
<td>153</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>47.452</td>
<td>42.546</td>
</tr>
<tr>
<td>total Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>463</td>
<td>463</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>45.950</td>
<td>39.887</td>
</tr>
<tr>
<td>non-FREE LUNCH younger Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>210</td>
<td>211</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>41.161</td>
<td>35.532</td>
</tr>
<tr>
<td>average Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>280</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>40.844</td>
<td>38.269</td>
</tr>
<tr>
<td>older Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>243</td>
<td>243</td>
</tr>
</tbody>
</table>

(Table 9 continues)
Table 10 shows the descriptive statistics for the reading and math scores of male and female students with SES. In both reading and math, the male and female non-free lunch students outscored the free/reduced students.
Table 10. Descriptive Statistics for Reading and Math Scores Based on SES and Gender

<table>
<thead>
<tr>
<th>FREE/REDUCED LUNCH STATUS KINDERGARTEN</th>
<th>STUDENT GENDER</th>
<th>TOTAL MATH SCALE SCORE CTBS GRADE 8</th>
<th>TOTAL READING SCALE SCORE CTBS GRADE 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MALE</td>
<td>777.59</td>
<td>751.68</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>196</td>
<td>196</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>50.845</td>
<td>42.624</td>
</tr>
<tr>
<td></td>
<td>FEMALE</td>
<td>775.56</td>
<td>749.13</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>267</td>
<td>267</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>42.075</td>
<td>37.797</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>776.42</td>
<td>750.21</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>463</td>
<td>463</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>45.950</td>
<td>39.887</td>
</tr>
<tr>
<td></td>
<td></td>
<td>795.22</td>
<td>773.08</td>
</tr>
<tr>
<td></td>
<td>MALE</td>
<td>323</td>
<td>324</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>44.547</td>
<td>43.337</td>
</tr>
<tr>
<td></td>
<td>FEMALE</td>
<td>804.56</td>
<td>776.57</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>410</td>
<td>410</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>40.121</td>
<td>34.434</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>800.45</td>
<td>775.03</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>733</td>
<td>734</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>42.354</td>
<td>38.629</td>
</tr>
</tbody>
</table>

Null Hypothesis 1

Ho1: There is no difference in eighth grade reading test scores based on students’ kindergarten entry age.
All students (N=1,197) were placed into one of three groups based on their age of entry to kindergarten. The mean reading score for the younger group (60-63 months) was 764.78, the mean score for the average age group (64-67 months) was 765.99 and the mean score for the older age group (68+ months) was 765.40.

A one-way analysis of variance (ANOVA) for the data of the three age groups in tests of between-subjects effects resulted in a p value of 0.918. Since this is greater than the alpha of 0.05, the null hypothesis was retained. There was no significant difference in the reading scores based on entry ages (Table 11). Additionally, Levene’s statistic was used to meet the assumption of variance homogeneity (see Appendix A). The ANOVA statistical analysis assumes that variances are equal across groups or samples. Levene’s test of homogeneity of variance is used to test the ANOVA assumption that each group has the same variance. Levene’s test of homogeneity was not significant at the 0.05 level; as a result, the ANOVA assumption that variances were equal across groups was met. A post-hoc test is needed after an ANOVA is completed. Tukey’s post-hoc test, which finds the differences between the means of all groups, determined that there were no significant differences between the means. Effect sizes were calculated using Cohen’s formula (Cohen, 1988). Cohen’s d effect size is the difference between the mean of the treatment group minus the mean of the control group divided by the pooled standard deviation. There were age differences in eighth grade reading scores. Among age groups, average age students outperformed older students, who outperformed younger students. The mean difference between the average and oldest students was .44, with a small effect size of d= 0.01. The mean difference between oldest and youngest students was .62, with a small effect size of d=0.01. The mean difference between youngest and
average students was 1.18, with a small effect size of \( \text{d}=0.03 \). Confidence intervals around effect sizes were also calculated. This statistic provides valuable information in that it indicates the spread in the data around the mean effect size. The confidence interval represents the likely range of the true population mean effect size, based on the data obtained from the sample. The confidence interval for the effect size for the average and oldest students spanned zero (-3.89-4.35). The confidence interval for the effect size for the youngest and average students spanned zero as well, (-3.74-3.92). Similarly, the confidence interval for the effect size for the youngest and oldest students spanned zero (-3.74-4.11). The calculations of the confidence interval for the effect sizes support the findings of the test as nonsignificant.

Table 11. Effect of Kindergarten Entry Age on CTBS Eighth Grade Reading Scores

### ANOVA

<table>
<thead>
<tr>
<th>Total Reading Scale Score</th>
<th>CTBS Grade 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum of Squares</td>
<td>df</td>
</tr>
<tr>
<td>Between Groups</td>
<td>288.802</td>
</tr>
<tr>
<td>Within Groups</td>
<td>2003338.198</td>
</tr>
<tr>
<td>Total</td>
<td>2003626.999</td>
</tr>
</tbody>
</table>

**Null Hypothesis 2**

**Ho2:** There is no difference in eighth grade CTBS math test scores based on students' kindergarten entry age.

All students \( (N=1,197) \) were placed into one of three groups based on their age of entry to kindergarten. The mean math score for the younger group (60-63 months) was 791.98, the mean score for the average age group (64-67 months) was 792.12 and the mean score for the older age group (68+ months) was 789.31.
A one-way ANOVA was used to analyze the data of the three age groups in tests of between-subjects effects. The resulting p value was 0.613. Since this is greater than the alpha of 0.05, the null hypothesis was retained. There was no significant difference in the math scores based on entry ages (Table 12). Additionally, Levene’s statistic was used to meet the assumption of variance homogeneity (see Appendix A). Levene’s test of homogeneity was not significant at the .05 level; as a result, the ANOVA assumption that variances were equal across groups was met. Tukey’s post-hoc analysis showed no significant differences between the means. Effect sizes calculated using Cohen’s formula (Cohen, 1988) showed age differences in eighth grade math scores. Among age groups, average age students outperformed younger students, who outperformed the oldest students. The mean difference between the average and oldest students was 2.81, with a small effect size of $d=0.06$. The mean difference between oldest and youngest students was 2.67, with a small effect size of $d=0.05$. The mean difference between youngest and average students was .86, with a small effect size of $d=0.00$. Confidence intervals around effect sizes were also calculated. The confidence interval for the effect size for the average and oldest students spanned zero ($-4.12$-$4.84$). The confidence interval for the effect size for the youngest and average students spanned zero as well, ($-4.38$-$4.18$). Similarly, the confidence interval for the effect size for the youngest and oldest students spanned zero ($-4.31$-$4.84$). The calculations of the confidence interval for the effect sizes support the findings of the test as nonsignificant.
Table 12. Effect of Kindergarten Entry Age on CTBS Eighth Grade Math Scores

ANOVA

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2008.568</td>
<td>2</td>
<td>1004.284</td>
<td>.489</td>
<td>.613</td>
</tr>
<tr>
<td>Within Groups</td>
<td>2450376.117</td>
<td>1193</td>
<td>2053.962</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2452384.686</td>
<td>1195</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Null Hypothesis 3

Ho3: There is no difference in eighth grade reading test scores of students based on their gender.

