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I am submitting herewith a dissertation written by Melissa H. Rifkin entitled "A Quantitative Analysis of Achievement Gain Scores of Students in Single-Grade and Multiage Classrooms." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

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We have read this dissertation
and recommend its acceptance:

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Associate Vice Chancellor and
Dean of The Graduate School

A Quantitative Analysis of Achievement Gain Scores of Students in Single-Grade and Multiage Classrooms

A Dissertation

Presented for the

Doctor of Philosophy Degree

The University of Tennessee, Knoxville

Melissa H. Rifkin

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Dedication

This dissertation is dedicated to my parents, Howard D. Rifkin and Noelle S. Rifkin, who have made this journey possible. Their constant encouragement has taught me that the sky is the limit. Their loyal support has taught me that education is a privilege. Through their strength, security, and everlasting love, I have experienced, grown, and achieved. Words cannot begin to express my gratitude.

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positiveness and security, as well as their wealth of love, and I am eternally grateful.

Abstract

Recently there has been an increase in multiage classrooms across the United States. However, there is a limited body of research on multiage grouping and academic achievement, or the gain in academic achievement scores of students in multiage classrooms. This study examined the gain in achievement scores of students, by grade and subject area, in a suburban East-Tennessee elementary school.

The purpose of this study was to examine differences in achievement gain scores of students in single-grade and multiage classrooms, as well as differences between the various levels of students within these classrooms. Student achievement scores in grades two through five, from 1992 through 1997, from the Tennessee Comprehensive Assessment Program's (TCAP) administration of the Comprehensive Tests of Basic Skills Fourth Edition (CTBS/4) were used. Using the SAS© System for statistical analysis, gain scores were computed in order to control for various student achievement levels. The general linear model procedure (GLM) was used to calculate two-way analysis of variance (ANOVA) for single-grade and multiage groups, in grade 3, grade 4, and grade 5 in the subject areas of language, reading, and mathematics.

This study found that overall there was not a consistent difference between single-grade and multiage student achievement gain scores. However, there were three significant findings in favor of multiage classrooms. This significance was in the areas of Reading and Language at Grade 3 and in Mathematics at Grade 4. In addition, there was a trend for lower level students to achieve higher gains than upper level students. Overall, the differences were greater for multiage classrooms than single-grade classrooms.

These results indicate that on the basis of these findings, which are based solely on achievement gain scores for this school, multiage grouping is at least similar to, if not more effective in certain instances, than single-grade settings. When considering this study's results, it appears from the data that multiage placements may slightly favor younger children in the group and children who achieve at a lower level.

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Chapter I

Introduction

Traditional single-grade classrooms group students by chronological age and/or ability. Multiage grouping places children with more than a one-year age span together in classrooms without grade level designations (Gutloff, 1995). The model of multiage grouping can be traced to the 1600's, the beginning of education in the United States, when one-room schools housed all students in one classroom regardless of age (Daniel, 1995). In the seventeenth century, Comenius suggested multiage groupings so that one pupil could serve as an example and stimulus for others (Chase and Doan, 1994). The multiage model was dominant in education until industrialization and urbanization began in the United States. As the population increased there was a need for larger schools. Students were separated into smaller groups and placed in separate rooms, leading to the development of grade-segregated classrooms.

In 1959, *The Nongraded Elementary School* was published by John Goodlad and Robert Anderson, strengthening a movement back to multiage classrooms. This movement, however, failed because of minimal changes, poor teacher training for these classrooms, and

lack of support(Hallion, 1994 in Haynes, 1996). During the twentieth century, a "progressive" movement in education occurred and throughout the nineties there has been a resurgence in the popularity of multiage classrooms.

The multiage grouping model is grounded on the body of research on learning and finds support from several theoretical orientations. This grouping strategy can be supported by the cognitive-developmental view of Piaget and the cognitive development theory of Vygotsky. Piaget and Vygotsky both emphasized the importance of social context in learning.

Multiage grouping focuses on the individual child and the process of learning. Ideally, the curriculum is individualized for each student's ability. Teachers set program goals to be achieved. Then, the child's present level is examined and the curriculum is designed to meet the individual's needs. Howard Gardner's theory of Multiple Intelligences provides a framework for the active learning and assessment experiences that occur in the multiage classroom. Much learning is hands-on and activity-based. Curricular elements such as thematic teaching and cooperative learning are used, as well as

assessment strategies such as observations, portfolios, and conferences.

Multiage grouping, as with graded grouping, has benefits and disadvantages. Research has shown that multiage grouping enhances social and cognitive benefits including higher self-concept, self-esteem, and more positive attitudes. Evidence suggests improvement of language skills, greater success for students at developmental extremes, a rise in achievement scores following longer stays in multiage classrooms, and increased personalism of teachers and their willingness to individualize curriculum (Cushman, 1990). Children are expected and encouraged to learn at different rates and levels. Further, multiage grouping demonstrates a continuous progress model that allows students to progress at their own rate. This model produces an alternative to retention and social promotion, which based on research, are not beneficial to student achievement and self-esteem.

On the other hand, the literature reveals that teachers sometimes feel a disadvantage with multiage classrooms is that it involves more planning, preparation, and work. For children, the younger students may become frustrated with the perceived gap

between their work and that of older students. In addition, teachers tend to provide fewer challenges to the older children.

Studies on achievement and multiage grouping have led to mixed conclusions. Several studies indicate little or no difference in the achievement of students in single-grade or multiage classrooms, whereas others show varying differences by age, subject, or grade. Further, several indicate findings in favor of either the single-grade grouping or multiage grouping. Four studies that used the Comprehensive Tests of Basic Skills as a measure of achievement were examined. The body of research is limited, yet the majority of studies have consistently shown little or no significant differences in the achievement scores of students in single-grade or multiage classrooms. As multiage grouping continues to increase in popularity throughout the United States, the body of research continues to grow.

Statement of the Problem

Recently there has been an increase in multiage classrooms across the United States. In studying the effectiveness of multiage grouping, research has focused on self-concept and school attitudes of multiage classroom students. This research has shown a higher

self-concept and more positive school attitude for students attending multiage classrooms (Miller, 1991; Pratt, 1983; Ford, 1977; Way, 1980). There is a limited body of research on multiage grouping and academic achievement, or the gain in academic achievement scores of students in multiage classrooms. I have chosen to examine the multiage classroom and student gain in achievement scores by grade level and subject area.

Purpose of the Study

The purpose of this study was first, to determine if significant differences existed between achievement gain scores of students in single-grade classrooms and students in multiage classrooms and second, to determine if differences in gain scores existed between the various levels of students in single-grade and multiage classrooms.

This study examined the gain in achievement scores of students in grades three through five in a suburban East-Tennessee elementary school. In this school students' attendance in traditional, single-grade classrooms or multiage classrooms is determined by parental choice. Multiage classrooms contained students in grades three, four, and five. I conducted this study in order to address the following two research questions

relevant to this elementary school: Do significant differences exist between achievement gain scores of students in traditional, single-grade classrooms and students in multiage classrooms? Do differences in gain scores exist between the various levels of students in single-grade and multiage classrooms?

Student achievement scores in grades two through five, from 1992 through 1997, from the Tennessee Comprehensive Assessment Program's (TCAP) administration of the Comprehensive Tests of Basic Skills Fourth Edition (CTBS/4) were used. Using the SAS© System for statistical analysis, gain scores were computed in order to control for various student achievement levels. The general linear model procedure (GLM) was used to calculate two-way analysis of variance (ANOVA) for single-grade and multiage groups, in grade 3, grade 4, and grade 5 in the subject areas of language, reading, and mathematics. No significant differences were expected to be found.

Results

In all, nine comparisons were made with the three grades and three subjects - Grade 3 Language, Reading, and Mathematics; Grade 4 Language, Reading, and Mathematics; and Grade 5 Language, Reading, and

Mathematics. Six of the comparisons found no statistically significant differences. The remaining three comparisons found statistically significant differences in favor of multiage classrooms.

For Grade 3, four scale score groups were compared for each subject. A total of twelve scale score groupings were used to compare mean gain scores. In six of the comparisons, mean gain scores were similar for single-grade and multiage classrooms. Of the remaining six comparisons, two showed higher mean gain scores for single-grade students and four showed higher mean gain scores for multiage students.

For Grade 4, three scale score groups were compared for each subject. A total of nine scale score groupings were used to compare mean gain scores. In five of the comparisons, mean gain scores were similar for single-grade and multiage classrooms. Of the remaining four comparisons, one showed higher mean gain scores for single-grade students and three showed higher mean gain scores for multiage students.

For Grade 5, three scale score groups were compared for each subject. A total of nine scale score groupings were used to compare mean gain scores. In six of the comparisons, mean gain scores were similar for single-

grade and multiage classrooms. Of the remaining three comparisons, one showed higher mean gain scores for single-grade students and two showed higher mean gain scores for multiage students.

Highest and lowest scale score groupings were also compared for each grade and subject. Of the twelve comparisons, three showed greater differences for single-grade students and six showed greater differences for multiage students. Furthermore, there was a trend for lower level students to achieve higher gains than upper level students. Overall, the differences were greater for multiage students.

These results indicate that on the basis of these findings, which are based solely on achievement gain scores for this school, multiage grouping is at least similar to, if not more effective in certain instances, than single-grade settings. When considering this study's results, it appears from the data that multiage placements may slightly favor younger children in the group and children who achieve at a lower level.

Chapter II

Literature Review

Traditional classrooms group students by chronological age and/or ability. Multiage or mixed-age grouping is the placement of children, with more than a one-year age span, together in classes without grade-level designations. Typically, ages range from six to twelve and students have the same teacher or teaching team for two to three years. At the beginning of each new school year, only the older students from any group enter new classes (Gutloff, 1995). Ideally, students are grouped together across ages in combinations most beneficial to their educational stimulation and success (Bacharach, Hasslen, & Anderson, 1995). The multiage classroom is described as heterogeneous and flexible. It follows a continuous progress model, using developmentally appropriate practices. Attention is given to the cognitive, physical, aesthetic, social, and emotional development of each child. Authentic work and assessment are its cornerstones (Hallion, 1994 in Haynes, 1996).

The rationale for and driving force behind multiage grouping is based on meeting students' individual needs

(Bacharach, Hasslen, & Anderson, 1995). Thoughtfully planned multiage grouping can allow children of various ability and age levels to work and learn in an environment that is intended to optimize their learning potential (Daniel, 1995). Common terms associated with nontraditional groupings include blends, heterogeneous, vertical, family, continuous progress, and ungraded or nongraded (Bacharach, Hasslen, & Anderson, 1995, Gaustad, 1996). Although some use these terms interchangeably, there are differences in placement procedures and philosophies between multiage and nongraded classrooms (Katz, Evangelou, & Hartman, 1990). For example, multiage classrooms use a random process of grouping students, whereas nongraded classrooms use a selective process of grouping students by ability.

History

Formal education began in the United States with the one-room school houses of the 1600's. Regardless of age or ability, all capable students worked in the same room (Daniel, 1995). In 1918, approximately seventy percent of the schools in the United States were one-room schools. In 1980, less than one percent of the schools were one-room schools (Muse & Moore, 1988).

Therefore, at first, multiage grouping was based on necessity. Later, multiage grouping became an educational strategy in this country (Goodlad & Anderson, 1959, 1987, in Chase & Doan). The history of this movement began in the seventeenth century with the teachings of Comenius. Comenius, who argued for a developmental view of education and maintained that children would need less disciplining if the curriculum made sense to them, suggested multiage groupings so that one pupil would serve as an example and a stimulus for others (Chase & Doan, 1994). It is documented in the works of Patrick Shannon (1990) that the multiage concept existed in the ideals and histories of what were known as "progressive" schools. For example, the Quincy Schools of the 1870's were founded on the system of individuality; the Moonlight Schools in Kentucky had as their slogan "Each one teach one"; and the Highlander Folk School in Tennessee instructed staff members to teach by demonstrating their own capacity to learn (Chase & Doan, 1994).

The multiage model dominated education until the industrial revolution and urbanization occurred in the United States. Several factors led to the idea of publicly supported education. One was the increase in

population and the shift from rural to urban areas. Children were seen more as competitors for jobs rather than as family support as they had been on farms. As more children went to school for longer periods of time the need for larger schools grew leading to the separation of students into smaller groups. Students were then placed in different rooms. This led to the multi-room schools and one-level grades. There are several reasons why this change took place. Anderson (1993) suggests it came as a means of administrative practicality that was first introduced by Horace Mann in Massachusetts. Mann initiated the idea in the mid-1800's, following the practices found in Prussia. Mann suggested that one reason gradedness became popular was the development of graded material such as the McGuffey reading series, five separate readers following one another in levels of difficulty. Blount (1992) writes that at first the implementation of separate grade classrooms separated children, but did not create the idea of set periods of time in a class followed by promotion or retention - however long it took to move to the next class, students advanced only when they were ready. We later developed the idea that all or almost all students could successfully complete the requirements

for a grade level in a set period of time. The growing population, compulsory attendance laws, and the overwhelming burden of financing schools all played major roles in creating the graded school we know today (Daniel, 1995).

John Goodlad and Robert Anderson published *The Nongraded Elementary School* in 1959 strengthening a movement back to multiage classrooms. This movement failed primarily due to poor definition. Many schools made only minimal changes while adopting the multiage label. There was a lack of teacher training, as well as a lack of parental and administrative support (Hallion, 1994 in Haynes, 1996). In 1987 *The Nongraded Elementary School* was revised and in the 1990's, a resurgence of multiage popularity has occurred throughout the United States. A few states, such as Kentucky and Oregon, have mandated multiage programs for primary classrooms. The Kentucky Education Reform Act of 1990 (KERA) established that each elementary school in the state would begin to implement these programs on or before the 1992-93 school year (Cesarone, 1995). Others, such as Maine, have strongly supported the movement in multiage education through innovative grants and state workshops.

The issue of grouping has been discussed by educational practitioners and theorists throughout the history of our educational system. Instructional settings are unique in relation to each individual school and community, and further one global grouping decision has not been agreed upon. The debate over multiage grouping and traditional, single-grade grouping continues.

Theoretical Basis

Children grow and develop at different rates that are separate and distinct from each other, yet interrelated with their environment. Multiage classroom practices are guided by a developmental, child-centered philosophy of learning (Chase & Doan, 1994). The multiage grouping model is grounded on the body of research on learning. This grouping strategy is supported by work of Piaget and Vygotsky that emphasized the importance of social context to learning.

Piaget

Cognitive-developmentalists, such as Piaget, believe learning is experiential and maturational. According to Piaget's theory, teaching strategies and curricula should be individualized enough for children to learn based on their cognitive developmental level (Bacharach, Hasslen,

& Anderson, 1995, & Crain, 1992). Educators must appreciate the extent to which children's interests and modes of learning differ (Crain, 1992). The teacher should not impose knowledge on the child, but should find materials that will interest and challenge the child, permitting the child to solve problems on his or her own (Piaget, 1969 in Crain, 1992).

Piaget emphasized that for development to occur, children must have opportunities to interact with their environment. Both the social and physical environment play important roles in shaping the individual (Bacharach, Hasslen, & Anderson, 1995). Piaget viewed the most beneficial interactions as those in which children feel a basic equality, as they most often do with their peers. Further, the most critical resource for advanced cognitive development is interaction with peers (Piaget, 1977 in Chase & Doan, 1994). The presumption that children's opportunities to interact with more and less advanced peers strengthens their cognitive skills has been supported by empirical findings (Brownell, 1990, Goldman, 1981, Howes & Farver, 1987, Mounts & Roopnarine, 1987).

Piaget's cognitive-developmental theory is reflected in several aspects of the multiage grouping strategy.

The individualized curriculum in multiage classrooms follows Piaget's theory. Multiage classrooms are also designed to provide students with opportunities to interact with the social and physical environments of interest to them. Multiage grouping brings together children at various developmental levels. Therefore, the opportunities for students to interact with one another increases, further adding to their knowledge bases, broadening their perspectives, and developing their social skills (Bacharach, Hasslen, & Anderson, 1995). In addition, younger children are often assigned to older students who act in roles of leadership and skills of instruction, assistance, and sympathy. In a multiage environment, older children perceive younger children as students in need of help and instruction (French, 1984 in Bacharach, Hasslen, & Anderson, 1995). This increased cooperation and acceptance increases the likelihood of a strong and trusting classroom community developing. Cognitive development is promoted because this trust allows students to dialogue and debate with one another (Chase & Doan, 1994).

