ABSTRACT

Title of dissertation: THE REGRESSION AND RECOUPMENT IN READING AND MATHEMATICS OF NONREFERRED STUDENTS AND STUDENTS WITH LEARNING DISABILITIES

Patti Elise Boyles, Doctor of Philosophy, 2005

Dissertation directed by: Professor Deborah L. Speece
Department of Education

Researchers have studied student summer regression in reading and mathematics with mixed results; the findings for children with disabilities are limited. If students with disabilities experience more regression and slower recoupment than average-achieving peers, summer education policies should be reexamined to ensure that students with learning disabilities continue to progress toward proficiency as mandated in the No Child Left Behind (NCLB) federal education initiative. I examined the differential summer regression and recoupment of 82 first through fourth grade students, 42 with learning disabilities (LD) and 42 students who were not referred (NR) for special education services, matched by grade, race, and gender. Students were grouped by two developmental levels: Primary (first and second grades) and Intermediate (third and fourth grades) and were tested with curriculum-based measurement fluency probes of reading and mathematics the last week of the school year and the first and sixth week of the following school year. Using repeated measures analysis of variance (Status x Developmental Level x Time), there were significant main effects for Status (LD, NR)

and Time (Spring, Fall, Recoupment) for both reading and mathematics and a significant Developmental Level x Time interaction for mathematics. Across all students, there was a nonsignificant trend for summer regression and a significant effect for recoupment. In mathematics, Primary students showed significantly more recoupment than did the Intermediate students. Although the study had low power to detect significant interactions, it appears that children with LD do not experience differential summer regression and fall recoupment compared to their nondisabled peers. However, the achievement gap between these two groups, as signified by the main effect of status, suggested that as early as first and second grade, children with LD are considerably behind their classmates. With NCLB requiring that all students reach levels of proficiency in reading and mathematics by the year 2014, more focused instruction will be needed for children with learning disabilities.

THE REGRESSION AND RECOUPMENT IN READING AND MATHEMATICS OF AVERAGE-ACHIEVING STUDENTS AND STUDENTS WITH LEARNING DISABILITIES

by

Patti Elise Boyles

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2005

Advisory Committee

Professor Deborah L. Speece, Chair
Professor Sylvia A. Rosenfield
Professor David H. Cooper
Professor Margaret J. McLaughlin
Professor Robert G. Croninger

Acknowledgments

This project has been a long, yet interesting process. There are so many people to thank; friends and family who heard over and over, “We can’t go this weekend. She’s still working on her dissertation.” And yet they continued to encourage me to finish. So I will try my best to thank everyone, but words aren’t enough for those who encouraged, supported, and taught me through this process. My thanks to:

My Lord and Savior who brought me through my own desert. And, although it didn’t last 40 years, there were times I thought it might. I am looking forward to putting this experience into the position for which He has prepared me.

Robert, my husband, who took care of me, kept me focused, and put his life on hold through this process. I could not have completed this without his total love through the joys and sorrows of the whole Ph.D. process.

Michael, my son, who challenged and encouraged me and shared coffee and his experiences at the college. I always looked forward to those conversations!

My advisor, Dr. Deborah Speece, who introduced me to new concepts in special education, who expected the best and guided me toward it, and who worked through personal loss and continued to raise the bar until the process was complete. Thanks, Debbie, for your guidance and patience.

My dissertation committee, Dr. Sylvia Rosenfield, Dr. Margaret McLaughlin, Dr. David Cooper, and Dr. Robert Croninger for your expert analysis of my research and for your suggestions.

My family and my church family who encouraged and supported me, prayed for me, and showed me what love really means.

And, finally, to the administrators, teachers, parents, and students in the district where this data was collected. They opened their schools, tolerated my interruptions, answered my questions, helped me collect information, and offered me needed support to make it a great experience.

TABLE OF CONTENTS

List of Tables

List of Figures

Chapter 1

Statement of the Problem

The possible regression of student skills during summer vacation has concerned educators and researchers since the early 1900s. According to Allinder and Eicher (1994), teachers believed that students did not retain all the skills that they had learned during the school year leading to recommendations for summer school and reviews of previous year's work the following fall and. Researchers studied the effects of summer break on IQ and achievement in every basic content area. They evaluated the effects of a variety of correlates of summer academic gains and losses including race, gender, age, socioeconomic status, and disability as well as the varying effects of intervention, styles of teaching and teacher personality, school calendars, and curriculum.

Despite research interest, the question of whether regression of skills occurs is not completely answered. Cooper, Nye, Charlton, Lindsay, & Greathouse (1996) conducted an analysis of empirical studies on the effects of summer vacation on student achievement. Studies were selected based on searches of electronic databases that included terms related to summer regression and learning. Of the 39 studies they located for their meta-analysis, 26 were over 20 years old and did not contain the information needed for the meta-analysis. The authors used a vote-count method for determining student summer academic gains and losses for these older studies. However, studies conducted since 1975 provided data suitable for a meta-analysis. Using the vote count method, they found that of the 17 studies of summer mathematics regression, all indicated losses, but of the studies of reading comprehension, 10 of the 17 studies showed summer gains. For the 13 studies completed from 1975 through the writing of their meta-analysis in 1994, the authors calculated effect sizes using the standardized mean difference approach and, when possible, the difference in grade-level equivalents. They found a weighted *d*-index of .00 for mathematics-related subjects and +.05 for reading- and language-related subjects. The difference between mathematics and reading-related subjects was significant and the reading index was significantly different from 0. These results included the effects of one large study that skewed the weighted gains in a positive direction. When this study was excluded from the analysis both academic domains showed losses (mathematics weighted d = -.16; reading and language d = -.11)

Cooper et al. (1996) concluded that mathematics achievement losses were greater than reading achievement losses possibly due to more summer opportunities to practice reading than mathematics. They tempered their conclusions by noting that many studies included instructional time and not just summer vacation. Analysis of the data by grade level indicated that children exhibited more losses in reading achievement as they progressed through school. This analysis covered grades 1 through 8 with most of the data coming from grades 5 through 8.

My interest was in younger children (grades 1 -4) so not all the studies they reviewed were pertinent to the current study. I used a vote-count of significant findings in reading and mathematics and found that there was almost an equal number of studies that did and did not demonstrate significant academic gains or losses in both subjects. Overall, in both the Cooper et al. meta-analysis and in my review, the studies indicated no clear answers to the question of summer academic regression in reading and mathematics skills among elementary school-age students.

Across all the studies I reviewed, researchers found only small differences in reading and in mathematics. Of the studies where statistical tests of significance were used and reported, five studies (Cook & Schwarz, 1969; Crowell & Klein, 1981; Heyns, 1978; Keys & Lawson, 1937; Reece, Myers, Nofsinger, & Brown, 2000) demonstrated significant student gains in reading. Three (Allinder & Eicher, 1994; Cornelius & Semmel, 1982; Heyns, 1978) showed significant student losses in reading. Two studies (Reece et al., 2000; Scott, 1967) showed significant mathematics gains, and five (Allinder & Eicher, 1994; Allinder & Fuchs, 1991; Allinder, Fuchs, Fuchs, & Hamlett, 1992; Keys & Lawson, 1937; Reece et al., 2000) demonstrated significant student losses in mathematics. This pattern tends to show that there are more gains than losses in reading and more losses than gains in mathematics. This analysis of the research with elementary age children supports the conclusions of Cooper et al. (1996) who examined a broader set of studies.

There are few studies that include children with disabilities. Research on students with disabilities is important because studies have shown that students with LD do not know how to store the information they learn (Swanson, Cooney, & O'Shaughnessy, 1998; Wong, 1996). Because they do not know how to store the information, they cannot retrieve it; therefore, although they have memory, they do not know how to access it (Swanson et al., 1998; Wong, 1996). Students with LD do not automatically use memory strategies as do their average-achieving peers (Wong, 1996). Younger children with LD generally have greater memory deficits than do adolescents. According to Swanson et al. “students with LD have difficulty remembering familiar items such as letters, words, numbers, and unfamiliar items that can easily be named and stored phonetically in memory" (p.131). Students with LD also have trouble recalling verbal information in sequential order (Swanson et al.). They not only have problems with short-term memory, they also have trouble with working memory on tasks that involve concurrent information processing and storage. There is research to show that the memory deficiencies of students with LD affect not only their reading, but also their mathematics achievement (Wong). Thus, it is likely that students with LD would lose skills and knowledge over an extended break.

Before disabilities, such as LD, were identified, researchers focused on the effects of ability levels defined by IQ on student summer gains and losses. Cooper et al. (1996) explained that one of the earliest areas of concern for researchers was the effect of IQ on summer academic losses. In their analysis, they found little evidence that IQ had any effect on summer gains or losses; however, they did caution that the earlier studies did not include students with abnormally low or high IQs or students with disabilities. Shaw's study (1982) was the only study of students with disabilities included in the Cooper et al. meta-analysis. Researchers found that although students with disabilities had lower test scores than did the average-achieving students, their results were similar; tending to make small gains in reading and small losses in mathematics.

Only one study (Allinder & Eicher, 1994) analyzed fall recoupment of student achievement, and their analysis was for students with high-incidence disabilities. They found that students with high-incidence disabilities regressed significantly in reading and mathematics over the summer and recouped significantly in reading after six weeks of fall instruction. Several studies analyzed student academic growth during times of schooling (Cornelius & Semmel, 1982; Heyns, 1978; Keys & Lawson, 1937) in addition to summer regression. They found that students gained achievement more quickly during times of schooling than they did during times of summer vacation.

The purpose of this study was to explore the differing levels of summer regression and fall recoupment of elementary students with LD and those students who were not referred for special education services or gifted and talented programs (NR). If students with LD experience regression and/or less recoupment the following fall, there would be implications for educational services. By nature of their disability, students with LD have lower levels of achievement and possible higher regression and less recoupment. This situation would increase the achievement gap between students with and without LD. Previous researchers found that the following factors could influence the results of studies evaluating the effects of summer vacation: student summer activity, family income, parent education levels, race, gender, and grade level. I will also control for or evaluate the effects of these factors in this study to determine their effects on student summer achievement.

The remainder of this chapter reviews the federal education policy in the No Child Left Behind Act (NCLB) for students with disabilities and the Extended School Year (ESY) provision of services in Individuals with Disabilities Education Act (IDEA), summarizes regression research on children with and without LD, and describes the study designed to address the issues raised.

Federal Educational Policy and Summer Vacation

The belief of educational professionals that students regress over the summer continues to affect educational policy. Based on the belief that regression occurs, teachers and local-, state-, and federal-level administrators spend resources on summer educational programs from ever-shrinking budgets. Considering the conflicting findings from past studies and the overall small levels of academic regression, this expense may not be necessary.

Disability policy. The demonstration of summer regression played a role in the shaping of federal disability policy in students with disabilities who showed significant regression and slow recoupment. In 1975, the passage of Public Law 94-142, the Education for All Handicapped Children Act (EAHCA), later renamed (IDEA), gave students with disabilities the right to a free appropriate public education (FAPE) [20 U.S.C. §§ 1401(18), 1412(2)(B). Starting in 1979, courts agreed with the parents of children with severe disabilities that a 180-day rule (a policy which restricted the school year to 180 days for all students) violated the students' rights to FAPE (e.g., "Armstrong v. Kline," 1979; "Battle v. Commonwealth," 1980). The plaintiffs demonstrated that some students with severe disabilities regressed significantly over long breaks from instruction and recouped those losses much more slowly than students with milder disabilities or average-achieving peers. The judges stated that the EAHCA required the consideration of the unique needs of each student. They declared that students whose regression-recoupment syndrome was so severe that the students regressed substantially over the summer and never recouped those losses should receive IEP services beyond the traditional 180-day academic school year.

Because of the U. S. Court of Appeals decision regarding *Armstrong v. Kline* ("Armstrong v. Kline," 1979) and other similar decisions, the consideration of ESY services for students with disabilities became an important issue for discussion during the annual review of the IEP meetings. In 1997, the federal legislators stated their reasoning for adding ESY policy to IDEA in the *Analysis of comments, discussions and changes from Attachment 1 ("Individuals with Disabilities Education Act," 1997).* They discussed their support of the litigation and their desire to ensure that the regulations for ESY were all in one place. ESY services entitle students with disabilities to the extra instructional time they needed to continue to progress toward their overall goals of equality of opportunity, empowerment, independent living, and economic self-sufficiency.

According to Stainback, Stainback, and Hatcher (1983), a student's regression-recoupment was one criterion to be considered when the IEP team determines eligibility for ESY services. Teachers should collect regression-recoupment data to determine whether ESY was appropriate. The criteria for ESY services vary from state to state. Alper and Noie (1987) and Katsiyannis (1990) conducted surveys to determine state policy for ESY for students with disabilities. Alper and Noie found that eight states used a regression-recoupment criterion for eligibility for ESY services and had written guidelines for qualifying levels of regression-recoupment. Katsiyannis (1990) found that students with multiple handicaps, severe handicaps, and mental retardation were identified for ESY services most often. The criteria used to determine eligibility included "regression/recoupment, severity of handicap, focus on areas of learning necessary for self-sufficiency and independent living, individual needs, and capacity of parents to monitor learned skills" (p. 26).

Federal educational policy for all students. When President Bush signed NCLB (P.L. 107-110) in January 2001, he and Congress made a clear statement about raising expectations for all students in the country. Within the NCLB, there is a strong focus on reading, mathematics, and science achievement for all groups of students. Mandated assessments for accountability are to be disaggregated by low income, race and ethnicity, disability, and limited English proficiency [34 CFR 200 §§1111(b)(2)(C)(v)(ll)]. The expectation is for all students to demonstrate specific percentages of yearly improvement and meet or exceed state-defined proficiency levels by the 2013-2014 school year including the subgroups of students defined above. Students with learning disabilities (LD) are an important population within the subgroup of students with disabilities in NCLB in that they represented 6% of the school population in the school year 2000-2001 (National Center for Education Statistics). They are now included in the accountability of the schools and are required to take the same tests as their regular education peers. A stated purpose of the NCLB is that all students, including students with disabilities, will "reach, at a minimum, proficiency on challenging State academic achievement standards and state academic assessments" (34 CFR 200 §§1001).

