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A study of the relationship between chronological age at the time of entrance to kindergarten and academic achievement

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Dedication

This study is dedicated to my mother, Josephine B. Stancil, who has assumed much of the responsibility for my two children during the course of my advanced work; and to my son, John, whose birthdate, October 9th, greatly increased my interest in this topic.

ACKNOWLEDGMENTS

The excellent academic experiences of seven years of advanced graduate work culminated by this study were made the more rewarding to the writer by the teaching excellence and scholarly interest of the faculty of the College of William and Mary.

The writer expresses sincere gratitude to Professor Robert Maidment who has consistently and effectively guided this student's development, specifically in the dissertation effort, and generally throughout the doctoral program. Appreciation is also extended to Professors William Bullock and Armand Galfo for their assistance, guidance, and wealth of knowledge.

A special debt of gratitude is owed to the school division from which the student sample was taken. The cooperative nature of personnel within the Department of Research and Planning facilitated the data collection.

Finally, I wish to acknowledge the strong support and unselfish understanding of my husband, Tony, during this endeavor and a loving thanks to my children, John and Stephanie, both of whom were born during the span of my doctoral program.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Introduction

The laws of every state determine the chronological age at which children are to be enrolled in school. Many educators readily admit that all children are not ready to begin formal education at the same age. Efforts to change these laws, however, must address several problems:

1. The identification of those variables which would be used in the selection process;

2. The cost of testing and other selection criteria at a time when school budgets are being cut rather than expanded;

3. Community values and tradition dating back to the first graded system in Quincy, Massachusetts in 1868;

4. The large number of women in the work force who face the problems of costly and/or inadequate child care facilities.

The belief that an educated and informed populace could only be realized if all children attended school developed slowly in the United States. The policy of admitting children to school on the basis of a minimum chronological age logically resulted from compulsory education laws. Massachusetts passed the first modern compulsory attendance law in 1852. While it has served as a pattern for other states, it was not until the latter decades of the nineteenth century that other states enacted similar legislation.

The passage of child labor laws and compulsory attendance statutes have been closely related. The demand for cheap labor led to the hiring of children in factories tending machines for long hours under unhealthy conditions (Cubberly, 1920). The potential for child neglect and exploitation in this labor market contributed to the passage of protective legislation for children. The first law regulating the employment of children was the Rhode Island Child Labor Law of 1840. Most child labor legislation was enacted after 1850.

Since those early laws were enacted, the trend has been to lower the minimum entrance age and raise the maximum attendance age. The attendance requirements have been increased from twelve weeks to cover the full school year, and the number of exemptions from compulsory attendance have been reduced. Newer laws have reflected stricter regulations for work permits and improved procedures for enforcement of the compulsory attendance requirements (Good, 1960).

Educators, parents, and early childhood specialists recognize the extreme importance of the early childhood years in establishing the foundation for future learning and intellectual development. Yet efforts to start academic instruction earlier may be damaging the youngster academically, socially, and emotionally (Haynes, 1979).

Parental and professional concern with the educational development of younger and older children within the same grade continues. The question as to whether the early school entrant will be as motivated, as happy, and as academically successful as one who starts later lingers.

Statement of the Problem

The purpose of this longitudinal study was to investigate empirically the relationship existing in a selected population between age at the time of entrance to kindergarten and academic achievement as reflected by standardized achievement tests administered in the fourth grade. The educational growth of a group of children who entered kindergarten before 5 years of age was compared with that of a group who entered after 5 years of age. Specific subproblems related to the problem investigated in this study were:

1. Do the younger children in a grade achieve as well as the older children in that grade in two major school subjects?

2. Does being a member of the older or younger portion of the class have differing effects on educational achievement by sex?

3. What is the relationship between intelligence, sex, race, and socioeconomic status with the achievement scores of early and late beginning students?

4. Are any variables of age, sex, race, socioeconomic status, or intelligence valid indicators of probable success in achievement?

Importance of the Study

This study was designed to contribute information concerning the relationship between age and achievement by examining a specific situation. The present study was deemed important for several reasons. In a rapidly changing society, the need to examine current educational practices to determine the most efficient and effective course of action constantly exists. Local research of attendance laws provides a valid base for future legislative efforts related to school policies.

Finally, this study considered recommendations for further research found in earlier studies concerned with the effect of varying entrance ages on achievement (Bellino, 1963; Lewis, 1972; Damuth, 1976).

Theoretical Rationale

Much of the theoretical basis for this study was extracted from the field of child growth and development. The importance of the early years of a child's life in terms of learning foundations and readiness for intellectual development is well accepted. The successful mastery of tasks at each developmental milestone is in part determined by earlier achievements. Thus, the early years are crucial for all that follows. While each individual has his own rate and pattern of maturity, broad patterns do exist in human growth and development which allow theorists to generalize predictable behavioral sequences. Despite individual variations, growth takes place in an orderly, sequential manner whether labeled stages of growth (Gesell, 1940; Piaget, 1952); stable characteristics (Bloom, 1964); or developmental tasks (Havighurst, 1972).

Hypotheses

The testing of the following general hypotheses was to determine the existence of statistically significant relationships:

1. There is a significant difference in the mean academic achievement scores of early and late school entrants.

2. There is a significant difference in the mean academic achievement scores of both male and female early and late school entrants.

Sample and Data Gathering Procedures

From a heavily-populated, suburban school system, 200 fourth-grade students were randomly selected according to their fifth birthday. The sample consisted of only those students whose fifth birthdate occurred on or between January 1, 1975 and March 31, 1975 or on or between October 1, 1975 and December 31, 1975. Sex, race, and birthdate information was determined from biographical data. Academic achievement and intelligence information was collected from standardized test data. Test instruments used for the study were part of a system-wide testing program. Socioeconomic levels were determined from previously collected free lunch data.

Definition of Terms

For the purpose of this study, the following definitions apply.

Early School Entrants. This term refers to children who entered kindergarten between the ages of 4 years, 8 months and 4 years, 10 months. Their birthdates fall in the months of October, November and December.

Late School Entrants. This term refers to children who entered kindergarten between the ages of 5 years, 5 months and 5 years, 7 months. Their birthdates fall in the months of January, February and March.

Chronological Age. The period of time that has passed since birth and generally expressed in years and months.

Academic Achievement. Academic achievement is defined as the growth scale scores in reading and math on the Science Research Associates (SRA) Achievement Test, Blue Level, Form E. The test was

administered during the fall semester of the fourth grade.

Intelligence. Intelligence is the subject's IQ score on the Kuhlman Anderson Test, Form CD. This instrument was administered to the subject students in the spring semester of the third grade.

Socioeconomic Status. As used in the study, this term refers to whether the subject did or did not qualify for free-lunch under federal guidelines established for that purpose.

Limitations of the Study

There are several limitations presented by this study which should be specified:

1. The lack of standardized test data from earlier grades which would help determine whether differences in the academic achievement of the two groups had existed throughout the primary school experience;

2. The lack of important data on the social, emotional, and physical developments of sample members;

3. The lack of information on those students who would have been in this population but whose parents elected an exemption;

4. The geographical limitation presented by the selection of the sample population from one school division in Virginia. No claim for general applicability to any other school system is suggested unless that system is considered to be similar to the one used.

Organization of the Remainder of the Study

In Chapter 2 a review of relevant literature and research is presented. In Chapter 3 the methodology employed in the study and the research design are examined. The results of the study, including an analysis of the findings, are reported in Chapter 4. A discussion of

the conclusions and implications for further research are presented in Chapter 5.

Chapter 2

Relevant Literature and Related Research

This chapter consists of a review of the most significant theories of development as they pertain to the roles of maturation and learning. A review of recent Virginia legislation in the area of school entrance age is also reported. Investigations relevant to school entrance age and achievement are recounted under two headings: Rejection of Early School Entrance and Support of Early School Entrance. This chapter incorporates the results of extensive library research.

Background of the Problem

In 1972, the Virginia legislature extended the minimum entrance age for kindergarten children from 5 years old on or before September 30th to 5 years old on or before December 31st. This extension was implemented in one-month intervals each year beginning with the 1972-73 school year, thus taking three years to accomplish (Code of Virginia 22-275.3).

In 1976, the compulsory attendance statute was amended to reflect this decision, however, children whose parents did not wish for them to attend at this age were exempted (Code of Virginia 22-275.1, 22-275.3).

This change generated discussion and dissent among professionals in the field as well as individual parents. The discussion centered on whether children with birthdays in the latter months covered by this admission were too young and/or immature to be successful in school.

In 1977, House Bill 1379 was introduced by Congressman C. D. Dunford to change the minimum birthdate cutoff to September 15th, a date even earlier than the previous date of October 1st.

Public hearings conducted across the State by the House Education Committee drew varied responses from educators, psychologists, and parents. Representatives of several school systems (often urban) adopted the position that the earlier the child comes to school, the better. Other speakers emphasized the increased number of retentions resulting from the earlier entrance age and criticized the exposure of these young children to the pressures of school. Parents, using their own children as examples, addressed the appropriateness or inappropriateness of the entrance date for young children. The bill was defeated.