Vygotsky

Vygotsky (1978) focused on the social aspect of children's learning through guidance and the example of

others. He theorized that cognitive development occurs within the zone of proximal development. This is the distance between the actual developmental level that is determined by independent problem solving ability and the level of potential development that is determined by problem solving under adult guidance or in collaboration with more capable peers (Crain, 1992). Assistance from a peer or teacher can enable a student to act on a capacity that is emerging, but not yet fully developed. This allows children to solve problems that they could not yet independently solve. The advantage of the multiage grouping strategy is that the various developmental levels optimize peer facilitation in the classroom. The zone of proximal development for some, is the independently functioning level of others. This enhances development, as well as assists children in moving to the next level of understanding. Vygotskian theorists believe cognitive conflict is important for internalizing new understandings. This cognitive conflict occurs in multiage classrooms when the younger children work to accommodate their understandings of concepts to the higher level of understandings of older peers (Whaley & Kantor, 1992).

Vygotsky's view was sociocultural and he stressed the importance of understanding the expectations, tools, skills, and interactions provided by a child's culture. Children need the intellectual tools provided by their culture to fully develop their minds. These tools include language, memory aids, numerical systems, writing, and scientific concepts (Crain,1992). Vygotsky proposed that these tools are first learned in social interactions with others, and are then applied to each individual's thinking. Many conceptual tools are learned first in school. Multiage classrooms are heterogeneous groupings that provide a variety of culturally appropriate tools, skills, and methods of interaction.

Curriculum and Assessment

In multi-grade or mixed-grade classes, students of different ages are taught in the same classroom, however, grade level designations are maintained with separate curricula for students in each grade (Gutloff, 1995). This differs from multiage grouping. In multiage grouping the focus is on the individual child and the process of learning. The curriculum is individualized for each student's ability and current achievement level. Students can "plug into" the curriculum at the appropriate level so they can be exposed to opportunities

for review as well as opportunities for acceleration (Bouchard, 1991).

Howard Gardner's theory of multiple intelligences may provide a framework for the active learning and assessment experiences that occur in multiage classrooms. The Multiple Intelligences theory is a cognitive theory that provides a means of mapping humans' broad range of abilities (Armstrong, 1994). Gardner theorizes that at least seven intelligences exist and each person has capacities in all seven intelligences. These include: Linguistic Intelligence - the capacity to use words effectively, orally or in writing; Logical-Mathematical Intelligence - the capacity to use numbers effectively and to reason well; Spatial Intelligence - the ability to perceive the visual-spatial world accurately and to perform transformations upon those perceptions; Bodily-Kinesthetic Intelligence - expertise in using one's whole body to express ideas and feelings and facility in using one's hands to produce or transform things; Musical Intelligence - the capacity to perceive, discriminate, transform, and express musical forms; Interpersonal Intelligence - the ability to perceive and make distinctions in the moods, intentions, motivations, and feelings of other people; and Intrapersonal

Intelligence - self-knowledge and the ability to act adaptively on the basis of that knowledge (Armstrong, 1994). The possibility of an eighth intelligence, Naturalistic Intelligence, is currently being considered.

Specific applications of the Multiple Intelligences theory are visible in multiage classroom environments. Activity centers allowing for demonstration of various intelligences, thematic units, and student choice are common to both. Thematic teaching is a common curricular element across multiage classrooms. This allows for students to share the same concept while also working at the appropriate developmental level. Much learning in the multiage classroom is hands-on and activity-based. This is accomplished with learning centers that include a variety of stimuli and allow for interaction and collaboration.

Cooperative learning strategies are also designed to facilitate students in working together to reach a common goal (Bacharach, Hasslen, & Anderson, 1995). Other curricular elements used in multiage classrooms include the process writing approach in which students are writing on the same theme or topic yet have a different process and product; literature-based reading in which class time is given and instruction is based on

individual interests and abilities; and math manipulatives that are concrete materials and activities students interact with on a consistent basis (Bacharach, Hasslen, & Anderson, 1995). The concept of cross-age and peer-tutoring instruction is also common to multiage grouping and has been found to produce a positive, cost effective impact on learning (Grant & Richardson, 1996).

In multiage classrooms, the teacher first delineates program outcomes or sets the benchmarks to be achieved. Next, the teacher examines where the child is or what level the child is on and then designs a curriculum and instruction to meet the student's needs. Finally, multiple indicators of achievement are utilized. Elements of assessment in multiage classrooms are ongoing, authentic, multidimensional, and collaborative (Bacharach, Hasslen, & Anderson, 1995). The Multiple Intelligences theory proposes an assessment system that relies on authentic measures (criterion-reference, benchmarked, or ipsative) that compare a student to his or her own past performances (Armstrong, 1994) rather than to an arbitrary standard. Authentic assessment is assessment that reflects actual learning experiences and occurs continually within the learning environment (Haynes, 1996). Such measures used to evaluate student

progress that are common to the multiage model include observations, journals, exhibitions, conferences, checklists, as well as portfolios or work samples (Chase & Doan, 1994). The use of portfolios is quite common in multiage classrooms. This is an authentic collection of samples of the student's work. The use of portfolios as measures of assessment can be controversial. This method differs greatly from traditional measures of assessment, such as testing, that measure a student's achievement against a standard for his or her age or grade. Conferences with the teacher, parent, and student are also common. These conferences allow for goals to be set, as well as for successes and concerns to be expressed. (Bacharach, Hasslen, & Anderson, 1995).

Benefits and Disadvantages

The most definitive evidence for benefits of multiage grouping suggests improvement of language skills; greater success for students at developmental extremes - males, and low-income students; increased self-esteem; rise in achievement scores following longer stays in multiage classrooms; the fostering of social development; and the increased personalism of teachers and their willingness to individualize education (Cushman, 1990). Research has also shown that multiage

grouping enhances social and cognitive development. Children from multiage classrooms score higher on self-concept and self-esteem measures, with students reporting better attitudes toward school and increased feelings of success (Miller, 1991; Pratt, 1983; Ford, 1977; Way, 1980).

Multiage groupings reflect the natural environment of home and community. This helps to prepare children for the world they will encounter as adults because younger children have significant positive interactions with older children (Roopnarine and Johnson, 1984) and older children solidify mastery of skills by helping younger children (Freedman, 1982). Further, teachers report a host of benefits in multiage classrooms. Role modeling and peer tutoring help students stay on task, and increase self-esteem (Uphoff and Evans, 1993). There is more student rapport, better parent relations, a wider comfort range for kids, and stronger social skills (Bozzone, 1995). Because most students remain with the same teacher for more than one year, the following year begins more smoothly.

In multiage classrooms, children are expected and encouraged to learn at different rates and levels. This may reduce pressure on children and decrease the chance

of academic failure. Students are supported at their current stage of development and this creates an environment where discipline problems and negative attitudes are far less likely to occur (Grant, 1993).

Multiage programs focus on the academic and developmental growth of students promoting the notion of continuous progress. Continuous progress allows students to progress through the primary school program at their own rate, without comparisons to the rates of others or consideration of the number of years in school (Haynes, 1996). Continuous progress allows students to advance as they become ready and able. Throughout the school year, individuals progress from simple to complex material at their own pace and begin each year from where they left off the year before. Continuous progress is an alternative to retention and social promotion. Retention is holding a student back at the end of an academic year and requiring the repetition of that grade. Social promotion is promoting poor-performing students with their age group.

Research has consistently shown that retention harms self-esteem, as well as increases the chance of dropping out. Retention worsens student achievement levels in the years following the retainment (Shepard & Smith, 1990,

Gutierrez & Slavin, 1992). Studies have also shown that when students repeat a curriculum that is too academic and does not match their developmental needs, a sense of incompetence or "learned stupidity" is acquired (Katz, 1988). Social promotion is also problematic. The student starts out behind his or her peers and unless there are appropriate interventions the student will remain behind (Cushman, 1990).

The literature reveals that some teachers believe a disadvantage of multiage classrooms is that it involves more planning, preparation, and work. In addition, multiage classroom teachers may encounter difficulty when scheduling students to work individually with special teachers. Some younger children may become frustrated with the perceived gap between their work and that of older students and there can also be a tendency for teachers to provide fewer challenges to the older children (Lodish, 1992). Because multiage grouping can take many forms, the term may lead to confusion or a lack of support from parents and educators (Hawkins, 1996).

Comparative Studies on Multiage Grouping and Achievement

Research addressing achievement and multiage classrooms has led to mixed conclusions. Numerous

studies indicate there is little or no difference in achievement of students in single-grade or multiage classrooms (Adams, 1953; Drier, 1949; Pratt & Treacy, 1986; Way, 1980). Several studies have found mixed results (Milburn, 1981; Rule, 1983; Schroeder & Nott, 1974; Yerry, 1964). Some studies indicate findings in favor of single-grade groupings (Foshay, 1948; Vogel & Bowers, 1972) or multiage groupings (Chace, 1961; Gajadharsingh & Melvin, 1987; Nye, 1995).

In a review of studies of multiage grouping up to 1983, Pratt (1986) concluded that no consistent effect on academic achievement was found. Miller (1990) in a review of studies up to 1986 concluded multi-grade and multiage classrooms do not negatively affect students' academic performance. Both of these reviews are of limited value because the particular forms of multi-grade and multiage classroom criteria for inclusion in the studies were not reported. Gutierrez and Slavin (1992) reviewed research for best evidence on the achievement effects of nongraded organization. Studies were included under five areas: 1) nongraded programs involving only one subject, 2) nongraded programs involving multiple subjects, 3) nongraded programs incorporating individualized instruction, 4) individually guided

education, and 5) studies lacking an explicit description of the nongraded program. This review concluded that the effects of nongraded programs depend on the type of program being implemented. Nongraded organization is shown to have a positive impact on student achievement if multiage grouping is used to allow teachers to provide more direct instruction to students, which involves more teacher instruction and structure, such as testing students and correcting the student when a wrong answer occurs. A positive impact on student achievement is not shown if multiage grouping is used as a framework for individualized instruction, which involves more work independent of the teacher, such as learning activity packets and learning centers. In another best evidence synthesis, Veenman (1995) concluded that in most studies, no significant differences were found. In terms of academic achievement, multiage classes appeared to be generally equivalent to single-age classes.

Anderson and Pavan (1993) reviewed sixty-four research studies comparing nongraded and graded students, published between January 1968 and December 1990. Fifty-seven studies used achievement tests to compare graded and nongraded schools, for a total of ninety-four comparisons. Nine of the ninety-four (nine percent)

favored graded, whereas sixty (sixty-four percent) favored nongradedness, and twenty-five (twenty-seven percent) indicated both groups performed in a similar manner. Fifty-two of the fifty-seven studies (ninety-one percent) indicated that for all comparisons, nongraded groups performed better (fifty-eight percent) or as well as (thirty-three percent) the graded groups on measures of academic achievement. Longitudinal results were examined in seventeen studies with fifty-eight comparisons. Two comparisons (three percent) favored graded schools, whereas forty (sixty-nine percent) favored nongraded and sixteen (twenty-eight percent) were similar, leading to the conclusion that the longer a student is in a nongraded school the better the academic performance. Of the sixty-four studies reviewed by Anderson and Pavan (1993), forty-two contained a mental health component with eighty-one comparisons reported. Ten comparisons favored graded students, whereas forty favored nongraded, and thirty-one indicated both groups performed in a similar manner. Eighteen studies examined nongradedness and "disadvantaged" students. Anderson and Pavan (1993) concluded that these students, including boys, blacks, underachievers, and students of low socioeconomic status, were more likely to perform better

and to feel more positive toward themselves and their schools in a nongraded environment. Again, the longer students were in nongraded programs, the greater the improvement in their achievement scores in relation to ability.

Four studies using multiage grouping and the Comprehensive Test of Basic Skills (CTBS) were found. Way (1980) examined the effects of multiage grouping on achievement using total scores in reading, mathematics, language arts, and study skills. Classroom type (multiage or single-age) and gender were variables. No significant differences were reported on the effects of classroom type, gender, or the interaction, for any of the achievement variables.

Stimson (1991) studied the effects of multigrade classes on student achievement in nine year-round schools, grades three through six. Students in the single-grade classes were found to achieve at significantly higher levels than students in multigrade classes in reading, mathematics, and language. According to Stimson, advantages to the single-grade classes may have occurred for two reasons. In multitrack year-round schools parents select the track depending on desired vacation time. Principals and teachers exert little

influence on the composition of the multigrade class. Second, multitrack year-round schools consistently performed below traditional-calendar schools in reading and mathematics (Quinlan, George, & Emmett, 1987 as cited in Stimson, 1991 as cited in Veenman, 1995).

Bledsoe (1994) examined the effects of student grouping strategies on the development of attitudes toward reading and reading achievement in the primary grades of one school. TCAP total reading scores for achievement, the Heathington Primary Reading Attitude Scale, and a parent survey were obtained for each of the forty-six students. The findings indicated no significant difference between total reading achievement test scores of students in the traditional or multiage settings. No significant difference was found between the attitudes toward reading of students in traditional or multiage settings and no significant relationship was found between the total reading achievement score and the reading attitude score of students in the traditional setting. However, a modest positive relationship was found between the total reading achievement score and the reading attitude score of students in multiage settings.

Finally, a longitudinal School Success Study (SSS) is being conducted (1993-1999) to determine academic and

social effects of nongraded (multiage, continuous progress) programs on elementary school students (Nye, 1995). Seven schools with nongraded programs are participating in the study for a sample of approximately 1,500 nongraded students and 2,250 single-grade students. Academic achievement is measured by the Tennessee Comprehensive Assessment Program (TCAP) administered in kindergarten through fourth grade, and the Tennessee Holistic Writing Assessment administered in grades three and four. Preliminary findings from a one-way analysis of variance, conducted in the first year of the study, showed first grade students from single-grade classrooms significantly outscored students from nongraded classrooms on the TCAP in vocabulary. At the end of second grade however, the nongraded students significantly outscored the graded students in all four areas of vocabulary, total reading, total language, and total math. At the end of third grade, the nongraded students significantly outscored the graded students in vocabulary and total reading. Students from nongraded classrooms also significantly outscored students from single-grade classrooms on the third and fourth grade Holistic Writing Assessment (Nye, 1995). This study's preliminary findings are in general agreement with

Pavan's (1992) earlier findings. "So far the schools using the nongraded programs have not proven to be detrimental to standardized test scores. In most instances the nongraded students score as well or better than those students attending single-grade programs" (Nye, 16).

Summary

In summary, multiage grouping is an educational strategy that dates back to the beginning of American education. The developmentally appropriate practices of the multiage classroom are compared to the lock-step curriculum of the traditional, single-grade classroom. Theoretically grounded by work of Piaget and Vygotsky, there is a growing body of literature on multiage classrooms. Research has shown multiage grouping enhances social and cognitive development with students reporting higher self-esteem and more positive attitudes. Overall, research on achievement and multiage classrooms has led to mixed results. However, studies have more consistently shown little or no significant differences in the achievement of students in multiage classrooms and students in traditional, single-grade classrooms.

Chapter III

Method

Participants

Student achievement scores from 1992 through 1997, of students grades two through five, in a suburban East-Tennessee elementary school were used. Students attended traditional, single-grade classrooms or multiage classrooms as determined by parental choice. The distribution of students' achievement scores in multiage classrooms remained even and not clustered. The intermediate multiage program at this elementary school has been in effect since the 1992-1993 school year. Initial groupings contained fourth and fifth grade students, and third grade was added later. Several classrooms also participate in the school's year-round program. Teachers volunteer or sign-up to teach in the multiage classrooms. From 1993 through 1997, students were taught by approximately eighteen single-grade teachers with an average of 16.6 years of experience and ten multiage teachers with an average of 12.5 years of experience. See Table I for teacher information from 1993 through 1997 by grade, gender, years of experience, and degrees obtained.