Because a lack of academic success is a part of the identification criteria of a student with a learning disability, it may be difficult for students with LD to meet the proficiency levels on the state assessments used to determine adequate yearly progress. They may represent an important subgroup of the school and district population, a number that could affect the yearly academic growth required of each school and district by NCLB. It is important to determine whether the break in instruction from summer vacation differentially affects the skills of regular education students and students with LD to establish whether more services are required to enable students with LD to maintain their gains in achievement.

Initially, the court findings that favored the provision of ESY services pertained to students with more severe disabilities. However, it is possible that students with high-incidence disabilities (i.e., learning disabilities, behavior disorders, mild mental retardation) could qualify for these services to limit the amount of summer regression and to continue their growth toward academic proficiency. This study will examine whether elementary students with learning disabilities experience differential regression and recoupment from their NR peers.

Overview of Regression Research on Elementary School Students Without Disabilities

The focus of the research was whether the belief of education professionals, that students experienced significant regression over summer vacation, was true. There were no clear results. The results of three studies demonstrated that students in grades three, four, and five regressed significantly in mathematics over summer break (Allinder et al., 1992; Keys & Lawson, 1937; Wintre, 1986); one study demonstrated a significant gain in reading in grades four and five (Keys & Lawson, 1937). Another researcher (Heyns, 1978) found that student race made a difference in the retention of academic skill over the summer; White students gained and Black students regressed in reading skills. Heyns also developed a student summer activity survey to be completed by the parents that reported the levels of student summer academic activity, such as summer school or time at the library, parent levels of education, and family income. Heyns only alluded to the survey in the discussion of her results. She noted that family income and parent education levels had a positive relationship with student achievement. However, in discussing student summer activities, Heyns mentioned only the positive influence of summer school attendance and did not mention the other student summer activities, such as library time, in the survey.

Researchers also began to study factors that could affect student summer regression. Alternate school calendars decreased the amount of mathematics regression, while the traditional calendar decreased that amount of regression in reading (Reece et al., 2000). Different mathematics curricula were also found to have an affect on the retention of student mathematics skills over the summer break (Scott, 1967).

Overview of Regression Research on Elementary School Students with Disabilities

Several authors studied summer regression among students with disabilities. The results of one study indicated that students who were categorized as educable mentally retarded demonstrated summer reading gains (Cook & Schwarz, 1969). Researchers of two other studies found that students with high-incidence disabilities regressed significantly in reading over the summer months. However, these students exceeded their spring reading scores after six weeks of fall instruction or five weeks of summer school (Allinder & Eicher, 1994; Cornelius & Semmel, 1982). Shaw (1982) found that students with LD demonstrated significant differences from their non-disabled peers in their levels of retention of mathematics skills. Shaw also discovered significant differences in the retention of reading skills over the summer between students with disabilities and students without disabilities with students with disabilities retaining significantly less reading achievement.

Rationale for Study

Several lines of evidence and reasoning provide the rationale for this study. First, there is no clear evidence of significant regression in reading or mathematics in students in the elementary grades in previous studies. The numbers of gains and losses reported were about the same. Second, researchers of only one study evaluated the rate of recoupment of students after summer vacation (Allinder & Eicher, 1994). That study involved only students with mild disabilities and did not compare the recoupment rate with other students. Third, only two groups of researchers analyzed summer regression comparatively in both students who were disabled and their non-disabled peers (Allinder & Fuchs, 1991; Shaw, 1982). Fourth, policy decisions at the state, local, and federal level have been based on the belief that regression occurs despite inconsistent empirical findings. Fifth, many of the authors included weeks or months of school instruction in the regression measure and thus confounded regression due to non-instructional time. Finally, student summer academic activities, family income, and parent educational levels were accounted for in only one study (Heyns, 1978). These variables may provide more understanding of the regression phenomenon should it be observed.

From previous research, we know that there is a trend toward more losses in mathematics than in reading, and more gains in reading than in mathematics and that students with disabilities follow that trend; however, overall, their scores are lower than those of their average-achieving peers. From the one study about student regression and recoupment, we know that students with high incidence disabilities regain their skills in reading and mathematics within six weeks of instruction. However, there are limitations to the above studies. First, many researchers used standardized assessments with grade-equivalent scores or percentile ranks which, because of the extrapolation of the scores during norming, are not valid indicators of student progress over the summer and cannot accurately measure small steps of student progress. In addition, and as noted by Cooper et al. (1996), the summer measure of many studies included weeks of spring or fall instruction that could hide regression and suggest a gain in achievement. Most of the researchers did not account for student summer activity, which could include summer school or time spent reading or playing mathematics games on the computer. Finally, there were no studies that analyzed the comparative regression and recoupment of students with LD to students who were average-achieving.

Therefore, in this study I used curriculum-based measurement that was developed to measure small achievement gains or losses. I compared the regression and recoupment of students with LD to NR students who were considered by their teachers to be achieving in the average range. This comparison is important because achieving the academic level of average or proficient is the ultimate goal for students with disabilities. I assessed the students during the last week and a half of school in the spring and the first week and a half of school in the fall, and I accounted for summer activity, both structured and unstructured, family income, and parent education levels, which have also been found to affect student learning. Finally, I controlled for race and gender effects by matching the students with LD and the NR students.

The Study

Purpose

This study had three purposes. The first purpose was to determine if there was differential regression in reading and mathematics achievement after the summer vacation in elementary school for NR students and students with LD. The second purpose was to determine if there was differential recoupment in reading and mathematics achievement after the summer vacation in elementary school for NR students and students with LD. Finally, the third purpose of this study was to determine how student summer activity, socioeconomic status, and student academic competence were related to summer retention of academic skills in reading and mathematics. Student summer activity is a potentially important variable in the determination of the effects of summer vacation. Practice of academic skills over the summer helps students retain their levels of achievement. There is also a suggestion in the literature that socioeconomic status and student academic competence may be related to retention of skills.

The research questions guiding this study are:

Question 1: Do NR students and students with LD in Primary and Intermediate grades experience differential regression over the summer in reading skills?

Question 2: Do NR students and students with LD in Primary and Intermediate grades experience differential regression over the summer in mathematics skills?

Question 3: Do NR students and students with LD in Primary and Intermediate grades experience differential recoupment in reading skills after six weeks of instruction in the fall?

Question 4: Do NR students and students with LD in Primary and Intermediate grades experience differential recoupment in mathematics skills after six weeks of instruction in the fall?

Question 5: Does academic competence, summer activity and family income account for significant variance in regression and recoupment scores in reading?

Question 6: Does academic competence, summer activity, and family income account for significant variance in regression and recoupment scores in mathematics?

Possible Outcomes

Although the number of pertinent research studies is limited, based on the previous studies on regression of academic skills over the summer break, significant differences are expected in the regression of reading and mathematics between students with LD and NR students. NR students are expected to maintain or have small gains in reading and maintain or experience small losses in mathematics. Students with LD will experience significantly more regression in both reading and mathematics. Although I reviewed no research about recoupment of academic skill by NR students, based on research of recoupment of students with disabilities, I believe NR students will recoup any losses they experience in mathematics. Their recoupment scores in reading will be significantly above the previous spring scores, and their mathematics scores will be equal to or above their previous fall scores. After the six weeks of fall instruction, students with LD will regain any skills they lost over the summer. In reading, they will score significantly above the previous spring levels, and in mathematics, they will regain their summer losses.

If there is a significant difference in the regression and recoupment between students with LD and students who are NR, I would expect that socioeconomic status, parent education, and time spent on educational activities would account for some of the variability in the scores. Researchers have demonstrated that these variable are related to student academic achievement (Cook & Schwarz, 1969; Cooper et al., 1996; Crowell & Klein, 1981; Heyns, 1978).

Definition of Terms

Curriculum-based measurement (CBM) – measures used to monitor student progress that are reliable and valid, simple and efficient, easily understood, and inexpensive (Deno, 1985). For this study, reading and mathematics CBM were used. I used oral reading fluency as the reading CBM. Students read a grade level passage aloud for one minute to the examiner. The measure of interest is the number of words the student read correctly in one minute (Germann & Tindal, 1985; D. B Marston, 1989). Mathematics fluency was the measure used for the mathematics CBM. Students work grade appropriate mathematics problems for two minutes. The measure of interest is the number of digits correct in one minute (Germann & Tindal, 1985; D. B. Marston & Magnusson, 1988). For the purposes of this study, the measure was the number of digits correct in two minutes.

Learning disability – the county determines whether a student has a learning disability by a discrepancy of one standard deviation or more difference between ability (determined by the *Wechsler Intelligence Scale for Children – Third Edition*) and achievement (determined by either the *Woodcock Johnson – Third Edition* or the *Wechsler Individual Achievement Test – Second Edition*). One standard deviation is equal to 15 points of the standard scale score on the subtests of the achievement tests M = 100 and SD = 15. For instance, if a student's IQ score was 100, the reading subtest score 85, and the mathematics subtest score 90, the student would qualify as a student with a learning disability in reading, but not mathematics.

Not referred (NR) – students who the teacher would not refer for special education services or for gifted and talented programs. The students were to be average-achieving, and so the teachers were given the above description for the students they were to identify for this study. However, with the exception of the CBM data collected for this study, I have no other indicators that they were average-achieving (i.e. test scores, grades), so, for the purposes of this study, they will be identified as not referred (NR).

Regression – the loss of academic skill following a break in instruction (summer vacation) defined in this study as number of words per minute for reading or digits per two minutes for mathematics.

Recoupment – the amount of academic skill in reading and mathematics regained after six weeks of instruction defined in this study as increased words or digits per minute.

Chapter 2

The focus of this study is the summer regression of skills in reading and mathematics in elementary students with LD compared to that of students without disabilities, and the recoupment of those skills for these students. An analysis of the effects of student summer activities, academic competence, and socioeconomic status will be included. Regression of skills over the summer has concerned researchers for over 100 years. Extensive instructional reviews at the beginning of the school year, summer school programs, and educational policy reflect the belief that students regress in critical skills when they are not in school. The results of research in this area are inconclusive. In general, more studies have indicated an increase, or at least no regression in reading skill (Heyns, 1978), while in mathematics, small losses are noted (Keys & Lawson, 1937; Wintre, 1986). Very little data are available on children with disabilities although there is an assumption in policy and law that children with disabilities regress over the summer.

Literature Search

I used several methods to locate studies of summer regression and fall recoupment for this literature review. First, I completed an electronic search of the University of Maryland library system, entering the education databases through MdUSA. I searched the Education Abstracts, ERIC, ERIC (EBSCO), and PsycINFO using the keywords, "ESY," "extended year services," "recoupment," "regression and recoupment," "summer academic losses," and "vacations and school breaks." I searched the same databases for authors, such as "Allinder, R.," "Fuchs, L.," and "Heyns, B." My advisor recommended writings by Heyns (1978). Several reference lists proved useful in my search for articles (e.g., Allinder & Eicher, 1994; Heyns, 1987; Shaw, 1982; Wintre, 1986).

I chose the articles that addressed the issues of focus in my study and that used tests of statistical significance. My first interest was in studies in which the analysis of summer regression focused on students with disabilities. Because I am interested in evaluating elementary school grades, I chose studies that focused on that age group. Reading and mathematics were the skills I assessed for summer regression and fall recoupment; therefore, I did not include studies in which the authors focused only on other subjects unless they addressed a variable of interest for this study. When other academic subjects were included in the researchers' assessments and discussions, I discussed only the outcomes of their reading and mathematics analyses. Also, although I addressed interventions to prevent summer losses, such as summer school and ESY, they were not the focus of this study.

The earliest researchers did not include the level of statistical significance of their findings, and in some studies, the authors' reported levels of significance were not for the reading and mathematics summer gains or losses. Therefore, a set of studies that were pertinent to the topic of student summer regression, but in which the significance of results was difficult to interpret, were not included in this literature review. However, because the findings of these studies added to what we know about summer gains and losses, I included their reviews in Appendix A.

Review of the Literature

I divided this chapter into three sections. First, I discuss the meta-analysis of the effects of summer vacation on achievement by Cooper et al. (1996). The next section addresses studies in which the researchers evaluated only summer regression in terms of the individual differences of the student (e.g., level of intelligence, achievement, or presence of a disability). These are descriptive studies. Finally, the third section addresses studies in which the researchers examined summer regression in conjunction with some form of intervention.

Cooper, Nye, Charlton, Lindsay, and Greathouse Meta-analysis

Cooper et al. (1996) located the research discussed in their article by database searches, referencing sections of reports, and contacting researchers known to be studying summer regression. The authors selected research reports that contained descriptions of empirical studies that analyzed the effects of summer vacation on student achievement. Of the 39 studies they located for their meta-analysis, 26 were over 20 years old and did not contain the information needed for the meta-analysis. The authors used a vote-count method for determining student summer academic gains and losses. However, studies conducted since 1975 provided data suitable for the meta-analysis. Cooper et al. wrote narrative summaries for all 39 studies. They did not restrict the studies by grade, so their sample included grades K – 8. They evaluated the effects of summer vacation on achievement test scores to determine the overall effects of summer vacation and the differential effects for different subject matter and different personal and family characteristics. They defined “students with special needs” as those who were not native English speakers, students who were in lower socioeconomic levels, or students with a learning disability.