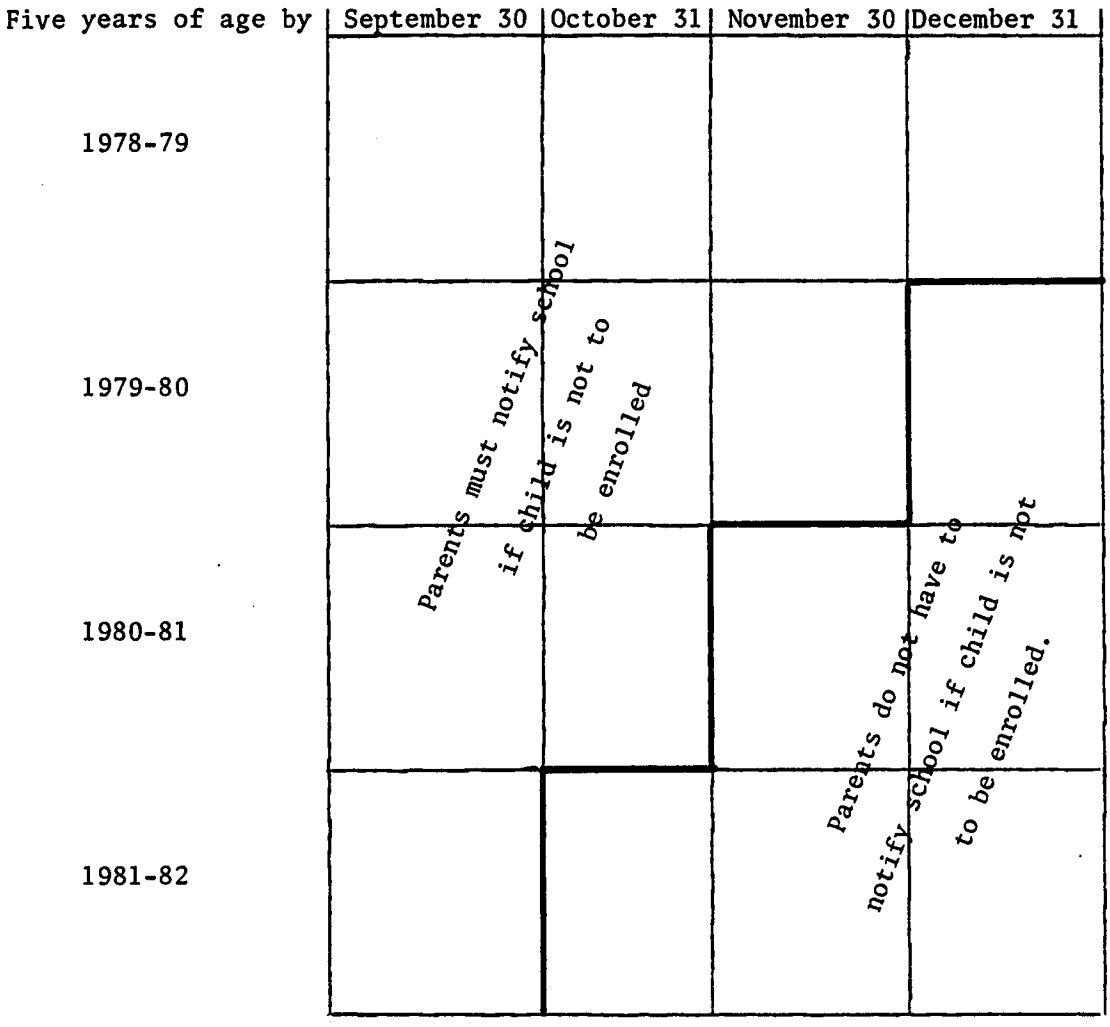
Virginia legislators have established a birthdate cutoff of 5 years old by December 31st for admission to kindergarten while providing an option for parents who do not desire for their children to attend until the following school year. While a reliable percentage is not available from the State Department of Education, very few parents appear to be using this option and are enrolling children as soon as they are chronologically eligible. This decision is represented graphically in Figure 1. The parents of children with fifth birthdays between September 30th and January 1 of a school year must be counseled by school division representatives on the advisability of sending their children to school at this early age.

Theories of Development

The thinking of developmental theorists of this century has been

Figure 1

Ages of Children Required to Attend



Code of Virginia 22-275.1

dominated by the general assumption that man's nature and development were genetically predetermined. It was not until the late 1950's and early 60's that a genuine need for and interest in research on the early learning and development of cognitive skills took place. Landmarks in this area were the publications of Piaget (1952), Hunt (1961), Bruner (1960), and Bloom (1964). It was at this time that a shift from a simple explanation of human development to one based on multiple causes as a result of internal and external influences took place.

While Gesell accepted the factor of individuality, he also recognized the sequential ground plan of human growth. Gesell (1940) described development as "a progressive morphogenesis of patterns of behavior." According to his conception of development, the child's behavior develops by means of remarkably patterned and predictable stages alternating between years of equilibrium and disequilibrium. Thus, efforts to speed up the maturity level of a child are futile until the development of the organism is fully ready. "You can mold and inflect behavior but you cannot determine either the shape it takes or the rate at which it will grow" (p. 60).

Personnel at the Gesell Institute of Child Development in New Haven, Connecticut, contend that their research shows that many emotional, learning disabled, and underachievement problems are directly related to early exposure to academic instruction and the demands which accompany it. Ames, another Institute researcher, specifically addressed the issue of entrance age and child development in her book. She examined the nature of both the kindergarten and

first-grade curricula across the United States in light of the knowledge gained from the extensive study of child growth and development. Ames concluded that the average girl needs to be fully 5 before starting kindergarten and the average boy fully 5-1/2. Girls develop more rapidly than boys in the early years. At this age a six-month lag (between the two sexes) is not unusual.

The thrust at the Institute was, and continues to be, toward the further refinement of the concept of behavior age, not chronological age, as the determining factor of when a child should enter school. Behavior age, the age which a child is exhibiting specific behaviors, serves as a more adequate guide for determining school readiness than the legal entrance age based on age in years or IQ alone.

Gesell presented a case for the theory that the older children are when they start school, the better their chances of doing well. Entrance ages in most communities are the same for both sexes. More boys than girls start school before they are ready. Approximately five times as many boys as girls experience school problems. Retentions are more prevalent among boys who started first grade before age 6. Ames contended that children who are unready for school do not "catch-up" in later years and that young males should be carefully screened for school readiness.

Ames promoted the existence of a direct correlation between age and grade placement. Children fully 5 and fully 6 demonstrate greater readiness for the demands of kindergarten and first grade than those who are younger. A kindergarten class with a mature 5-1/2 year old and an immature child of 4 years, 9 months presents the teacher with a

two years differential in behavior age.

Gesell was unsupportive of early entrance based on special exceptions to age requirements because of high intelligence. He coined the term "superior immature" to denote the bright children who were immature for their ages. Ames (1972) viewed early entrance as "a special privilege that later on boomerangs to the sorrow and confusion of all concerned" (p. 182). Grosse Pointe, Michigan, is cited as a school system which gave up early entrance after 11 years because of the poor adjustment of the children involved.

Gesell believed, "It is time to have a reckoning and to realize before it is too late the futility of pushing nature" (Ames, 1972, p. 176). He envisioned the future screening of potential kindergarten students with recommended placement in a full kindergarten experience, pre-kindergarten experience, or continued home/nursery experience with more attention given to sexual differences in the rate of development.

Piaget, like Gesell, associated behavioral landmarks with specified chronological ages. He was primarily concerned with the continuous interactions of the person and the environment through two functions which he labeled accommodation and assimilation. Piaget focused on the match between the circumstances that the child encountered as he developed and the nature of his own intellectual organizations at the time he encountered them.

Piaget saw cognitive growth as a process which moved slowly from heavy reliance on movement and the senses to higher and more abstract forms of thinking and reasoning. He described this process in four stages of growth which merge gradually into each other; yet each stage

is distinct and different. The development of children's thinking proceeds through the various stages roughly in accordance with age but is also affected by individual differences, experiences, and affective components of behavior. He appeared to be more concerned with the sequential nature of the stages than he was with age associations (Bruner, 1960).

The intellectual development of the child is uneven as he moves through stages and substages. It can be influenced by the environment. If the school does not provide opportunities for the child which challenge him to move into further developmental stages, it may be necessary to go back to an earlier stage of development in order to provide the child with the understanding he needs for further development. The age at which children are able to move into higher stages of complex thinking and reasoning differs, but the sequence in which these stages unfold is invariable regardless of time or culture.

Bloom (1964) represented the theory that growth and development are not in equal units per units of time but that stable characteristics experience periods of relatively rapid growth as well as periods of relatively slow growth. He proposed that factors which influence the growth of certain characteristics are of far greater importance in the periods of rapid development than during other periods of growth. According to Bloom, some human characteristics continue to develop throughout the life of the individual while others reach approximately full development much earlier. He based his theory on longitudinal studies over a fifty-year span.

In referring to the stability of achievement data, Bloom cited an

Ebert-Simmons (1943) study which found that one-third of general achievement has been developed by the time the individual starts school. Other longitudinal studies of educational achievement cited by Bloom indicate that approximately 50% of general achievement at grade twelve has been reached by the end of grade three (approximately age 9). Bloom further reported that approximately 17% of the growth achievement takes place between the ages 4 and 6. This, of course, demonstrates the powerful effect of the home environment on the educational achievement of children. It also placed increased emphasis on the preschool experience and the first three years of elementary school.

Bloom characterized intelligence as a function which arrives at 50% of its development between the time of conception and age 4. Thus, as much development takes place in the first four years as in the next thirteen years according to Bloom. If this is the case, the effect of extreme environments during this time can be significant, and efforts to greatly reduce deprivations should be made as early as possible.

Bloom elaborated on this point:

> The increased ability to predict long-term consequences on environmental forces and developmental characteristics places new responsibilities on home, school, and society. If these responsibilities are not adequately met, society will suffer in the long run. If these responsibilities are neglected, the individual will suffer a life of continual frustration and alienation. The responsibilities are great, the tasks ahead are difficult, and only through increased understanding of the interrelations between

environments and individual development will we be able to secure more adequate solutions. (p. 231)

Havighurst (1972) extended the idea of developmental stages to more specific learnings labeled as developmental tasks; the mastery of which he related to both cultural approval and age appropriate behavior. A continuous thread of development is woven as one task forms the basis for the next developmental task. The successful achievement of one task thus leads to success with later tasks. Havighurst differentiated between the increase in body mass known as growth, the behavioral changes labeled as development; and the biological processes which come into play through maturation. He supported the idea that development represents a relationship between the organism, the environment, and the responsive interaction of the two.

The foundation for cognitive development is established early in a child's life. The sequential nature of this development is evident in all theories of human growth and development despite the attached label. This invariable allows generalization to all children despite the variations which exist in each individual.