Table I

Teacher Information for 1993 Through 1997 by Grade, Gender, Years of Experience, and Highest Degree Obtained

Grade	Number of Teachers	Gender	Average Years of Experience	Degrees Obtained
3	5	5 Females	14.8	2 BS 1 BS^{30} 2 MS
4	6	6 Females	13.3	1 BS 3 MS 1 MS^{15} 1 MS^{45}
5	7	6 Females 1 Male	20.6	1 BS^{30} 2 MS 1 MS^{30} 2 MS^{45} 1 EdS
Total 3,4,5	18	17 Females 1 Male	16.6	3 BS 2 BS^{30} 7 MS 1 MS^{15} 1 MS^{30} 3 MS^{45} 1 EdS
Multiage	10	9 Females 1 Male	12.5	3 BS 1 BS^{30} 3 MS 1 MS^{15} 1 MS^{45} 1 EdD

Note. BS = Bachelor of Science; BS^{30} = Bachelor of Science plus 30 additional credit hours; MS = Master of Science; MS^{15} = Master of Science plus 15 additional credit hours; MS^{30} = Master of Science plus 30 additional credit hours; MS^{45} = Master of Science plus 45 additional credit hours; EdS = Specialist in Education; and EdD = Doctor of Education.

In this study, 2,314 student achievement gain scores in single-grade classrooms and 958 student achievement gain scores in multiage classrooms were analyzed in the subject areas of language, reading, and mathematics. See Table II for a description of sample sizes of gain scores by grade, type of classroom, and subject area. See Table III for approximate student sample sizes by grade, gender, and classroom type.

Instrumentation

The Tennessee Comprehensive Assessment Program (TCAP) is an annual, state-wide achievement testing program. From 1992 through 1997, the TCAP consisted of the administration of the Comprehensive Tests of Basic Skills Fourth Edition (CTBS/4). CTBS/4 is a standardized, group administered test published by CTB Macmillan/McGraw-Hill School Publishing Company in Monterey, California. The CTBS/4 reports achievement scores for sub-tests and total batteries. The CTBS/4 content areas include Reading, Spelling, Language, Mathematics, Study Skills, Science, and Social Studies. Scale scores, normal curve equivalents, national stanines, national percentiles, and national percentile ranges are also reported. "CTBS/4 is intended to measure students' understanding of the broad concepts developed

Table II

Sample Sizes of Gain Scores by Grade, Single-Grade Classrooms (SG), Multiage Classrooms (MA), and Subject

	Grade and Classroom Type					
	3		4		5	
	SG	MA	SG	MA	SG	MA
Subject	n =	n =	n =	n =	n =	n =
Language	292	130	254	107	231	83
Reading	275	121	251	107	228	85
Mathematics	295	132	250	107	238	86

Table III

Approximate Student Sample Sizes by Grade, Gender, Single-Grade Classrooms (SG), and Multiage Classrooms (MA)

	Gender and Classroom Type			
	Male		Female	
	SG	MA	SG	MA
Grade	n =	n =	n =	n =
3	146	81	149	51
4	127	55	127	60
5	125	54	113	32

by all curricula as opposed to content specific to any particular instructional program," (CTBS/4, 8).

CTBS/4 reliability was measured in terms of internal consistency using the Kuder-Richardson Formula 20 (KR20). Kuder-Richardson Formula 20 reliabilities for grades 3, 4, and 5 were generally high with averages of .85 for Reading, .85 for Language, .82 for Mathematics, .66 for Science, and .74 for Social Studies. Standard Error of Measurement values and Standard Error Curves are also reported in the Technical Bulletin.

Procedures

Students in a suburban East-Tennessee elementary school completed the CTBS/4 through the TCAP administration. It is assumed that all students received the same test administration due to the stringent guidelines established by test standardization and the Tennessee State Department of Education. The elementary school received score reports on all students. To protect for identity, student scores were coded using a 0 to signify students in single-grade classrooms, and a 1 to signify students in multiage classrooms. This list was then merged with an existing database of the state's TCAP scores.

Data Analysis

The data collected for this study were analyzed to answer two research questions relevant to this elementary school. First, do significant differences exist between achievement gain scores of students in traditional, single-grade classrooms and students in multiage classrooms? Second, do differences in gain scores exist between the various levels of students in single-grade and multiage classrooms?

In order to control for initial differences between student achievement levels, gain scores were calculated using the scale scores derived from the norm-referenced component of the TCAP, the CTBS/4. The scale scores indicate a student's current level of attainment in a subject and are designed to increase from year to year as the student learns (Sanders & Horn, 1995a). In the present study, student scores from 1992 through 1997, grades two through five were used. Each student's gain scores were calculated using each student's scale score minus that student's scale score of the previous year.

The SAS© System was used for statistical analysis. The initial model contained teachers nested within type and a teacher by average score interaction nested within type. This model was fitted to the data for each

subject, for each grade. However, excluding the teacher and its interaction from the model did not alter the overall conclusions. Since the inference space of this study is restricted to this school and this population of teachers, it was observed that the exclusion of these terms from the model did not alter the conclusions regarding the comparison of single-grade and multiage effect.

The general linear model (GLM) procedure was used to calculate two-way analysis of variance (ANOVA). GLM is a flexible statistical procedure that allows for incorporating combinations of categorical and continuous predictor variables fitted with various dependent variables. In this study, the two categorical predictors, or factors, are the achievement rankings and the type of classroom. See Appendix for ANOVA tables. Seven levels of test scores were arbitrarily used with score values of less than 550, 550-599, 600-649, 650-699, 700-749, 750-799, 800-849. In order to eliminate bias, the average of the current year and previous year's scores was used. Calculated scores were placed in these categories in order to observe the student levels in which significant differences occurred. Scale score

groups were not included in analyses if there were fewer than ten students in that grouping.

Chapter IV

Results

This study analyzed achievement gain scores of students attending single-grade or multiage classrooms, in one elementary school. Two research questions were examined and the results are presented in this chapter.

The first research question was examined to determine if significant differences in achievement gain scores exist between students in single-grade and multiage classrooms. This was studied by calculating two-way analysis of variance (ANOVA). Gain scores were analyzed for grade 3, grade 4, and grade 5 in the subject areas of language, reading, and mathematics. See Table IV for single-grade and multiage least squares means and standard errors by grade and subject. (Refer to the Appendix for means and standard deviations.) See Table V, VI, and VII for ANOVA summary tables of grade 3, grade 4, and grade 5 respectively. The results are as follows:

- In Grade 3 Language there was a significant difference ($p < .01$) in gain scores favoring multiage classrooms.
- In Grade 3 Reading there was a significant difference ($p < .05$) in gain scores favoring multiage classrooms.

Table IV

Single-grade (SG) and Multiage (MA) Least Squares Means and Standard Errors by Grade and Subject

		Grade and Classroom Type					
		3		4		5	
Subject		SG	MA	SG	MA	SG	MA
Language							
	Mean	27.3	35.2	19.8	28.6	16.3	21.1
	SD	2.4	5.2	2.3	3.0	1.9	3.4
Reading							
	Mean	35.6	55.8	23.1	18.2	17.7	21.5
	SD	2.6	4.2	2.4	3.3	2.3	3.6
Mathematics							
	Mean	66.5	55.6	13.3	30.5	28.9	25.5
	SD	3.1	4.8	3.1	3.0	2.1	3.4

Note. Refer to Appendix for means and standard deviations.

Table V

ANOVA Summary Tables for Grade 3 Language, Reading, and Mathematics Gain

Source	SS	df	MS	F	p
Average Language	10420.4	3	3473.5	3.3	.02**
Type	1989.1	1	1989.1	1.9	.17
Average Language*Type	14674.5	3	4891.5	4.6	.003***
Error	437750.3	414	1057.4		
Average Reading	123780.3	3	41260.1	28.5	.0001***
Type	24079.3	1	24079.3	16.7	.0001***
Average Reading*Type	14397.8	3	4799.3	3.3	.02**
Error	561137.6	388	1446.2		
Average Mathematics	60129.4	3	20043.1	9.9	.0001***
Type	7348.3	1	7348.3	3.6	.06**
Average Mathematics*Type	4841.7	3	1613.9	0.8	.49
Error	845391.5	419	2017.6		

* $p < .10$ ** $p < .05$ *** $p < .01$

Table VI

ANOVA Summary Tables for Grade 4 Language, Reading, and Mathematics Gain

Source	SS	df	MS	F	p
Average Language	2793.0	2	1396.5	1.6	.20
Type	4677.8	1	4677.8	5.5	.02**
Average Language*Type	1992.0	2	996.0	1.2	.31
Error	303420.9	355	854.7		
Average Reading	7615.8	2	3807.9	5.7	.004***
Type	24079.3	1	954.6	1.4	.23
Average Reading*Type	1870.9	2	935.4	1.4	.25
Error	233927.2	352	664.6		
Average Mathematics	1086.7	2	543.3	0.7	.49
Type	11763.8	1	11763.8	15.6	.0001***
Average Mathematics*Type	7738.7	2	13869.3	5.1	.007***
Error	265601.7	351	756.7		

* $p < .10$ ** $p < .05$ *** $p < .01$

Table VII

ANOVA Summary Tables for Grade 5 Language, Reading, and Mathematics Gain

Source	SS	df	MS	F	p
Average Language	7554.8	2	3777.4	5.3	.005***
Type	1073.9	1	1073.9	1.5	.22
Average Language*Type	1425.1	2	712.5	1.0	.37
Error	219364.8	308	712.2		
Average Reading	1105.7	2	552.8	0.6	.54
Type	704.4	1	704.4	0.8	.38
Average Reading*Type	3021.9	2	1511.0	1.7	.19
Error	274025.1	307	892.6		
Average Mathematics	5498.0	2	2749.0	3.6	.03**
Type	566.7	1	566.7	0.7	.39
Average Mathematics*Type	1436.3	2	718.1	0.9	.39
Error	242829.1	318	763.6		

* $p < .10$ ** $p < .05$ *** $p < .01$

- In Grade 4 Mathematics there was a significant difference ($p < .01$) in gain scores favoring multiage classrooms.

The second research question was studied to determine if differences in gain scores existed between the various levels of students in single-grade and multiage classrooms. Seven levels of test scores were arbitrarily used with score values of less than 550, 550-599, 600-649, 650-699, 700-749, 750-799, and 800-849. In order to eliminate bias, the average of the current year and previous year's scores was used. Calculated scores were placed in these categories to observe student levels and differences. Scale score groups were not included in analyses if there were fewer than ten students in that grouping. See Tables VIII, IX, and X for single-grade and multiage mean gain scores, sample sizes, and standard error by scale score groups for grades 3, 4, and 5 respectively. Figures I through VIII show line graphs by grade and subject for the single-grade and multiage mean gain scores with standard error, by scale score groups. (Scaling and range differ in order to fit the data on one table.) The results are as follows:

Table VIII

Single-grade (SG) and Multiage (MA) Mean Gain Scores, Standard Error (SE), and Sample Sizes (N) by Scale Score Groups for Grade 3

		Scale Score Groups			
		550-599	600-649	650-699	700-749
Language					
SG	Mean	37.8	22.4	29.5	19.4
	SE	7.7	3.9	3.0	3.5
	N	18	68	121	85
MA	Mean	38.7	51.1	25.5	25.5
	SE	18.8	6.0	4.1	5.4
	N	3	29	62	36
Reading					
SG	Mean	52.6	47.5	31.0	11.2
	SE	7.1	4.3	3.7	4.9
	N	29	77	108	61
MA	Mean	107.3	60.3	41.5	14.1
	SE	12.7	7.6	5.2	6.5
	N	9	25	53	34
Mathematics					
SG	Mean	95.5	75.0	58.5	36.9
	SE	7.5	4.3	4.2	7.7
	N	36	111	114	34
MA	Mean	68.9	63.0	56.4	33.9
	SE	14.2	6.6	6.2	9.4
	N	10	46	53	23

Table IX

Single-grade (SG) and Multiage (MA) Mean Gain Scores, Standard Error (SE), and Sample Sizes (N) by Scale Score Groups for Grade 4

		Scale Score Groups		
		650-699	700-749	750-799
Language				
SG	Mean	21.3	16.4	21.8
	SE	2.9	2.6	5.5
	N	100	127	28
MA	Mean	36.2	28.3	21.4
	SE	5.1	4.0	6.4
	N	33	53	21
Reading				
SG	Mean	29.8	16.3	23.4
	SE	2.5	2.3	6.3
	N	108	127	17
MA	Mean	27.2	19.1	8.3
	SE	4.8	3.1	8.2
	N	29	68	10
Mathematics				
SG	Mean	16.1	21.6	2.4
	SE	2.3	2.8	8.7
	N	145	97	10
MA	Mean	34.2	22.6	34.6
	SE	4.6	3.7	6.9
	N	36	55	16

Table X

Single-grade (SG) and Multiage (MA) Mean Gain Scores, Standard Error (SE), and Sample Sizes (N) by Scale Score Groups for Grade 5

		Scale Score Groups		
		650-699	700-749	750-799
Language				
SG	Mean	21.8	15.3	12.0
	SE	3.3	2.4	4.1
	N	65	124	43
MA	Mean	34.9	18.3	10.2
	SE	8.0	4.4	4.4
	N	11	36	36
Reading				
SG	Mean	13.0	16.6	23.6
	SE	3.4	2.7	5.3
	N	76	120	32
MA	Mean	28.7	16.9	19.0
	SE	7.7	4.4	6.2
	N	15	47	23
Mathematics				
SG	Mean	32.0	29.7	25.1
	SE	3.0	2.5	4.9
	N	84	122	32
MA	Mean	36.2	26.0	14.4
	SE	7.7	4.1	5.2
	N	13	45	28

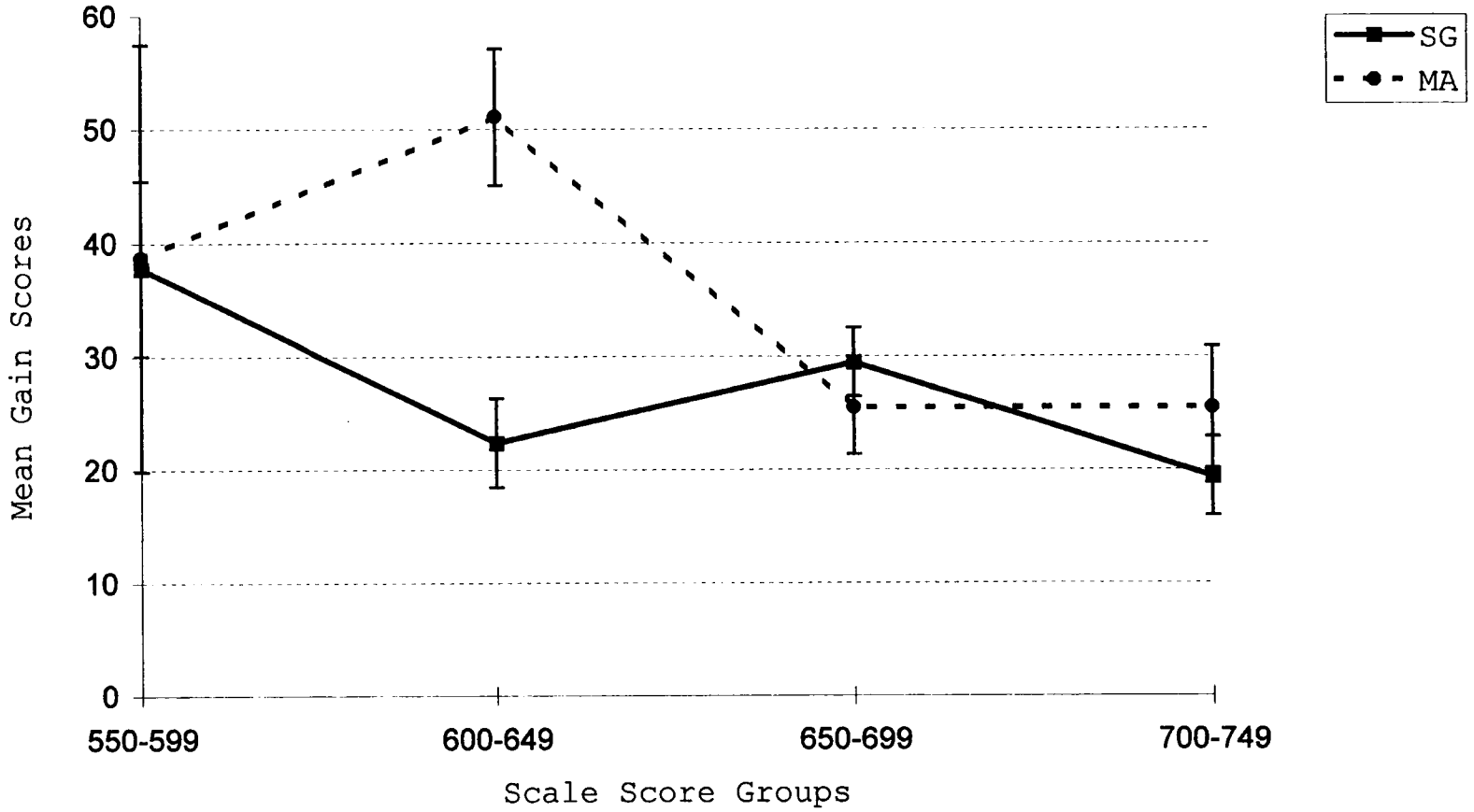


Figure I. Single-Grade (SG) and Multiage (MA) Mean Gain Scores With Standard Error by Scale Score Groups: Grade 3 Language.