Cooper et al. (1996) identified methodological issues that they believed affected the results of all the studies they reviewed of student regression over breaks in instruction. The first was the length of the testing interval. Not all summer vacations lasted the same amount of time. Some studies included as much as four months of instruction, which, as the authors pointed out, could hide any summer regression and show only gains. Their next methodological concern was the type of measurement used. Some researchers used raw scores and standardized scores to measure absolute change, which, as Cooper et al. stated, are "ordinally equivalent to each other, but are not linear transforms" (p. 231). To measure academic changes relative to a comparison group or a national sample, researchers may use grade-level equivalents. However, these measures are normed over 10 months with the assumption that students gain one month of achievement over the three months of summer. Are extrapolated scores valid indicators of student change over the summer? Researchers also used percentile ranks, but, again, grade-level equivalents and percentile ranks are not linear transformations. Cooper et al. believed these scores were poor indicators of student progress because the scores are "smoothed out" by extrapolation. They do not show small changes students make over certain periods of time.

The earliest researchers did not include measures of the statistical significance of their findings. Using a vote-count synthesis to address the lack of statistical tests, Cooper et al. (1996) determined that over the summer vacation, there were 0 gains and 17 losses in mathematical computation, 6 gains and 6 losses in mathematical concepts, 10 gains and 7 losses in reading comprehension, and 10 gains and 5 losses in other language skills (e.g., vocabulary, literature, grammar). Overall, they found a clear loss in mathematical computation and no clear findings for the other subjects; however, the authors pointed out that they did not account for sample size or for the type of metric used, so their results were imperfect and only suggestive. In addition, the focus of most of the previous research was on fourth through ninth grade; therefore, inferences could not be made for the early elementary grades. The effect of the level of intelligence was one of the most frequently tested moderators in the early studies, but there was no consistent pattern of relationship. A single test of the effects of gender demonstrated no differences in summer achievement, and a single test of the effects of socioeconomic status indicated that students with higher levels of socioeconomic status gained in reading and vocabulary skills, while students with lower socioeconomic status lost in those areas.

For the more recent studies, Cooper et al. (1996) conducted a meta-analysis to determine the effects of summer vacation on achievement. They computed the effect sizes by using weighted and unweighted procedures to calculate a standardized mean difference (*d*-index) for each sample to show the sample's own change in achievement relative to itself, regardless of the metric. The weighted procedures took into account the size of the sample, giving larger samples more weight. Only the weighted *d*-indexes were analyzed for statistical significance. A *d*-index of +.20 meant that the average achievement was two tenths of a standard deviation higher than was the average score. The authors also calculated, when possible, the difference in grade-level equivalents (DGLE), allowing them to express change in the achievement scores relative to the national norms. Cooper et al. then used a shifting unit of analysis, where each effect size was coded as if it were an independent event. If a study analyzed the summer effects on both mathematics computation and reading comprehension, an effect size was determined for each skill. For the overall effect of summer on achievement, an effect size was computed for the entire study. The effects of possible moderators on the summer achievement were determined through homogeneity analysis.

Cooper et al. (1996) found 66 independent samples in 12 of the 13 studies. The total number of students in all the samples was 47,994; however, 38,384 came from one study. The authors found that there was little academic growth over the summer for all subjects combined, either including the large study (unweighted *d*-index = -.09, weighted *d*-index = +.02, $p < .05$) or without the large study (unweighted *d*-index = -.10, weighted *d*-index = -.13, $p < .05$). At the most, students lost only one month of grade-level equivalent skills relative to national norms. The authors state that these scores are optimistic because many of the studies included four months for the regression measure. They also found that when the amount of time included in the summer measure increased, the amount of loss decreased. They believed that if the measures were taken the day students left for and returned from summer vacation, a larger decrease (or loss) in the scores would have been the result. The large study included in this analysis had nearly eight weeks of instruction included in the summer measure and that study alone could have swayed the results more toward an indication of summer gains.

For individual academic subjects, Cooper et al. (1996) found that more losses were observed in mathematics including the large study (unweighted *d*-index = -.13, weighted *d*-index = .00) and excluding the large study (unweighted *d*-index = -.20, weighted *d*-index = -.18, $p < .05$). Spring to fall gains were found in reading when the large study was included (unweighted *d*-index = -.04, weighted *d*-index = +.08, $p < .05$) and a spring to fall loss when the large study was excluded (unweighted *d*-index = -.14, weighted *d*-index = -.15, $p < .05$). The *d*-indexes for the subskills in reading demonstrated a significant loss for comprehension (weighted -.19) and gains for reading recognition and vocabulary (weighted = +.03 and +.12, $p < .05$, respectively). The *d*-

indexes for mathematics demonstrated a significant loss for computation (weighted = -.32, $p < .05$) and significant gains for mathematics concepts and applications (weighted = +.01 and +.17, $p < .05$, respectively) The losses found in mathematics computation and reading comprehension were explained by the authors' belief that more factual and procedural knowledge is necessary for mathematics computation. Gains in reading comprehension, mathematics concepts, and problem solving were explained by the fact that they are more conceptually based. There is less time for practice for factual and procedural skills during the summer, while conceptual understanding requires more experience and less practice. The authors' reasoning does not explain the significant negative loss for reading comprehension.

In their analysis of student differences, Cooper et al. (1996) found, using vote-count analysis, that student intelligence had no important relationship with summer achievement, and that, based on one study (Shaw, 1982), students with disabilities and students who were non-disabled demonstrated losses in mathematics skill, although students in special classes showed the largest loss. In reading, students who were not identified as disabled showed gains over the summer, while students with disabilities experienced losses. Socioeconomic levels did make a difference, particularly in reading and language achievement where students from low-income families demonstrated significant losses, which, on average, amounted to a three-month gap between middle- and low-income students. There was little difference in the mathematics skills of the middle- and low-income students after summer vacation. Gender and race also caused no significant change in the summer effects on student achievement. Finally, grade did have a significant effect in that students in first and second grade demonstrated non-significant gains relative to national norms and students in the fourth grade and above showed significant losses. The authors attributed these findings to a floor effect in scaling.

Descriptive Studies

As I reviewed the descriptive studies, I found that they fell into two groups. In the first subsection, the authors (Allinder et al., 1992; Heyns, 1978; Keys & Lawson, 1937; Soar & Soar, 1969; Wintre, 1986) examined only the effects of the summer break on all students' academic skills. The investigators in the second subsection evaluated the summer regression of students with disabilities (Allinder & Eicher, 1994; Allinder & Fuchs, 1991; Shaw, 1982). Table 1 shows an overview of studies and the areas of significant results for the descriptive studies of regression. Some of these studies were included in the meta-analysis by Cooper et al. (1996). At the end of this section, I will compare my findings with theirs and point out methodological differences.

Descriptive Studies of Summer Regression

Students without disabilities. The following four studies focused on the summer gains and losses of students. Keys and Lawson (1937) were concerned that previous researchers of regression did not consider the practice effect or student familiarity with the tests or the changes in test setting from the spring pretest to the fall posttest. Heyns (1978) examined the impact of summer regression on students by race and socioeconomic status using a word recognition assessment, while Wintre (1986), concerned about costly fall reviews, analyzed summer regression by subject and grade. Allinder, Fuchs, Fuchs, and Hamlett (1992) studied the effects of the summer break on the mathematics skills of second though fifth grade students who were normal achievers.

Table 1

Overview of Studies and Significant Results for Descriptive Studies of Regression

Authors	Purpose	Testing Dates	Grade Level	Sample Size	Disability	Reading Gains	Reading Losses	Math Gains	Math Losses
			Studies of Students with and without Disabilities						
Allinder et al. (1992)	Effects of school breaks on math and spelling skills	Last 3 weeks of school, first 2 weeks of school	2 & 3	275	None	NT	NT	NS	4 & 5
Heyns, B (1978)	Differential effects times of schooling and non-schooling	May, October	5, 6	2978	None	WS, WS with SS	BS, BS with SS	NT	NT
Keys, N., & Lawson, J. V. (1937)	Summer versus winter gains	Early May, October 1	4 – 8	164	None	4 – 8	NS	NS	4 – 8

Note. NT = Not tested, NS = Not significant, WS = White students, BS = Black students, SS = Summer school

Table 1 (continued)

Authors	Purpose	Testing Dates	Grade Level	Sample Size	Disability	Reading Gains	Reading Losses	Math Gains	Math Losses
Wintre, M. G. (1986)	Differential effects of summer vacation according to content and grade level	First week of June, second week of September	1, 3, 5	182	None	NS	NS	NS	3
			Studies of Students with Disabilities						
Allinder, R.M., & Eicher, D. D. (1994)	Regression and recoupment of students with disabilities	Last week and first week of school, six weeks later	2 & 3, 4 & 5	75	LD, BD, MMH	Recoup from fall 2 & 3, 4 & 5	2 & 3 4 & 5	NS	2 & 3, 4 & 5

Note. BD = Students who are behaviorally disordered , Recoup = Recoupment, MMH = Students who are mildly mentally handicapped

Table 1 (continued)

Authors	Purpose	Testing Dates	Grade Level	Sample Size	Disability	Reading Gains	Reading Losses	Math Gains	Math Losses
Allinder, R.M., & Fuchs, L.S. (1991)	Effects of school breaks on math skills	April, end of August	5, 6, 7	44	LD, LA	NT	NT	NS	LA 5
Shaw, T. V. (1982)	Differences between summer regression of students with LD and regular students	Last week of school, first 2 weeks of school	Ages 6 through 11.8	294	Regular, LD Resource, LD Special Class	NA	NA	NA	NA

Note. LA= Students who are low achieving, NA = Not applicable – measured only differences between groups

Keys and Lawson (1937) believed that students' gains or losses over the summer vacation in prior studies were influenced by differences in the pre- and posttest administrations (e.g., the test administrators, the classrooms, and the students' familiarity with the tests). The authors tested 492 students in early May and then retested the students around October 1. It is important to note that of the five months that separated the spring and fall tests, only three of those months were without instruction. Keys and Lawson believed that allowing the students several weeks back in school after the summer break would more accurately reflect the students' true retention of previous learning because the students would have readapted to the school environment. The authors also compared student achievement during the "seven" (October – April) winter months with the "five" summer months (May – September).

Keys and Lawson (1937) subtracted the summer C-score (a C-score unit "equals approximately one-tenth of the quartile of all pupils of the same chronological age") from the winter C-score to determine the average monthly gain or loss. For the purpose of this literature review, only reading and arithmetic results are discussed. In arithmetic operations and in arithmetic problems, students demonstrated a significant loss of 1.05 years and .78 years over the summer, respectively. The authors found that, over the summer, these students lost nearly all the arithmetic achievement they had gained from instruction the previous school year (October – April). In reading, students demonstrated significant gains of .03 years during the summer.

Heyns (1978) believed that achievement was a continuous process and the way to measure the effects of times of schooling was to use the summer, or time of non-schooling, as a control. She questioned whether there were differential learning rates of students during times of schooling and non-schooling, and what effects diverse student backgrounds had on summer learning. Heyns theorized that children in higher socioeconomic levels made cognitive gains regardless of whether school was in session because their home environment fostered intellectual growth. Children in low socioeconomic levels were dependent on schools for learning and during times of non-schooling their academic growth slowed. She believed that school was an equalizing factor, but that it could not overcome the disadvantages of poverty.

Heyns (1978) did not attempt to select a representative sample of students: Instead, students in grades 5 and 6 were equally balanced by race, but heterogeneous on socioeconomic background. The school district administered IQ tests to every fourth grade student and those scores were available for this study. The district also administered the Metropolitan Achievement Test (MAT) to 1493 sixth grade students in the fall of 1971, the spring of 1972, and the fall of 1972. Heyns used the word knowledge subtest scores because she stated that they were the most reliable for White and Black students, they correlated closely with IQ, and they had the highest relationship to measures of parental socioeconomic status. A parent survey developed by Heyns assessed the socioeconomic levels of students' families, the parent levels of education, and the students' summer activity. Heyns did not statistically evaluate the data for gains or losses specifically, so there are no summer regression statistics to report, only the effects of factors of interest for my study.

Using regression and path analysis, Heyns (1978) determined that socioeconomic status (parent income) had a significant relationship with both school and summer gains in both White and Black students, but that it accounted for more variability in the summer achievement scores than the school year achievement scores. The level of parent education had a stronger positive effect during the school year than in summer, and it correlated significantly with both summer and school achievement in Black and White students. However, when prior achievement and family income were controlled, parent education was no longer significant for White children, but it maintained significance for Black students. IQ also predicted summer gains, but it did not eliminate the effects of socioeconomic status and race. Heyns stated that the environment outside the school had a large effect on students; that families and socioeconomic status had the greatest influence on a student's achievement. Schools minimize the effects of that influence, but summer vacation widened the achievement gap between the socioeconomic levels and between Black and White students.

Wintre (1986) challenged the assumption of academic losses over the summer. Her review of the literature of summer academic losses showed mixed results. She believed that children learn academic skills outside of the school setting. She examined the effect of summer vacation on academic skills by grade level and content area. Early in June and again in mid-September, the word knowledge, reading, mathematics computation, and mathematics concepts subtests of the Metropolitan Achievement Test (MAT) were administered to 182 English-speaking, middle-class first, third, and fifth grade students. None of the students participated in summer school programs. The author stated that the same forms were given for both pre- and post-tests because the concept of “forgetting” would have been meaningless if parallel forms had been used.