An independent samples t-test was conducted to determine the significance of gender on the reading scores of the eighth grade students. The mean of the male student scores for reading was 765.01. The mean of the female student scores for reading was 765.75. The mean difference between males and females was -0.736, with a p-value of 0.758. Since this is greater than the alpha of 0.05, the null hypothesis was retained. There was no significant difference in the reading scores based on gender. Effect sizes were calculated using Cohen’s formula (Cohen, 1988). There were gender differences in eighth grade reading scores. Female students performed better than did male students, yet the effect size was small (d=0.14). Confidence intervals around effect sizes were also calculated. The confidence interval for the effect size for the male and female students spanned zero (-3.82-2.86). The calculations of the confidence interval for the effect sizes support the findings of the test as nonsignificant. Table 13 illustrates the statistical results from the t-test.
Table 13. Effect of Gender on CTBS Eighth Grade Reading Scores

<table>
<thead>
<tr>
<th>TOTAL READING SCALE SCORE CTBS GRADE 8</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>Std. Error Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal variances assumed</td>
<td>-.308</td>
<td>1195</td>
<td>.758</td>
<td>-.736</td>
<td>2.388</td>
</tr>
</tbody>
</table>

Null Hypothesis 4

Ho4: There is no difference in the eighth grade CTBS math scores of students based on their gender.

An independent samples t-test was conducted to determine the significance of gender on the math scores of the eighth grade students. The mean of the male student scores for math was 788.56. The mean of the female student scores for math was 793.13. The mean difference between males and females was -4.56, with a p-value of 0.084. Since this is greater than the alpha of 0.05, the null hypothesis was retained: there was no significant difference in the math scores based on gender. Effect sizes were calculated using Cohen's formula (Cohen, 1988). There were gender differences in means of the eighth grade math scores. Female students performed better than male students, yet the effect size was small (Cohen's effect size, d=0.10). Confidence intervals around effect sizes were also calculated. The confidence interval for the effect size for the male and female students spanned zero (-4.21-3.16). The calculations of the confidence interval for the effect sizes support the findings of the test as nonsignificant. Table 13 illustrates the statistical results from the t-test. Table 14 illustrates the statistical results from the t-test.
Table 14. Effect of Gender on CTBS Eighth Grade Math Scores

<table>
<thead>
<tr>
<th>TOTAL MATH SCALE SCORE CTBS GRADE 8</th>
<th>Equal variances assumed</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>Std. Error Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-1.728</td>
<td>1194</td>
<td>.084</td>
<td>-4.563</td>
<td>2.641</td>
</tr>
</tbody>
</table>

Null Hypothesis 5

Ho5: There is no difference in the eighth grade CTBS reading scores of students based on students' kindergarten entry age and students' gender.

A two-way analysis of variance was conducted to determine the significance of gender and kindergarten entry-age on the eighth grade CTBS reading scores. The resulting p-value of gender and entry age combined was 0.963 (see Table 15). Since the p-value was greater than 0.05, the null hypothesis was retained. There is no significant difference in the eighth grade CTBS reading test scores of students based on their kindergarten entry age and their gender. Levene’s test of homogeneity was significant at the 0.05 level; as a result, the ANOVA assumption that variances were equal across groups was not met and the obtained differences in sample variances are unlikely to have occurred based on random sampling.

This analysis determined if there is a difference in eighth grade reading scores when comparing gender and age of entry groups. Effect sizes were calculated using Cohen’s formula (Cohen, 1988). In the female group, average age students outperformed younger students, who outperformed oldest students. The mean difference between the youngest and oldest female students was 0.02 with a small effect size of $d=0.00$. The mean difference between oldest and average female students was 1.11, with a small effect size of $d=0.03$. The mean difference between youngest and average female students was 1.09,
with a small effect size of $d=0.03$. In the male group, there were differences in eighth grade reading scores when comparing gender and age of entry. The oldest male students outperformed the average age male students, who outperformed the youngest male students. The mean difference between the oldest and average male students was 0.11, with a small effect size of $d=0.00$. The mean difference between oldest and youngest male students was 1.52, with a small effect size of $d=0.03$. The mean difference between the average and youngest male students was 3.14, with a small effect size of $d=0.03$.

Confidence intervals around effect sizes were also calculated. The confidence interval for the effect size for the average and oldest male students spanned zero (-6.01-7.12). The confidence interval for the effect size for the youngest and average male students spanned zero as well, (-6.57-5.98). Similarly, the confidence interval for the effect size for the youngest and oldest male students spanned zero (-6.57-7.08). The confidence interval for the effect size for the average and oldest female students spanned zero (-5.15-5.25). The confidence interval for the effect size for the youngest and average female students spanned zero as well, (-4.45-5.15). Similarly, the confidence interval for the effect size for the youngest and oldest female students spanned zero (-4.42-5.23). The calculations of the confidence intervals for the effect sizes support the findings of the test as nonsignificant.
Table 15. Effect of Kindergarten Entry Age and Gender on CTBS Eighth Grade Reading Scores

Tests of Between-Subjects Effects
Dependent Variable: TOTAL READING SCALE SCORE CTBS GRADE 8

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
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<td>116.006</td>
<td>.069</td>
<td>.997</td>
</tr>
<tr>
<td>Intercept</td>
<td>6.836E8</td>
<td>1</td>
<td>6.836E8</td>
<td>406461.295</td>
<td>.000</td>
</tr>
<tr>
<td>gender</td>
<td>169.152</td>
<td>1</td>
<td>169.152</td>
<td>.101</td>
<td>.751</td>
</tr>
<tr>
<td>monthgrp</td>
<td>302.697</td>
<td>2</td>
<td>151.349</td>
<td>.090</td>
<td>.914</td>
</tr>
<tr>
<td>gender *</td>
<td>126.713</td>
<td>2</td>
<td>63.357</td>
<td>.038</td>
<td>.963</td>
</tr>
<tr>
<td>monthgrp</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>2003046.968</td>
<td>1191</td>
<td>1681.819</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7.033E8</td>
<td>1197</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Corrected Total</td>
<td>2003626.999</td>
<td>1196</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .000 (Adjusted R Squared = -.004)

Null Hypothesis 6

Ho6: There is no difference in the eighth grade CTBS math scores of students based on their kindergarten entry age and their gender.

A two-way ANOVA was conducted to determine the significance of gender and kindergarten entry age on the eighth grade CTBS math scores. The resulting p-value of gender and entry age combined was 0.810. (see Table 16). Since the p-value was greater than 0.05, the null hypothesis was not rejected. There is no significant difference in the eighth grade CTBS math test scores of students based on their kindergarten entry age and their gender. Levene's test of homogeneity was not significant at the .05 level; as a result, the ANOVA assumption that variances were equal across groups was met.