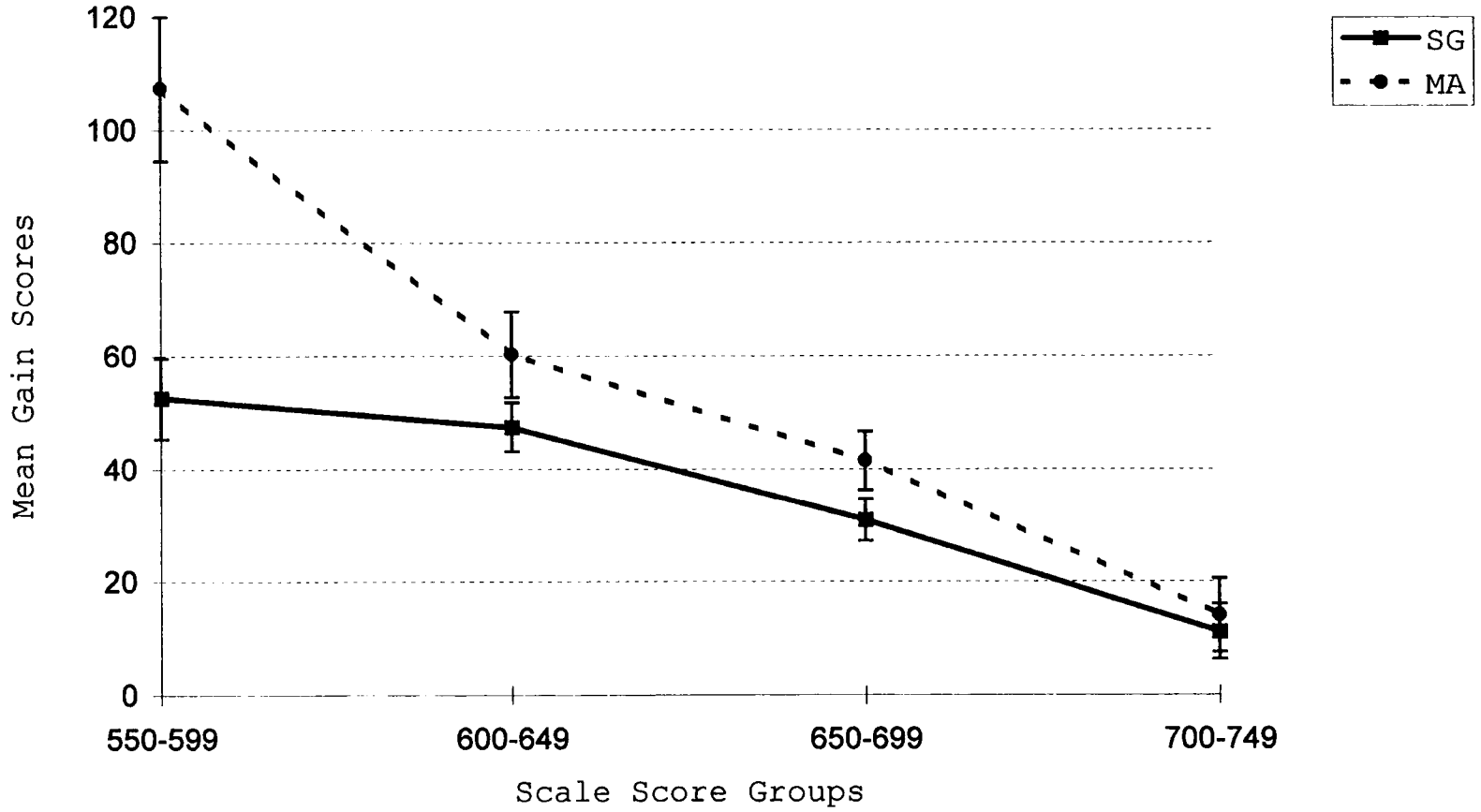


Figure II. Single-Grade (SG) and Multiage (MA) Mean Gain Scores With Standard Error by Scale Score Groups: Grade 3 Reading.

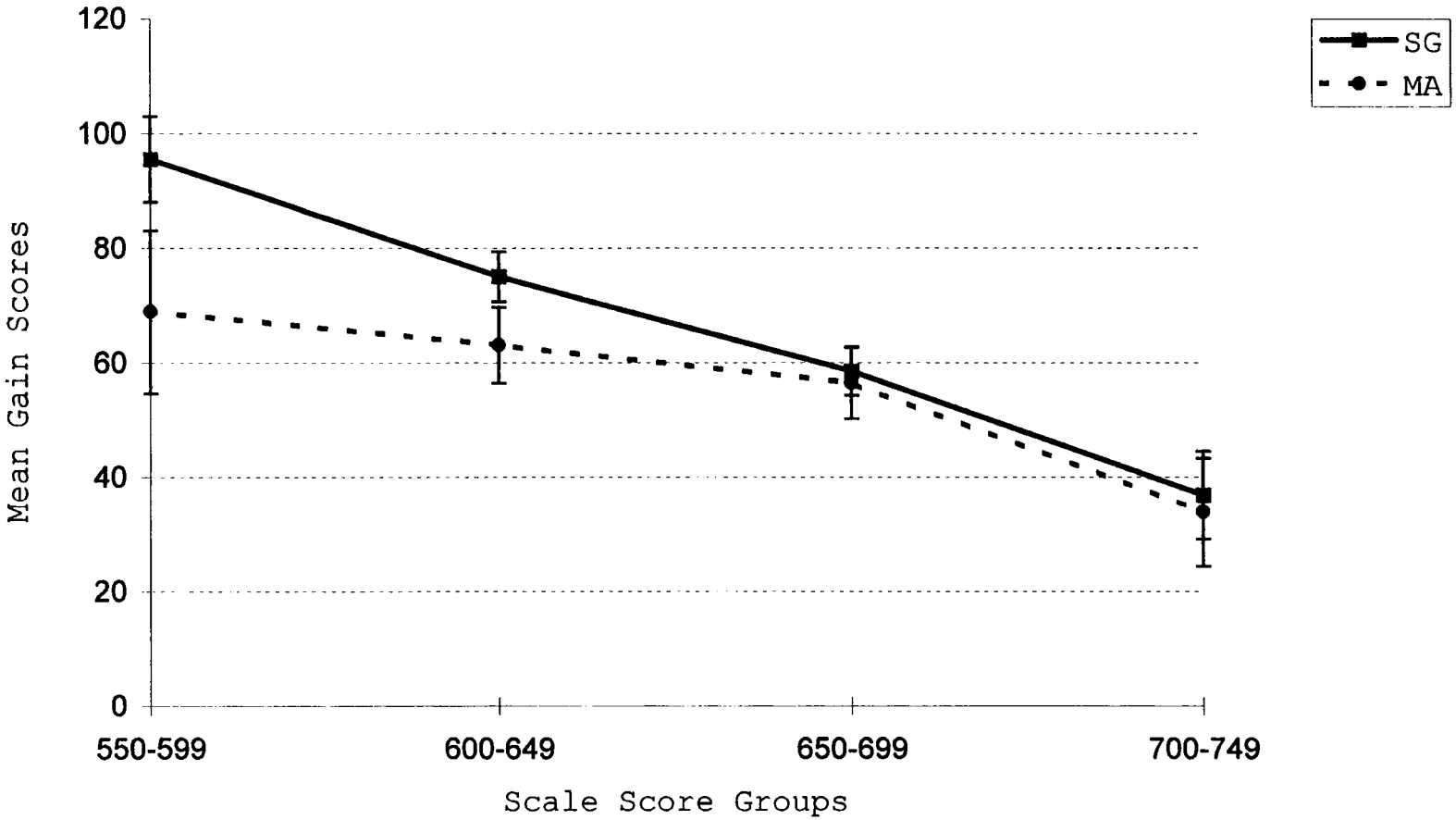


Figure III. Single-Grade (SG) and Multiage (MA) Mean Gain Scores With Standard Error by Scale Score Groups: Grade 3 Mathematics.

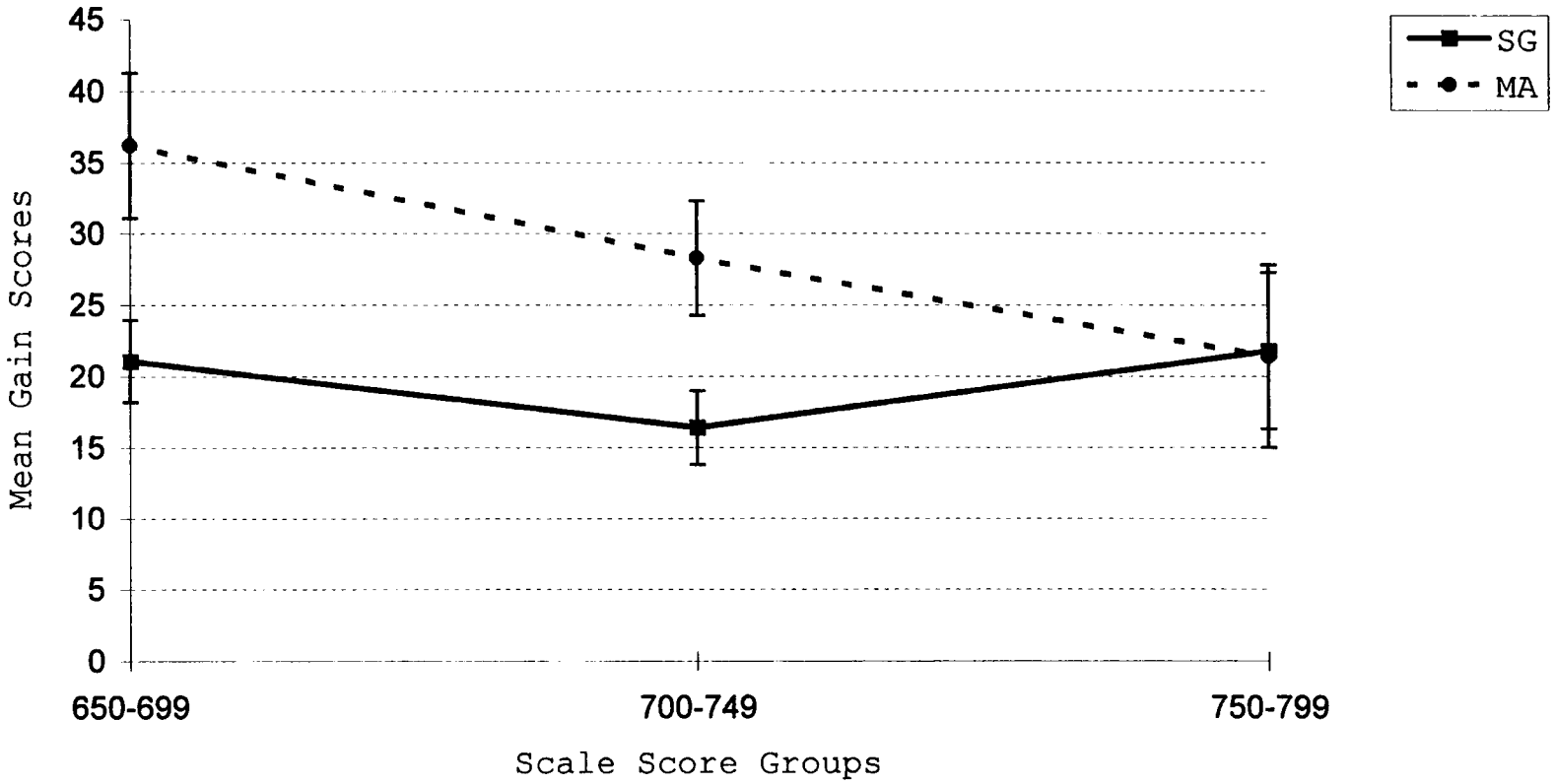


Figure IV. Single-Grade (SG) and Multiage (MA) Mean Gain Scores With Standard Error by Scale Score Groups: Grade 4 Language.

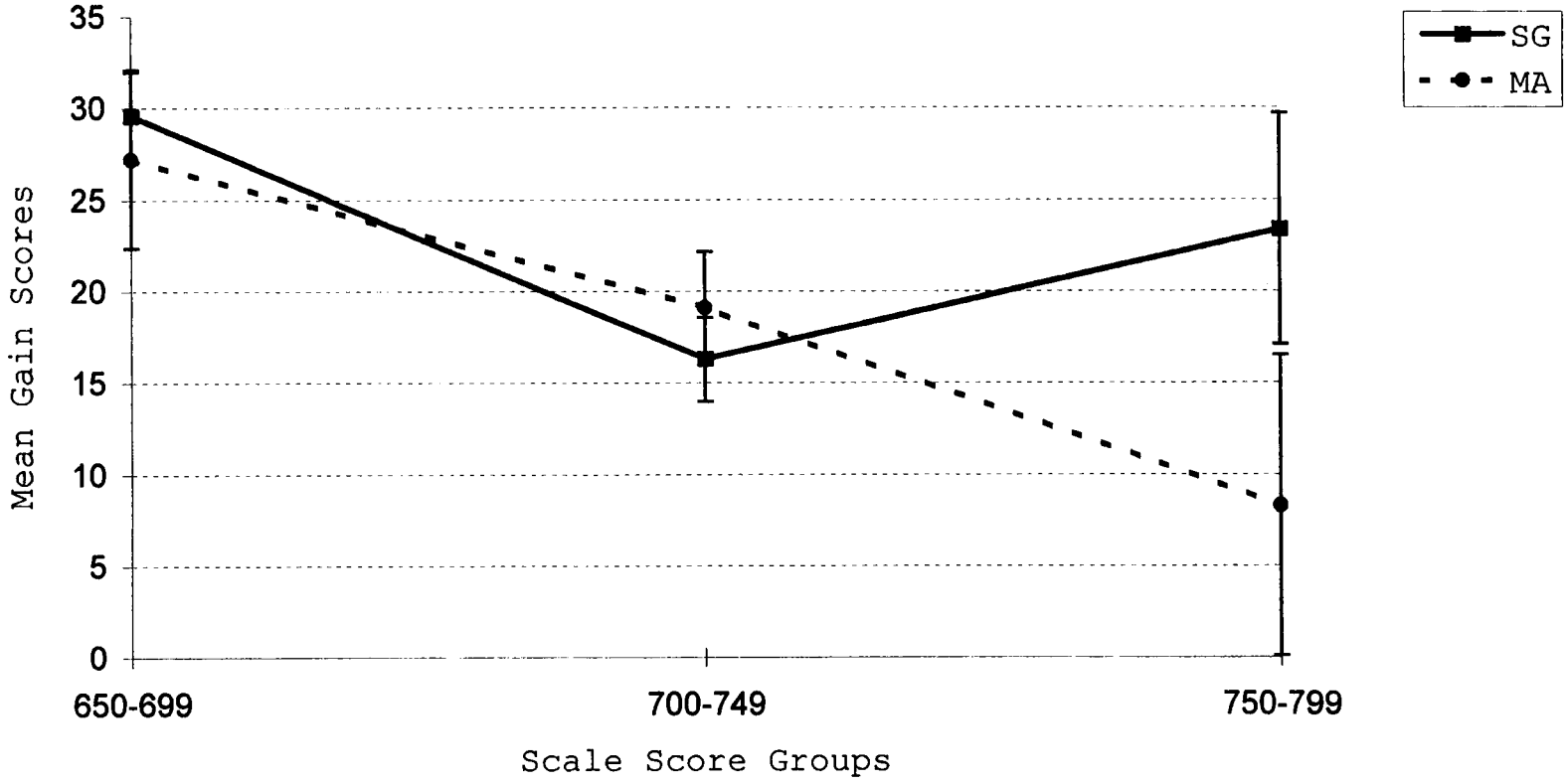


Figure V. Single-Grade (SG) and Multiage (MA) Mean Gain Scores With Standard Error by Scale Score Groups: Grade 4 Reading.