Wintre (1986) used percentage scores as a common metric in a MANOVA with repeated measures. Grade (1, 3, and 5) by occasion (spring and fall) by content area (word knowledge, reading, mathematics concepts, and mathematics computations) demonstrated a significant interaction between occasion and grade level. When content was combined, children in grades 1 and 5 experienced significant mean percentage score spring to fall gains of 2.93% and 3.49% respectively. Students in grade 3 demonstrated a non-significant gain of 0.13%. There was also a significant interaction between occasion and content, indicating mean percentage score spring to fall gains in word knowledge, reading, and mathematics concepts, and losses in mathematic computations when the grades were combined. Wintre found another significant interaction between grade level and content with mean percentage score spring to fall gains in all grades in word knowledge, reading, and mathematics concepts. The interaction was accounted for by a significant loss in mathematics computation for third grade students.

Wintre (1986) hypothesized that generally held assumptions of academic losses over the summer may not be valid for middle-class students. Her pattern of findings was more indicative of summer gains. She stated that the cognitive development theories of Piaget explained the differences in achievement loss or gains over the summer. Grades 1 and 5, in which students realized significant gains, coincided with transition to other cognitive development stages.

In 1992, Allinder, Fuchs, Fuchs, and Hamlett studied the effects of summer break on the spelling and mathematics skills of 95 students in grades 2 through 5. They believed that student summer regression could affect educational practice and policy; educational practice through fall reviews and educational policy through varying school calendars. They also were interested in the school break’s effect on two different academic domains; spelling for which, according to the authors, little direct classroom instruction is given, and mathematics, which receives more classroom instruction and review. For the purpose of this review, I will only discuss the mathematics results. CBM mathematics probes were administered weekly to students three weeks before the end of school in the spring. Two weeks after returning in the fall, two more mathematics probes were given. The students' aggregated score for spring was the median score of the three spring probes; and the aggregated fall score was the mean of the two fall probes. The scores were converted to *z*-scores and entered into a repeated measures ANOVA with grades 2 and 3 combined into a primary group and grades 4 and 5 combined into an intermediate group. The between- subjects factors were subject and grade, and the within-subject factor was time (pre-break vs. post-break scores). The analysis revealed a significant three-way interaction for subject x grade x time. In follow-up ANOVAs to examine the three-way interaction, Allinder et al. (1992), using z-scores derived from the post-break scores minus the pre-break scores and found that the intermediate group demonstrated a significant regression in mathematics, while the primary group's loss was not significant. They speculated that the mathematics problems for the intermediate grades were more complex, and students may not have practiced them over the summer. The authors suggested that further research was needed to determine the effects of mastery and practice on student's maintenance of skills, to identify students who regress and how their needs should be met, and to determine the effects of school breaks on other academic areas.

Students with disabilities. Shaw (1982) questioned the amount of time in a summer school program needed for students not to regress during the summer. He was also concerned about the lack of studies of summer regression for students with disabilities. He believed that the results of studies of summer regression of regular education students could not be generalized for students with disabilities. He studied the effects of summer vacation on the retention of reading and mathematics skills of students, ages 6 through 11.8. He compared the summer retention of students with LD in special classes with regular education students. He also compared the summer retention of students with LD in a resource program with regular education students. The Wide Range Achievement Test (WRAT), Level 1 Reading and Arithmetic subtests were administered to 128 regular education students, 108 students served by a resource specialist, and 58 students in a special class. The students with disabilities were matched according to age with the regular education students. Tests were administered during the last week of school before summer vacation and within the first two weeks of the following school year.

Shaw (1982) used an ANCOVA to analyze the data, with the post-tests as dependent variables, and pre-tests and age as covariates and the level of significance set at .05. There were significant main effects for student type in reading and mathematics with non-disabled students demonstrating less regression than students with LD taught by resource specialists and in special classes. He found that the regular education students gained five months in reading, while students in resource specialist and special classes each lost one month. Regular education and resource students regressed two months and special class students regressed four months in arithmetic. A BETA analysis ["BETA coefficient squared gives the percentage of variance of the dependent variable that can be attributed to the independent variable after adjustment for covariates" (p. 43)] revealed that although differences in the summer retention of reading and mathematics between students with LD and regular students were significant, the associations were weak.

Allinder and Fuchs (1991) stated that the belief by educational professionals of student summer regression in academic skills led to fall reviews which might or might not be needed. They investigated the effects of summer vacation on the mathematics skills of fifth, sixth, and seventh grade students. Ten of the 44 students (one each in fifth and sixth grade and eight in seventh grade) were classified as learning disabled (LD) and 34 were classified as students who were low-achieving (LA), as determined by their teachers (lowest achieving students who had not been classified as disabled). Students were given the Mathematics Computation Test-Revised (1988) in April and then again in August. The authors used the number of correct problems and the number of digits correct in the answers as dependent measures. They utilized a three-factor ANOVA with grade and placement the between-subjects factors and time as the within-subjects factor. The interaction of placement (LD vs. LA), grade (5 vs. 6 vs. 7), and time (spring vs. fall) was significant. Follow-up ANOVAs using difference scores (posttest – pretest) to compare students' performance before and after the summer break indicated that the mean differences in the mathematics scores of the LD students in grades 5, 6, and 7 were 3.00, -10.00, and -.38, and these were not significant. The LA students' mean difference scores were –7.91, 3.36, and 11.75 in grades 5, 6, and 7 respectively. The grade 7 mean difference scores were significantly different from grades 5 and 6, and grade 6 mean difference scores were significantly different from grade 5. Only the LA students in grade 5 regressed significantly.

Allinder and Fuchs (1991) speculated that the students with LD did not experience significant losses because of the individualized instruction they received at their appropriate level and that the teachers of students with disabilities tended to focus on a particular skill until it was mastered. The authors discussed other literature that stated that mastery correlated with maintenance of skills. LA students in grade 5 regressed over the summer. The authors explained that their inspection of the classrooms showed that the fifth grade students were taught fifth grade material, but the sixth and seventh grade students were taught lower level material, and the sixth and seventh grade teachers modified their instruction for the low-achieving students. Allinder and Fuchs speculated that students who were taught at their instructional level (students with LD) rather than their grade level (LA students) might maintain more of their mathematics skills over the summer.

Allinder and Eicher (1994) stated that the increased difficulty of attainment of academic skills for students with mild disabilities could slow these students' progress even further if they regressed over the summer and then took longer to regain those skills in the fall. They studied the effects of summer vacation on students with mild disabilities and the amount of recoupment after six weeks of instruction in the fall. Seventy-five students were available for testing the last week of school before summer break, the first week of school after summer break the following fall, and five weeks later for the recoupment measure. The students, in grades two through five, were identified as having a behavior disorder, a learning disability, or mild mental retardation. They were tested in mathematics and reading.

All students were given two CBM mathematics probes during the last week of school and one grade-level test of mixed computational problems from their curriculum. Addition and subtraction probes were administered to second and third grader students, and multiplication and division probes were administered to the fourth and fifth grade students. Students had 2 minutes to complete each probe and the grade-level test, and each student's score consisted of the number of correct digits in the answers. Reading progress was measured through the individualized testing with passages randomly selected from the students' curriculum. Students were given one minute to read aloud, and words were scored incorrect that were mispronounced, omitted, or substituted. The student's aggregated score for each subject was the median score of the three reading probes and the additive score of the three mathematics probes. Allinder and Eicher (1994) analyzed the variables using repeated measures ANOVAs with grade level [grades 2-3 (primary), and grades 4-5 (intermediate)] the between-subjects factors and time (spring, fall, and recoupment), the within-subjects factor.

In reading, the authors found significant main effects for time and level; the interaction of time and grade was not significant. Paired *t*-tests completed on the time and combined grades factors demonstrated significant differences between all three test times (spring, fall, and recoupment), indicating that students scored higher in spring (M = 49.53) than fall (M = 43.52), higher at recoupment (M = 54.15) than fall (M = 43.52), and higher at recoupment (M = 54.15) than spring (M = 49.53). Allinder and Eicher did not analyze the main effect for level. In mathematics, they found significant main effects only for time. Follow-up paired *t*-tests revealed a significant regression in students' scores in spring (M = 97.82) to fall (M = 77.19) and a significant gain from fall (M =

77.19) to recoupment (M = 94.03). There was no significant difference between the scores at spring and recoupment. These findings indicated that students with high incidence disabilities do regress in mathematics and reading skills over the summer break. Five weeks into the next school year, they had recouped their losses in mathematics and surpassed their spring reading levels.

Summary

Of the five studies that investigated the effects of summer break on student reading skills, two demonstrated evidence of summer gains (Keys & Lawson, 1937; Wintre, 1986). One study demonstrated evidence of summer gains by White students, but summer losses by Black students (Heyns, 1978), and another study showed significant losses in students with mild disabilities (Allinder & Eicher, 1994). The fifth study demonstrated significant differences in summer gains or losses between non-disabled students and students with LD with non-disabled students exhibiting gains in reading and students with LD exhibiting losses (Shaw, 1982).

In mathematics, of the seven studies of the effects of summer vacation, two reported mathematics gains (Allinder & Fuchs, 1991; Wintre, 1986), and five reported mathematics losses (Allinder & Eicher, 1994; Allinder & Fuchs, 1991; Allinder et al., 1992; Keys & Lawson, 1937; Wintre, 1986). Shaw (1982) studied the differences between non-disabled students and students with LD, and he did not determine the level of significance of mathematics losses.

Limitations

There were limitations in the above studies. Many of the researchers (Keys & Lawson, 1937; Shaw, 1982; Wintre, 1986) used standardized tests, which sample only a few items of a particular skill and are not sensitive to small amounts of change. Another limitation was the amount of school time included in the vacation measure. Keys and Lawson, and Allinder and Fuchs (1991) included two months of school in their summer measure. When measuring the effects of times of no instruction (summer break), any instruction that takes place during that time threatens the validity of the results. A third limitation was that most researchers did not take into consideration characteristics of the students, such as race, gender, and socioeconomic status. A fourth limitation in the Allinder and Fuchs study only was the sample size of the students with LD which consisted of one student each in fifth and sixth grades and eight students in seventh grade. Finally, none of these researchers controlled for summer activity, which could have a large effect on the findings of their studies. Students who attended summer school, read, or who played educational games could demonstrate more gains than those who did not participate in these activities. Allinder, Fuchs, Fuchs, and Hamlett (1992) and Shaw discussed the importance of practice on students' retention of skills over summer vacation.

Intervention Studies of Summer Regression

This section of the literature review describes studies in which the measure of student regression was used to determine the benefits of a certain school program or differing school calendars. These researchers believed that the effectiveness of a school program or curriculum could be evaluated through the measurement of summer retention or regression. Because of the concerns of student regression over the summer, regression levels were also used to determine the success of different school calendars. Table 2 shows the studies and the significant findings in this section. The following paragraphs contain a more detailed discussion of these studies.

Different School Programs

Scott (1967) stated that during a curricular reform academic professionals compare the new programs with the old programs. In the curriculum reform of elementary school mathematics, studies of the modern mathematics program versus the traditional program showed little to no advantage of one over the other. However, teachers believed there was a difference, and the author determined that an evaluation of the strengths of both programs would be beneficial so that future revisions of the program would be based on knowledge rather than intuition.

He studied of the effect of two mathematics programs, modern and traditional, on the summer retention of mathematics skills third through sixth grade students. He found that fifth grade students retained significantly more with the modern mathematics program. Scott determined that there were no obvious retention patterns for either mathematics program. The author did not discuss pre- and post-test data; he found the difference score between the pre-test and post-test scores and called that a retention score. He used an ANCOVA to determine significant differences between the mathematics programs at each grade level. Since he did not include the pre- and post-test scores in his report, there is no way to determine actual student gains or losses of mathematics achievement over the summer. Scott stated that most students suffer mathematics losses over the summer, regardless of the program they are studying, but gave no evidence for this in his report.

Table 2

Overview of Studies and Significant Results for Intervention Studies of Regression

Authors	Purpose	Testing Dates	Grade Level	Sample Size	Disability	Reading Gains	Reading Losses	Math Gains	Math Losses
			Studies on All Students						
Crowell, K.C., & Klein, T.W. (1981)	Effect of providing books over the summer to low income children	Last weeks of spring, first month of fall	1 & 2	50	None	1	NS	NT	NT
Scott, L. F. (1967)	Differential effects of math programs	June, first week of school in September	3 – 6	1306	None	NT	NT	M - 5	NS

Note. NS = Not significant, NT = Not tested, M = Modern math program

Table 2 (continued)

Authors	Purpose	Testing Dates	Grade Level	Sample Size	Disability	Reading Gains	Reading Losses	Math Gains	Math Losses
Reece, J.L., Myers, C.L., Nofsinger, C.O., & Brown, R.D. (2000)	Differential effects of traditional and alternative calendars	2 weeks prior to end, 2 weeks after beginning	1, 3, 5	749	None	T - 3, 5 A - 1,3,5	NS	A - 1,5	T- 1

Note. T = Traditional calendar, A = Alternative calendar

Table 2 (continued)

Authors	Purpose	Testing Dates	Grade Level	Sample Size	Disability	Reading Gains	Reading Losses	Math Gains	Math Losses
Studies on Students with Disabilities									
Cook, J.J., & Schwarz, R. H. (1969)	Effects of summer school	June and September	Ages 7 to 13	52	EMR	Primary and Inter-mediate	NS	NS	NS
Cornelius, P.L., & Semmel, M.I., (1982)	Effects of five week summer reading program	June, July, September	1, 3, 5	60	LD	NS	No SS, 2nd SS – July only	NT	NT

Note. SS = Summer school

Cook and Schwarz (1969) had concerns about assumptions made by professionals that affected the program development of students who were classified as educable mentally retarded (EMR). Two of the assumptions they questioned were: There is regression or loss on academic skills over the summer, and summer school programs have a positive effect on academic learning. They completed a posteriori analysis of data collected on students who were EMR. For the purpose of this literature review, of the four hypotheses the authors analyzed, only student summer regression and the effects of summer school were of interest. Sixty-one students with a mean IQ of 67.5 were available for the June and September testing. Approximately two-thirds of the sample were male and non-white. The Wide Range Achievement Test (WRAT) was administered to 24 primary students (ages 7-10) and 37 intermediate students (ages 10-13). The authors used separate repeated measure *t* tests to analyze the scores of the reading and arithmetic subtests for each group of students.