Effect sizes were calculated using Cohen's formula (Cohen, 1988). In the female group, average age students outperformed younger students, who outperformed oldest students. The mean difference between the youngest and oldest female students was 4.62, with a
small effect size of $d=0.02$. The mean difference between oldest and average female students was 1.15, with a small effect size of $d=0.03$. The mean difference between youngest and average female students was 0.48, with a small effect size of $d=0.01$. In the male group, there were differences in eighth grade math scores when comparing gender and age of entry. The youngest male students outperformed the average age male students, who outperformed the oldest male students. The mean difference between the youngest and average male students was 0.17, with a small effect size of $d=0.00$. The mean difference between average age and oldest male students was 4.45, with a small effect size of $d=0.09$. The mean difference between the youngest and oldest male students was 4.62, with a small effect size of $d=0.09$. Confidence intervals around effect sizes were also calculated. The confidence interval for the effect size for the average and oldest male students spanned zero (-6.39-7.58). The confidence interval for the effect size for the youngest and average male students spanned zero as well, (-7.35-6.49). Similarly, the confidence interval for the average and oldest female students spanned zero (-5.44-6.12). The confidence interval for the youngest and average female students spanned zero as well, (-5.40-5.46). Similarly, the confidence interval for the youngest and oldest female students spanned zero (-5.37-6.11). The calculations of the confidence interval for the effect sizes support the findings of the test as nonsignificant.
Table 16. Effect of Kindergarten Entry Age and Gender on CTBS Eighth Grade Math Scores

**Tests of Between-Subjects Effects**

Dependent Variable: TOTAL MATH SCALE SCORE CTBS GRADE 8

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>8703.985*</td>
<td>5</td>
<td>1740.797</td>
<td>.848</td>
<td>.516</td>
</tr>
<tr>
<td>Intercept</td>
<td>7.289E8</td>
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<td>7.289E8</td>
<td>354975.642</td>
<td>.000</td>
</tr>
<tr>
<td>gender</td>
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<td>5717.881</td>
<td>2.784</td>
<td>.095</td>
</tr>
<tr>
<td>monthgrp</td>
<td>1956.673</td>
<td>2</td>
<td>978.336</td>
<td>.476</td>
<td>.621</td>
</tr>
<tr>
<td>gender *</td>
<td>863.364</td>
<td>2</td>
<td>431.682</td>
<td>.210</td>
<td>.810</td>
</tr>
<tr>
<td>monthgrp</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>2443680.700</td>
<td>1190</td>
<td>2053.513</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
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<td></td>
<td></td>
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<tr>
<td>Corrected Total</td>
<td>2452384.686</td>
<td>1195</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .004 (Adjusted R Squared = -.001)

Null Hypothesis 7

Ho7: There is no difference in the eighth grade CTBS reading scores of students based on their SES.

A one-way ANOVA was done to determine the significance of SES on the eighth grade CTBS reading scores. The mean score of the free/reduced lunch students was 750.21, whereas the mean score of the non-free students was 775.03. As indicated in Table 17, the p-value of SES on reading scores was less than 0.05. As a result, the null hypothesis was rejected. According to the analysis, SES did have a significant effect on eighth grade reading scores. Levene's test of homogeneity was not significant at the 0.05 level; as a result, the ANOVA assumption that variances were equal across groups was met.

Effect sizes were calculated using Cohen's formula (Cohen, 1988). According to Cohen (1992), effect sizes of 0.20 are small, 0.50 are moderate, and 0.80+ are large.
There were SES differences in eighth grade reading scores. Non-free lunch students performed better than free/reduced lunch students. The Cohen's effect size was $d=0.63$. Confidence intervals around effect sizes were also calculated. The confidence interval for the effect size for the non-free lunch students and free/reduced lunch students was $-4.27-2.16$. Therefore, based on this sample of data, it is estimated that the true effect size in the population from which the sample is taken is 95% certain to be in the range of $-4.27-2.16$. Since it could be zero, the observed effect size of 0.63 could have been obtained by chance.

Table 17. Effect of SES on CTBS Eighth Grade Reading Scores

<table>
<thead>
<tr>
<th>ANOVA Table</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>TOTAL READING</td>
</tr>
<tr>
<td>SCALE SCORE CTBS</td>
</tr>
<tr>
<td>GRADE 8 *</td>
</tr>
<tr>
<td>FREE/REduced LUNCH STATUS</td>
</tr>
</tbody>
</table>

Null Hypothesis 8

$H_08$: There is no difference in the eighth grade CTBS math scores of students based on their SES.

A one-way ANOVA was carried out to determine the significance of SES on the eighth grade CTBS math scores. The mean score of the free/reduced lunch students was 776.42, whereas the mean score of the non-free students was 800.45. As indicated in Table 18, the p-value of SES on reading scores was less than 0.05. As a result, the null hypothesis was rejected. According to the analysis, SES did have a significant effect on eighth grade math scores. Levene's test of homogeneity was not significant at the 0.05
level; as a result, the ANOVA assumption that variances were equal across groups was met.

Effect sizes were calculated using Cohen's formula (Cohen, 1988). There were SES differences in eighth grade math scores. Non-free lunch students performed better than free/reduced lunch students. The effect size was moderate; $d=0.54$. The confidence interval for the effect size for the non-free lunch students and free/reduced lunch students was -4.73-2.52. Therefore, based on this sample of data, it is estimated that the true effect size in the population from which the sample is taken is 95% certain to be in the range of -4.73-2.52. Since it could be zero, the observed effect size of .54 could have been obtained by chance.

Table 18. Effect of SES on CTBS Eighth Grade Math Scores

<table>
<thead>
<tr>
<th>ANOVA Table</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
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<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>163786.692</td>
<td>85.450</td>
</tr>
<tr>
<td>SCALE SCORE CTBS GROUPS</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRADE 8 *</td>
<td>Within Groups</td>
<td>2288597.994</td>
<td>1194</td>
<td>1916.749</td>
<td></td>
</tr>
<tr>
<td>FREE/REDUCED LUNCH STATUS</td>
<td>Total</td>
<td>2452384.686</td>
<td>1195</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Null Hypothesis 9

$H_09$: There is no difference in the eighth grade CTBS reading scores of students based on their kindergarten entry age and their SES.

A two-way ANOVA was carried out to determine the significance of SES and kindergarten entry age on the CTBS eighth grade reading scores. The mean scores of the free/reduced lunch students were as follows: younger group 753.77, average group
748.08, and older group 748.80. The mean scores of the non-free lunch students were as follows: younger group 772.82, average group 775.96, and older group 775.86. As illustrated in Table 19, the p-value of SES and age of entry combined was 0.24. Therefore, the null hypothesis was retained. According to the analysis, the combined variables of SES and kindergarten entry age did not have a significant effect on eighth grade CTBS reading scores. Levene's test of homogeneity was not significant at the .05 level; as a result, the ANOVA assumption that variances were equal across groups was met.