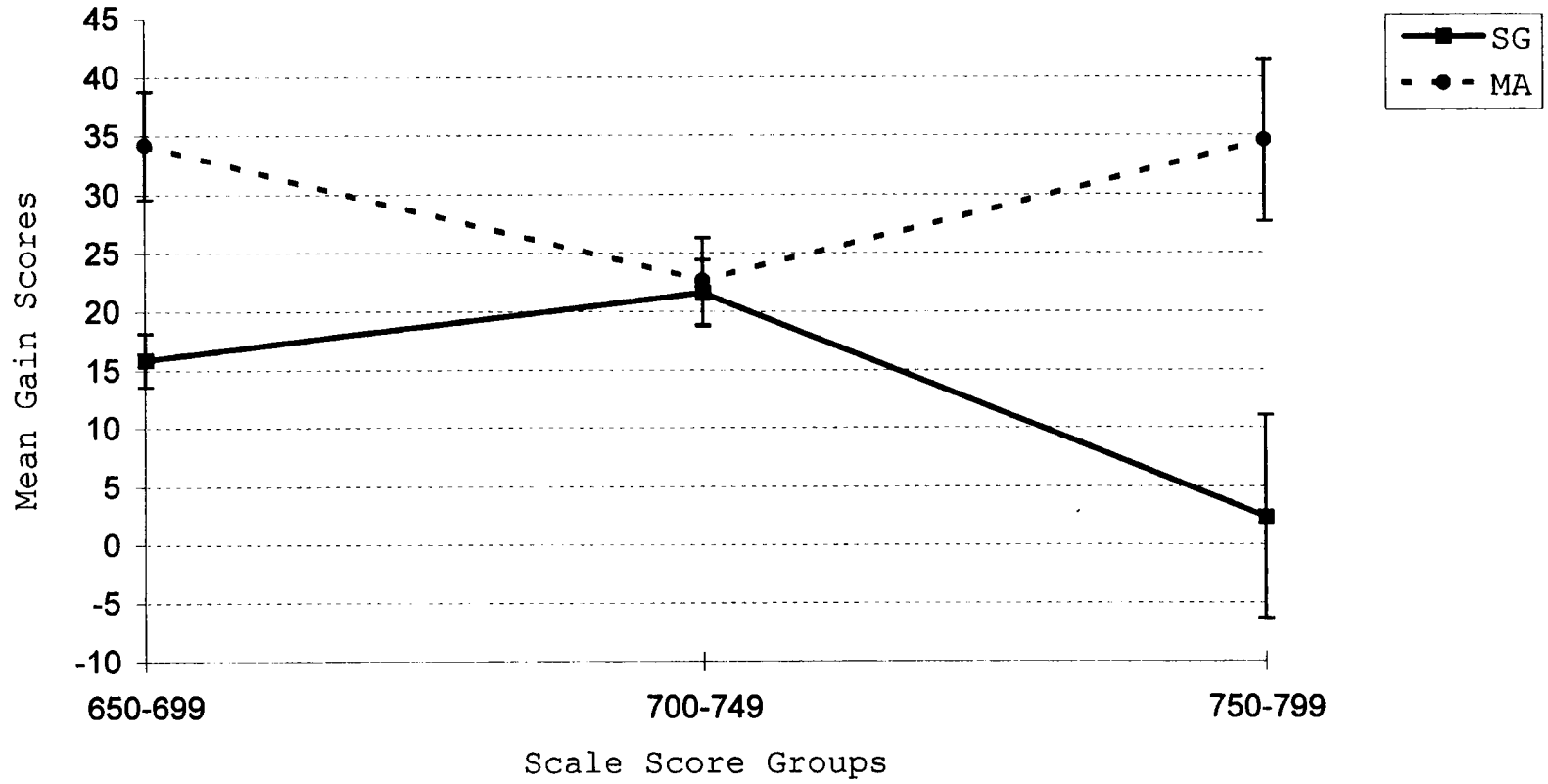


Figure VI. Single-Grade (SG) and Multiage (MA) Mean Gain Scores With Standard Error by Scale Score Groups: Grade 4 Mathematics.

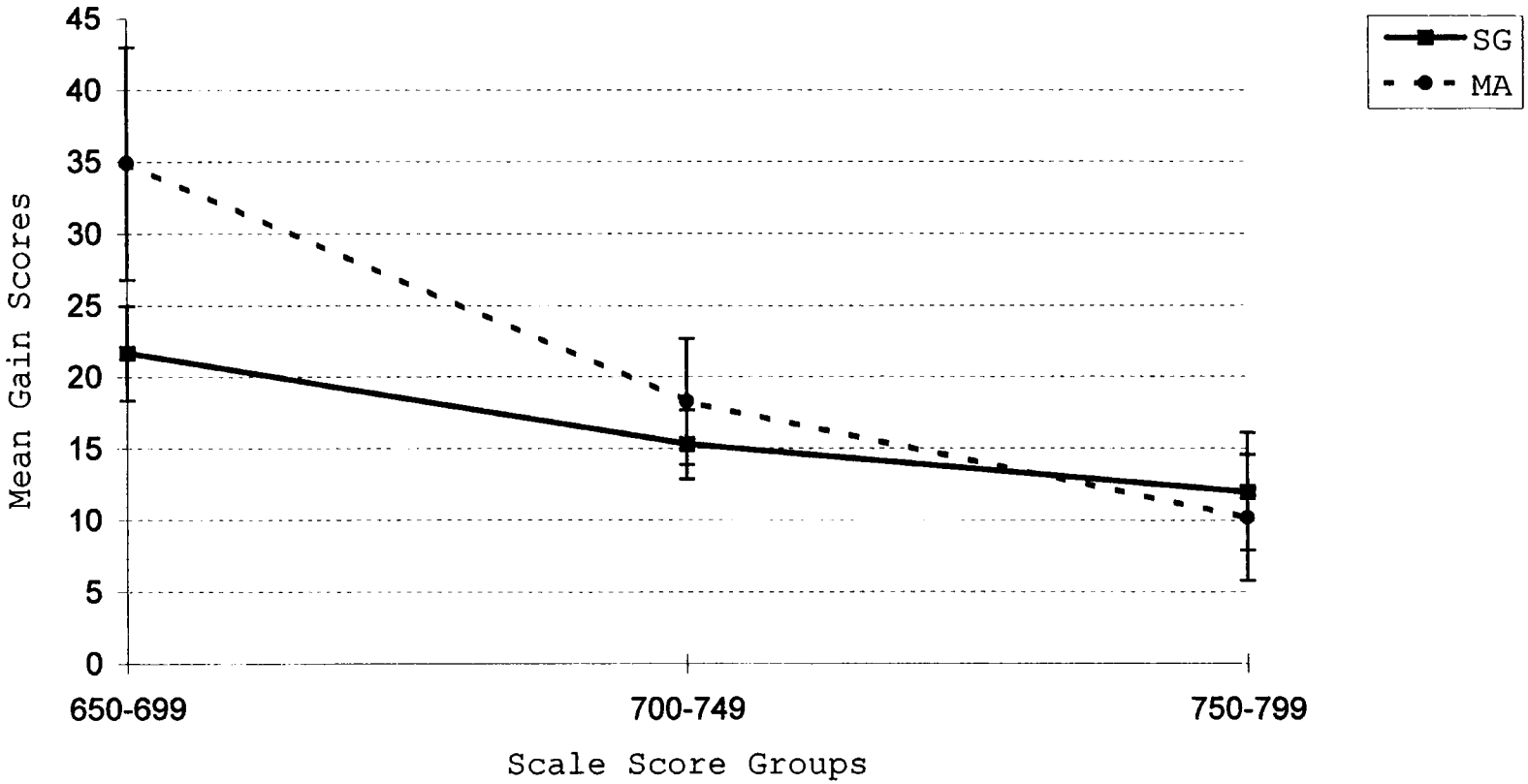


Figure VII. Single-Grade (SG) and Multiage (MA) Mean Gain Scores With Standard Error by Scale Score Groups: Grade 5 Language.

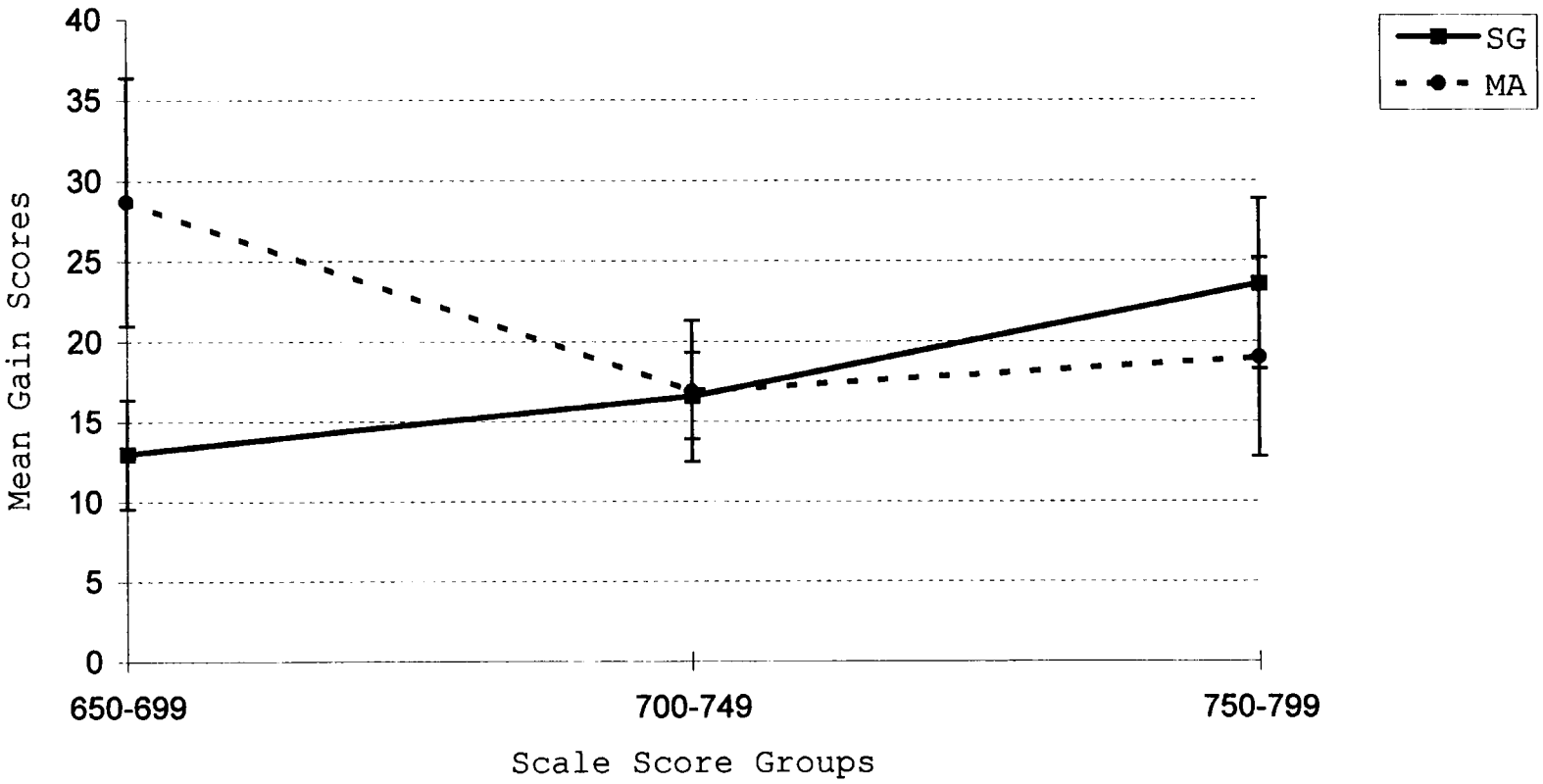


Figure VIII. Single-Grade (SG) and Multiage (MA) Mean Gain Scores With Standard Error by Scale Score Groups: Grade 5 Reading.

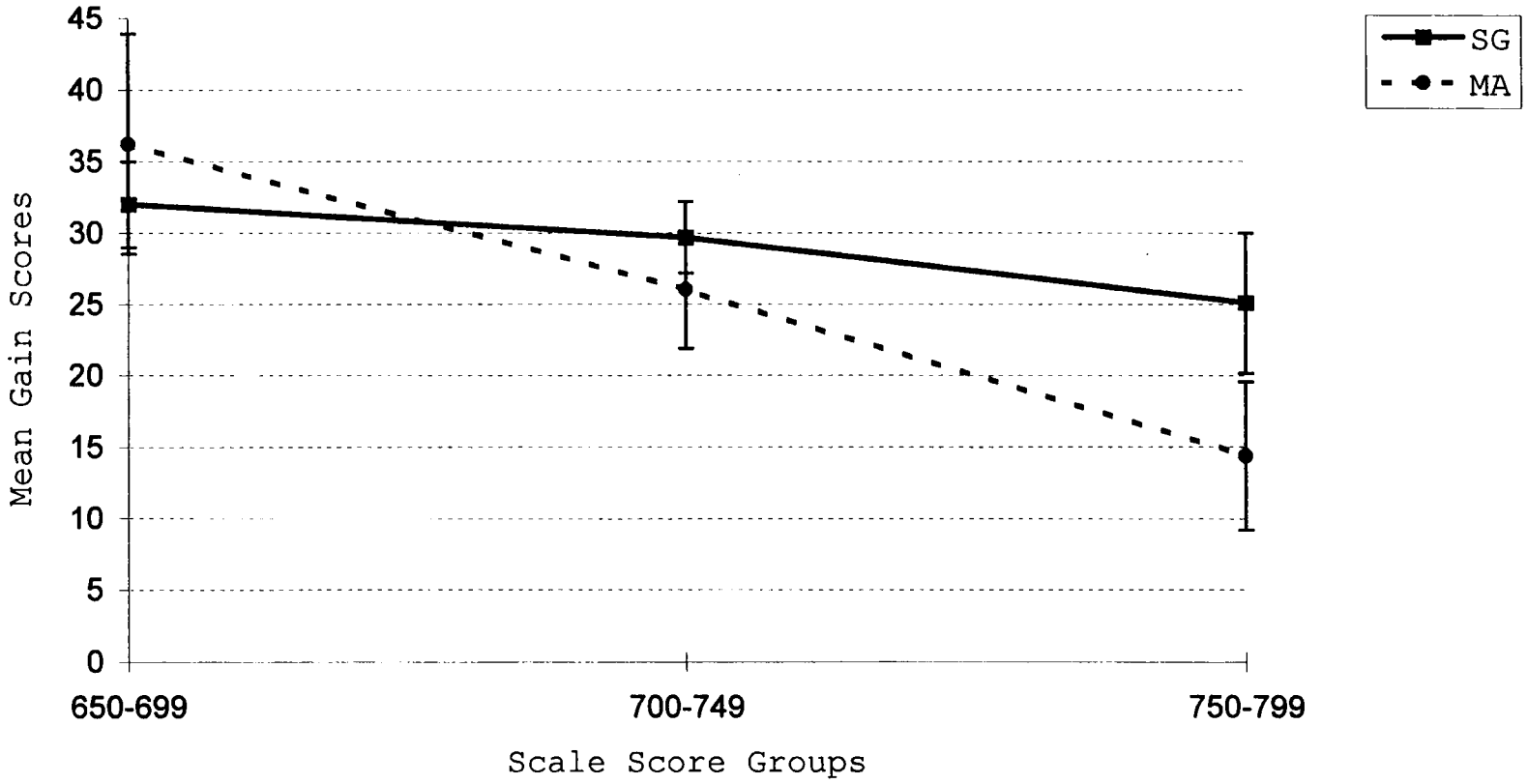


Figure IX. Single-Grade (SG) and Multiage (MA) Mean Gain Scores With Standard Error by Scale Score Groups: Grade 5 Mathematics.

- At the 600-649 scale score grouping, the multiage mean gain score was at least 26.6 points and at most 30.8 points higher than the single-grade mean gain score.

See Figure II: Grade 3 Reading

- At the 550-599 scale score grouping, the multiage mean gain score was at least 49.1 points and at most 60.3 points higher than the single-grade mean gain score.
- At the 600-649 scale score grouping, the multiage mean gain score was at least 9.5 points and at most 16.1 points higher than the single-grade mean gain score.
- At the 650-699 scale score grouping, the multiage mean gain score was at least 9 points and at most 12 points higher than the single-grade mean gain score.