The impact of the school environment cannot be ignored in any of these theories. Nursery schools, kindergartens and the primary grades can, and do, have far reaching consequences on the child's general learning power. However, regardless of the theories, at what age school experience should begin to supplement the child's other experiences as well as the process of maturation continues to be a question asked by educators, parents, and legislators.

Related Research

The concept of instructional readiness and the effects of school entrance age on subsequent school performance are of continuing concern to parents and educators. Considerable research has been generated. The populations have been diverse in numbers and levels, ranging from kindergarten through 12th grade with research samples as large as 5,000.

Most investigators analyzed data derived from the administration of standardized tests as well as grades and other data collected on the student samples during the school experience to arrive at the desired results. Since the conclusions drawn from the available research differ widely, the research will be divided based on whether it lends evidence to the rejection of early school entrance or provides support for early entrance.

Rejection of Early School Entrance

Hamalainen (1952) selected a sample of 4,277 kindergarten children from a school system with a minimum entrance age to kindergarten of 4 years, 9 months. The underage students made up 16.5% of the sample population. Seventy-six percent of the underage group readily adjusted to kindergarten while 94% of those over the minimum age adjusted readily. Of the children who entered school younger than 5 years old, one out of four experienced considerable difficulty while only 1 out of 16 among the normal entrance age group failed to adjust well.

Pauly (1951) addressed the problem of sex differences among young children. One thousand five hundred and two second graders were selected for the study. While the mean chronological age of the boys

was two months higher than the girls, the girls scored two months higher on the Gates-MacGinitie Reading Test. An examination of the preprimary or lower first-grade groups found twice as many boys in these groups as girls. On a third-grade arithmetic test, the mean score for the 1,201 boys was 51.8 compared to the girls' 52.4 despite the facts that the boys were three months older, and generally find math easier than girls. His research supported the idea that girls should be admitted to school at least three or more months earlier than boys or that the entrance age for boys should be raised three or more months.

Forester (1955) examined the records of 500 high school pupils. Examining both chronological and mental ages, he found that those students labeled very old-very dull for their grade level did not do well in school; that those designated as very old-very bright excelled throughout their school career; and that those falling into the very bright-very young category had difficulty starting with junior high and continuing through high school. They made average grades and were less mature physically, emotionally, and socially. He concluded that children should be at least 5 years old when they enter kindergarten if they are to adjust satisfactorily and have a successful school experience. Conversely, early entry may result in maladjustment not only in school but in adult life.

King (1955) attempted to measure differences in both the achievement and affective behaviors of two groups of children. She studied attendance records, psychological referrals, speech referrals, and teacher comments. The student population was composed of sixth graders.

The younger group consisted of 54 children who had entered first grade between the ages of 5 years, 8 months and 5 years, 11 months. The 50 older subjects had first-grade entrance ages between 6 years, 5 months and 6 years, 8 months. All of these students had attended the same school for six years. Only subjects with intelligent quotients in the 90-110 range were selected. The mean difference in the ages of the two groups was 9 months and the IQ difference of the two groups favored the younger group.

The 19 boys and 16 girls in the younger group had poorer school attendance records and more defects and maladjustments than the students from the older group as measured by the aforementioned criteria. Members of the younger group had greater difficulty achieving on grade level in the basic skills. Of 11 children who repeated the grade, only one had started school after 6 years of age.

Carter (1956) concluded that 87% of the underage students in his sample of sixth graders were below the normal age children in scholastic achievement based on their achievement in grades two through six. Fifty students under 6 years of age and 50 students 6 years old or older when they entered school were matched for sex and intelligence. An equal number of boys and girls were selected for the study.

Older girls were significantly superior to the younger girls in reading, spelling, and English with no significant difference in their arithmetic achievement. The older sixth-grade boys were significantly superior to the younger boys in all four subjects as measured by the Metropolitan Achievement Tests.

These findings were further supported by Hall (1963) who conducted

extensive research to determine whether age at entrance and sex made a difference in achievement. He conducted this study when many parents deemed it important to have the chronological age for school admission lowered. Eight hundred and one retained pupils were grouped by sex and age. Seventy-five percent of the retainees were boys, and 78% of the boys and 80% of the girls entered school before they were at least 6 years, 6 months of age. Hall also maintained that the younger boys achieved at a lower level than any other group.

Hampleman (1959) addressed the more specific question of whether chronological age had an effect on reading success. He examined the cumulative records of 58 students in terms of birthdate, IQ score, and SAT reading scores. The students were assigned to one of two groups: Group one students had school entrance ages of 6 years, 3 months or younger while group two had school entrance ages of 6 years, 4 months or older. These two groups were further subdivided to allow for a youngest and oldest group.

Hampleman found that the older students were superior in reading achievement to the younger group as measured by the Stanford Achievement Test administered at the end of sixth grade. This difference was even greater when the scores of the very youngest were compared with the scores of the very oldest. Hampleman did find, however, that those children in the younger group with above-average intelligence had an excellent chance for reading success despite their earlier entrance ages. This was not true for the younger entrants with IQ's below 100. He advised parents that a few months later entrance would increase the chance for reading success rather than a few months earlier.

Graves (1961) reported a study on the relationship between school entrance age and school progress. She examined both the percentage of early entrants and late entrants who had failed first grade and the percentage of groups in the lower and upper sections of junior high school who were early and late beginning first graders. Graves found a higher percentage of younger entrants repeating first grade and a fewer number of younger entrants in the accelerated groups of junior high. Also a higher intelligence quotient was needed by the younger entrants in order to attain the same level of academic achievement.

Another study concerned with school entrance age and achievement was conducted by Howell (1962). The subjects consisted of fifth-grade pupils composing two matched groups of older and younger beginners. Data taken from the cumulative folders of these students showed that older pupils had significantly greater gains in total achievement than the younger pupils as measured by standardized achievement tests at various grade levels.

Carroll (1963) used 29 pairs of third graders from five elementary schools in four different school systems to conduct a study. The different school systems were utilized in an effort to eliminate the effect which the educational philosophy and practice of a particular school system might have on achievement. The students were matched on sex, IQ, and socioeconomic status. The older students made consistently higher scores than their young classmates which supported the frequent comments of Carroll's colleagues who used age and maturity to explain the low academic achievement of many of their students.

Much of the research which has been done in this area identified

early-age children as those children whose birthdates would not warrant their attending school but were allowed to attend because of exceptions to the minimum age policy. Weiss studied a group of such children in 1963 by matching them with normal-age, above-average IQ kindergarten children on such variables as IQ, personality adjustment, and sex. They were matched with average and below-average IQ students on personality adjustment and sex. She found the achievement and adjustment of the above-average, early-age children to be approximately that of the class as an average but below that of older kindergarten children with comparable IQ's. Weiss concluded that these same children, while performing satisfactorily, would have achieved at a higher level if held back a year.

Green and Simons (1963) examined the records of 213 white fourth-grade students in public schools. Students were classified into two groups based on their entrance age to school. Fifty-four boys and girls entered school before the age of six and were labeled early entrants. The remaining 159 subjects were labeled late beginners. The difference in the mean age of the two groups was approximately six months.

Early entrants were poorer in average achievement at the fourth grade level than were those students of similar intelligence in the normal group who had entered school at the usual time and consequently were a year older at the fourth grade level. While the early entrants had better achievement scores for their age, they had poorer achievement scores for their grade level. Although the findings support an advantage for the older beginners, the authors believe the differences

existed before the children began school and that brighter pupils (IQ over 130) receive the most benefit from delayed first-grade entrance.

Toquinto (1968) investigated the effect of 7 to 12 months entrance age differences on first-grade academic achievement as well as achievement at other grade levels. He further examined the differences by sex studying the promotion and retention records as well. Selected subject areas were examined for differences between the age groups and the sexes. Of particular interest to this study was whether differences in chronological age readiness were maintained during the elementary school experience.

The 408 subjects for Toquinto's study were selected from 11 elementary schools whose first-grade cutoff age was 6 by December 31st. The subjects were sixth graders who had attended these schools since entering first grade. The 209 boys and 199 girls were classified as underage (October, November, and December birthdays--age 5 at entrance); overage (January, February, and March birthdays--age 6 at entrance); and normal age (April - September birthdays--age 6 at entrance).

Based on the results of the Lee-Clark Reading Readiness Test, Toquinto concluded that underage students required a delay in the beginning of formal reading more often than students classified as normal or overage. Further analysis of this data showed girls had greater readiness for formal reading instructions at this level than boys. The results of the Iowa Tests of Basic Skills at the third and fifth grade levels reported higher mean scores for the overage group in all areas except spelling, but the differences were not statistically

significant. Mean differences were significant in five of six subject areas when analyzed by sex. Similar findings came from the fifth-grade scores.

Retentions were more frequent among the underage group especially among underage boys. An examination of end of year grades showed the overage group with better grades throughout the elementary school experience. An examination of these same marks by sex indicated that girls were significantly better than boys in reading, and this achievement gap in favor of girls was found in all subjects by fourth and fifth grades.

Haines (1975) selected students for her sample from 11 sixth-grade classes in two white, middle class school systems. Data were taken from the Metropolitan Readiness Test (MRT) and the Ohio Survey Test (fourth and sixth grades). The 116 younger entrants were born in July, August, and September and entered kindergarten between the ages of 4 years, 11 months and 5 years, 3 months while the older entrants entered between the ages of 5 years, 4 months and 5 years, 10 months. None of the scores favored the younger entrants.

Support for Early Entrance

Miller (1957) used a school system with a "5 years old by December 31st admission policy" with special cases born in January, February, and March admitted on a six week trial basis. The four age groups with corresponding birth months were as follows: Young (January, February, March--special cases); Fairly Young (November, December); Average (April through October); and Older (January, February, March).

Miller administered both the MRT and the Stone-Webster Reading Test to each group. The young group was the only group that did not have any students among the lowest one quarter, but it also had the smallest percentage in the top. The fairly young group performed at approximately the same level as the older groups. Miller supported the position that children must be considered individually when predicting academic success and that too much emphasis has been placed on chronological age and its effect on academic, social, and emotional adjustment.