Effect sizes were calculated using Cohen's formula (Cohen, 1988). It has already been established that there were statistically significant differences in math and reading scores when analyzing the relationship between SES and academic performance. This analysis determined if there is a difference in eighth-grade reading scores when comparing SES and age of entry. In the free/reduced lunch group, younger students outperformed older students, who outperformed average age students. The mean difference between the youngest and oldest students was 4.90, with a small effect size of $d=0.13$. The mean difference between oldest and average students was 0.72, with a small effect size of $d=0.02$. The mean difference between youngest and average students was 5.69, with a small effect size of $d=0.15$. In the non-free lunch group, there were differences in eighth grade reading scores when comparing SES and age-of-entry. In the non-free lunch group, average students outperformed oldest students, who outperformed youngest students. The mean difference between the average and oldest students was 0.10, with a small effect size of $d=0.00$. The mean difference between oldest and youngest students was 3.04, with a small effect size of $d=0.08$. The mean difference
between the average and youngest students was 3.14, with a small effect size of $d=0.09$. Confidence intervals around effect sizes were also calculated. The confidence interval for the effect size for the average and oldest free/reduced lunch students spanned zero (-6.58-6.72). The confidence interval for the effect size for the youngest and average free/reduced lunch students spanned zero as well, (-5.37-6.70). Similarly, the confidence interval for the effect size for the youngest and oldest free/reduced lunch students spanned zero (-5.37-6.87). The confidence interval for the effect size for the average and oldest non-free lunch students spanned zero (-4.48-5.23). The confidence interval for the effect size for the youngest and average non-free lunch students spanned zero as well, (-4.88-4.40). Similarly, the confidence interval for the effect size for the youngest and oldest non-free lunch students spanned zero (-4.87-5.15). The calculations of the confidence intervals for the effect sizes support the findings of the test as nonsignificant.
null hypothesis was not rejected. According to the analysis, the combined
variables of SES and kindergarten entry age did not have a significant effect on eighth grade CTBS math scores. Levene’s test of homogeneity was not significant at the .05 level; as a result, the ANOVA assumption that variances were equal across groups was met.

It has already been established that there are statistically significant differences in math and reading scores when analyzing the relationship between SES and academic performance. This analysis determined if there was a difference in eighth grade math scores when comparing SES and age of entry. Effect sizes were calculated using Cohen’s formula (Cohen, 1988). In the free/reduced group, younger students outperformed average students, who outperformed oldest age students. The mean difference between the youngest and oldest students was 12.57, with a notable effect size of $d = 0.28$. The mean difference between oldest and average students was 6.95, with a small effect size of $d = 0.15$. The mean difference between youngest and average students was 5.62, with a small effect size of $d = 0.13$. In the non-free lunch group, there were differences in eighth grade math scores when comparing SES and age of entry. In the non-free lunch group, oldest students outperformed average age students, who outperformed youngest students. The mean difference between the average and oldest students was 0.89, with a small effect size of $d = 0.02$. The mean difference between oldest and youngest students was 2.59, with a small effect size of $d = 0.06$. The mean difference between the average and youngest students was 1.70, with a small effect size of $d = 0.04$. Confidence intervals around effect sizes were also calculated. The confidence interval for the effect size for the average and oldest free/reduced lunch students spanned zero (-7.21-7.67). The confidence interval for the effect size for the youngest and
average free/reduced lunch students spanned zero as well, (-6.64-7.48). Similarly, the confidence interval for the effect size for the youngest and oldest free/reduced lunch students spanned zero (-6.48-7.80). The confidence interval for the effect size for the average and oldest non-free lunch students spanned zero (-4.80-5.65). The confidence interval for the effect size for the youngest and average non-free lunch students spanned zero as well, (-5.67-4.74). Similarly, the confidence interval for the effect size for the youngest and oldest non-free lunch students spanned zero (-5.69-5.61). The calculations of the confidence intervals for the effect sizes support the findings of the test as nonsignificant.

Table 20. Effect of SES and Kindergarten Entry Age on CTBS Eighth Grade Math Scores

Tests of Between-Subjects Effects
Dependent Variable: TOTAL MATH SCALE SCORE CTBS GRADE 8

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
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<td>35348.184</td>
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<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
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<td>7.017E8</td>
<td>366938.206</td>
<td>.000</td>
</tr>
<tr>
<td>freelunch</td>
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<td>162069.977</td>
<td>84.751</td>
<td>.000</td>
</tr>
<tr>
<td>monthgrp</td>
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<td>2326.608</td>
<td>1.217</td>
<td>.297</td>
</tr>
<tr>
<td>freelunch * monthgrp</td>
<td>10508.887</td>
<td>2</td>
<td>5254.443</td>
<td>2.748</td>
<td>.064</td>
</tr>
<tr>
<td>Error</td>
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<td>1912.306</td>
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<tr>
<td>Corrected Total</td>
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<td>1195</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .072 (Adjusted R Squared = .068)

The purpose for this study was to determine if there were significant differences in scores on the eighth grade math and reading achievement tests, based on kindergarten entry age, gender, and SES. This chapter presented the analyses of those research questions. The following chapter includes a summary of the study and the research
findings, as well as conclusions, discussion, and recommendations for further policy, for practice, and for further research.
Chapter V

Recommendations for Policy, Practices and Future Research

Currently, even though most students enter kindergarten at the age of five, the cutoff month for entrance varies greatly. Some educators have recommended holding out children deemed not ready for school for an extra year to give those children the benefit of the gift of time. The underlying theory is that the extra year of growth will give the child time to mature and they will be better equipped to handle academic requirements of kindergarten (Stipek, 2002). Parents also are unsure of the right thing to do when considering the notion of when their child should begin kindergarten.

This study sought to determine the age that is most beneficial for students to start school by examining the relationship between school entry age and middle school academic achievement. The purpose of this study was to determine if any statistically significant and practical significant differences would appear in scores on eighth grade math and reading achievement assessments, based on kindergarten entry age, gender, and socioeconomic status (SES). Of importance in this study was the fact that this researcher evaluated the effects of the age of entry after controlling for the mentioned demographic variables. Most previous research on this issue has not reflected this advantage of longitudinal, explanatory design, yet this design is critical for understanding the unique effect of age.

This chapter presents a summary of the study, including the research problem, findings and conclusions. In addition, it also provides policy and practical implementations for educational administrators, as well as recommendations for future research.
School administrators, teachers, parents and policy makers have debated the suitable age for a child to begin kindergarten for decades. There is enduring controversy about the optimal or appropriate age at which children should enter school. A review of the literature yielded mixed findings on the optimal age to enter kindergarten. The aim of this study was to provide more information to administrators and teachers who may question the long-term effect of a student being the youngest or oldest in a class.

**Summary**

This section summarizes the evidence of the effects of the age at which children enter school on academic achievement. The total number of participants for this research was 1,197. The STAR database provided the data used in the study. The students were from Tennessee school systems and represented a variety of inner city, suburban, urban, and rural schools. The STAR study was designed so that all students were assigned at random to one of three experimental conditions: a small class with 13-17 students, a regular class with 22-25 students, or a regular class with a full-time teacher aide and 22-25 students (Finn et al., 2007). All 1,197 students in the present study were students in regular classes with 22-25 students. This experimental group was used in order to better generalize findings to the common population. All students had taken the eighth grade CTBS math and reading test in the spring of 1994.