See Figure III: Grade 3 Mathematics

- At the 550-599 scale score grouping, the single-grade mean gain score was at least 19.9 points and at most 33.3 points higher than the multiage mean gain score.
- At the 600-649 scale score grouping, the single-grade mean gain score was at least 9.7

points and at most 14.3 points higher than the multiage mean gain score.

See Figure IV: Grade 4 Language

- At the 650-699 scale score grouping, the multiage mean gain score was at least 12.7 points and at most 17.1 points higher than the single-grade mean gain score.
- At the 700-749 scale score grouping, the multiage mean gain score was at least 10.5 points and at most 13.3 points higher than the single-grade mean gain score.

See Figure V: Grade 4 Reading

- At the 750-799 scale score grouping, the single-grade mean gain score was at least 13.2 points and at most 17 points higher than the multiage mean gain score.

See Figure V: Grade 4 Mathematics

- At the 650-699 scale score grouping, the multiage mean gain score was at least 15.8 points and at most 20.4 points higher than the single-grade mean gain score.
- At the 750-799 scale score grouping, the multiage mean gain score was at least 30.4

points and at most 34 points higher than the single-grade mean gain score.

See Figure VI: Grade 5 Language

- At the 650-699 scale score grouping, the multiage mean gain score was at least 8.4 points and at most 17.8 points higher than the single-grade mean gain score.

See Figure VII: Grade 5 Reading

- At the 650-699 scale score grouping, the multiage mean gain score was at least 11.4 points and at most 20 points higher than the single-grade mean gain score.

See Figure IX: Grade 5 Mathematics

- At the 750-799 scale score grouping, the single-grade mean gain score was at least 10.4 points and at most 11 points higher than the multiage mean gain score.

Overall, there was a trend for lower level students to achieve higher gains than upper level students, which is typical across the state of Tennessee with some notable exceptions. However, overall the differences were greater for multiage classrooms than single-grade classrooms. Single-grade classrooms had greater differences between the lowest and highest scale score

groups only in Grade 3 Language and Mathematics and Grade 4 Mathematics. Multiage classrooms had greater differences between the lowest and highest scale score groups in Grade 3 Reading, Grade 4 Language and Reading, and Grade 5 Language, Reading, and Mathematics. See Table XI for the single grade and multiage mean gain score differences between the lowest and highest scale score groups by subject and grade. Figures X, XI, and XII display these results for each grade level.

Table XI

Single-grade (SG) and Multiage (MA) Mean Gain Score Differences Between the Lowest and Highest Scale Score Groups by Subject and Grade

	Subject and Classroom Type					
	Language		Reading		Mathematics	
Grade	SG	MA	SG	MA	SG	MA
3	18.4	13.2	41.4	93.2	58.6	35
4	-0.5	14.8	6.4	18.9	13.7	-0.4
5	9.8	24.7	-10.6	9.7	6.9	21.8

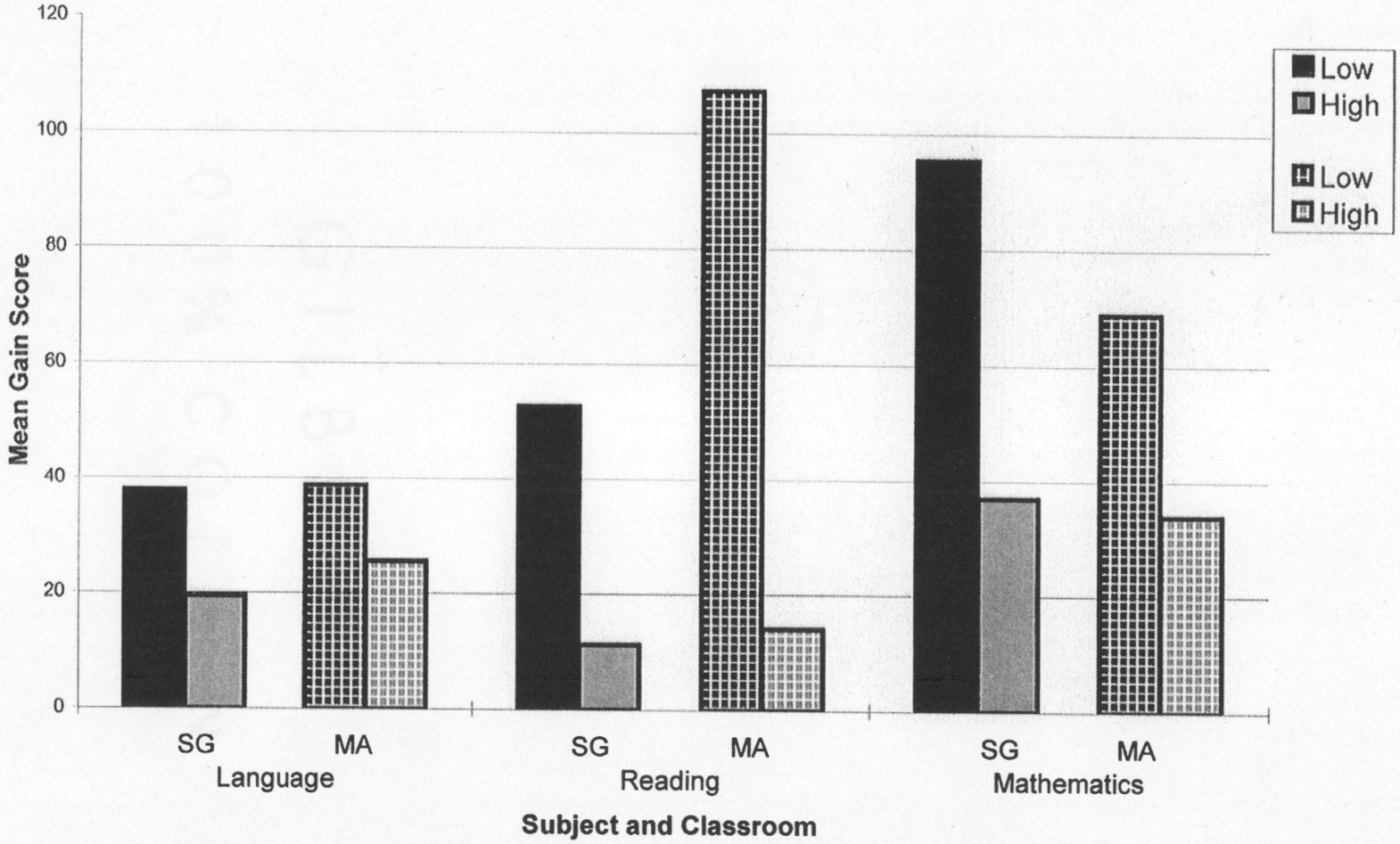


Figure X. Single-grade (SG) and Multiage (MA) Mean Gain Scores by Subject for the Lowest and Highest Scale Score Groups in Grade 3.

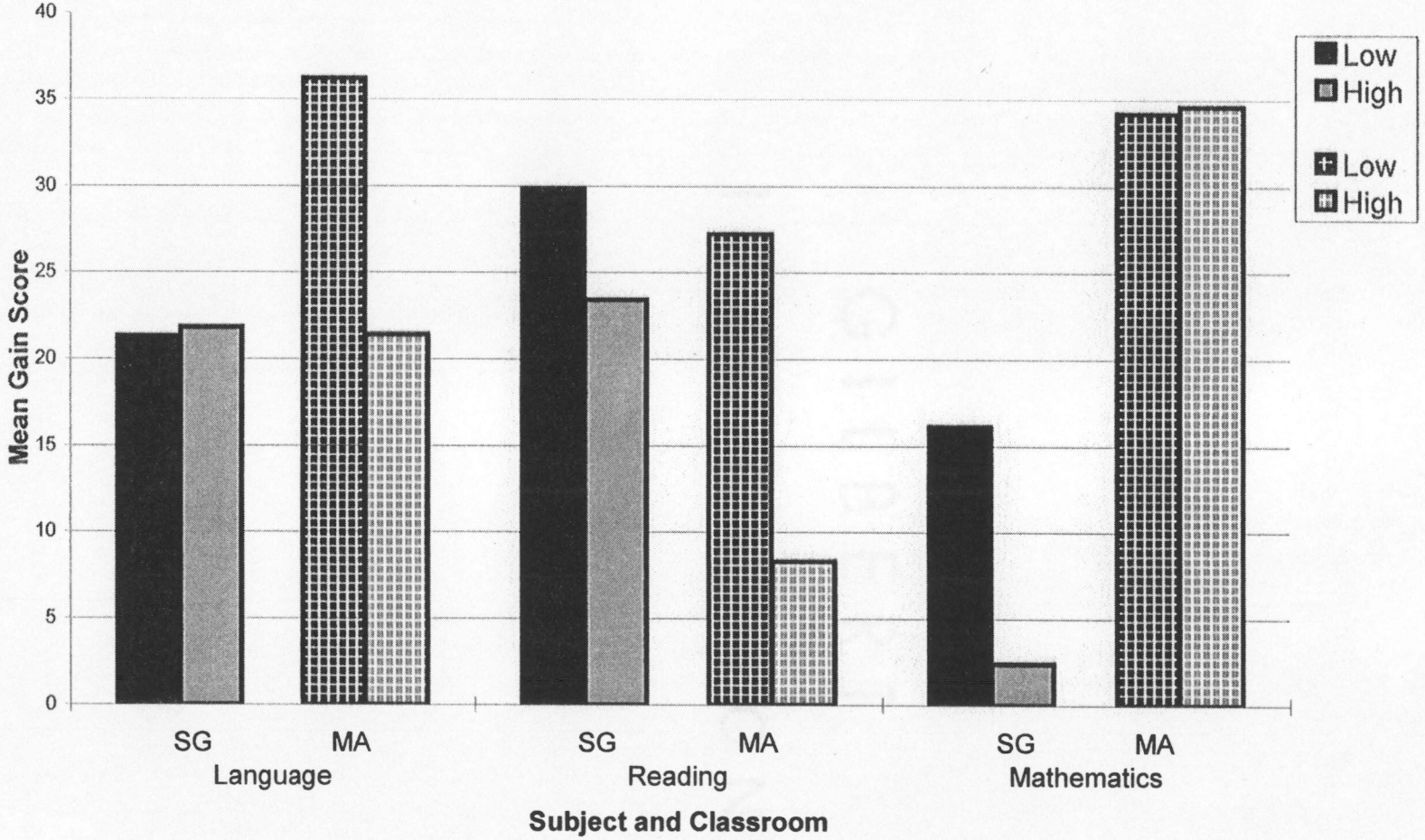


Figure XI. Single-grade (SG) and Multiage (MA) Mean Gain Scores by Subject for the Lowest and Highest Scale Score Groups in Grade 4.

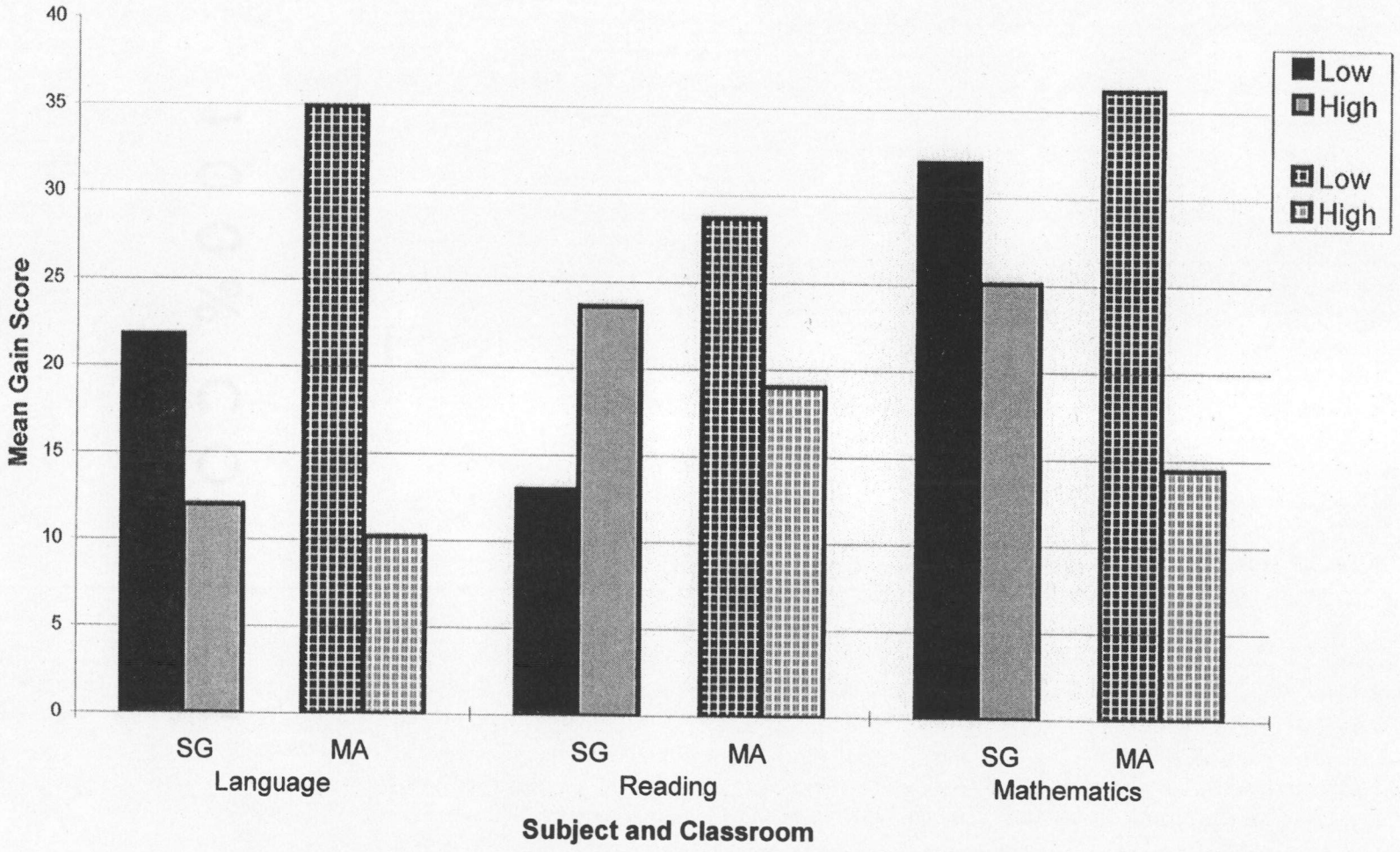


Figure XII. Single-grade (SG) and Multiage (MA) Mean Gain Scores by Subject for the Lowest and Highest Scale Score Groups in Grade 5.

Chapter V

Discussion

The purpose of this study was to examine differences in achievement gain scores of students in single-grade and multiage classrooms, as well as differences between the various levels of students within these classrooms. This study found that overall there was not a consistent difference between single-grade and multiage student achievement gain scores. However, there were three significant findings in favor of multiage classrooms. This significance was in the areas of Reading and Language at Grade 3 and in Mathematics at Grade 4. In addition, there was a trend for lower level students to achieve higher gains than upper level students. Overall, the differences were greater for multiage classrooms than single-grade classrooms. On the basis of these findings, which are based solely on achievement gain scores for this school, multiage grouping is at least similar to, if not more effective in certain instances, than single-grade settings.

As used in the present study, achievement gain scores can serve as an effective means for evaluating the academic side of multiage classrooms. Looking at just standardized scores at the end of an academic year can give a distorted picture of how well, or poorly, students are doing.

Comparing gain scores can better demonstrate how much students have learned, no matter where they started. Student gains can provide information on educational effects that measures of ability cannot provide (Sanders & Horn, 1995b). "By focusing on measures of academic gain, each student serves as his or her own "control" - or, in otherwords, each child can be thought of as a "blocking factor" that enables the estimation of school system, school, and teacher effects on the academic gain with the need for few, if any, of the exogenous variables" (Sanders & Horn, 1994, p. 305).

When considering this study's results, it appears from the data that multiage placements may slightly favor the younger children in the group and children who achieve at a lower level. This might be expected from looking at the theories of Piaget and Vygotsky. The older, higher achieving students will naturally become the models for the younger, lower achieving students. However, these students have no models other than similar students and the teacher. Although these students do not seem to be hurt by the placement, they are not helped as much. The implication from this is that if multiage classrooms are to be as effective with the older, more academically advanced students in the class, teachers must provide the same type

of stimulation the younger, less advanced students are receiving. Several suggestions for teachers are as follows:

- Extend the curriculum. Repetition is built in for the average student, however it may not be necessary for the above average. These students need acceleration. Begin the next step. For example, in mathematics allow the student to begin pre-algebra if he or she is ready. In reading, assign more advanced books. In language, give additional spelling words or a more advanced spelling list.
- Provide enrichment activities such as independent projects, science fair projects, and so on. These can be completed individually or with others. Allow the student(s) to assist with the choices involved, such as the topic and type of project that will be completed.
- Group students or assign "buddies" in order for students to work at their appropriate level.