Shaw (1957) selected 248 students from 20 classrooms in three counties. The school entrance age was 6 years on or before January first. The students were divided into two age groups. The younger group was composed of those children who were 5 years, 8 months through 5 years, 11 months. The older group was composed of children who were 6 years through 6 years, 8 months. In the fall of their first-grade experience, the following tests were administered: Haggerty-Olson-Wickman Behavior Rating Schedule, Metropolitan Readiness Test, California Mental Maturity Test, and a sociometric test. The sample students were retested 6 months later. He found that private and public preschool experiences were more significant than no organized preschool experience.

It is often assumed that the older children within a particular grade level will have higher mental ages and subsequently higher achievement. Fava (1957) found little difference in the mental ages of the younger and older children within the same level. The younger students in grades five and six had a higher average mental age than

the older children. She concluded that age was not a detriment to those students classified as early entrants. She found that the lower grade scores of the younger students underwent changes over the elementary school years resulting, in many instances, in higher achievement scores and higher mental ages on the part of the younger students in the upper grades.

The very next year, Nicholson (1958) found, after studying 2,000 children entering first grade, that the mean IQ of the youngest quarter of the population was higher than the mean IQ of the oldest quarter. While a difference of nine months in chronological age existed between the two groups, the oldest group was only three months more advanced mentally, and there was little difference between the achievement scores in reading at the end of grade one for the younger and older students.

Baer (1958) sought to establish whether students who began school early experienced problems and achievement similar to those who waited a year to enter school. He selected 146 11th graders. Seventy-three students with November and December birthdates were matched on the basis of IQ and sex with 73 students born in January and February.

While the differences between the overage students and the underage students tended to decrease, the overage students made higher marks. Girls consistently made better grades than the boys. Most underage students made average school progress.

Plessner (1963) referred to data collected on high school seniors. The students were classified as academic or non-academic based on their course of study. While girls, particularly young girls, tended to

select non-academic courses more frequently than boys, academic achievement as measured by the senior cumulative point average did not appear to reflect differences in first-grade entrance ages. A disproportionate amount of the females in the middle age group tended toward a lower mental maturity classification. Age did, however, appear to be an advantage at the sixth grade level.

Nimnicht, Sparks, and Mortensen (1963) conducted a three-year study of variables that affected success in first grade. The project involved 9,000 students in 84 school districts. IQ scores on the students were obtained from the administration of the Lorge-Thorndike Test of Mental Maturity during the first week of school. The birthdate, father's occupation, and sex of each child were also recorded. Teacher ratings on the success of the students were gathered after the fifth six-weeks.

The results of the study indicated significant relationships between IQ, father's occupation, sex, and school success; however, less than 1/3 of the participating districts found age to be a strong factor in first-grade success. Nimnicht and his colleagues did caution against the use of these relationships in making individual predictions because of other problems involved.

Bellino (1963) studied the mental and educational growth of 5,273 students attending school in five communities of varying size and type. He found that the younger children within a grade had higher IQ's than the older children for that grade level. The mental ages of the two age groups were not as disproportionate as expected even though the older children within the normal grade level age range consistently

exhibited a higher mental age than the younger quarter. The mental age differences decreased as the students proceeded through the grade levels.

No achievement differences in major academic subjects were noted with the possible exception of first-grade reading achievement where the older children tended to achieve slightly higher than the younger children. The sex of the student did not appear to have any effect on the educational development of the students with the exception of first grade where the older boys tended to achieve higher than the younger boys.

Clouser (1965) studied the influence of chronological age at the time of entrance to first grade on the achievement scores of first- and second-grade students who began school at various chronological ages. Three hundred and thirty-two first and second graders were involved. The results of the Metropolitan Achievement Test (MAT) and the California Test of Mental Maturity provided data for analysis. The late beginners achieved significantly higher than early beginners in second grade. However, he concluded that the mental age score was the best predictor of first-grade success, and first-grade achievement scores were the best predictors of second-grade achievement.

Miller and Norris (1967) measured 135 fourth and fifth-grade students in the following areas: readiness, achievement, social adjustment, and intelligence. All of these students had entered one of four elementary schools and were grouped according to their entrance ages: early (5 years, 8 months through 5 years, 11 months); normal (6 years through 6 years, 7 months); and late (6 years, 8 months through

6 years, 11 months).

The following results were reported: (a) the late group had the highest psychological referral and retention rates; (b) the normal group scored higher than the early group on 28 of 30 variables (subtests of the readiness test, the MATs, and IQ); (c) the normal group did not score lowest on any variables; (d) the early group scored lowest on the reading readiness test; (e) the late group scored lower than the normal group on 16 of the 30 variables, scoring lowest of all groups on four of the variables; (f) the normal group scored high on eight of nine sociometric variables; (g) the late group scored lowest on all nine sociometric variables; (h) the normal group received the most favorable sociometric rating from their classmates; and (i) the late group received the least favorable sociometric rating. Miller and Norris allude to a possible cause for the unusual results regarding the late group.

Rosenthal (1969) utilized her own kindergarten students in a study of achievement in reading readiness for children whose entrance ages were different. The 18 younger entrants were between 4 years, 9 months and 5 years, 1 month when they began school while the 21 members of the older group fell between 5 years, 5 months and 5 years, 8 months. She administered the Lee-Clark Reading Readiness Test to both groups in December of their kindergarten year and again the following March. The results of the first testing yielded a mean score of 39.33 for the younger group and a mean of 47.62 for the older group. The second testing revealed a mean score of 53.12 for the younger group and a mean score of 56.19 for the older. She concluded that early exposure to

formal school training appeared beneficial for all children as a positive correlation existed between reading readiness and kindergarten training for both older entrants (5.5 - 5.8) and younger entrants (4.9 - 5.1).

Lewis (1972) looked at the relationship of sex, intelligence, and chronological age with achievement using a three month chronological age differential at the time of entrance into first grade as the major variables. He sampled 88 elementary school students looking at the academic achievement of these students for the 6 years they had attended this school. All 88 of the students had September and December birthdates and had entered the school in first grade. Testing instruments, the California Achievement Tests and the California Short Form Test of Mental Maturity, were used to measure achievement and rate of intellectual growth.

He did not find significant differences in achievement as a result of the age differential or as a result of sex. He did find significant differences in general achievement over the elementary school experience as a result of intelligence. While he suggested several considerations for early admission policies, he did not recommend changing admission policies to school in an effort to gain greater achievement on the part of the students.

Allen (1974) hypothesized that only chance relationships existed between first-grade entrance age and achievement as measured by certain areas on the SRA subtests in grades one, two, and three. The only significant correlation found was between entrance age and arithmetic achievement in grade two.

One hundred and ninety-five third-grade children comprised the sample of Damuth (1976) as she studied the relationship between school entrance age and children's academic achievement in the primary grades. The average age group was composed of students with May and June birthdates and the underage group had birthdates in November or December. The students' scores on the math and reading subtests of the Stanford Achievement Test were used as the achievement measure. Her major hypotheses proposed significant differences in achievement as a result of school entrance age and sex. Each of the hypotheses was rejected for failing to reach significance at the .05 level. Younger entrants had as much chance for success as their average age classmates. However, she did note several trends which would suggest differences existed since older children were consistently higher in achievement scores; the average age group consistently outperformed the underage children; and the female mean scores were consistently higher than the mean male scores.

Summary

Considerable research has been done in relation to the topic of this study, especially during the early 60's and 70's when interest in early childhood education was sparked by the federal government. Many researchers looked at academic achievement in relation to first-grade entrance age since kindergarten was optional in most school systems and not included in compulsory school laws. Some studies focused on short-term school progress in relation to age while others centered on later school achievement. Many studies dealt with general achievement patterns while other researchers focused in on specific skill areas.

While a few studies took a closer look at the social and emotional adjustment of students in relation to age, the majority of the studies dealt with academic achievement as measured by some form of standardized instrument. Factors other than age such as sex, intelligence, and mental age were included in many studies to determine the effect of these factors, if any, on achievement.

Despite the abundance of investigators maintaining that the research on early entrance supports the position that no adverse effects result from early entrance, there are numerous other authorities claiming that lower achievement does result from early entrance. In several studies cited in this review, students of similar intelligence scores were compared, and the results favored the older children over the younger. While research provides ample reason to question laws that require early school entrance, an analysis of the literature on entrance age and school success does not support a blanket statement that children young for their grade placement always have difficulty in school. Children of the same chronological ages demonstrate other developmental differences. Differences in the significant results of these studies leave decision-makers without conclusive evidence concerning this matter. Subsequently, school entrance age cut-offs rest with the legislatures, early intervention advocates lobby for an even younger entrance age, and teachers continue to express concern about the "young" child in the classroom.

Chapter 3

Methodology

The purpose of this study was to determine whether there was a significant difference in the achievement of students who began kindergarten before the age of 5 as compared with students who were five or older at the time of entrance. An effort also was made to determine if significant differences in academic achievement could be further accounted for on the basis of sex, intelligence, race, and/or socioeconomic level.

Chapter three contains an explanation and description of the methodology used to accomplish this objective. The following sections are included: (a) Research site and experimental population; (b) Sample selection and procedures; (c) Instrumentation; (d) Statistical hypotheses; (e) Analysis; and (f) Summary.

Research Site and Experimental Population

The research site for this study was a Central Virginia community comprised of 245 square miles of residential neighborhoods, large expanses of farmland, and manufacturing and industrial facilities. In 1980 the county population was 178,914.

The county school system contained 45 schools with a student enrollment of more than 32,000. In January of 1980, there were 15,204 students enrolled in the system's 33 elementary schools. Almost 80% of this enrollment were white, 18.5% black, with the remaining small percentage representing Hispanics, Asians, and Indians.

The regular classroom teacher to pupil ratio in grades K-5 is approximately 1:23. More than 1/3 of the classroom teachers hold master's degrees. Eighty-seven percent of the teachers are white. The population of this study consisted of 986 fourth-grade students drawn from this heavily populated suburban school system during the 1979-80 academic year.