The purpose of this study was to examine the effect of kindergarten entry age on student’s future academic achievement in the areas of math and reading. Age of kindergarten entry, gender, and SES were independent variables for this study. Students who were eligible to start kindergarten if they turned five by September 30, 1985 were included in this study. Based on previous research examining the age of entry issue
students were divided into three groups according to their age in months at the time of entry into kindergarten. The youngest group included students who were 60-63 months old at the time of kindergarten entry. Group 2, the average group, were 64-67 months old at time of entrance to kindergarten; and group 3, the oldest group, were 68 months or older (included redshirted students) at the time of entrance to kindergarten. The youngest group had the least number of students, n=364. The average group had the most students, n=436, while the oldest group had a total n=396. With reference to gender, female students numbered n=677, while the male students numbered n=520. The mean age of the female group was 65.4 months (average group) and the mean age of the male group was 66 months (average group). SES was determined by a students’ eligibility to receive free or reduced lunch at school and two groups were established, free and reduced lunch and non-free lunch groups. Free and reduced students numbered n=463 and non-free lunch students numbered n=734. The mean age of the students in the free and reduced group was 65.6 months, while the mean age for the non-free lunch was almost identical, at 65.7 months. The dependent variables were the CTBS math and reading scores. The following research questions guided the study:

1. What differences exist, if any, in eighth grade math and reading test scores based on kindergarten entrance age?

2. What differences exist, if any, in eighth grade math and reading scores based on gender or SES?

3. What differences exist, if any, in eighth grade math and reading scores based on age of entry, gender and SES?
A total of ten null hypotheses were included in this study. The findings were reported by using one-way and two-way ANOVAs and independent samples t-tests. Additionally, in order to determine the strength and size of the relationship between two variables, Cohen’s effect sizes were calculated. Effect size helps to determine whether a statistically significant difference is a difference of practical concern. For Cohen’s $d$, an effect size of 0.2 to 0.3 might be a small effect, around 0.5 a medium effect and 0.8 to infinity, a large effect (Cohen, 1988). In the social sciences, researchers attempt to find interventions or effects that generate $d$ values of at least 0.25 (Coe, 2002). This conventional frame of reference allows researchers to have a common understanding of the practical relationship between variables. The study was conducted to test the null hypotheses at the significance level of 0.05. The data were analyzed with SPSS statistical software. Of the ten null hypotheses, eight were retained.

The subject of null hypotheses 1 and 2 was the differences in reading and math CTBS scores based on kindergarten entry age. One-way ANOVA tests were applied to both research questions and this analysis revealed no significant differences in the eighth-grade CTBS reading and math scores based on entry age. Similar to the findings of no statistical significance for these analyses, effect sizes revealed very small differences between the variables of age of entry and academic performance on CTBS math and reading assessments.

The subject of null hypotheses 3 and 4 was the effect gender had on CTBS math and reading scores. An independent samples t-test was applied. Results indicated that there were no statistically significant differences in math or reading eighth grade CTBS
scores based on gender. Effect sizes were slightly higher for these analyses but still indicated only a small effect.

The subject of null hypothesis 5 and 6 was the effect of age of entry and gender on eighth grade reading and math CTBS scores. A two-way ANOVA revealed no significant difference in eighth grade CTBS reading or math scores based on kindergarten entry age and gender. Effect sizes were small and indicated no difference between the groups.

The subject of null hypothesis 7 and 8 was the effect of SES on reading and math CTBS scores. A one-way ANOVA test revealed a significant difference in math and reading scores when considering solely based on SES. As a result, the null hypothesis was rejected. The effect sizes for the relationship between SES and reading and math were 0.63 and 0.54, respectively, which indicated a strong relationship between the two variables.

The subject of null hypotheses 9 and 10 was the effect of age of entry and SES on eighth grade reading and math CTBS scores. A two-way ANOVA revealed no statistically significant difference in the eighth grade reading and math CTBS scores when considering an interaction of kindergarten entry age and SES. Investigation of the free/reduced lunch group revealed that effect sizes were slightly elevated, but still small. The non-free lunch group effect sizes indicated little or no relationship between variables.

**Conclusions**

**Age of Entry**

The data from this study of students who participated in Project STAR are consistent with findings of most previous studies that show the age of entry effects in
achievement do not persist as students grow older. Oshima and Domaleski (2006) found that the academic advantages of being oldest in the class diminish throughout early grades and become nonexistent in middle school. Similarly, Stipek & Byler (2001) found that children who enter kindergarten relatively young perform as well as their older peers in third grade standardized assessments. Jones and Mandeville (1990) and Grau and DiPerna (2000) reported findings consistent with this research in that relative age does not influence academic achievement as students get older.

The cognitive and developmental theories of learning provide a framework for interpreting the results of the analysis of the relationship between kindergarten entry age and academic achievement. The findings of this study indicated that entry age for kindergarten had no effect on eighth-grade academic achievement. This indicates that younger children, on average, did not perform significantly better or more poorly than older children on standardized achievement tests in eighth-grade. Consequently, the results of this present study lend support to the cognitive theories of learning, especially that of Jean Piaget.

Cognitive development theory has to do with the additional learning tasks an individual can accomplish as they mature mentally, physically and emotionally. According to cognitive theorist Piaget, this maturation process impacts all children and progresses in a slow, continuous fashion as they grow older. Central to Piaget’s theories is the idea that children are able to solve certain problems only at certain ages and that these problems can be organized into a developmental sequence that defines discrete stages of cognitive development (Genovese, et al, 2003). Piaget’s fourth stage of cognitive development presumes that by the time students are in eighth grade they will
have reached the stage of formal operations whereby most students over the age of eleven
can think logically about abstract propositions and test hypothesis systematically
(Genovese et al., 2003). Regarding the first two hypotheses of this research, a finding
that children who are different ages but perform similarly in school by eighth-grade
supports cognitive development theory.

Parents believe that older children out-compete younger peers in the classroom.
Thus, eager to give their children an edge, parents are willing to hold back their child one
year in order to shift them up in the pecking order (Weil, 2007). Thus, it is anticipated
that older students, including redshirted students, should perform better than any other
group of students in a classroom, especially the youngest. In contrast to this belief, this
study determined that younger students are not necessarily disadvantaged, nor
advantaged. Present findings for students’ academic achievement in math and reading
reinforce findings of the lack of a statistically significant relationship to school entry age.
However, based on mean comparisons, average age students and youngest students in a
classroom consistently outperformed the oldest group of students in the classroom.
Similar to present findings, Cascio and Schazenbach, (2006) found that children who
enter school a year later are at a disadvantage due to the fact that they reach the rest of
life’s milestones later. In an analysis of longitudinal data from a nationally representative
sample, Lincoye and Painter (2006) also found that younger students at age of entry to
kindergarten are more likely than older students at age of entry, especially redshirted
students, to graduate from college and are more likely to earn higher salaries at the age of
25. This may be perhaps due to the fact that delayed entrants to kindergarten lose a year
of participation in the workforce.
Conversely, in contrast to the findings of this current study, Kinard and Reinharz (1986) determined that significant differences exist among different age groups in the same classroom, with the oldest group having the highest test scores. In another age relative study, Vecchiotti (2007) determined that children who began school at a somewhat older age performed better at the start of school, and functioned at a more advanced level in third grade than did children who started school at the same time but were relatively younger than their peers. Finally, in contrast to the results of this study, Datar (2006) concluded that there are significantly sizeable results to delaying entrance to kindergarten if a child has a summer birthday, at least through second grade. However, Datar (2006) also noted that the gap in the literature of later academic success, either middle or high school, may prove to show that benefits of being relatively older in a classroom do not persist in the long run.