Providing an appropriate and challenging curriculum, as well as supportive and encouraging learning environments, is essential.

As previously reviewed, research addressing achievement and multiage classrooms has led to mixed conclusions. The results of the study overall are in concordance with several

other studies indicating there is little or no difference in achievement of students in single-grade or multiage classrooms (Adams, 1953; Bledsoe, 1994; Drier, 1949; Miller, 1990; Pratt, 1986; Pratt & Treacy, 1986; Veenman, 1995; Way, 1980). Where there are differences, the significant grade and subject findings are in favor of multiage classrooms. This is consistent with several other studies that showed results favoring multiage grouping (Chace, 1961; Gajadharsingh & Melvin, 1987; Hamilton, 1956). Nye (1995), in the first year of the longitudinal School Success Study, found that students from nongraded or multiage classrooms significantly outscored students from single-grade classrooms in Grade 3 Vocabulary and Reading, as well as the Holistic Writing Assessment. The present study also found significant differences in favor of multiage classrooms for Grade 3 Language and Reading.

Stimson (1991) conducted one of the few studies in which students in the single-grade classes were found to achieve at significantly higher levels than students in multigrade classes in reading, mathematics, and language. In her study, students in the upper level of the multigrade class achieved at higher levels than students in the lower level of the multigrade class. Students in this study attended year-round, multitrack schools and were placed in

multiage classrooms by parental choice. Stimson explains the advantages of single-grade classrooms in this study was possibly due to the multitrack year-round schooling. Parents select the track based on when the desired school vacation time occurs. Further, a 1987 study conducted by Quinlan, George, and Emmett found multitrack, year-round schools consistently performed below traditional-calendar schools in reading and mathematics (Stimson, 1991 cited in Veenman, 1995). In the Stimson study, attending school year-round did not make up for being in a multiage classroom. The multitrack, year-round organization had a more profound (negative) effect than multigrade classrooms did on student achievement (Veenman, 1995).

When considering the significance of the present study's results for schools in general, the limitations imposed by existing conditions should be considered. These limitations include the following:

- The sample was from one school. Therefore, the results may be more specific to this school than to others.
- The data are considered by single school years rather than in a longitudinal study, limiting the extent to which generalizations can be made.
- Social and cognitive development may be affected

by single-grade and multiage classrooms. The existing body of research, though limited, shows higher self-concept, self-esteem, and a more positive attitude for students in multiage classrooms, thus confirming the theoretical basis. Achievement variables were examined in the present study, however social and cognitive variables were not. This limits generalizations on the effectiveness of multiage classrooms.

- Factors outside of the educational realm, such as illness, the home environment, parental and teacher influences, availability of materials, genetic endowment, or other school influences (Travers, 1981 cited in Sanders & Horn, 1994) may affect rates of student learning and/or achievement scores but cannot be taken into account in the study. These factors may influence results.

Before we can make conclusions and generalizations regarding multiage classrooms, an expanded body of literature and research is necessary.

In the existing body of literature and research, the terms that are used and degree of description vary greatly. For example, although defined differently, the terms multiage and ungraded are sometimes used synonymously.

Recommendations for further research should include detailed explanations of programs in order to eliminate confusion of terms. Longitudinal studies on achievement in multiage classrooms, as well as studies including numerous schools will be beneficial. As multiage programs are growing and changing, factors vary. Therefore, effective and useful research requires the details of the various multiage programs to be carefully evaluated prior to comparison. If it is true that students in multiage classrooms perform as well as their peers, than the next step should be to focus on constructs more difficult to measure such as self-concept and self-esteem.

In conclusion, the present study is an addition to the expanding body of research on achievement and multiage classrooms. Although generalizations are restricted specifically to this school, this study can serve as an example to other programs. Hopefully this study will also serve as a first step for continued studies at this school.

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APPENDIX

LIST OF STATISTICS

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Multiage Grouping vs. Regular
1993-1997
Grade=3

General Linear Models Procedure
Class Level Information

Class	Levels	Values
AVGLANG	4	550-599 600-649 650-699 700-749
TYPE	2	0 1

Number of observations in data set = 422

Class	Levels	Values
AVGREAD	4	550-599 600-649 650-699 700-749
TYPE	2	0 1

Number of observations in data set = 396

Class	Levels	Values
AVGMATH	4	550-599 600-649 650-699 700-749
TYPE	2	0 1

Number of observations in data set = 427

Multiage Grouping vs. Regular
1993-1997
Grade=3

General Linear Models Procedure

Dependent Variable: G_06 LANGUAGE GAIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	26706.0542	3815.1506	3.61	0.0009
Error	414	437750.2799	1057.3678		
Corrected Total	421	464456.3341			

R-Square	C.V.	Root MSE	G_06 Mean
0.057500	119.0651	32.5172	27.3104

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AVGLANG	3	8333.5745	2777.8582	2.63	0.0500
TYPE	1	3697.9400	3697.9400	3.50	0.0622
AVGLANG*TYPE	3	14674.5398	4891.5133	4.63	0.0034

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AVGLANG	3	10420.3735	3473.4578	3.29	0.0208
TYPE	1	1989.0770	1989.0770	1.88	0.1709
AVGLANG*TYPE	3	14674.5398	4891.5133	4.63	0.0034

Multiage Grouping vs. Regular
1993-1997
Grade=3

General Linear Models Procedure
Least Squares Means

AVGLANG	G_06 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
550-599	38.2500000	10.1390162	0.0002
600-649	36.7822008	3.6059148	0.0001
650-699	27.5063983	2.5393354	0.0001
700-749	22.4500000	3.2330694	0.0001

TYPE	G_06 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
0	27.2971824	2.4427237	0.0001
1	35.1971172	5.2162160	0.0001

AVGLANG	TYPE	G_06 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
550-599	0	37.8333333	7.6643758	0.0001
550-599	1	38.6666667	18.7738100	0.0401
600-649	0	22.4264706	3.9432888	0.0001
600-649	1	51.1379310	6.0382911	0.0001
650-699	0	29.5289256	2.9561084	0.0001
650-699	1	25.4838710	4.1296876	0.0001
700-749	0	19.4000000	3.5269848	0.0001
700-749	1	25.5000000	5.4195321	0.0001

Multiage Grouping vs. Regular
1993-1997
Grade=3

General Linear Models Procedure

Level of AVGLANG	N	G_06 Mean	G_06 SD
550-599	21	37.9523810	35.9478458
600-649	97	31.0103093	42.8241304
650-699	183	28.1584699	25.7622695
700-749	121	21.2148760	33.3454661

Level of TYPE	N	G_06 Mean	G_06 SD
0	292	25.4383562	33.9781560
1	130	31.5153846	31.1498590

Level of AVGLANG	Level of TYPE	N	G_06 Mean	G_06 SD
550-599	0	18	37.8333333	36.7587525
550-599	1	3	38.6666667	37.8989886
600-649	0	68	22.4264706	42.0292422
600-649	1	29	51.1379310	38.2395869
650-699	0	121	29.5289256	26.3328294
650-699	1	62	25.4838710	24.5989084
700-749	0	85	19.4000000	35.0041494
700-749	1	36	25.5000000	29.0639689

Multiage Grouping vs. Regular
1993-1997
Grade=3

General Linear Models Procedure

Dependent Variable: G_03 READING GAIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	136629.680	19518.526	13.50	0.0001
Error	388	561137.560	1446.231		
Corrected Total	395	697767.240			

R-Square	C.V.	Root MSE	G_03 Mean
0.195810	104.8939	38.0293	36.2551

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AVGREAD	3	108831.960	36277.320	25.08	0.0001
TYPE	1	13399.906	13399.906	9.27	0.0025
AVGREAD*TYPE	3	14397.813	4799.271	3.32	0.0200

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AVGREAD	3	123780.327	41260.109	28.53	0.0001
TYPE	1	24079.251	24079.251	16.65	0.0001
AVGREAD*TYPE	3	14397.813	4799.271	3.32	0.0200

Multiage Grouping vs. Regular
1993-1997
Grade=3

General Linear Models Procedure
Least Squares Means

AVGREAD	G_03 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
550-599	79.9597701	7.2553832	0.0001
600-649	53.8672727	4.3769696	0.0001
650-699	36.2032669	3.1889810	0.0001
700-749	12.6800868	4.0695486	0.0020

TYPE	G_03 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
0	35.5518927	2.5708945	0.0001
1	55.8033056	4.2453292	0.0001

AVGREAD	TYPE	G_03 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
550-599	0	52.586207	7.061871	0.0001
550-599	1	107.333333	12.676447	0.0001
600-649	0	47.454545	4.333846	0.0001
600-649	1	60.280000	7.605868	0.0001
650-699	0	30.953704	3.659375	0.0001
650-699	1	41.452830	5.223732	0.0001
700-749	0	11.213115	4.869158	0.0218
700-749	1	14.147059	6.521978	0.0307

Multiage Grouping vs. Regular
1993-1997
Grade=3

General Linear Models Procedure

Level of AVGREAD	N	G_03 Mean	G_03 SD
550-599	38	65.5526316	56.8486361
600-649	102	50.5980392	40.3136858
650-699	161	34.4099379	31.1469244
700-749	95	12.2631579	39.9460302

Level of TYPE	N	G_03 Mean	G_03 SD
0	275	33.4763636	41.1677446
1	121	42.5702479	43.4403473

Level of AVGREAD	Level of TYPE	N	G_03 Mean	G_03 SD
550-599	0	29	52.586207	52.7754795
550-599	1	9	107.333333	51.2371935
600-649	0	77	47.454545	39.0915072
600-649	1	25	60.280000	43.2536318
650-699	0	108	30.953704	32.2337793
650-699	1	53	41.452830	27.7790500
700-749	0	61	11.213115	41.3344549
700-749	1	34	14.147059	37.8570936

Multiage Grouping vs. Regular
1993-1997
Grade=3

General Linear Models Procedure

Dependent Variable: G_09 MATH GAIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	101608.607	14515.515	7.19	0.0001
Error	419	845391.491	2017.641		
Corrected Total	426	947000.098			

R-Square	C.V.	Root MSE	G_09 Mean
0.107295	70.92953	44.9182	63.3279

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AVGMATH	3	91135.5900	30378.5300	15.06	0.0001
TYPE	1	5631.3037	5631.3037	2.79	0.0955
AVGMATH*TYPE	3	4841.7135	1613.9045	0.80	0.4944

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AVGMATH	3	60129.3509	20043.1170	9.93	0.0001
TYPE	1	7348.3144	7348.3144	3.64	0.0570
AVGMATH*TYPE	3	4841.7135	1613.9045	0.80	0.4944

Multiage Grouping vs. Regular
1993-1997
Grade=3

General Linear Models Procedure
Least Squares Means

AVGMATH	G_09 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
550-599	82.2000000	8.0282261	0.0001
600-649	69.0063651	3.9382325	0.0001
650-699	57.4582092	3.7338753	0.0001
700-749	35.3759591	6.0635363	0.0001

TYPE	G_09 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
0	66.4639500	3.0747307	0.0001
1	55.5563167	4.8180523	0.0001

AVGMATH	TYPE	G_09 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
550-599	0	95.5000000	7.4863594	0.0001
550-599	1	68.9000000	14.2043683	0.0001
600-649	0	74.9909910	4.2634427	0.0001
600-649	1	63.0217391	6.6228209	0.0001
650-699	0	58.4824561	4.2069708	0.0001
650-699	1	56.4339623	6.1699833	0.0001
700-749	0	36.8823529	7.7034003	0.0001
700-749	1	33.8695652	9.3660831	0.0003

Multiage Grouping vs. Regular
1993-1997
Grade=3

General Linear Models Procedure

Level of AVGMATH	N	G_09 Mean	G_09 SD
550-599	46	89.7173913	65.1428049
600-649	157	71.4840764	44.9326569
650-699	167	57.8323353	36.9689959
700-749	57	35.6666667	46.8802934

Level of TYPE	N	G_09 Mean	G_09 SD
0	295	66.7220339	47.8924250
1	132	55.7424242	44.6926094

Level of AVGMATH	Level of TYPE	N	G_09 Mean	G_09 SD
550-599	0	36	95.5000000	66.4536358
550-599	1	10	68.9000000	58.5575690
600-649	0	111	74.9909910	43.6940802
600-649	1	46	63.0217391	47.2080450
650-699	0	114	58.4824561	37.2751625
650-699	1	53	56.4339623	36.6152078
700-749	0	34	36.8823529	48.4134746
700-749	1	23	33.8695652	45.5285169

Multiage Grouping vs. Regular
1993-1997
Scale Score Gain by Achievement Groups

Grade 3

			SCALE SCORE GROUPS				
			550-599	600-649	650-699	700-749	750-799
TYPE							
0	LANGUAGE GAIN	MEAN	37.8	22.4	29.5	19.4	33.7
		N	18	68	121	85	10
1	LANGUAGE GAIN	MEAN	38.7	51.1	25.5	25.5	26.9
		N	3	29	62	36	8

			SCALE SCORE GROUPS					
			<550	550-599	600-649	650-699	700-749	750-799
TYPE								
0	READING GAIN	MEAN	52.5	52.6	47.5	31.0	11.2	11.2
		N	20	29	77	108	61	9
1	READING GAIN	MEAN	81.4	107.3	60.3	41.5	14.1	-10.4
		N	5	9	25	53	34	8

			SCALE SCORE GROUPS					
			<550	550-599	600-649	650-699	700-749	750-799
TYPE								
0	MATH GAIN	MEAN	115.6	95.5	75.0	58.5	36.9	100.0
		N	8	36	111	114	34	2
1	MATH GAIN	MEAN	4.0	68.9	63.0	56.4	33.9	80.0
		N	4	10	46	53	23	2

Multiage Grouping vs. Regular
1993-1997
Grade=4

General Linear Models Procedure
Class Level Information

Class	Levels	Values
AVGLANG	3	650-699 700-749 750-799
TYPE	2	0 1

Number of observations in data set = 361

Class	Levels	Values
AVGREAD	3	650-699 700-749 750-799
TYPE	2	0 1

Number of observations in data set = 358

Class	Levels	Values
AVGMATH	3	650-699 700-749 750-799
TYPE	2	0 1

Number of observations in data set = 357

Multiage Grouping vs. Regular
1993-1997
Grade=4

General Linear Models Procedure

Dependent Variable: G_06 LANGUAGE GAIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	12780.6857	2556.1371	2.99	0.0117
Error	355	303420.9154	854.7068		
Corrected Total	360	316201.6011			

R-Square	C.V.	Root MSE	G_06 Mean
0.040419	133.0891	29.2354	21.9668

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AVGLANG	2	1900.58947	950.29474	1.11	0.3301
TYPE	1	8888.12467	8888.12467	10.40	0.0014
AVGLANG*TYPE	2	1991.97157	995.98578	1.17	0.3130

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AVGLANG	2	2793.04223	1396.52112	1.63	0.1966
TYPE	1	4677.75608	4677.75608	5.47	0.0199
AVGLANG*TYPE	2	1991.97157	995.98578	1.17	0.3130

Multiage Grouping vs. Regular
1993-1997
Grade=4

General Linear Models Procedure
Least Squares Means

AVGLANG	G_06 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	28.6565657	2.9382651	0.0001
700-749	22.3462338	2.3904246	0.0001
750-799	21.6250000	4.2197620	0.0001

TYPE	G_06 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
0	19.7873968	2.2580380	0.0001
1	28.6311362	3.0318142	0.0001

AVGLANG	TYPE	G_06 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	0	21.1313131	2.9382651	0.0001
650-699	1	36.1818182	5.0892245	0.0001
700-749	0	16.4094488	2.5942195	0.0001
700-749	1	28.2830189	4.0157868	0.0001
750-799	0	21.8214286	5.5249654	0.0001
750-799	1	21.4285714	6.3796806	0.0009