Sample Selection and Procedures

The sample included 200 students randomly selected through the use of a table of random numbers from a computerized list of all fourth graders whose fifth birthdays occurred on or between January 1, 1975 and March 31, 1975 or on or between October 1, 1975 and December 31, 1975.

One hundred students represented early school entrants and were composed of those students who had entered kindergarten between the ages of 4 years, 8 months and 4 years, 10 months. The late school entrants were represented by 100 students who had entered kindergarten between the ages of 5 years, 5 months and 5 years, 7 months.

The following data were secured for each member of the sample:

1. Sex (male, female)
2. Race (Negro, Caucasian, Oriental)
3. Birthdate (January, February, March, October, November, December, 1970)
4. IQ (Kuhlman-Anderson)
5. Socioeconomic level (free lunch vs. no free lunch)
6. SRA reading growth scale value
7. SRA math growth scale value

The Kuhlman-Anderson Test, Form CD, was given to each student in the Spring of 1979. The seventh edition, 1963, was the most recent revision of this test. The student test booklet for Form CD includes eight tests whose total scores yield a deviation IQ (mean of 100 and a standard deviation of 16), grade percentile ranks, and stanine equivalents. Although there have been some questions raised on whether a representative sample was selected as a norm reference group for the Kuhlman-Anderson Test, it continues to be widely used with minor revisions.

The SRA Achievement Test, Form E, was administered to the sample population in the fall of 1979. Further information on this instrument is found in this chapter under instrumentation.

The School Food Services Department through data processing supplied information on each sample member receiving free lunch at school. Eligibility for free meals served under the National School Lunch Program was determined by the family size and income. The scale ranged from a family size of 1 with a maximum family income of $4,590 to a family size of 12 with a maximum family income of $20,540. In addition, families not meeting these criteria who had unusually high medical bills, shelter costs in excess of 30 percent of income, special education expenses resulting from the mental or physical condition of a child, and disaster or casualty losses were urged to apply.

Permission to obtain this information for each sample member was granted through the Department of Research & Planning by the Director of Research with the stipulation that student, school, and school division data would be protected. Since all elementary schools (33) in

this school system have demographic similarities and uniform entrance requirements and employ essentially the same educational program and curriculum, no attempt was made to separate the students by schools.

The procedure and codes for compiling the data on a single IBM punch card for each student included:

1. Assigning a one-digit code to designate the age group as follows:

   0 = Early school entrant

   1 = Late school entrant

2. Assigning a one-digit code to designate sex as follows:

   0 = Male

   1 = Female

3. Assigning a one-digit code to designate race as follows:

   0 = White

   1 = Black

4. Assigning a one-digit code to designate socioeconomic status as follows:

   0 = Free-lunch recipient

   1 = No free lunch

5. All intelligence test scores were punched at face value and required a two or three-column position on the card.

6. Achievement test scores were indicated by growth scale values and were punched at face value.

Instrumentation

The SRA Achievement Test was used in this study to measure the dependent variable. It is a widely-used norm-referenced test dating

back to 1954.

The SRA Achievement Series, Blue Level, Form E, is designed to measure general academic progress in reading, mathematics, language arts, social studies, science, and work/study skills. The full battery requires approximately 270 minutes to administer.

The questions on the test are intended to represent widespread instructional objectives. The content validity of the test varies from user to user depending on the similarity between local goals and those measured by the test. In The Eighth Mental Measurement Yearbook (Buros, 1978), Bauernfeind contends that there are no achievement series with better written items. The format is uncrowded and easy to follow except for the reading test which includes selections requiring the student to turn back in the test booklet to former passages to respond correctly to given test items. The 48-page Blue Level includes subtests in reading comprehension, vocabulary, grammar usage, spelling, math concepts, and math computation. The scores can be reported in various forms: national, local and special percentiles, stanines, deciles, grade equivalents, and growth scale values. Achievement scores reported as growth scale values were used in this study.

A national standardization was conducted in 1971 to obtain the present percentiles and grade equivalents. A sample of nearly 156,000 students was tested across grades 1 through 12. Users are cautioned by SRA about interpreting grade equivalents literally to mean that the student is capable of doing work on that grade level. The growth scale values, ranging from 0 to 850, were developed in 1967 to show continuous growth in student performance from grade 1 through 12 for each

subject-matter area. The scales were developed so that they would remain consistent across standardizations. They are also independent of each other. These forms of the test score were selected for use in this study since they are equal interval scales.

The KR-20 reliability coefficients for all subjects average 1.88 or above for all scores except math concepts which is slightly lower. There are no reliability data available on equivalent forms of the test or test-retest correlations.

Specific Hypotheses

The directional hypotheses tested for significance at the .05 level of confidence were:

Hypothesis 1 The reading achievement scores of late school entrants is significantly higher than the reading achievement scores of early school entrants in the fourth grade.

Hypothesis 2 The mathematics achievement scores of late school entrants is significantly higher than the mathematics achievement scores of early school entrants in the fourth grade.

Statistical Treatment

The analysis of covariance was used to test the significance of the difference between the means of the age groups by taking into account the correlation between achievement and the following pertinent independent variables: sex, race, intelligence, and socioeconomic status. In analysis of covariance, the set of independent variables includes both a metric covariate, intelligence, and the four nonmetric factors of age, sex, race, and socioeconomic status.

Intelligence, the covariate, was assessed before the factor main

effects and then factor main effects were assessed with adjustments made for other factors and the covariate. The procedure virtually controlled intelligence, somewhat as matching would, and actually removed the variance due to measured intelligence from the dependent variable measures before the test of significance was applied. The 0.05 level of significance was deemed appropriate for this study.

The ability to vary one independent variable while controlling other independent variables that might contribute to the variance of the dependent variable enhanced the precision and exactness of the research results. Achieving control of attribute variables not only separated the influences ascribed to the independent variables but also yielded additional research information about their effect upon the dependent variable.

Summary

This study was designed to contribute information concerning the relationships between age and achievement by examining a specific situation while controlling for other independent variables that might contribute to the variance of the dependent variable. The subjects under investigation were fourth-grade students during the 1979-80 school year.

The SRA Achievement Test was the instrument selected to assess achievement as the dependent variable. An analysis of covariance was used to test the statistical significance of the relationship between the variables.

Chapter 4

Analysis of Results

The purpose of this investigation was to determine the relationship between age at the time of entrance to kindergarten and academic achievement as defined. Specifically, this study was directed by the following questions:

1. Is there any significant difference in achievement between the two groups which can be attributed to age?

2. Does being a member of the older or younger portion of the class have differing effects on the educational achievement of the different sexes?

3. What is the relationship between intelligence, sex, race and socioeconomic status with the achievement scores of early and late beginning students?

4. Which of these variables: age, sex, race, socioeconomic status or intelligence seem to be the best indicators of probable success in achievement?

The following analyses by hypothesis were performed using all 200 subjects in the sample. The data obtained were subjected to an analysis of covariance. The analysis of covariance analyzes the difference between the groups on the achievement scores after taking into account differences between the groups on the covariate. In this study, the covariate was the intelligence score.

Analysis of Data and Findings

Hypothesis 1. Hypothesis 1 states that the reading achievement

scores of students who entered kindergarten between the ages of 5 years, 5 months and 5 years, 7 months will be significantly higher than the reading achievement scores of students who entered kindergarten between the ages of 4 years, 8 months and 4 years, 10 months as determined by the SRA Achievement Test administered in the fourth grade. To test the hypothesis, achievement data in reading were subjected to analysis of covariance which adjusted for intelligence differences in the two groups.

The analysis produced the F ratio of F = 21.829 which is significant at the p = 0.000 level. Analysis of the covariate, intelligence, indicated that intelligence was a significant covariate p = 0.000. When the main effects were assessed with adjustment for intelligence, the F ratio was statistically significant for age p = 0.000 and sex p = 0.015. Table 1 displays the statistical findings resulting from the analysis of covariance in testing the hypothesis. The reading scores are reported in Appendix A.

The research hypothesis that there would be a significant difference between the two age groups in terms of reading achievement was accepted. There were statistically significant differences between the two groups in terms of reading achievement below the p = 0.05 level.

An examination of the multiple classification analysis, Table 2, indicates an increasing difference between the two age groups as controls were instituted. Initially, without any adjustments, there was a 7.68 point difference between the means of reading achievement data obtained from the two age groups and a grand mean of 285.66.

Table 1

Hypothesis 1 - Analysis of Covariance of

Reading Scores on the SRA Achievement Test

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Covariates	161006.313	1	161006.313	123.329	0.000
(Intel)	161006.313	1	161006.313	123.329	0.000
Main Effects	34678.563	4	8669.641	6.641	0.000
Age	28497.410	1	28497.410	21.829	0.000
Sex	7820.176	1	7820.176	5.990	0.015
Race	514.458	1	514.458	0.394	0.531
SES	10.699	1	10.699	0.008	0.928
2-Way Interactions	4301.313	6	716.885	0.549	0.770
Age Sex	417.671	1	417.671	0.320	0.572
Age Race	574.307	1	574.307	0.440	0.508
Age SES	2283.282	1	2283.282	1.749	0.188
Sex Race	131.109	1	131.109	0.100	0.752
Sex SES	1741.718	1	1741.718	1.334	0.250
Race SES	1192.131	1	1192.131	0.913	0.341
3-Way Interactions	4507.000	4	1126.750	0.863	0.487
Age Sex Race	701.996	1	701.996	0.538	0.464
Age Sex SES	1096.201	1	1096.201	0.840	0.361
Age Race SES	405.551	1	405.551	0.311	0.578
Sex Race SES	385.834	1	385.834	0.296	0.587
4-Way Interactions	2368.125	1	2368.125	1.814	0.180
Age Sex Race SES	2368.139	1	2368.139	1.814	0.180
Explained	206861.313	16	12928.832	9.903	0.000
Residual	238906.313	183	1305.499		
Total	445767.626	199	2240.038		

Table 2

Hypothesis 1 - Multiple Classification Analysis

Grand Mean = 285.66 Variable + Category	N	Unadjusted Dev'n	ETA	Adjusted for Independents Dev'n	BETA	Adjusted for Independents + Covariates Dev'n	BETA
Age							
0	100	-3.84		-4.48		-12.46	
1	100	3.84		4.47		12.45	
			0.08		0.09		0.26
Sex							
0	98	3.91		4.40		6.43	
1	102	-3.75		-4.23		-6.18	
			0.08		0.09		0.13
Race							
0	169	3.46		2.66		0.75	
1	31	-18.86		-14.51		-4.10	
			0.17		0.13		0.04
SES							
0	28	-17.74		-12.23		-0.63	
1	172	2.89		1.99		0.10	
			0.15		0.10		0.01
Multiple R Squared							0.439
Multiple R							0.663

Included in this variance were possible differences resulting from differences in intelligence and other factors. When adjustments were made for sex, race, and socioeconomic factors, differences in means increased to 8.95. The difference increased to 24.91 points when the adjustment was made for the covariate and the independents.