In reading, the primary group and the intermediate groups demonstrated a significant gain in the raw scores of 2.6 points and 0.9 points, respectively. In arithmetic, there was no significant change in the raw scores of either group. The authors stated that a possible reason for the gains in reading was that the students attended remedial classes in the summer. However, only eight of the 61 students tested attended summer school; the other students did not, and the authors mentioned no other summer remediation. Thus, it is unlikely that summer school attendance was a major factor in the reading results.

Crowell and Klein (1981) analyzed criterion-referenced tests (CRTs) that were administered to public school students in September to determine students' placement in reading. They were concerned that primary level students appeared to regress more than one grade level in reading over the summer. When they compared the performance of the public elementary schools with the private elementary schools that enrolled students from middle and upper class families, Crowell and Klein found that there was no regression in reading comprehension and only slight regression in sight vocabulary in the private elementary schools. They speculated that the difference was because the low-income families whose children attended the public schools had few books in the home and little time for family reading. For their study, they chose 50 first and second grade students from low-income urban homes and divided them into two groups. The authors administered the Gates-MacGinitie Reading Test (vocabulary and comprehension) during the last weeks before summer vacation. Each student in the treatment group received a book in the mail at that student's reading level each week of the summer vacation. Students in the control group did not receive any books. An alternate form of the Gates-MacGinitie Reading Test was administered during the first weeks of September.

Crowell and Klein (1981) found small but primarily non-significant gains in the raw scores of the Gates-MacGinitie Reading Test for all the students in the study. The researchers ran an ANCOVA with group (treatment and control) and grade (first and second) to determine the significance of the difference in the scores. The results of the ANCOVA showed that although the vocabulary scores of both the first and second grade students in the treatment group improved, only the difference in the scores of the first grade students were significant. There were no other significant differences. Crowell and Klein believed that because they chose books that could be read easily by the students, the practice in sight vocabulary and the decoding improved the students' vocabulary, but did little to improve their comprehension scores.

Cornelius and Semmel (1982) stated that parents and special educators expressed concerns about the fall placement of students with LD based on the previous spring assessment. They believed that students with LD regressed during the summer, and educators spent significant time in the fall reviewing these lost skills. The authors studied the extent of regression, recoupment, and the effect of five weeks of summer school instruction on the reading achievement of students with LD. The sample was composed of 60 students in grades 3 through 8 who were learning disabled. The authors did not discuss how the sample was chosen. All students had an IQ score of 90 or above and were two or more years below grade level in reading. Fifteen students in the group that attended summer session one and fifteen students in the group that attended summer session two were matched with thirty students in the control group by school attended, reading level, IQ, age, and sex. The Slosson Oral Reading Test (SORT) was administered in June and then again, just after summer vacation in September. Two summer school sessions were offered, Session 1, which was held for five weeks immediately after school let out for the summer, and Session 2, which was held five weeks before school began again in the fall. In mid-July, the SORT was again given to the students who attended summer school as a posttest for the students in Session 1 or a pre-test for students in Session 2. Students in the treatment groups received a total of 24 hours (one hour per day) of individualized instruction in the summer session. The students in summer school were tested three times, June, mid-July, and September. Students in the control group who did not attend summer school were tested in June and September.

Cornelius and Semmel (1982), using dependent *t* tests, found that students in the control group experienced a significant loss over the summer in reading. Students who attended Session 2 demonstrated a significant loss in reading from the June to mid-July test, just before they started the summer session. Students who attended the Session 1 did not demonstrate a significant summer reading loss. When the June to September scores of the two treatment groups were compared, the differences were not significant. Students who attended either summer session did not regress significantly in reading. The students in the control group did significantly regress. Cornelius and Semmel analyzed the individual scores and found that 80 percent of the students in the treatment group recouped the losses they experienced during the break in their instruction, while 99 percent of the students in the control group regressed in reading.

Different School Calendars

Reese et al. (2000) compared the summer retention skills of students in the alternative calendar schools with students in schools with traditional calendars. The alternative schools had a summer break of eight weeks instead of the traditional ten-week summer break. Of the 749 first, third, and fifth grade students in this study, 251 attended schools with alternative calendars and 498 attended schools with traditional calendars. No demographic information other than percent of students receiving free and reduced lunch was available to the researchers. Students who attended summer school were excluded from this study. The authors used CBM probes to evaluate the students' academic skills. The reading probe was scored as the number of words read correctly in one minute, the mathematics probe as the number of correct digits in two minutes, the spelling probe as the number of correct letter sequences from 17 words given at 10 second intervals, and the written language probe as the number of correct word sequences written from a story starter in three minutes. The authors administered the probes two weeks before the end of school (May) and two weeks after school began in August.

Reese et al. (2000) evaluated the spring-fall differences in the CBM scores of students in grades 1, 3, and 5 in the four subjects areas (reading, spelling, written expression, and mathematics) using matched-sample t-tests. These analyses revealed more significant increases and fewer significant decreases in all subject areas with the alternative calendar. The authors used ANCOVAs to control for initial differences in the scores, using the spring scores as a covariant and the fall score as the dependent variable. Reese et al. found no slope differences in a moderated multiple regression procedure; however, analyses of the y-intercepts indicated that of 12 slope comparisons (3 grades x 4 academic subject areas), five were significant (e.g., first-grade mathematics, written expression, and reading, third grade written expression, and fifth-grade reading).

Reese et al. (2000) found that with the traditional calendar, students in first grade demonstrated a significant summer loss, and students in third and fifth grade had non-significant summer gains in mathematics. With the alternative calendar, first and fifth grades showed significant summer reading gains, and third grade had a non-significant summer loss in mathematics. In reading, third and fifth grade students in schools with a traditional calendar demonstrated significant summer gains, and students in first grade showed a non-significant summer loss. Students in first, third, and fifth grades in the alternative calendar schools demonstrated significant summer gains in reading. Overall, there were more significant gains in reading and mathematics over the summer in the alternative schedule schools.

Reece et al. (2000) found that in the initial testing in the spring, the scores of students in schools with the alternative calendar were higher than the scores of students in schools with traditional calendars. They determined that the results were age-specific, with the first grade students in the alternate calendar demonstrating significant academic gains while the first grade students in the traditional calendar demonstrating significant academic regression. They believed that the length of the summer break could be detrimental to young learners because the primary learners are at the beginning stages of learning academic skills. The authors theorized that the reason that there was little effect with the third and fifth graders was because the alternative calendar had only been in effect for one year. Other research had shown that alternative calendars must be in effect for several years before the benefits to academic achievement are noted. The authors discussed the limitations of their study and stated that the differences noted could also have been caused by other factors, such as the failure to control for other demographic variables, and factors such as teacher skill, administrative and parent support, and the students' ability level and age.

Summary

Three of the four studies of reading showed significant gains (Cook & Schwarz, 1969; Crowell & Klein, 1981; Reece et al., 2000), and one study demonstrated significant losses (Cornelius & Semmel, 1982). In mathematics, Scott(1967) and Reece et al. (2000), discovered significant gains in 5th grade and with students in 1st and 5th grade in schools when alternative calendars were used, respectively. Reece et al. (2000) found significant regression in mathematics in 1st grade in schools with traditional calendars.

Limitations to Intervention Studies

Limitations in these studies included the use of standardized tests to measure student growth (Cook & Schwarz, 1969; Cornelius & Semmel, 1982; Crowell & Klein, 1981) and that the measurement of summer achievement included at least a month of school time in the summer measure (Crowell & Klein, 1981). Also, the characteristics of the students were not considered as variables by these researchers.

Comparisons of the Cooper et al. (1996) and the Current Literature Review

Cooper et al. (1996) and I reviewed several of the same studies. Although we both used a vote-count on the Keys and Lawson (1937) and the Scott (1967) studies, I included only studies in which the authors reported significant summer gains and losses and my vote-count included only significant findings. Cooper et al. counted any reported increase or decrease. Of the later studies, Cooper et al. calculated and analyzed the effect sizes, where, again, I counted only the statistically significant gains and losses. Studies not included in the meta-analysis were Allinder and Eicher (1994), Allinder and Fuchs (1991), Cook and Schwarz (1969), Cornelius and Semmel (1982), Crowell and Klein (1981), and Reece, Myers, Nofsinger, and Brown (2000). The two most recent studies not included in their meta-analysis were Allinder and Eicher and Allinder and Fuchs, who specifically evaluated summer regression. Allinder and Eicher found losses in both reading and mathematics and Allinder and Fuchs tested only mathematics and reported summer losses. The other studies used measures of summer regression to compute the effects of changes to the curriculum or school calendar. Of these studies, three found reading gains, one reported reading losses, and one found mathematics gains and losses.

Variables that Require Further Study

Several factors identified in the literature review of student summer regression are pertinent to the proposed study. These factors are disability, gender, race, socioeconomic level, and age or grade. The following paragraphs discuss the effects of those factors found in the literature review.

Disability

In their meta-analysis of summer regression, Cooper et al. (1996) found by vote-count that intelligence as measured by IQ showed no relationship to student gains or losses. The Shaw (1982) study was the only study of students with disabilities included in the Cooper et al. meta-analysis. Shaw found significant differences in the retention of reading skills between regular education students and students with LD over the summer, with regular education students demonstrating higher retention rates than students with disabilities. Regular education students showed gains in reading skills and students with LD showed losses. Both regular education students and students with LD demonstrated losses in arithmetic skills. Allinder and Fuchs (1991) found that students who were low achieving regressed significantly over the summer while students with LD regressed, but not significantly. Allinder and Eicher (1994) found that students with mild disabilities regressed significantly in reading and mathematics over the summer but were able to regain all their skills within six weeks of instruction.

Cook and Schwarz (1969) attributed summer gains in reading by students who were EMR to summer school, although only eight of the 61 students attended a summer academic program. Cornelius and Semmel determined that students with LD regressed significantly in reading skills over the summer, but there was no regression in the fall if the students attended a five-week summer program during the summer. Thus, there are only two studies that indicate children with high incidence disabilities regress in their achievement levels over the summer despite the prevailing wisdom that regression is the norm for this group of students. Further study is required.

Grade

Using a homogeneity analysis with the *d*-indexes, Cooper et al. (1996) found there was no effect of grade level on mathematics summer achievement. However, in reading, grade levels did make a significant difference. First and second grades experienced gains and grades three through eight experienced progressively larger losses. Allinder et al. (1992) found that intermediate students (grades four and five) regressed significantly in mathematics, while the primary students (grades two and three) did not. Winter (1986) determined that over the summer students in first grade and fifth grade gained in word knowledge, reading, and mathematics concepts. First grade students gained in mathematics computations, but fifth grade students regressed. The third grade students made smaller gains in word knowledge, reading, and mathematics concepts; however, they regressed significantly in mathematics computations.

Crowell and Klein (1981) found that students in first grade had significantly higher vocabulary scores when books were sent home over the summer than did the second grade students. Scott (1967) found, of the four grades tested, that fifth grade students in the modern mathematics program had the only significantly higher score in mathematics. Students in grades 3, 4, and 6 in traditional or modern mathematics programs showed no significant differences in scores. In the study by Reece et al. (2000), first grade students in schools with a traditional calendar significantly regressed in mathematics, while first and fifth grade students in schools with the alternative calendar gained significantly over the summer in mathematics. Third and fifth grade students in schools traditional calendars gained significantly in reading skills over the summer, while first, third, and fifth grade students in school with alternative calendars scored significantly higher in reading skills after the summer break.

Gender, Race, and Socioeconomic Status

Although many of the researchers did not attempt to determine the effects of race, gender, and socioeconomic factors on student summer regression, some accounted for these factors or controlled for them by matching. In their meta-analysis, Cooper et al. (1996) found that summer had no effect on mathematics achievement among students from low- and middle-income families. Students from middle-income families demonstrated significantly greater reading gains than did students from low-income families; middle-income students exhibited small summer gains and low-income students demonstrated reading losses. Cooper et al. found that race and gender had no relationship to summer gains or losses in reading or mathematics.

Shaw (1982), Allinder and Eicher (1994), and Cornelius and Semmel (1982) accounted for or controlled for gender, and Allinder and Eicher and Allinder et al. (1992) accounted for or controlled for race. Heyns (1978) found that race and socioeconomic factors have significant effects on student summer regression. White and Black students in high socioeconomic levels and White students in middle socioeconomic levels gained in academic skills over the summer, while Black students in middle socioeconomic levels and White and Black students in low socioeconomic levels regressed in academic skills over the summer. Reece et al. (2000) matched the schools with alternative school calendars to schools with traditional calendars based on the percentage of students on free and reduced lunch so that socioeconomic levels were comparable. Finally, Crowell and Klein (1981) discussed the fact that large losses in basal reading scores over the summer for students in the low income families, but in the middle and upper class students those losses were much smaller. First grade students who received the books made significantly larger gains in reading skills over the summer than the control group. Therefore, although Cooper found that race and gender had no significant effects and socioeconomic status had only small effects on summer achievement, I controlled for these factors because there is evidence that race and socioeconomic status do make a difference on summer gains and losses. I controlled for gender because several other researchers felt that gender could also have an effect on summer achievement.