The scarcity of evidence related specifically to age of kindergarten entrance and academic achievement in middle school prompted this investigation. According to Stipek, 2002, the body of evidence for age of entry debate leads to the conclusion that age of entry effects dissipate over time. A review of the research supports the notion that when considering the age differences of a group of students in any given classroom, the developmental span closes after approximately third or fourth grade (Oshima and Domaleski, 2006; Stipek and Byler, 2001; Stipek, 2002). However, when analyzing results of these types of studies, it is important to consider individualized decisions for every child. As noted, what was once considered the curriculum for first grade is now the province of kindergarten (Shepard and Smith, 1986). Kindergarten pupils have increasing demands placed upon them. The curriculum from higher grades is pushed
down to lower ones and, as a result, some children could possibly be at risk to begin a cycle of experiencing school failure. Students who start school young may begin school at a disadvantage to the older, more experienced students. These younger students could potentially be considered “at-risk” students who would need intense support in order to keep up with the rest of the class and not fall too far behind. The developmental theory of learned helplessness in children is a phenomenon in which individuals gradually, as a result of repeated failure, become less willing to attempt tasks (Myers, 2002). Nolen-Hoeksama, et al. (1986) determined that learned helplessness, as measured by Depression Inventories, in students who were five to eleven years old was directly related to school achievement. Too often, relatively young for grade students struggle with challenging curricula (Datar, 2004) and educators are then unable to meet the needs of those students. Consequently, some of these young students may be recommended to repeat kindergarten. Research on retention in school states that not only is retention not beneficial, but it is actually harmful to the student (Roderick, 1995) and does not produce long-term academic success (Owings and Magliaro, 1998).

It is reasonable to conclude that educators attempt to create opportunities in education for all children, regardless of their age. The challenge for school districts is to provide an academically challenging curriculum, while also meeting the needs of each student in the classroom. Educators have the responsibility of creating a learning environment that is ready for any child. Therefore, while the results of this current study indicate no relationship between the variables of age of kindergarten entrance and academic achievement in grade 8, developmental theories, such as learned helplessness in children, need to be considered for young students.
Gender

In this study, comparisons were made between the oldest and the youngest students on several factors that might systematically influence academic achievement. The variable of gender can make a difference in achievement in school (Crosser, 1998; Warder, 1999; Zill et al., 1998). This researcher found no evidence that the age-group differences in reading and math skills could be explained by gender. While some differences did exist in the mean scores of males and females, no variation was of practical or significant difference. In this experimental sample, differences in student’s age or gender did not translate to significant differences in student’s eighth-grade test scores. These findings are consistent with research conducted by Gay (2000), and Kundert, May and Brent (1995), who reported that age and gender have no impact on achievement test scores. These previous research findings, however, only reported findings through fifth grade. This research adds to the existing literature base in that it strengthens the notion that, at least through eighth-grade, gender does not have an impact on academic achievement.

Two theories of learning exist that provide a framework for understanding school readiness. Stipek (2002) identified two different views of kindergarten readiness that shapes the age of entry debate as both a policy and practice issue. The first is a maturational point of view that expects the child to be mature and ready for school, while the second perspective has a preference for experience gained in the school over maturation. Maturational theory of development assumes that older children are more ready and better able to profit from formal schooling. This belief that older is better is based on a theory of development which privileges the contributions of biological
maturation (Gullo & Burton, 1992). As a result, since girls are widely believed to mature more quickly than boys, it is boys who are most commonly held out from starting school on time. Research reports that boys are more likely than girls to be held out, by a factor of nearly 2 to 1 (Brent et al., 1996). The findings from this study support the fact that as children grow older and progress through school, the gender of a student has less of an effect on academic achievement. These findings support the concept of the second theory, which states that experience outweighs maturation. Advocates of this perspective propose that it should be the educational system's responsibility to be ready to meet the individual needs of the child, not the child's responsibility to be ready for school (Graue & DiPerna, 2000). The pressure to increase test scores may encourage teachers or education administrators to advise parents to hold out relatively young children, especially boys, who they consider to be at risk for poor achievement. The results of this research expands upon the idea that by the time students are in middle school, demographic differences such as age and gender no longer have a statistically significant effect on academic achievement.

**Socioeconomic Status**

The relationship between SES of the family with academic achievement of the child was examined in this study. The results of the analyses regarding the effect of SES on achievement, as well as the interaction of SES and age of entry and its effect on achievement, provided clarification of some of the factors that result in an effect on academic performance.

The association between academic achievement and SES is well known. Evidence suggests that students from high SES families outperform those students who
are from low SES families on standardized tests (Lee & Burkham, 2002; Bickel et al., 1991). This current study adds to that foundation of literature. Statistical analyses and effect sizes from this study indicated that there are statistically significant and practical significant effects of SES on academic achievement. Overall, entrance age alone, or the interaction between entrance age and SES, do not appear to be good predictors of learning or academic success; however, SES alone is a strong predictor of achievement. Specifically, the results of this study indicate that the youngest children do as well as the oldest children within this particular sample. The risk of low SES was not further compounded for children who were chronologically young relative to other classmates at entry to kindergarten. Therefore, in this study, the youngest students from a class who are coming from low-income backgrounds do not represent a group of children who are at higher risk for reading and math difficulties when compared with their older peers who also come from low-income families. Nevertheless, all students from low-income backgrounds were found to be at risk for math and reading difficulties relative to their more affluent peers. Therefore, SES did have a statistically significant effect on achievement and showed practical significance. In other words, within the scope of this research study and the questions posed, it is only the variable that had an effect on academic achievement. Adjusting entrance age to kindergarten will not remediate the effects that SES has on achievement in school.

Lee and Burkham (2002) found similar results. They reported that differences in SES among students begin even before the children start kindergarten, with lower cognitive scores and fewer opportunities to attend quality preschools. Most researchers agree that SES affects the academic performance of children. Bradley and Corwyn
(2002), as well as Ram and Hous (2003), determined that while SES does affect all children in their academic achievement and cognitive abilities, it tends to be most detrimental in the earliest years of schooling. Jones and Mandeville (1990) determined that the power of SES to predict school success was 13 times greater than that attributed to entry age. With regard to low-income families, Datar (2006) concluded that there is no real entrance age effect on cognitive skills; so delaying children's entrance into school may deprive many children who are ready for the benefits that accrue from schooling without any offsetting benefits to them or their families. This is especially true for disadvantaged children, since high-quality preschool or day care may not be an option. Additionally, postponing school for low-income families can place a significant economic burden on parents (Stipek, 2002), since they would be required to fund an additional year of daycare or preschool. Similarly, Vecchiotti (2007) stated that children from less advantaged homes benefit from attending school as early as possible since school attendance functions as a mechanism for nonparental care of children that is publicly funded, and access to such care and its benefits is particularly important for low SES families where funds for quality child care are relatively low. Implicit in the theory underlying practices of delaying entrance to school is the notion that keeping a child out of an education setting for an extra year will give them a head start when they finally do begin school. Stipek (2002) confirmed that low-income children begin school, on average, with substantially lower academic skills than children from middle- and upper-income families. The practice of holding children out, especially those children from a low-income family, will not provide equal benefits to those available to children whose families have the resources to provide an enriched environment. This study affirms that
SES continues to have an impact on achievement throughout middle school, making the gap between low-income and middle- and high-income students even wider.