The relationship between age and reading achievement and sex and reading achievement increased significantly as controls were introduced. The opposite was true with race and socioeconomic factors. The factors were not related in the context of achievement. Multiple R^2 0.439 represented the proportion of variation in reading achievement explained by the additive effects of age, sex, race, socioeconomic status, and intelligence.

The beta scores on the multiple classification table suggest a relationship between age and sex and race and socioeconomic status. The major source of variation in all cases was the covariate, intelligence.

Hypothesis 2. Hypothesis 2 states that the mathematics achievement scores of students who entered kindergarten between the ages of 5 years, 5 months and 5 years, 7 months will be significantly higher than the mathematics achievement scores of students who entered kindergarten between the ages of 4 years, 8 months and 4 years, 10 months as determined by the SRA Achievement Test administered in the fourth grade. To test the hypothesis, math growth scale values were subjected to analysis of covariance which adjusted for intelligence differences between the two groups. The analysis produced the F ratio of F = 13.667 which is significant at the p = 0.000 level. Analysis of covariate, intelligence

scores, indicated that intelligence was a significant covariate, $p = 0.000$. When the main effects were assessed with adjustments for intelligence scores and other factors, the F ratio was statistically significant for age alone, $p = 0.000$. Table 3 reveals information resulting from the analysis of covariance in testing the hypothesis. The math growth scale values are reported in the Appendix.

The research hypothesis that there would be a significant difference between the two age groups in terms of mathematics achievement as determined by the SRA Achievement Test was accepted. There were statistically significant differences between the two groups in terms of mathematics achievement at the $p < 0.05$ level.

The multiple classification analysis, Table 4, revealed that an initial mean difference of 4.16 between the two age groups increased to 4.92 points when adjusted for sex, race, and socioeconomic status. When further controlled for the covariate and independents, the difference in mean scores increased to 20.18.

The relationship between age and mathematics achievement and sex and mathematics achievement increased as controls were introduced. The opposite was true of race and socioeconomic status. The factors were not related in the context of mathematics achievement. No significant interactions were found. Multiple R^2 0.410 represented the percentage (41%) of variation in mathematics achievement explained by the additive effects of age, sex, race, socioeconomic status, and intelligence.

Examination of the data indicates some trends which, while not significant, may indicate a need for further research. The beta scores from the multiple classification analysis suggested a relationship be-

Table 3

Hypothesis 2 - Analysis of Covariance of

Math Scores on the SRA Achievement Test

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Covariates	157527.500	1	157527.500	115.062	0.000
Intel	157527.500	1	157527.500	115.062	0.000
Main Effects	21551.438	4	5387.859	3.935	0.004
Age	18710.496	1	18710.496	13.667	0.000
Sex	1716.742	1	1716.742	1.254	0.264
Race	535.169	1	535.169	0.391	0.533
SES	485.745	1	485.745	0.355	0.552
2-Way Interactions	1233.125	6	205.521	0.150	0.989
Age Sex	38.936	1	38.936	0.028	0.866
Age Race	0.586	1	0.586	0.000	0.984
Age SES	87.408	1	87.408	0.064	0.801
Sex Race	0.377	1	0.377	0.000	0.987
Sex SES	264.394	1	264.394	0.193	0.661
Race SES	567.910	1	567.910	0.415	0.520
3-Way Interactions	4301.188	4	1075.297	0.785	0.536
Age Sex Race	1318.247	1	1318.247	0.963	0.328
Age Sex SES	1454.066	1	1454.066	1.062	0.304
Age Race SES	337.914	1	337.914	0.247	0.620
Sex Race SES	932.952	1	932.952	0.681	0.410
4-Way Interactions	1561.375	1	1561.375	1.140	0.287
Age Sex Race SES	1561.340	1	1561.340	1.140	0.287
Explained	186174.625	16	11635.914	8.499	0.000
Residual	250538.500	183	1369.063		
Total	436713.125	199	2194.538		

Table 4

Hypothesis 2 - Multiple Classification Analysis

Grand Mean = 268.85 Variable + Category	N	Unadjusted Dev'n	ETA	Adjusted for Independents Dev'n	BETA	Adjusted for Independents + Covariates Dev'n	BETA
Age							
0	100	-2.08		-2.46		-10.09	
1	100	2.08		2.46		10.09	
			0.04		0.05		0.22
Sex							
0	98	0.81		1.07		3.01	
1	102	-0.78		-1.03		-2.90	
			0.02		0.02		0.06
Race							
0	169	3.62		2.59		0.77	
1	31	-19.72		-14.14		-4.18	
			0.18		0.13		0.04
SES							
0	28	-20.81		-15.34		-4.24	
1	172	3.39		2.50		0.69	
			0.18		0.13		0.04
Multiple R Squared					0.050		0.410
Multiple R					0.223		0.640

tween age and sex and race and socioeconomic status. The cell means further suggested that late entrance may have a more positive effect on the mathematics achievement of males than that of females. This was particularly true of females of low socioeconomic status. The mean scores of high socioeconomic status were always higher than those of low socioeconomic status yet not significantly higher.

Other Observations

To assist in the interpretation of the findings, correlations were obtained between the variables. The Pearson correlation coefficients supported a strong positive relationship between reading achievement and mathematics achievement ($p = 0.000$); reading achievement and socioeconomic status ($p = 0.016$); and mathematics achievement and socioeconomic status ($p = 0.005$). Negative relationships appeared to exist between race and both reading and mathematics achievement ($p = 0.008$ and $p = 0.005$ respectively) and race and socioeconomic status ($p = 0.000$). These findings are presented in Table 5. These results confirmed the complexity of predicting the achievement level of students considering the multiple number of possible intervening variables.

Significant relationships also existed between intelligence and mathematics achievement ($p = 0.000$), reading achievement ($p = 0.000$), age ($p = 0.000$), race ($p = 0.003$), and socioeconomic status ($p = 0.001$) supporting the idea that intelligence was the single most important variable in this study used to determine achievement. Of particular interest to this study was the observation that age does not appear to be of significant value unless it is broken down to denote early and late school entrance.

Table 5

Other Findings Related to Reading Achievement, Math Achievement, Age, Sex, Race, Socioeconomic Status and Intelligence Using Pearson Correlations

	Read	Math	Age	Sex	Race	SES	Intel
Read	1.0000 (200) P=*****	0.6090 (200) P=0.000	0.0814 (200) P=0.126	-0.0811 (200) P=0.127	-0.1711 (200) P=0.008	0.1516 (200) P=0.016	0.6010 (200) P=0.000
Math	0.6090 (200) P=0.000	1.0000 (200) P=*****	0.0445 (200) P=0.266	-0.0171 (200) P=0.405	-0.1808 (200) P=0.005	0.1797 (200) P=0.005	0.6006 (200) P=0.000
Age	0.0814 (200) P=0.126	0.0445 (200) P=0.266	1.0000 (200) P=*****	0.1000 (200) P=0.079	-0.0138 (200) P=0.423	-0.0576 (200) P=0.209	-0.2546 (200) P=0.000
Sex	-0.0811 (200) P=0.127	-0.0171 (200) P=0.405	0.1000 (200) P=0.079	1.0000 (200) P=*****	-0.0224 (200) P=0.377	-0.0208 (200) P=0.385	0.0380 (200) P=0.296
Race	-0.1711 (200) P=0.008	-0.1808 (200) P=0.005	-0.0138 (200) P=0.423	-0.0224 (200) P=0.377	1.0000 (200) P=*****	-0.3846 (200) P=0.000	-0.1973 (200) P=0.003
SES	0.1516 (200) P=0.016	0.1797 (200) P=0.005	-0.0576 (200) P=0.209	-0.0208 (200) P=0.385	-0.3846 (200) P= 0.000	1.0000 (200) P=*****	0.2171 (200) P=0.001
Intel	0.6010 (200) P=0.000	0.6006 (200) P=0.000	-0.2546 (200) P=0.000	0.0380 (200) P=0.296	-0.1973 (200) P=0.003	0.2171 (200) P=0.001	1.0000 (200) P=*****

When intelligence was recoded as a factor with 1 = lowest through 90; 2 = 91 through 110; and 3 = 111 through highest, age and intelligence had significant F ratios ($p = 0.005$ and $p = 0.000$) as well as the two-way interaction of sex and intelligence ($p = 0.023$). These findings are found in Table 6.

An analysis of variance run with intelligence as a factor rather than a covariate revealed that intelligence continued to account for the greatest amount of mean variance with age second. The adjusted eta changed only slightly when mean scores were adjusted for other independents. These findings are summarized in Table 7.

Intelligence was identified as the only significant variable when examining mathematics achievement ($p = 0.000$). Several interactions emerged: age and intelligence ($p = 0.051$); age, sex, and race ($p = 0.024$); age, race, and socioeconomic status ($p = 0.012$); sex, race, and intelligence ($p = 0.054$); and race, socioeconomic status, and inligence ($p = 0.009$). All of the variables explained only 22% of the total variation found in mathematics achievement. These findings are presented in Tables 8 and 9.