Conclusions

Based on this review of the literature, I have come to the following conclusions. There were more significant gains (five) than losses in reading (three) and more significant losses (six) than gains (two) in mathematics over the summer for all students, although there are nearly as many studies without differences. These findings are similar to the findings of the Cooper et al. (1996) meta-analysis who found losses in mathematics and some gains in reading. Students with disabilities demonstrated significantly more regression than did students without disabilities (Shaw, 1982), while Allinder and Fuchs (1991) found that students who are low achieving regressed more than did students with LD. Summer interventions appear to minimize the regressive effects of summer vacation for all students (Cook & Schwarz, 1969; Cornelius & Semmel, 1982; Crowell & Klein, 1981). Two studies focused on regression and recoupment. Allinder and Eicher (1994) found that, although students with disabilities regressed significantly in reading and mathematics over the summer, they regained most of their skills after six weeks of school. Cornelius and Semmel (1982) determined that students with high incidence disabilities regress over the summer in reading skills when they do not participate in a summer reading course.

Some researchers controlled for race (Allinder & Eicher, 1994; Allinder et al., 1992) and socioeconomic status (Crowell & Klein, 1981; Reece et al., 2000), although only Heyns (1978) studied these factors specifically. She found that both factors were associated with significant differences. Cooper et al. (1996) found that race had no significant effect on summer gains or losses; however, they found that although socioeconomic status had no significant effect on summer achievement of mathematics, it did have a significant relationship with summer reading skills. Several researchers also controlled for gender (Allinder & Eicher, 1994; Allinder et al., 1992), although Cooper et al. found no significant relationship between gender and summer achievement.

There are still several unresolved issues. First, there are only two studies that compare the regression of students with disabilities to non-disabled students (Allinder & Fuchs, 1991; Shaw, 1982). Only one study (Allinder & Eicher, 1994), analyzed the regression and recoupment of students with disabilities, and the authors did not include students without disabilities in their study. Researchers addressed gender, race, and socio-economic status in their studies by controlling for these factors. Only Heyns (1978) attempted to control for student summer activity with a parent survey. As Cooper et al. pointed out, most researchers (e.g., Crowell & Klein, 1981; Keys & Lawson, 1937; Reece et al., 2000) included one to two months of instruction as a part of their summer measure, which would invalidate a measure of regression due to formal instruction. Assessments used to measure the gains or losses over the summer were often standardized tests that do not show small changes in achievement (e.g., Cornelius & Semmel, 1982; Heyns, 1978; Wintre, 1986).

The purpose of this study was to analyze the differential summer regression in reading and mathematics of students with LD and their normally developing peers and to determine the recoupment after six weeks of the same students. Because only one study has analyzed recoupment of students with disabilities and one study has compared the regression of students with disabilities with normally developing peers, this study will add to the knowledge of the regression and recoupment of students with LD compared to NR peers. In addition, I controlled for grade, race, and gender by matching same grade, race, and gender students with LD to students without disabilities because some studies found that these factors could make a difference in student summer academic gains or losses..

The limitations of previous studies include the use of standardized tests to measure changes in student progress, included weeks of schooling in the summer measure, and did not control for student summer activity. I used valid and reliable CBM measures that were developed to measure changes in student progress over time, and I collected the data over the last week and a half of the spring semester, the first week and a half of the fall semester and then six weeks into the fall semester. Finally, I controlled for summer activity through a parent survey of the students' summer activities, including summer school, recreational reading, educational computer games, and summer camps. The socioeconomic status of the student's family and the parents' education levels were also reported on the parent survey. I controlled for student academic competence with a teacher-rated scale.

Chapter 3

Methods

The purposes of this study were to (a) determine if NR children and children with learning disabilities in Primary (first and second) and Intermediate (third and fourth) grades experience differential regression in reading and mathematics skills over summer vacation; (b) if these students experience differential recoupment of those skills after six weeks of instruction the following fall; and (c) if summer academic activity of the student, family socioeconomic status, and teacher-rated academic competence explain variance in the regression and recoupment of reading and mathematics skills.

Participants and Setting

Setting. The study was conducted in 2003 in a rural school system in the mid-Atlantic states within 50 miles of two major metropolitan areas. The total number of students in K-12 in this system was 7,525, and 15.29% of the students received free and reduced meals. Fifty-two percent of the students were male. The racial distribution of the system was 0.24% Indian, 0.84% Asian, 0.90% Hispanic, 9.74% African-American, and 88.28% Caucasian. Seven elementary schools educated 3,481 students, with 16.74% receiving free and reduced meals. The gender distribution was 51.48% male, and the racial distribution in the elementary schools was 0.32% Indian, 1.09% Asian, 1.21% Hispanic, 8.62% African-American, and 88.77% Caucasian. Table 3 shows the distribution of students with LD and students who were NR in the sample by school and level for the seven elementary schools. The last two columns of the table indicate the total number of children with LD in the school and the grade levels they represent, respectively. Proportionately, Schools 3, 4, and 7 provided fewer students to the sample.

These three schools are the only schools in the district with grades K – 5, and they are more rural than the other four elementary schools.

Table 3

Number of Children by Classification in Sample and Schools

	Primary		Intermediate		Total LD In School	Grades
	LD	NR	LD	NR	LD	
School 1	NA	NA	10	9	53	3 – 5
School 2	5	4	NA	NA	15	K – 2
School 3	3	1	2	1	33	K – 5
School 4	1	0	0	1	24	K – 5
School 5	NA	NA	9	9	34	3 – 5
School 6	5	12	NA	NA	17	K – 2
School 7	2	2	3	3	34	K - 5

Note. NA indicates that no students of that Developmental Level are included in the school.

Students. Students with LD in the participating county received their instruction and special education support in regular education classes. To establish my sample, I asked my contact at each school to have the teachers in each classroom, grades one through four, identify all students with LD in their classrooms. The teachers then selected students they would not refer for special education or gifted programs (NR) who matched the students with LD by race and gender. I asked the teachers to list all qualifying students in their classes to solicit a large pool of students for matching purposes. I offered a small prize as an incentive for students who promptly returned the signed informed parent consent forms whether or not they were allowed to participate. Teachers sent 137 permissions slips home with students with LD and 402 permission slips with NR students. Of the 539 permission slips sent out, 146 (27%) were returned. Table 4 shows the number of permission slips sent out and the number and percentage returned by Developmental Level and Status. Three permission slips were returned from parents who did not want their child to participate. Because other studies do not often report the return rate, it is difficult to interpret the rate achieved for this study. The low response rate may limit generalizations and will be discussed in Chapter 5.

Table 4

Number of Permission Slips Sent to and Returned from Parents

		Primary		Intermediate	
		NR	LD	NR	LD
Sent	N	122	37	280	79
Returned	N	47	19	54	26
	%	39	51	19	33

Parents granted permission for me to access the students' school files to identify the race and gender of participating students as reported by the parents on the school information form distributed by the school system at the beginning of the school year. I also requested permission from parents of students with LD to determine from the IEP records the student's IQ and reading and mathematics achievement scores so that I could further describe the characteristics of my sample.

Sixteen students with LD in first and second grades and twenty-six students with LD in the third and fourth grades were matched with sixteen students and twenty-six students who were not referred, respectively, for a total sample size of 84 students. To be eligible for special education services as a student with a learning disability in the participating school system, a student must demonstrate a significant discrepancy (one standard deviation) between ability and achievement as determined by the Weschler Intelligence Scale for Children – III (WISC-III) (Weschler, 1991)) and the Weschler Individual Achievement Test (WIAT) (Weschler, 2001) or the Woodcock-Johnson – III (WJ-III) (Woodcock, McGrew, and Mather, 2001).

A second way a child can qualify as having a learning disability in this district when he does not demonstrate a discrepancy between ability and achievement is when his academic classroom performance is less than is indicated based on his IQ and achievement assessment results. When a student has been referred by the teacher or parents to the special education process to determine eligibility for the program, he is assessed for IQ and achievement levels. If he does not qualify for services based on the significant discrepancy between IQ and achievement levels, and his classroom performance is less than what would be expected based on these levels, then he may also be identified as a student with LD.

Based on student records, the mean verbal IQ score of 39 students with LD who participated in this study (three were unavailable) was 97.21 (SD = 9.99) with a range of 76 to 117. Among the Primary students, one student scored above average IQ (>110), 13 scored in the average range (90 – 110), and two scored below average (<90). Among the

Intermediate students, two students scored above average IQ, 16 scored in the average range, and six scored below average.

Students with average or above average IQs would qualify for special education services as a student with LD if there was a significant discrepancy between the student's classroom performance and his IQ and achievement scores or if a significant discrepancy between ability (IQ) and achievement (measured by the WIAT or the WJ-III) was determined. However, the achievement score could be in the average or above average range (>90) as long as the required discrepancy was achieved. Another way a student with LD could have a high achievement score in this study was if he was identified with a disability in reading, but not in mathematics, or in mathematics, but not in reading. He could have a high achievement score in the subject in which he was not identified disabled.

The mean reading achievement score (either WIAT or WJ-III) of 39 students with LD (three were unavailable) was 85 (*SD* = 9.73) with a range of 66 to 118, and the mean mathematics achievement score of 36 students (six were unavailable) was 93.42 (*SD* = 11.90) with a range of 68 to 124. The reading and mathematics scores I used were the Basic Skills Cluster (WJ-III) or the Word Reading and Numerical Operations (WIAT II) scores. The Primary students (*N* = 16) included five with goals for reading and mathematics, seven with goals for reading, and four with goals for mathematics. The Intermediate students included six students with both reading and mathematics goals, seventeen with reading goals, and three with mathematics goals.

Of the students with LD, seven of the sixteen and five of the twenty-six of the Primary and Intermediate students, respectively, did not demonstrate a 1 SD discrepancy between ability and achievement for either reading or mathematics. According to the school psychologist, these 12 children qualified as LD based on the classroom performance criterion. Table 5 contains the descriptive information for the sample.

Table 5

Sample Characteristics

	LD	NR	N	%
Primary	16	16	32	38
First	9	9	18	21
Second	7	7	14	17
Intermediate	26	26	52	62
Third	12	12	24	29
Fourth	14	14	28	33
Male	24	24	48	57.1
Female	18	18	36	42.9
White	39	39	78	92.9
Black	3	3	6	7.1
Parental Income	6.2[a]	6.7		
Father Education Level	2.6[b]	2.7		
Mother Education Level	3.0	2.8		

Note. N = 84.

[a] Based on a scale of 1-10, 6 is equal to the $50.000 – 59,000 range of income

[b] Based on a scale of 1-6, 2 is high school graduate and 3 is some college coursework

Before selecting the final sample, I tested all students with LD (*N* = 42) and NR (*N* =101) for whom permission was obtained. The NR group was over-sampled to provide replacements in the event of subject mortality over the summer. When I completed all testing, the NR students were listed alphabetically by grade, and then by race and gender within grade. I matched each student with LD by grade, race, and gender to the next non-referred student on the list who met the matching criteria. According to Anderson, Auquier, Hauck, Oakes, Vandaele, and Weisberg (1980), when participants from one study group are matched by potential confounding factors to participants in the other study group, the groups are more comparable. Matching eliminated the need to correct for these differences through statistical analysis. I did not use the data for the NR students who were not matched to a student with LD. The students were not matched by classroom or by school because I was not measuring teacher or curriculum effect.

Measures

Curriculum-based measurement (CBM) (Deno, 1985) probes of oral reading fluency and mathematics computation fluency were administered to assess reading and mathematics skill. CBM measures are valid and reliable, curriculum-specific, and sensitive indicators of student growth (Deno, 1985; Faykus & McCurdy, 1998; Fuchs & Fuchs, 1992, 1999; Kranzler, Brownell, & Miller, 1998; Marston, Fuchs, & Deno, 1986; Marston & Magnusson, 1985; Powell-Smith & Bradley-Klug, 2001; Tindal, 1988). They measure inter-individual and intra-individual academic growth (Fuchs & Fuchs, 1997). Powell-Smith and Bradley-Klug (2001) determined that generic CBM measures assessed student growth as adequately as measures developed from the student's curriculum.

Reading. Oral reading fluency (ORF) is a measure of a student's speed and accuracy in reading connected text. In this study, the students, tested individually, read a short passage at their grade level for one minute as the examiner scored the number of words read correctly. I reported the students' scores as words read correctly per minute.

The probes I used were developed by Speece and Case (2001) and were grade specific. Students read passages that contained approximately 100-330 words that were commensurate with their grade level. At each time point, children read two different passages with the order counterbalanced randomly. A copy of a reading passage, the protocol, and directions for administering and scoring are in Appendix C.

Extensive research has documented the technical adequacy of oral reading fluency as a measure of reading achievement. Alternate-forms reliability is strong (r = .98, .94) (Kranzler et al., 1998; Speece and Case (2001). The criterion-related validity coefficients based on other reading measures range between r = .73 and .91 (Deno, Mirkin, & Chiang, 1982; Fuchs et al., 1988; Jenkins & Jewell, 1993; Kranzler et al., 1998; Marston & Magnusson, 1985) and indicate that it is a valid measure of reading ability and comprehension.

For the current study, rater reliability of the reading fluency measures was determined by tape-recording 25% of the sessions for each testing time (spring, fall, and recoupment). These recordings were scored by another professional trained in scoring CBM reading fluency measures to establish rater reliability by dividing the number of agreements or raw score (± 1) by the number of agreements plus disagreements. The rater reliability of the reading probes was 89.47%.

Mathematics. Mathematics calculation fluency measures a student's speed and accuracy in basic mathematical computations. Students compute mathematics problems at their grade level for two minutes and the scorer counts the number of correctly written digits during the two minutes. For this study, I used probes from Monitoring Basic Skills Progress: Basic Mathematics Computation Manual, Second Edition developed by Fuchs, Fuchs, and Hamlett (1998). The grade 1 and grade 2 probes included addition and subtraction problems, whereas grade 3 and grade 4 included mixed computation problems of addition, subtraction, multiplication, and division. I reported the scores as the number of correct digits per two minutes. I have included a copy of the protocol, the student's assessment, and directions for administration and scoring in Appendix C.