Multiage Grouping vs. Regular
1993-1997
Grade=4

General Linear Models Procedure

Level of AVGLANG	N	G_06 Mean	G_06 SD
650-699	132	24.8939394	28.9646422
700-749	180	19.9055556	26.8240068
750-799	49	21.6530612	39.6870839

Level of TYPE	N	G_06 Mean	G_06 SD
0	254	18.8464567	29.2553844
1	107	29.3738318	29.3516492

Level of AVGLANG	Level of TYPE	N	G_06 Mean	G_06 SD
650-699	0	99	21.1313131	29.7536300
650-699	1	33	36.1818182	23.4113415
700-749	0	127	16.4094488	26.8021423
700-749	1	53	28.2830189	25.1956783
750-799	0	28	21.8214286	37.3908818
750-799	1	21	21.4285714	43.5046796

Multiage Grouping vs. Regular
1993-1997
Grade=4

General Linear Models Procedure

Dependent Variable: G_03 READING GAIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	13507.6766	2701.5353	4.07	0.0013
Error	352	233927.2424	664.5660		
Corrected Total	357	247434.9190			

R-Square	C.V.	Root MSE	G_03 Mean
0.054591	118.2440	25.7792	21.8017

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AVGREAD	2	11626.6549	5813.3274	8.75	0.0002
TYPE	1	10.1560	10.1560	0.02	0.9017
AVGREAD*TYPE	2	1870.8657	935.4329	1.41	0.2461

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AVGREAD	2	7615.77499	3807.88750	5.73	0.0036
TYPE	1	954.57240	954.57240	1.44	0.2315
AVGREAD*TYPE	2	1870.86575	935.43287	1.41	0.2461

Multiage Grouping vs. Regular
1993-1997
Grade=4

General Linear Models Procedure
Least Squares Means

AVGREAD	G_03 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	28.4104093	2.6984703	0.0001
700-749	17.6947661	1.9368682	0.0001
750-799	15.8264706	5.1368454	0.0022

TYPE	G_03 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
0	23.0876964	2.3696184	0.0001
1	18.2000676	3.3190645	0.0001

AVGREAD	TYPE	G_03 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	0	29.5794393	2.4921672	0.0001
650-699	1	27.2413793	4.7870732	0.0001
700-749	0	16.3307087	2.2875322	0.0001
700-749	1	19.0588235	3.1261846	0.0001
750-799	0	23.3529412	6.2523691	0.0002
750-799	1	8.3000000	8.1520919	0.3093

Multiage Grouping vs. Regular
1993-1997
Grade=4

General Linear Models Procedure

Level of AVGREAD	N	G_03 Mean	G_03 SD
650-699	136	29.0808824	26.4208266
700-749	195	17.2820513	23.2881421
750-799	27	17.7777778	37.3942955

Level of TYPE	N	G_03 Mean	G_03 SD
0	251	22.4541833	25.3292103
1	107	20.2710280	28.5969289

Level of AVGREAD	Level of TYPE	N	G_03 Mean	G_03 SD
650-699	0	107	29.5794393	25.1951019
650-699	1	29	27.2413793	30.9523311
700-749	0	127	16.3307087	21.7970637
700-749	1	68	19.0588235	25.9217435
750-799	0	17	23.3529412	37.9406464
750-799	1	10	8.3000000	36.3594707

Multiage Grouping vs. Regular
1993-1997
Grade=4

General Linear Models Procedure

Dependent Variable: G_09 MATH GAIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	16558.4981	3311.6996	4.38	0.0007
Error	351	265601.7372	756.7001		
Corrected Total	356	282160.2353			

R-Square	C.V.	Root MSE	G_09 Mean
0.058685	132.4757	27.5082	20.7647

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AVGMATH	2	528.37208	264.18604	0.35	0.7055
TYPE	1	8291.43626	8291.43626	10.96	0.0010
AVGMATH*TYPE	2	7738.68977	3869.34489	5.11	0.0065

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AVGMATH	2	1086.6976	543.3488	0.72	0.4884
TYPE	1	11763.8356	11763.8356	15.55	0.0001
AVGMATH*TYPE	2	7738.6898	3869.3449	5.11	0.0065

Multiage Grouping vs. Regular
1993-1997
Grade=4

General Linear Models Procedure
Least Squares Means

AVGMATH	G_09 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	25.0203963	2.5647152	0.0001
700-749	22.0965323	2.3215951	0.0001
750-799	18.4812500	5.5444514	0.0009

TYPE	G_09 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
0	13.2769423	3.1404644	0.0001
1	30.4551768	3.0197753	0.0001

AVGMATH	TYPE	G_09 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	0	15.8741259	2.3003498	0.0001
650-699	1	34.1666667	4.5846971	0.0001
700-749	0	21.5567010	2.7930328	0.0001
700-749	1	22.6363636	3.7092026	0.0001
750-799	0	2.4000000	8.6988511	0.7828
750-799	1	34.5625000	6.8770456	0.0001

Multiage Grouping vs. Regular
1993-1997
Grade=4

General Linear Models Procedure

Level of AVGMATH	N	G_09 Mean	G_09 SD
650-699	179	19.5530726	26.9223025
700-749	152	21.9473684	27.3897040
750-799	26	22.1923077	39.6666300

Level of TYPE	N	G_09 Mean	G_09 SD
0	250	17.5400000	27.1564041
1	107	28.2990654	29.1153253

Level of AVGMATH	Level of TYPE	N	G_09 Mean	G_09 SD
650-699	0	143	15.8741259	26.4233857
650-699	1	36	34.1666667	24.0529179
700-749	0	97	21.5567010	26.5922017
700-749	1	55	22.6363636	28.9804299
750-799	0	10	2.4000000	37.0381185
750-799	1	16	34.5625000	37.0800373

Multiage Grouping vs. Regular
1993-1997
Scale Score Gain by Achievement Groups

Grade 4

			SCALE SCORE GROUPS					
			550-599	600-649	650-699	700-749	750-799	800-849
TYPE								
0	LANGUAGE GAIN	MEAN	12.8	29.3	21.3	16.4	21.8	6.0
		N	6	40	100	127	28	1
1	LANGUAGE GAIN	MEAN	32.0	-13.8	36.2	28.3	21.4	22.0
		N	1	5	33	53	21	1

			SCALE SCORE GROUPS						
			<550	550-599	600-649	650-699	700-749	750-799	800-849
TYPE									
0	READING GAIN	MEAN	59.0	69.5	36.8	29.8	16.3	23.4	.
		N	3	13	34	108	127	17	.
1	READING GAIN	MEAN	.	8.0	26.7	27.2	19.1	8.3	28.0
		N	.	3	6	29	68	10	3

			SCALE SCORE GROUPS						
			<550	550-599	600-649	650-699	700-749	750-799	800-849
TYPE									
0	MATH GAIN	MEAN	35.0	42.2	30.6	16.1	21.6	2.4	14.0
		N	1	5	37	145	97	10	1
1	MATH GAIN	MEAN	42.0	153.0	61.1	34.2	22.6	34.6	-3.0
		N	2	2	7	36	55	16	1

Multiage Grouping vs. Regular
1993-1997
Grade=5

General Linear Models Procedure
Class Level Information

Class	Levels	Values
AVGLANG	3	650-699 700-749 750-799
TYPE	2	0 1

Number of observations in data set = 314

Class	Levels	Values
AVGREAD	3	650-699 700-749 750-799
TYPE	2	0 1

Number of observations in data set = 313

Class	Levels	Values
AVGMATH	3	650-699 700-749 750-799
TYPE	2	0 1

Number of observations in data set = 324

Multiage Grouping vs. Regular
1993-1997
Grade=5

General Linear Models Procedure

Dependent Variable: G_06 LANGUAGE GAIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	8111.59610	1622.31922	2.28	0.0469
Error	308	219364.75103	712.22322		
Corrected Total	313	227476.34713			

R-Square	C.V.	Root MSE	G_06 Mean
0.035659	160.9349	26.6875	16.5828

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AVGLANG	2	6159.00950	3079.50475	4.32	0.0141
TYPE	1	527.52233	527.52233	0.74	0.3901
AVGLANG*TYPE	2	1425.06427	712.53213	1.00	0.3689

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AVGLANG	2	7554.78252	3777.39126	5.30	0.0054
TYPE	1	1073.93361	1073.93361	1.51	0.2204
AVGLANG*TYPE	2	1425.06427	712.53213	1.00	0.3689

Multiage Grouping vs. Regular
1993-1997
Grade=5

General Linear Models Procedure
Least Squares Means

AVGLANG	G_06 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	28.3217330	4.3553431	0.0001
700-749	16.7818100	2.5262479	0.0001
750-799	11.0717054	3.0144365	0.0003

TYPE	G_06 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
0	16.3230612	1.9274495	0.0001
1	21.1271044	3.4044990	0.0001

AVGLANG	TYPE	G_06 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	0	21.7343750	3.3359388	0.0001
650-699	1	34.9090909	8.0465872	0.0001
700-749	0	15.2580645	2.3966092	0.0001
700-749	1	18.3055556	4.4479184	0.0001
750-799	0	11.9767442	4.0698072	0.0035
750-799	1	10.1666667	4.4479184	0.0230

Multiage Grouping vs. Regular
1993-1997
Grade=5

General Linear Models Procedure

Level of AVGLANG	N	G_06 Mean	G_06 SD
650-699	75	23.6666667	32.2977421
700-749	160	15.9437500	19.4736548
750-799	79	11.1518987	32.7829257

Level of TYPE	N	G_06 Mean	G_06 SD
0	231	16.4415584	26.5767928
1	83	16.9759036	28.1554812

Level of AVGLANG	Level of TYPE	N	G_06 Mean	G_06 SD
650-699	0	64	21.7343750	32.8982280
650-699	1	11	34.9090909	27.1641475
700-749	0	124	15.2580645	19.0018702
700-749	1	36	18.3055556	21.1292883
750-799	0	43	11.9767442	33.4646141
750-799	1	36	10.1666667	32.3944440

Multiage Grouping vs. Regular
1993-1997
Grade=5

General Linear Models Procedure

Dependent Variable: G_03 READING GAIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	4776.13004	955.22601	1.07	0.3769
Error	307	274025.09680	892.58989		
Corrected Total	312	278801.22684			

R-Square	C.V.	Root MSE	G_03 Mean
0.017131	173.5250	29.8762	17.2173

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AVGREAD	2	1394.84388	697.42194	0.78	0.4587
TYPE	1	359.33692	359.33692	0.40	0.5262
AVGREAD*TYPE	2	3021.94924	1510.97462	1.69	0.1857

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AVGREAD	2	1105.67109	552.83554	0.62	0.5390
TYPE	1	704.36818	704.36818	0.79	0.3751
AVGREAD*TYPE	2	3021.94924	1510.97462	1.69	0.1857

Multiage Grouping vs. Regular
1993-1997
Grade=5

General Linear Models Procedure
Least Squares Means

AVGREAD	G_03 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	20.8201754	4.2205034	0.0001
700-749	16.7324468	2.5704826	0.0001
750-799	21.2907609	4.0835551	0.0001

TYPE	G_03 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
0	17.7162281	2.2870721	0.0001
1	21.5126940	3.6102558	0.0001

AVGREAD	TYPE	G_03 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	0	12.9736842	3.4270401	0.0002
650-699	1	28.6666667	7.7140128	0.0002
700-749	0	16.5500000	2.7273154	0.0001
700-749	1	16.9148936	4.3578979	0.0001
750-799	0	23.6250000	5.2814235	0.0001
750-799	1	18.9565217	6.2296273	0.0025

Multiage Grouping vs. Regular
1993-1997
Grade=5

General Linear Models Procedure

Level of AVGREAD	N	G_03 Mean	G_03 SD
650-699	91	15.5604396	36.2476693
700-749	167	16.6526946	22.2664392
750-799	55	21.6727273	37.7256444

Level of TYPE	N	G_03 Mean	G_03 SD
0	228	16.3508772	30.4442822
1	85	19.5411765	28.4050435

Level of AVGREAD	Level of TYPE	N	G_03 Mean	G_03 SD
650-699	0	76	12.9736842	37.0052154
650-699	1	15	28.6666667	29.8344639
700-749	0	120	16.5500000	22.9701487
700-749	1	47	16.9148936	20.5942476
750-799	0	32	23.6250000	36.9566005
750-799	1	23	18.9565217	39.4409550

Multiage Grouping vs. Regular
1993-1997
Grade=5

General Linear Models Procedure

Dependent Variable: G_09 MATH GAIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	8183.09078	1636.61816	2.14	0.0602
Error	318	242829.13144	763.61362		
Corrected Total	323	251012.22222			

R-Square	C.V.	Root MSE	G_09 Mean
0.032600	97.78586	27.6336	28.2593

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AVGMATH	2	5817.45893	2908.72946	3.81	0.0232
TYPE	1	929.37720	929.37720	1.22	0.2708
AVGMATH*TYPE	2	1436.25465	718.12732	0.94	0.3915

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AVGMATH	2	5498.00245	2749.00122	3.60	0.0284
TYPE	1	566.64935	566.64935	0.74	0.3896
AVGMATH*TYPE	2	1436.25465	718.12732	0.94	0.3915

Multiage Grouping vs. Regular
1993-1997
Grade=5

General Linear Models Procedure
Least Squares Means

AVGMATH	G_09 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	34.0769231	4.1179530	0.0001
700-749	27.8512750	2.4097884	0.0001
750-799	19.7410714	3.5754315	0.0001

TYPE	G_09 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
0	28.9351093	2.0873346	0.0001
1	25.5110704	3.3826455	0.0001

AVGMATH	TYPE	G_09 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
650-699	0	32.0000000	3.0150685	0.0001
650-699	1	36.1538462	7.6641705	0.0001
700-749	0	29.6803279	2.5018249	0.0001
700-749	1	26.0222222	4.1193679	0.0001
750-799	0	25.1250000	4.8849694	0.0001
750-799	1	14.3571429	5.2222519	0.0063

Multiage Grouping vs. Regular
1993-1997
Grade=5

General Linear Models Procedure

Level of AVGMATH	N	G_09 Mean	G_09 SD
650-699	97	32.5567010	30.0922087
700-749	167	28.6946108	20.5129147
750-799	60	20.1000000	38.7108797

Level of TYPE	N	G_09 Mean	G_09 SD
0	238	29.8865546	27.8272198
1	86	23.7558140	27.6779530

Level of AVGMATH	Level of TYPE	N	G_09 Mean	G_09 SD
650-699	0	84	32.0000000	31.3284197
650-699	1	13	36.1538462	20.9676185
700-749	0	122	29.6803279	21.6727221
700-749	1	45	26.0222222	16.9054710
750-799	0	32	25.1250000	37.7254513
750-799	1	28	14.3571429	39.7037308

Multiage Grouping vs. Regular
1993-1997
Scale Score Gain by Achievement Groups

Grade 5

			SCALE SCORE GROUPS					
			550-599	600-649	650-699	700-749	750-799	800-849
TYPE								
0	LANGUAGE GAIN	MEAN	-12.0	35.2	21.8	15.3	12.0	2.0
		N	1	23	65	124	43	1
1	LANGUAGE GAIN	MEAN	.	54.0	34.9	18.3	10.2	21.7
		N	.	2	11	36	36	3

			SCALE SCORE GROUPS					
			550-599	600-649	650-699	700-749	750-799	800-849
TYPE								
0	READING GAIN	MEAN	99.4	26.6	13.0	16.6	23.6	39.0
		N	5	26	76	120	32	2
1	READING GAIN	MEAN	33.5	-12.0	28.7	16.9	19.0	17.0
		N	2	1	15	47	23	2

			SCALE SCORE GROUPS					
			550-599	600-649	650-699	700-749	750-799	800-849
TYPE								
0	MATH GAIN	MEAN	31.5	11.5	32.0	29.7	25.1	70.0
		N	4	12	84	122	32	1
1	MATH GAIN	MEAN	103.0	.	36.2	26.0	14.4	65.5
		N	2	.	13	45	28	4

Vita

Melissa H. Rifkin was born in Broward County, Florida on September 30, 1974. She attended the public school system of Broward County, where she graduated high school in June, 1992. She entered The Florida State University in August of 1992 and received her Bachelor of Science degree in Child Development, in April of 1996.

After spending the summer as a preschool instructor, she entered The University of Tennessee, Knoxville Graduate School in August of 1996. She will earn the Doctor of Philosophy degree in Education, with a concentration in School Psychology, in August of 2000 after completing an internship with Florida State University Regional Multidisciplinary Evaluation and Consulting Center.