Despite the significant interactions which emerged between intelligence as a factor and other variables, the significance of age cannot be ignored. The overall conclusions of the study are unchanged.

Summary

The results presented may be summarized according to the hypotheses and the four directional questions.

The analysis of covariance pertaining to reading achievement indicated that school entrance age was a significant factor. The research

Table 6

Analysis of Variance of

Reading Scores on the SRA Achievement Test

Using Intelligence as a Factor

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Main Effects	124667.563	5	24933.512	14.955	0.000
Age	13271.102	1	13271.102	7.960	0.005
Sex	3400.811	1	3400.811	2.040	0.155
Race	218.360	1	218.360	0.131	0.718
SES	1097.866	1	1097.866	0.658	0.418
Intel	100822.938	1	100822.938	60.472	0.000
2-Way Interactions	23037.125	10	2303.712	1.382	0.192
Age Sex	2.573	1	2.573	0.002	0.969
Age Race	110.613	1	110.613	0.066	0.797
Age SES	4225.031	1	4225.031	2.534	0.113
Age Intel	927.262	1	927.262	0.556	0.457
Sex Race	125.430	1	125.430	0.075	0.784
Sex SES	405.156	1	405.156	0.243	0.623
Sex Intel	8824.645	1	8824.645	5.293	0.023
Race SES	5547.430	1	5547.430	3.327	0.070
Race Intel	63.792	1	63.792	0.038	0.845
SES Intel	322.311	1	322.311	0.193	0.661
3-Way Interactions	7957.563	10	795.756	0.477	0.903
Age Sex Race	925.012	1	925.012	0.555	0.457
Age Sex SES	3059.667	1	3059.667	1.835	0.177
Age Sex Intel	12.468	1	12.468	0.007	0.931
Age Race SES	1094.891	1	1094.891	0.657	0.419
Age Race Intel	42.048	1	42.048	0.025	0.874
Age SES Intel	88.644	1	88.644	0.053	0.818
Sex Race SES	0.020	1	0.020	0.000	0.997
Sex Race Intel	2736.106	1	2736.106	1.641	0.202
Sex SES Intel	2690.833	1	2690.833	1.614	0.206
Race SES Intel	1375.612	1	1375.612	0.825	0.365
Explained	155662.250	25	6226.488	3.735	0.000
Residual	290105.375	174	1667.272		
Total	445767.625	199	2240.038		

Table 7

Multiple Classification Analysis

Intelligence as a Factor

Grand Mean = 285.66 Variable + Category	N	Unadjusted Dev'n	ETA	Adjusted for Independent Dev'n	BETA	Adjusted for Independents + Covariates Dev'n	BETA
Age							
0	100	-3.84		-8.32			
1	100	3.84		8.32			
			0.08		0.18		
Sex							
0	98	3.91		4.23			
1	102	-3.75		-4.07			
			0.08		0.09		
Race							
0	169	3.46		0.50			
1	31	-18.86		-2.70			
			0.17		0.02		
SES							
0	28	-17.74		-6.34			
1	172	2.89		1.03			
			0.15		0.05		
Intel							
2	57	-36.66		-37.48			
3	143	14.61		14.94			
			0.49		0.50		
Multiple R Squared					0.280		
Multiple R					0.529		

Table 8

Analysis of Variance of

Math Scores on the SRA Achievement Test

Using Intelligence as a Factor

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Main Effects	94271.625	5	18854.324	10.566	0.000
Age	6268.559	1	6268.559	3.513	0.063
Sex	163.379	1	163.379	0.092	0.763
Race	510.111	1	510.111	0.286	0.594
SES	2924.306	1	2924.306	1.639	0.202
Intel	72457.688	1	72457.688	40.607	0.000
2-Way Interactions	10583.563	10	1058.356	0.593	0.818
Age Sex	38.869	1	38.869	0.022	0.883
Age Race	457.778	1	457.778	0.257	0.613
Age SES	3.885	1	3.885	0.002	0.963
Age Intel	6909.492	1	6909.492	3.872	0.051
Sex Race	167.495	1	167.495	0.094	0.760
Sex SES	11.775	1	11.775	0.007	0.935
Sex Intel	891.202	1	891.202	0.499	0.481
Race SES	881.014	1	881.014	0.494	0.483
Race Intel	726.772	1	726.772	0.407	0.524
SES Intel	393.078	1	393.078	0.220	0.639
3-Way Interactions	21380.750	10	2138.075	1.198	0.295
Age Sex Race	9230.223	1	9230.223	5.173	0.024
Age Sex SES	3169.158	1	3169.158	1.776	0.184
Age Sex Intel	6610.492	1	6610.492	3.705	0.056
Age Race SES	11501.391	1	11501.391	6.446	0.012
Age Race Intel	1989.896	1	1989.896	1.115	0.292
Age SES Intel	4719.797	1	4719.797	2.645	0.106
Sex Race SES	1691.051	1	1691.051	0.948	0.332
Sex Race Intel	6714.059	1	6714.059	3.763	0.054
Sex SES Intel	778.332	1	778.332	0.436	0.510
Race SES Intel	12446.094	1	12446.094	6.975	0.009
Explained	126235.938	25	5049.438	2.830	0.000
Residual	310477.188	174	1784.352		
Total	436713.125	199	2194.538		

Table 9

Multiple Classification Analysis

Intelligence as a Factor

Grand Mean = 268.85		Unadjusted		Adjusted for Independents		Adjusted for Independents + Covariates	
Variable + Category	N	Dev'n	ETA	Dev'n	BETA	Dev'n	BETA
Age							
0	100	-2.08		-5.72			
1	100	2.08		5.72			
			0.04		0.12		
Sex							
0	98	0.81		0.93			
1	102	-0.78		-0.89			
			0.02		0.02		
Race							
0	169	3.62		0.76			
1	31	-19.72		-4.13			
			0.18		0.04		
SES							
0	28	-20.81		-10.34			
1	172	3.39		1.68			
			0.18		0.09		
Intel							
2	57	-32.27		-31.78			
3	143	12.86		12.67			
			0.44		0.43		
Multiple R Squared					0.216		
Multiple R					0.465		

hypothesis that there would be a significant difference between the two age groups in terms of reading achievement was accepted.

The analysis of covariance related to mathematics achievement also identified school entrance age as a significant variable. There were statistically significant differences between the two age groups in terms of mathematics achievement at the p 0.05 level of significance.

Intelligence appeared to be the variable which best indicated probable success in achievement in both reading and mathematics. The significance of school entrance age in both areas, however, could not be ignored. There seemed to be some evidence to suggest that a later entrance age has more of an impact on the reading and mathematics achievement of males than females. The absence of overwhelming evidence in this regard indicated that caution must be exercised in drawing implications which the data do not specifically warrant.

Sex appears to have a greater impact on reading achievement than on mathematics achievement. The significant relationship between sex and reading achievement did not exist for mathematics achievement.

Chapter 5

Summary, Conclusions, and Recommendations

The statement of the problem, a selected review of the literature, an outline of the study design, and analysis of the findings were presented in the first four chapters. This chapter contains a summary of the investigation including conclusions and recommendations for further research.

Summary of the Investigation

The purpose of this study was to investigate the academic achievement of children who entered kindergarten before 5 years of age with that of a group who entered after 5 years of age. Measures of achievement were scores attained by the subjects on the SRA Achievement Test, Form E.

A review of the research related to age and achievement yielded inconclusive findings. The preponderance of the literature dealt with achievement difficulties on the basis of maturational development and the need for adjusted entrance ages or curriculum to provide for sexual differences. Even with significant findings in a particular research study, it was not possible to project the results beyond the specific group under investigation. The review of previous research focused on two main areas: (a) research which provided for the rejection of early school entrance, and (b) research which focused on support for early school entrance.

The research setting was a central Virginia suburban community. A sample of fourth graders whose fifth birthdays occurred on or between

October 1, 1975 and December 31, 1975 or on or between January 1, 1975 and March 31, 1975 was randomly selected. These fourth graders were selected because they represented the first grade level to fully implement the state's revised kindergarten entrance age requirements. The data for the study were available from the school system's permanent records. Permission to obtain these data was granted through the Department of Research and Planning. No attempt was made to separate the students by schools.

The total sample group consisted of 100 subjects representing early school entrants and 100 subjects representing late school entrants. For each student the birthdate, sex, race, IQ, socioeconomic level, and SRA reading and mathematics growth scale values were recorded. The data were treated to an analysis of covariance.

The hypotheses tested for significance at the $p < 0.05$ level were:

1. Late school entrants will score significantly higher than early school entrants in reading achievement.

2. Late school entrants will score significantly higher than early school entrants in mathematics achievement.

Virginia Public Schools admit children to kindergarten in August/September if those children reach age 5 by December 31st of the same year. Children entering school whose birthdates are in October, November, and December are from seven to twelve months younger than those entering at the same time whose birthdates fall in January, February, or March.

Findings and Conclusions

The findings of the study resulted from a statistical treatment of raw and coded data by the analysis of covariance technique. Significance at the .05 level was determined by the F ratio when applied to the F table. The findings were:

1. The analysis of covariance pertaining to reading achievement indicated that school entrance age was a significant factor. The research hypothesis that there would be a significant difference between the two age groups in terms of reading achievement was accepted.

2. The analysis of covariance related to mathematics achievement also identified school entrance age as a significant variable. There were statistically significant differences between the two age groups in terms of mathematics achievement at the $p < 0.05$ level of significance.

3. When children were classified as either early or late school entrants by chronological age, significant differences were shown in reading and mathematics achievement of late entrants over early entrants. This difference increased when achievement was adjusted for inequities in intelligence, sex, race, and socioeconomic status.