There are few published studies on the reliability and validity of mathematics fluency measures. Fuchs, Fuchs, Hamlett, and Stecker (1990) reported CBM mathematics reliability was $r = .85$. Marston (1989) summarized test-retest and parallel forms reliability from various sources and reported strong ($r = .93$ to .98) to moderate ($r = .48$ to .72) reliability coefficients, respectively. Fuchs, Fuchs, and Hamlett (1988) found the internal consistency reliability ($r = .93$) to be high.

Marston (1989) reported that an unpublished study by Skiba, Magnusson, Marston, and Erickson indicated that the criterion-related validity was low to average ($r = .26$ to .67). Fuchs, Fuchs, Hamlett, and Stecker (1990) reported CBM mathematics criterion validity was $r = .78$ to .80.

To assess rater reliability for the mathematics computation fluency for the current study, 25% of the mathematics fluency measures were scored a second time by another professional and the number of agreements on the raw score (± 1) was divided by the number of agreements plus disagreements. The rater reliability of the mathematics probes was 100%.

Administration of the fluency measures. Before I administered the assessments in the spring, I organized the order of subject (reading and mathematics) and the probe sets within the subject. I counterbalanced the measures by creating two orders of administration: reading followed by mathematics (Order 1) or mathematics followed by reading (Order 2). Children were randomly assigned to one of the testing orders. I counterbalanced the *sets* of reading and mathematics probes the same way. For each testing time (spring, fall, and recoupment), I needed two probes for reading and two probes for mathematics. Reading and mathematics each had a pool of six probes divided into three sets for each grade level. I used a die to determine the set order for each testing session. A 1 or 2 represented the first set, a 3 or 4, the second set, and a 5 or 6, the third set. I determined all orders and sets for the three administrations for each student before the spring administration. I tested each student with his/her grade level reading and mathematics probe for the spring testing, and I administered the same grade level test in the fall and for recoupment.

These CBM measures were administered to the students during the last one and a half weeks of school in the spring, the first one and a half weeks of school in the fall to determine regression, and six weeks after school resumed to determine recoupment. I tested the students in the same order for each assessment to ensure the same amount of time between each assessment. For the reading measure, each student read two ORF probes (Appendix C) during each testing time (spring, fall, and recoupment). Two copies of each probe, one for the student and a numbered copy for scoring for me, was prepared and administered according to the directions (see Appendix C: Directions for Administration of CBM Probes from http://www.glue.umd.edu/%7Edlspeece/cbmreading/). The reading probes were scored according to the directions (see Appendix C: Procedures for Scoring CBM Probes from http://www.glue.umd.edu/%7Edlspeece/cbmreading/examinermat/scoring.html) with mispronunciations, substitutions, and omissions counted as errors (Shinn, 1989). If the student self-corrected an error within 3 seconds, then that error was not counted. I used the mean score of the two probes at each testing time for the analyses. In the same testing session, a mathematics probe was placed face down on the student's desk. I gave the directions [see Appendix C: Procedures for Administering Mathematics Fluency Probes from Nolet (1998)] and allowed the student two minutes to complete the probe. The second mathematics probe was administered in the same way. The probes were scored by counting the number of correctly written digits in two minutes [see Scoring Math Probes using Correct Digits from Nolet (1998)]. The mean raw score of the two probes for each testing session was used for data analyses.

Teacher ratings of academic behavior. The Academic Competence subtest of the Social Skills Rating System – Teacher (SSRS, Gresham & Elliot, 1990) evaluates student academic functioning as rated by the student's teacher. Items measured include the student's reading and mathematics performance, motivation, parental support, and general cognitive functioning. The teacher answers nine questions about the student using a 5-point scale. Internal consistency and test-retest reliability of this subtest (r = .95 and .93 respectively) are high (Gresham & Elliot). Content, social, and criterion-related validity are moderate to high as determined by independent reviewers (Benes, 1995; Furlong & Karno, 1995).

During the last week and a half of school before summer vacation, I distributed the SSRS Academic Competence subtest to teachers for students who received a positive reply on the permission slip and explained to the teachers how to complete it. I collected the forms on the last day of school. The teachers completed and returned 100% of the forms after several reminders. Teachers who completed the forms received $10.00.

Summer activity survey. Parents provided information about their child's summer activities, the family income, and the parent education level on the survey developed for this purpose (Appendix C). I developed this survey with guidance from a survey found in Appendix C of Heyns (1978a).

I designed the survey to find information about three types of student summer activity: time spent on mathematics practice, time spent on reading practice, and time spent on unstructured activities. Of the 19 questions asked, five were about mathematics activities, six were about reading activities, and eight were about unstructured activities. I attempted with the reading and mathematics questions to cover every activity where the students might practice their reading and mathematics skills, such as summer school, visits to the library, and instructional computer games. The unstructured activities included time spent with friends, at camps, on vacation, and on hobbies.

I also included on the survey a self-report of family income and parent education level to determine the socioeconomic status of the family. In two studies (Crowell & Klein, 1981; Heyns, 1978) socioeconomic status had an effect on the retention of skills over the summer. Although self-reporting raises questions of reliability, it was the only way to determine the socioeconomic status of the students' families.

I piloted the survey with five parents of students not included in the study to receive feedback on clarity and to check for errors. I asked the parents if they had any difficulties or issues with the questions and if they had found any errors. I also showed it to a professional who developed surveys to help clarify some of the questions. I made several wording changes from this feedback.

The day school resumed in August, I sent the survey (Appendix C) and a self-addressed, stamped envelope to the parent of each student in the study. Overall, of 146 surveys mailed, 141 (96.6%) were returned by mail or completed by phone after two follow-up attempts. I was unable to reach five (3.4%) parents. Six weeks from the day I first mailed the surveys, I randomly selected 44 (30%) of the parents to complete the survey again to determine the reliability of the measure. Thirty-three (75%) parents returned those surveys; I called the 11 (25%) parents from whom I did not receive the survey for the reliability check and completed them over the phone.

I scored the student activities part of the parent survey such that more points were associated with more time spent in an activity. The levels of activity were daily (3 points), 2-3 times a week (2 points), weekly (1 point), and not at all (0 points). When I received the second set of parent surveys, I scored all surveys and then used the Spearman Rho correlation to determine the test- retest reliability. The Spearman Rho coefficient is used when the assumption is that both variables are not normally distributed; it is recommended for the correlation of ordinal (or ranked) numbers (http://www.wellesley.edu/Psychology/Psych205/spearman.html). Table 6 illustrates that the scores from the first parent survey were strongly correlated to the same scores in the second parent survey, indicating strong test-retest reliability.

Table 6

Correlation of Parent Surveys to Determine Test-Retest Reliability

	Reading Activities Score	Math Activities Score	Unstructured Activities Score	Reading and Math Score Combined	Total Activities Score
Reliability Activities Scores	.802	.794	.840	.813	.855

Procedures

I obtained approval from the Institutional Review Board (IRB) (Appendix C) and parent permission on which I also requested the parents' phone numbers and home addresses so that I could mail the surveys to the parents and follow up with phone calls. I then set up testing schedules for the spring, fall, and recoupment testing sessions. I tried to test at each school in the same order for fall and recoupment as I did in the spring to maintain consistency in the number of days between testing across all students. For the most part, the schools were tested in the same order for each testing session. During the last 1.5 weeks of the spring session, I tested all students for whom I had received permission from parents. I retested them within the first 1.5 weeks of the fall semester, and then retested six to seven weeks after the fall session had started. I chose six weeks for the recoupment measure to replicate the study by Allinder and Eicher (1994).

I met with each student individually to administer both the reading and mathematics computation fluency measures. Before I tested each student each time, I read the *Student Permission Form* (Appendix B) to gain his/her assent to be a part of the study. All students agreed to participate during the spring testing; however, one student refused to be tested during the fall session. During the week in the spring that I tested the students, I gave the SSRS Academic Competency Scale to the students' teachers to complete. I received 100 percent of those surveys back.

I mailed the Student Activity Survey to the parents when school started in the fall to determine the reading, mathematics, and unstructured activity of the students during the summer. After four weeks, I called parents from whom I did not receive the survey and completed the form over the phone (Appendix C: Phone script). I was unable to contact five parents. During the sixth week of school, I randomly chose 30 percent of the parents and mailed the same survey to them to determine test-retest reliability. Again, I called those parents who did not return the survey and completed the survey over the phone.

Data Analysis

For the primary analyses, I used the students' mean raw scores (spring, fall, and recoupment) for reading and mathematics, their raw SSRS score, and the scores from the parent survey. The students' scores were collapsed such that students in first and second grade formed the Primary group and students in the third and fourth grade formed the Intermediate group. The following questions guided the initial analyses:

Research Question 1: Do NR students and students with LD in Primary and Intermediate grades experience differential regression over the summer in reading skills?

Research Question 2: Do NR students and students with LD in Primary and Intermediate grades experience differential regression over the summer in mathematics skills?

Research Question 3: Do NR students and students with LD in Primary and Intermediate grades experience differential recoupment in reading skills after six weeks of instruction in the fall?

Research Question 4: Do NR students and students with LD in Primary and Intermediate grades experience differential recoupment in mathematics skills after six weeks of instruction in the fall?

The purpose of an ANOVA is to determine whether the means of different populations are equal to one another (Huck, 2000). I used repeated measures ANOVA (general linear model) to answer research questions one through four. The repeated measures ANOVA is the analysis used when the same measurement is made several times on each participant. It has an advantage over multivariate regression analyses and an analysis of variance (ANOVA) in that it can be used with repeated measures using a univariate analyses (George & Mallery, 2001) (http://www.statsoftinc.com/textbook/stglm.html#basic_ideas).

Separate 2 (Status: LD, NR) X 2 (Developmental Level: Primary, Intermediate) X 3 (Time: spring, fall, recoupment) repeated measures ANOVAs were conducted for reading and mathematics to determine whether there was a significant difference between the spring, fall, and recoupment scores for the LD and/or NR students in Primary and Intermediate grades. The between-subjects factors were the student Status (LD vs. NR) and Developmental Level (Primary vs. Intermediate). The within-subjects factor was

Time; spring vs. fall vs. recoupment. I used the SPSS for Windows 11 program to analyze the data, and I reported the mean, Type III Sum of Squares, F statistic, *df*, *p* values, partial eta squared (η_p^2) as effect size, and observed power for these analyses. Eta squared (η^2) and η_p^2 are the sample effect sizes reported by the SPSS statistical program when the analysis is an ANOVA. When there is more than one independent variable in the analysis, SPSS reports η_p^2 instead of η^2 because the denominator in the latter would contain systematic variance attributable to other effects and interactions. The denominator for η_p^2 includes the amount of variance attributable to the effect plus the error variance of that effect ($\eta_p^2 = SS_{effect} / (SS_{effect} + SS_{error})$) (http://www.unige.ch/cyberdocuments/theses2000/VanReekumC/these_notes.html). Although it is a proportion of the variability of the effects of the independent factors, the sums of η_p^2 values are not additive and could possibly be greater than 1.00. The greater the η_p^2, the greater the amount of variance explained by the independent variables. (http://web.uccs.edu/lbecker/SPSS/glm_effectsize.htm#Partial%20Eta%20squared,%20hp2).

The observed power is the chance of detecting an effect if there is one. It ranges from 0 to 1, and an observed power of 0.80 means that there is an 80 percent chance of detecting an effect and if no effect is noted, then the researcher can conclude that there is none (http://www.linguistics.ucla.edu/faciliti/facilities/statistics/power.htm). A repeated contrasts analysis illustrated, if significant differences were found, where these differences occurred. The repeated contrasts analysis replaced a post hoc test, which must have more than two levels.

The remaining research questions were:

Question 5: Does academic competence, summer activity and family income account for significant variance in regression and recoupment scores in reading?

Question 6: Does academic competence, summer activity, and family income account for significant variance in regression and recoupment scores in mathematics?

A correlation analysis was conducted relating the parent survey scores, family income level, parent education level, and the student academic competency survey to the reading and mathematics difference scores. Willett (1994) cautions the researcher about the use of difference scores in data analyses. He argues that if they are used to measure within- and between-person changes, the data should be longitudinal to reduce the level of measurement error. The measurement of a pre- and post-test does not take into consideration the small changes in between those two points. He believes a trend line, or trajectory, made up of several points is a more reliable measurement of change. Although collecting summer CBM scores several times over the summer and then through the six weeks of fall instruction might have added interesting information about regression and recoupment, it was beyond the scope and purpose of this study. It would also have added another factor to the study in that the collection of the data during the summer would have been an instructional activity and during the fall would have taken the students in the sample away from their normal curriculum. CBM is a valid, reliable measurement of small changes in progress, and the point of using a mean score from two CBM probes for both reading and mathematics at each data collection point was to reduce the measurement error.

Chapter 4

Results

The purpose of this study was to determine if there was differential summer regression and fall recoupment in reading and mathematics between students with LD and NR students. I used a repeated measures ANOVA to analyze the effects of the between-subjects factors, student Status (LD vs. NR) and the two Developmental Levels (Primary vs. Intermediate). The within-subjects factor was Time; spring vs. fall vs. recoupment. First, I discuss the results of the reading analysis and then the mathematics analysis to answer Questions 1 through 4. Then, I will address Questions 5 and 6.

Summer Regression and Fall Recoupment in Reading

The mean scores from the reading probes for spring, fall, and recoupment were analyzed using the repeated measures general linear model program on SPSS version 11.5. The mean scores in words per minute and standard deviations for the spring, fall, and recoupment reading probes are reported in Table 7. Primary students read fewer words per minute than did the NR students, although the passages increased in difficulty for each grade. The students with LD read about half the number of words as did the NR students supporting the contention that students with LD, as a group, experienced reading difficulties. The standard deviations are large, indicating sizable variability in the scores. Large variability is a typical phenomenon with CBM (Allinder & Eicher, 1994; Allinder & Fuchs, 1991; Allinder et al., 1992). The skewness for each level of Developmental Level, Status, and Time was within ± 1.0. The kurtosis for each level of the independent variables was within ± 1.5. Thus, the distributional properties were well within acceptable boundaries.