Schools are not in the position to prevent or alleviate the SES and cultural conditions that affect a student. However, administrators and teachers must be made aware of the potentially devastating impact of low SES on academic achievement. Schools can interrupt the deterministic relationship of educational performance and socioeconomic status through in-school interventions. A student’s individual achievement in school, regardless of their SES, should be markedly influenced by the school’s adjustment of the student’s individual needs. Being raised in a low-income family often means having fewer educational resources at home, in addition to poor health care and nutrition factors that can compound lower academic performance (Viadero, 2000). There are certain in-school factors that can be implemented that have consistently demonstrated a positive effect on academic achievement. Education administrators must make strides early on in attempting to lessen the achievement gap between children who represent low SES and the children who represent middle and high SES. One suggestion that could facilitate change and provide a developmentally beneficial effect on academic achievement would be to expand and increase access to quality early childcare and preschool experiences. Children from low SES households typically begin kindergarten far behind their suburban peers in language and other skills essential for early school success. To close this learning gap and to have economically disadvantaged children enter school on a more even footing with their peers from more advantaged backgrounds, possible in-school interventions include an implementation of full day kindergarten and full day preschool for all three and four year old children in a
well-planned, high quality preschool. This expansion will have a significant and substantial positive impact on academic achievement in both early and later school years (Vecchiotti, 2006).

Another proven tactic that could address the achievement gap is reducing class size. The profound and lasting effects of class size reduction on students’ opportunity to learn and achieve in Grades K-3 are well documented (Tienken & Achilles, 2009). The original purpose of the experimental STAR database utilized for this study was to measure the effect class size had on student achievement. Results of the STAR study revealed that students in the smallest classes through third grade scored highest on achievement tests, regardless of their SES. Furthermore, STAR follow-up studies through eighth grade showed small class size students continually outperformed their peers who had attended regular classes and regular with aide classes on academic achievement tests (Word et al., 1990).

Another in-school factor that has proven to influence student achievement is high quality teaching (The Teaching Commission, 2004; Berry, 2005). Often it is difficult to attract high quality, experienced teachers to high-poverty schools. As a result, there is frequently a lack of high expectations for poor students, as well as inadequate approaches to learning. Teachers must be focused on academic achievement by providing a high quality education to all of their students. Education administrators must work with their staff to learn to match their pedagogy to their students’ needs. In light of the findings of this research, it is imperative that teachers hold rigid expectations and permit high expectations to guide interactions with all of their students in order to address the factors that contribute to and exacerbate achievement gaps.
Age of entry policy issues are directly related to access to educational systems and are particularly important for children from less advantaged homes. This study sought to illuminate the relations between age of kindergarten entrance and academic achievement over an extended period of time, while also controlling for several confounding factors that have been shown to predict academic achievement. Data from the National Assessment of Educational Progress (NAEP) indicates that by the end of fourth grade, poor students of all races are two years behind other students. By eighth grade, they have slipped three years behind, and when they reach twelfth grade, poor students are, on average, about four years behind. This study provides a framework for policymakers and education administrators to seek answers to the question of how to ensure that students from low-income families have the opportunity to succeed in school and will stay on track with students from higher income families.

As a final point, education administrators must support the belief in the transformative role of education, as well as the value of accessing diversity. School personnel must hold high expectations and give students opportunities to participate in a meaningful way in their education. There is a need for a paradigm shift in understanding the role of SES and its impact on students. Results from this study indicate that adjusting entrance age does not overcome the effects of SES. Practical solutions, such as a reduction in class size during the early years of school, preschool expansion, and a movement to produce high quality teachers, are called for in order to alleviate the achievement gap and influence achievement gains.

Analyzing gender, SES, and age of kindergarten entry allowed this researcher to identify how age affected CTBS reading and math scores in relation to other
demographic variables. The fact that age of entry effects were small in magnitude and dwarfed by other aspects of children's family experiences suggests that age at starting school should not be regarded as a major determinant of children's school achievement. Therefore, in light of popular beliefs widely held by many about age of entry effects, the results of this study demonstrate that the effects of age of entry on children's long-term academic achievement are not of major importance. Entry age concerns merit consideration in context with other more important factors, such as SES, but this study has proven that age and gender alone should not be the deciding factors.

**Policy and Practical Implications**

With the absence of federal guidelines for school entry age, states have been left to their own devices to develop policies. School entry age cutoff dates for many of the states in the U.S. have moved from the beginning of the calendar year to the beginning of the school year. The rationale for this change is to prepare children to handle a demanding academic kindergarten curriculum. Pressure is placed on students in kindergarten, first and second grades to meet high academic standards and progress in their grade level curriculum in order to perform well on third grade standardized testing.

Based on the results of the present research, it is clear that the nationwide trend to increase the minimum entrance age into kindergarten is of no benefit to students. As a matter of fact, if there is no entrance age effect on academic achievement, as shown in this study, delaying entrance to school may inhibit a student's achievement, particularly in the case of those students who come from disadvantaged families. At the classroom level, redshirting widens the age range in a classroom and makes teaching all the more
difficult. The presence of substantially older children can affect the other children both academically and socially (Oshima and Domaleski, 2006). As a result, the accepted trend of delaying kindergarten entry requires careful assessment. Educators and parents should not be concerned about a child’s academic performance based solely on age. Instead, focus should aim at the individual child’s academic and developmental abilities, general readiness for the academic rigors of kindergarten, and the background of the individual. Based on the results of this research, it would benefit education administrators to educate parents regarding the social, emotional, and academic expectations of students enrolled in kindergarten, as well as expected readiness skills in order to meet success in kindergarten.

In becoming educated on the topic of age of school entry, people will have an opportunity to make informed decisions about educating a full continuum of students. In keeping with this idea, research findings need to be presented and disseminated. Administrators and educators have conclusions brought to their attention so that application of appropriate interventions, if needed, will transpire. Policy makers increase their awareness of the findings so that review of policies regarding entrance age will occur. Parents are an important part of the decision making process, and should be informed of all information so that will allow them to make educated decisions regarding their child. Faculty involved in teacher and administrator preparation programs need to access to full information so that professionals are aware of the potential effects that may arise due to differences student age and sociodemographic variables, such as SES and gender.
In conclusion, consideration of kindergarten entrance age policies is not simply a matter of the child’s age at school entry. Instead, based on the conclusions of this research, consideration of other factors, namely SES, is essential. In light of these findings, reconsideration of many of the current policies and practices implemented with the intent of addressing the “problem” between age and academic achievement may be required.