4. Intelligence scores produced consistent significant correlations with mathematics achievement, reading achievement, age, race, and socioeconomic status supporting the premise that intelligence was the single most important variable in this study used to determine achievement. While a strong positive relationship was shown between both reading and mathematics achievement and socioeconomic status, a negative correlation appeared to exist between race and both reading and mathematics achievement. Sex appeared to have a greater impact on

reading achievement than on mathematics achievement.

With the present study completed, it appears that significant differences in academic achievement are likely to occur as a result of age differentials at the time of entrance into kindergarten with an advantage for late beginning children. A move to delay the chronological age for school admission might improve readiness and subsequent academic achievement for some children.

Implications for Further Research

Further research is needed to provide data necessary for improved educational decision making. The following recommendations are based on information gained from this study:

1. A similar study should be undertaken to analyze the difference between the achievement of those young children who entered school with that of a comparable group whose parents utilized the option of waiting a year.

2. An analysis of successful and unsuccessful primary grade children should be done to determine the respective characteristics of each group.

3. A study should be made to assess the effectiveness of various kindergarten curricula and environments on the achievement of early and late school entrants.

APPENDIX A

STATISTICAL ANALYSIS SYSTEM

READ	AGE	SEX	RACE	SES	INTEL	MATH
203	0	0	0	0	112	221
269	0	0	0	0	115	238
276	0	0	0	0	118	273
203	0	0	0	1	104	252
312	0	0	0	1	104	216
281	0	0	0	1	106	200
264	0	0	0	1	106	168
256	0	0	0	1	107	249
256	0	0	0	1	110	181
330	0	0	0	1	110	181
239	0	0	0	1	110	221
256	0	0	0	1	111	216
243	0	0	0	1	112	252
262	0	0	0	1	113	249
325	0	0	0	1	114	267
230	0	0	0	1	115	226
235	0	0	0	1	116	242
269	0	0	0	1	118	205
292	0	0	0	1	119	315
286	0	0	0	1	119	278
239	0	0	0	1	119	252
304	0	0	0	1	119	276
278	0	0	0	1	120	267
318	0	0	0	1	120	252
295	0	0	0	1	121	315
259	0	0	0	1	121	249
278	0	0	0	1	124	278
360	0	0	0	1	126	318
312	0	0	0	1	127	315
269	0	0	0	1	127	255
239	0	0	0	1	127	249
298	0	0	0	1	128	234
320	0	0	0	1	133	355
348	0	0	0	1	133	321
307	0	0	0	1	134	342
343	0	0	0	1	136	321
292	0	0	0	1	138	375
318	0	0	0	1	139	331
373	0	0	0	1	140	338
283	0	0	0	1	140	298
281	0	0	0	1	143	304
309	0	0	0	1	143	346
360	0	0	0	1	144	328
364	0	0	0	1	146	298
315	0	0	0	1	148	289
289	0	0	1	0	105	270
235	0	0	1	0	108	211
230	0	0	1	0	108	258
262	0	0	1	0	130	211

READ	AGE	SEX	RACE	SES	INTEL	MATH
218	0	0	1	1	98	226
230	0	0	1	1	101	226
281	0	0	1	1	109	221
203	0	0	1	1	121	264
334	0	0	1	1	127	301
262	0	1	0	0	116	273
203	0	1	0	1	108	211
271	0	1	0	1	109	238
283	0	1	0	1	109	270
266	0	1	0	1	109	187
120	0	1	0	1	110	205
247	0	1	0	1	110	234
247	0	1	0	1	113	211
158	0	1	0	1	115	226
256	0	1	0	1	115	226
295	0	1	0	1	116	325
273	0	1	0	1	116	249
203	0	1	0	1	117	270
341	0	1	0	1	117	325
343	0	1	0	1	117	351
243	0	1	0	1	118	230
315	0	1	0	1	118	168
295	0	1	0	1	119	264
309	0	1	0	1	120	245
309	0	1	0	1	121	276
247	0	1	0	1	122	264
235	0	1	0	1	124	211
276	0	1	0	1	125	292
307	0	1	0	1	126	328
256	0	1	0	1	127	238
309	0	1	0	1	131	321
286	0	1	0	1	131	226
271	0	1	0	1	132	255
325	0	1	0	1	133	292
301	0	1	0	1	137	315
338	0	1	0	1	138	321
286	0	1	0	1	140	255
325	0	1	0	1	141	267
315	0	1	0	1	142	325
334	0	1	0	1	142	365
350	0	1	0	1	144	318
338	0	1	0	1	145	295
295	0	1	0	1	152	318
353	0	1	0	1	156	351
218	0	1	1	0	107	200
262	0	1	1	0	111	304
298	0	1	1	0	133	273
320	0	1	1	0	144	258
336	0	1	1	1	114	238

READ	AGE	SEX	RACE	SES	INTEL	MATH
328	0	1	1	1	128	325
203	0	1	1	1	130	194
262	1	0	0	0	92	258
243	1	0	0	0	100	249
360	1	0	0	0	114	301
341	1	0	0	0	117	287
320	1	0	0	0	122	284
195	1	0	0	1	101	181
292	1	0	0	1	103	249
292	1	0	0	1	103	325
309	1	0	0	1	103	370
312	1	0	0	1	109	276
264	1	0	0	1	109	295
230	1	0	0	1	110	211
262	1	0	0	1	111	261
286	1	0	0	1	112	261
278	1	0	0	1	114	242
243	1	0	0	1	114	261
289	1	0	0	1	114	205
315	1	0	0	1	115	258
323	1	0	0	1	116	264
315	1	0	0	1	116	252
286	1	0	0	1	116	309
251	1	0	0	1	117	242
338	1	0	0	1	117	221
330	1	0	0	1	117	295
360	1	0	0	1	117	287
298	1	0	0	1	119	273
273	1	0	0	1	120	278
281	1	0	0	1	121	292
289	1	0	0	1	123	211
283	1	0	0	1	124	245
338	1	0	0	1	130	261
338	1	0	0	1	131	342
312	1	0	0	1	133	270
378	1	0	0	1	135	342
402	1	0	0	1	141	331
318	1	0	0	1	141	381
348	1	0	0	1	146	400
295	1	0	1	0	110	216
276	1	0	1	1	94	245
259	1	0	1	1	104	234
273	1	0	1	1	106	249
271	1	0	1	1	115	287
276	1	0	1	1	123	267
343	1	0	1	1	130	315
158	1	1	0	0	101	230
251	1	1	0	0	101	200
251	1	1	0	0	104	205

READ	AGE	SEX	RACE	SES	INTEL	MATH
247	1	1	0	0	109	245
273	1	1	0	0	114	255
243	1	1	0	1	91	200
224	1	1	0	1	98	281
251	1	1	0	1	102	276
224	1	1	0	1	104	211
286	1	1	0	1	105	205
168	1	1	0	1	106	249
264	1	1	0	1	106	245
230	1	1	0	1	106	194
243	1	1	0	1	107	284
251	1	1	0	1	107	255
218	1	1	0	1	109	238
295	1	1	0	1	110	298
247	1	1	0	1	110	234
269	1	1	0	1	112	258
235	1	1	0	1	112	226
283	1	1	0	1	114	264
336	1	1	0	1	114	309
259	1	1	0	1	114	258
269	1	1	0	1	116	273
309	1	1	0	1	116	230
343	1	1	0	1	117	289
373	1	1	0	1	117	328
298	1	1	0	1	117	338
289	1	1	0	1	117	261
304	1	1	0	1	120	252
259	1	1	0	1	120	276
286	1	1	0	1	121	309
318	1	1	0	1	122	245
298	1	1	0	1	123	258
295	1	1	0	1	125	387
353	1	1	0	1	126	306
345	1	1	0	1	126	321
330	1	1	0	1	127	242
368	1	1	0	1	129	321
312	1	1	0	1	129	278
320	1	1	0	1	130	292
281	1	1	0	1	132	309
350	1	1	0	1	132	276
348	1	1	0	1	139	346
338	1	1	0	1	142	312
378	1	1	0	1	143	335
350	1	1	0	1	144	338
353	1	1	0	1	148	338
224	1	1	1	0	99	226
264	1	1	1	0	110	287
266	1	1	1	0	110	234
295	1	1	1	0	118	226

READ	AGE	SEX	RACE	SES	INTEL	MATH
328	1	1	1	0	122	252
211	1	1	1	1	96	211
177	1	1	1	1	101	216
266	1	1	1	1	107	278

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Abstract

A STUDY OF THE RELATIONSHIP BETWEEN CHRONOLOGICAL AGE AT THE TIME OF ENTRANCE TO KINDERGARTEN AND ACADEMIC ACHIEVEMENT

Jo Lynne DeMary, Ed.D.

The College of William and Mary in Virginia, 1981

Chairman: Dr. Robert Maidment

The purpose of this study was to investigate empirically the relationship that exists between age at the time of entrance to kindergarten and academic achievement as reflected by standardized achievement scores administered in the fourth grade. The theoretical framework of this study is found in the field of child growth and development.

The sample included 200 students whose fifth birthdays occurred on or between January 1, 1975 and March 31, 1975 or on or between October 1, 1975 and December 31, 1975. They were selected from a suburban school system located in Central Virginia. The sex, race, birthdate, I.Q., socioeconomic level, and the SRA reading and math growth scale values of each sample member were collected.

Statistical tests of significance for the research hypotheses involved the use of analysis of covariance. The effect of age was determined by comparing the achievement scores of the two age groups. The covariate, intelligence, was used to control for initial inequalities. The hypotheses were tested for statistically significant ($p < 0.05$) relationships between (a) entrance age and reading achievement, and (b) entrance age and math achievement.

1. The hypothesis that the reading achievement scores of late school entrants would be significantly higher than the reading achievement scores of early school entrants was accepted.

2. The hypothesis that the math achievement scores of late school entrants would be significantly higher than the math achievement scores of early school entrants was accepted.

In conclusion, it appears that significant differences in academic achievement are likely to accrue as a result of age differentials at the time of entrance into kindergarten with an advantage for late beginning children. A move to delay the chronological age for school admission might improve readiness and subsequent academic achievement.