Accountability measures based on a narrow, high stakes, testing-driven view of achievement has placed demands on grades as early as kindergarten to teach skills tested on standardized assessments. With the accountability pressures that schools are under in the decade encompassing the 2010’s, along with a push for improved student performance demanded by today’s society, educators are seeking ways to increase student test scores in all grades. With changing education expectations and heightened requirements, there has been a national trend in recent years toward raising the minimum entrance age for kindergarten. Increasing the age of school entry is a politically attractive strategy for policymakers to raise test scores because it is simple and economical (Stipek, 2002). However, the results of the present study add to the trend of recent research that indicates that entrance age to kindergarten has no long-term effect on academic achievement. While administrators may find this to be an attractive quick fix intervention, results from this study demonstrate that raising the entrance age will not achieve an increase in test scores. On the other hand, practical solutions such as decreasing class size, expanding preschool options, and delivering high quality teachers are options that have proved beneficial to academic achievement.
**Recommendations for Future Research**

Based on the findings of this study, several recommendations are proposed for future study that would benefit the consideration of kindergarten entry age. As noted in the literature review in chapter 2, there is currently very little research on age of entry in kindergarten and its relationship to high school academic achievement. A follow-up study, possibly using the information-rich STAR database, is necessary to determine if kindergarten entry age, gender, or socioeconomic status have an effect on academic achievement during high school.

Results of the present study suggest that being older when starting school does not create any long-term academic advantage for students. In fact, results from this research imply that younger students maybe at an academic advantage over older students upon reaching the eighth grade. Lincove and Painter (2006) found that when comparing young students with older students in the same grade while in high school, young students had significantly higher test scores than older students in 10th grade (p < .001) and 12th grade (p < .05). Researchers should further analyze this notion to determine the effect that age of kindergarten entry has on academic success, as students grow older.

According to Stipek (2002), three strategies have been employed to assess the effects of the age of school entry on children's academic achievement. The first of these studies compares outcomes for children who delayed entry by a year with children who entered school when they were eligible. The second strategy is to compare children in the same grade who differ in birth dates. The third strategy is to compare children who are the same age, but in different grades. This current study utilized Stipek's second
strategy and provided valuable information on whether older students perform better, on average, than do younger students. Future researchers concerned with the topic of age of entry would benefit from analyzing a large data set, such as STAR, while applying one of the other two strategies suggested by Stipek.

This research examined the effect of age of entry on academic achievement in eighth grade by analyzing the results of the math and reading sections of the CTBS, a norm-referenced, standardized assessment. Norm-referenced tests are designed to highlight achievement differences between and among students to produce a dependable rank order of students across a continuum of achievement from high achievers to low achievers (Stiggins, 1994). These types of tests are often used to help teachers select students for different ability levels for assignment to reading or mathematics instructional groups. An alternative testing technique can be a criterion-referenced assessment. While norm-referenced tests ascertain the rank of students, criterion-referenced tests determine what test takers can do and what they know, not how they compare to others (Bond, 1996). Criterion-referenced tests report how well students are doing relative to a pre-determined performance level on a specified set of educational goals or outcomes included in the school, district, or state curriculum. While this present study analyzed the results of a norm-referenced test, additional research that analyzes the outcomes of a criterion-referenced test may prove to be helpful. Criterion-reference tests give detailed information about how well a student has performed on each of the educational goals or outcomes included on that test; for instance, a score might describe which arithmetic operations a student can perform or the level of reading difficulty he or she can
comprehend. Criterion-referenced tests may provide additional, detailed information that norm-referenced tests do not provide.

The present study did not consider variables such as preschool experience, retention, special education, race, and family structure. These family and school variables would also enable the researcher to identify factors related to educational success. Future research should take these variables into account to provide a better understanding of academic performance differences among different subgroups of students.

This study included a large sample size with a wide range of racial and economic diversity. However, all students from this research all resided in the state of Tennessee. Future research using a national data set, such as the National Educational Longitudinal Study (NELS-1988) or the Early Childhood Longitudinal Study (ECLS-1998), may be beneficial for extending and generalizing the understanding of age differences in academic achievement.

As a final point, the findings presented here represent analyses on data collected over 25 years ago. While it has been determined for this study that age of entry did not have a statistically significant effect on academic achievement in eighth grade, it is with caution these results are interpreted. The educational standards of 2010 are much more challenging than they were back in 1985. Eighth grade academic requirements currently include curriculum items once reserved for high school curricula. In order to add to the knowledge base, and to provide insight into the topic of age of entry, an analysis of age of kindergarten entry and later academic achievement using data collected more recently would prove beneficial to this field of study.
References
References


Null Hypothesis #1
Post Hoc Tukey

Null hypothesis #1
Levene's test of homogeneity

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Test of Homogeneity of Variances
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Null hypothesis #2
Post Hoc Tukey

TOTAL MATH SCALE SCORE CTBS GRADE 8
Tukey

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Null Hypothesis #2
Levene’s Test of Homogeneity

Test of Homogeneity of Variances
TOTAL MATH SCALE SCORE CTBS GRADE 8

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Null Hypothesis #5
Levene’s Test of Homogeneity

Levene’s Test of Equality of Error Variances
Dependent Variable: TOTAL READING SCALE SCORE CTBS GRADE 8

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a. Design: Intercept + monthgrp + gender + monthgrp * gender

Null Hypothesis #6
Levene’s Test of Homogeneity

**Levene's Test of Equality of Error Variances**
Dependent Variable: TOTAL MATH

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Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + monthgrp + gender + monthgrp * gender

Null Hypothesis #7
Levene’s Test of Homogeneity

**Test of Homogeneity of Variances**
TOTAL READING SCALE SCORE CTBS

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Null Hypothesis #8
Levene’s Test of Homogeneity

**Test of Homogeneity of Variances**
TOTAL MATH SCALE SCORE CTBS

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Test of Homogeneity of Variances
TOTAL MATH SCALE SCORE CTBS
GRADE 8

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Null Hypothesis #9
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Levene's Test of Equality of Error Variances
Dependent Variable: TOTAL READING SCALE SCORE CTBS
GRADE 8

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<th>df1</th>
<th>df2</th>
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<tbody>
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<td>.141</td>
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Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + monthgrp + gkfreelunch + monthgrp * gkfreelunch

Null Hypothesis #10
Levene’s Test of Homogeneity

Levene's Test of Equality of Error Variances
Dependent Variable: TOTAL MATH SCALE SCORE CTBS GRADE 8

<table>
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Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + monthgrp + gkfreelunch + monthgrp * gkfreelunch
IRB Non Review Certification

STUDENT: Nicole Buten
Title of Dissertation: The effect of kindergarten entrance age on children's reading and math achievement in the 8th grade.

I certify, by my signature below, that the above indicated study does not require IRB review as a result of a lack of involvement with human subjects (see OHRP flow chart) and as indicated by any or all of the following (check all that apply).

1. Historical research
2. Public data base
   X STAR DATABASE
3. Proprietary data base
4. Freedom of Information
5. Right to know - sunshine law

Student signature: X Nicole A. Buten
Advisor approval: X M. G. Shankes

Reviewed by:
Marty Finklestein - Higher Ed
Daniel Gutmore - K-12

- Proprietary data that does not identify individuals