Table 7

Descriptive Statistics for Oral Reading Fluency

Time of Testing	LD				NR			
	Primary		Intermediate		Primary		Intermediate	
	M	SD	M	SD	M	SD	M	SD
Spring	32.44	24.47	41.90	19.07	65.25	30.04	80.81	25.88
Fall	27.09	22.40	41.44	19.95	63.06	30.93	78.17	21.55
Recoupment	33.00	26.78	43.62	18.24	69.22	32.64	87.13	24.26

Note. N = 84

The results of the repeated measures ANOVA for the reading scores with the NR students and students with LD (Status) and Primary and Intermediate (Developmental Level) and the spring, fall, and recoupment (Time) are shown in Table 8. The table reflects the interaction terms of interest to this study (Time x Status, Time x Developmental Level, and Time x Status x Developmental Level). Because Mauchly's Test of Sphericity was not significant ($p < 0.240$), I used the Sphericity Assumed statistics. Sphericity is used for repeated measures ANOVA designs and is a mathematical assumption that all the variances of all the differences are equal (http://www-staff.lboro.ac.uk/~hutsb/Spheric.htm).

There was a significant main effect for Time [F (2,78) = 7.68, $p < .001$], Status [F (1,78) = 51.98, $p = .00$], and Developmental Level [F (1,78) = 7.13, $p < .009$]. The repeated measures ANOVA demonstrated that spring scores were greater than fall scores ($p < .10$) and recoupment scores were greater than fall scores ($p = .00$). Across Status and Developmental Level, the mean spring score was 56.59 wpm (SD = 31.00), the mean fall score was 54.20 wpm (SD = 30.19), and the mean recoupment score was 59.94 wpm (SD = 32.73). As expected, the Intermediate students read more words correctly per minute compared to the Primary students [spring score mean = 61.36 wpm (SD = 29.87) and 48.84 wpm (SD = 31.69), respectively] and the NR students read more words correctly per minute compared to the students with LD [spring mean score = 74.88 wpm (SD = 28.23) and 38.30 wpm (SD = 21.51), respectively]. Table 8 shows there were no significant interactions between Time and Status, Time and Developmental Level, Time and Status and Developmental Level. Figure 1 shows a line graph demonstrating the mean reading scores of the students by Status and Developmental Level across each time of testing.

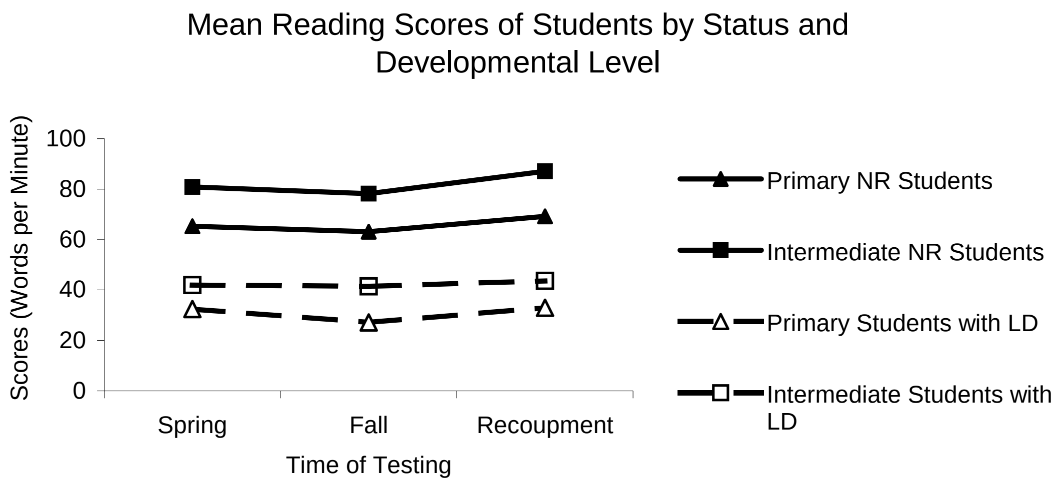
Table 8

Results from the Repeated-Measures ANOVA for Reading Fluency

	Mean Square	Type III Sum of Squares	*F*	*df*	*p*	η_p^2	Observed Power
T	667.78	1335.57	7.68	2	.001	.09	.95
S	27648.01	27648.01	51.98	1	.000	.39	1.00
DL	3792.09	3792.09	7.13	1	.009	.08	.75
T * S	94.80	189.60	1.09	2	.339	.01	.24
T * DL	27.10	54.20	.31	2	.733	.00	.10
T * S * DL	59.94	119.87	.69	2	.503	.01	.17

Note. T = Time; S = Status; D = Developmental Level

Figure 1



Summer Regression and Fall Recoupment in Mathematics

The mean scores from the mathematics probes for spring, fall, and recoupment were analyzed using the repeated measures general linear model program on SPSS version 11.5. The mean scores in digits per two minutes and standard deviations for the spring, fall, and recoupment mathematics probes are reported in Table 9. Although the differences are not quite as large as with reading, the students with LD correctly completed significantly fewer digits correct compared to their NR peers. Again, the standard deviations are large, indicating sizable variability in the scores. The skewness for each level of the three independent variables (Developmental Level, Status, and Time) was within ± 1.0. The kurtosis of the three independent variables was within ± 1.5. As with reading, the distributional properties were within acceptable boundaries.

The results of the repeated measures ANOVA for the mathematics scores with the NR students and students with LD (Status) and Primary and Intermediate (Developmental Level) and the spring, fall, and recoupment (Time) are shown in Table 10. The table reflects the interaction terms of interest to this study (Time x Status, Time x Developmental Level, and Time x Status x Developmental Level). Again, because Mauchly's Test of Sphericity was not significant ($p < 0.978$), I used the Sphericity Assumed statistics.

Table 9

Descriptive Statistics for Mathematics Fluency

Time of Testing	LD				NR			
	Primary		Intermediate		Primary		Intermediate	
	M	SD	M	SD	M	SD	M	SD
Spring	7.65	4.39	10.40	3.74	14.13	6.17	17.40	6.84
Fall	7.38	3.72	10.71	4.70	12.69	5.45	14.67	7.26
Recoupment	13.25	6.22	13.75	5.72	19.94	6.01	18.06	6.49

Note. N = 84

Figure 2 depicts the mathematics scores by Time, Developmental Level, and Status. The repeated measures ANOVA for mathematics scores yielded significant main effects for Time (spring, fall, and recoupment) [F (2, 78) = 45.08, $p < .001$] and for Status (NR and LD) [F (1,78) = 24.91, $p = .00$]. A significant interaction was found for Time x Development Level (Primary and Intermediate) with F (2, 78) = 7.2, $p < .001$. With respect to the significant effect for Time, spring scores were greater than fall scores ($p < .10$) and fall scores were significantly less than recoupment scores ($p = .00$). Collapsing Developmental Level and Status, the mean spring score was 12.76 (SD = 6.52), the mean fall score was 11.68 (SD = 6.11), and the mean recoupment score was 16.17 (SD = 6.59). Table 11 shows the descriptive statistics for Time and Developmental Level to assess the interaction. It appears that the interaction is due to the Primary children's increase from fall to recoupment. This does not mean that the Primary students surpassed the Intermediate students since the level of difficulty was different for the two groups. There are no significant main effects for Developmental Level and no significant interactions for Time x Status, or Time x Status x Developmental Level.

Table 10

Results from the Repeated-Measures ANOVA for Mathematics Fluency

	Mean Square	Type III Sum of Squares	F	df	p	η_p^2	Observed Power
T	525.48	1050.95	45.08	2	.001	.36	1.00
S	626.34	626.34	24.91	1	.000	.23	.99
D	54.68	54.68	2.17	1	.144	.03	.31
T * S	22.02	44.04	1.89	2	.155	.02	.39
T * DL	82.76	165.52	7.1	2	.001	.08	.93
T * S * DL	10.79	21.59	.93	2	.398	.01	.21

Note. N = 84

T = Time; S = Status; D = Developmental Level.

Summary

In reading, significant main effects were determined for Time, Status, and Developmental Level. No significant interactions were found. However, in the mathematics analysis, I found significant main effects for Time and Status and a significant interaction for Time x Developmental Level.

Figure 2

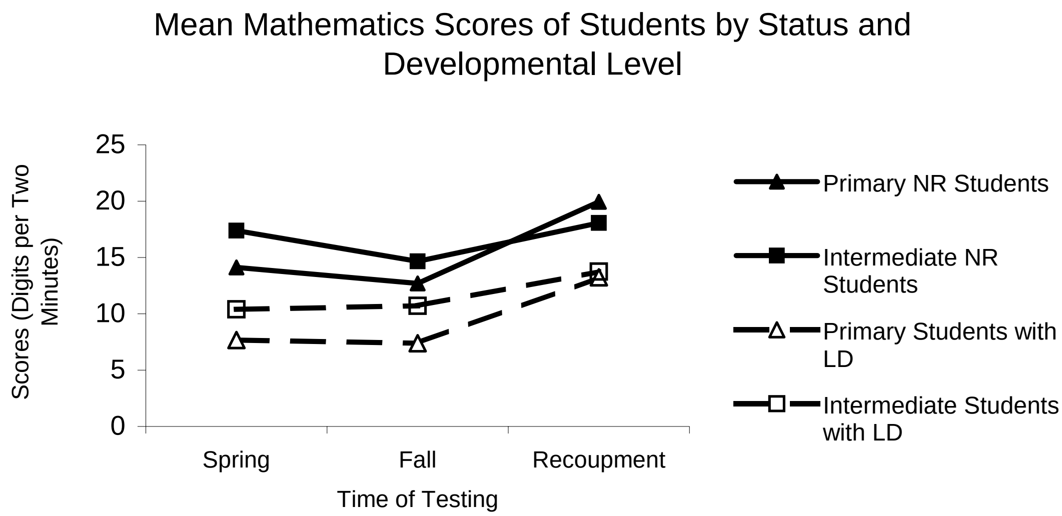


Table 11

Descriptive Statistics for Math Fluency by Time and Developmental Level

Time of Testing	Primary		Intermediate	
	M	SD	M	SD
Spring	10.89	6.21	13.90	6.50
Fall	10.03	5.33	12.69	6.38
Recoupment	16.59	6.91	15.90	6.44

Note. N = 84

Parent Summer Survey

The Parent Summer Survey included the following subscales: summer reading activity (sum of ratings of time spent in reading activities), summer mathematics activity (sum of ratings of time spent in mathematics activities), and summer unstructured activity (sum of ratings of time students spent in unstructured activities) during the summer. Family income and father's and mother's highest education level were the amount of income reported by the family and father's and mother's reported highest education level on the survey. I also included the SSRS Academic Competency survey. Table 12 shows the median, range, and possible minimum and maximum responses for the subscales and for the SSRS Academic Competence (SAC) rating completed by teachers.

Table 12

Descriptive Statistics for the Parent Survey

	Median	Range	Minimum	Maximum
SRA	5.00	11	0	15
SMA	2.00	10	0	15
SUA	11.00	18	0	27
FI	7.00	10	1	10
FHE	2.00	6	1	6
MHE	3.00	6	1	6
SAC	29.00	36	9	45

Note. N = 84

SRA = Summer reading activity, SMA = Summer mathematics activity, SUA = Summer unstructured activity, FI = Family income, FHE = Father's highest education, MHE = Mother's highest education, SAC = SSRS Academic Competence.

The skewness for the subscales from the parent survey and the SSRS Academic Competence was within ± 1.5. The kurtosis for each of the subscales and the SSRS

Academic Competence was within ± 1.7. Thus, the distributional properties were within acceptable boundaries. The correlations of the activities, family income, father's and mother's education levels, and student academic competency are found in Table 13. There are significant correlations ($p < .01$) between the three summer activity variables

Table 13

Intercorrelations of the Parent Survey and Academic Competence Rating

	SRA	SMA	SUA	TSA	FI	FHE	MHE	SAC
SRA	1							
SMA	.521**	1						
SUA	.288**	.230*	1					
TSA	.814**	.712**	.688**	1				
FI	.153	.142	.153	.251*	1			
FHE	.226*	.056	.140	.252*	.575**	1		
MHE	.193	.075	.089	.192	.499**	.445**	1	
SAC	.007	.056	.062	.094	.145	.212	.192	1

Note. N = 84

SRA = Summer reading activity, SMA = Summer mathematics activity, SUA = Summer unstructured activity, TSA = Total Summer Activity (SRA + SMA + SUA), FI = Family income, FHE = Father's highest education, MHE = Mother's highest education, SAC = SSRS Academic Competence..

*p < .05, **p < .01.

(summer reading, summer mathematics, and summer unstructured activities) and their sum (total summer activities). Total summer activities also demonstrates a moderate significant relationship with family income and father's highest education level. The father's highest education level shows a moderate relationship with summer reading activity. The background variables (education and income) do not correlate with the other activity subscales with the exception of unstructured activities and family income. It appears if children are rated as active, they tend to be rated higher in all three areas, and parents with higher incomes rate their children as participating in more unstructured activity than do parents with lower levels of income. Summer mathematics activity has significant correlations ($p < .01$) and ($p < .05$) with reading and mathematics activity and summer unstructured activity, respectively. Summer unstructured activity is significantly correlated ($p < .01$) with reading and mathematics activity, family income is significantly correlated ($p < .01$) to father's and mother's highest education level, and father's highest education level is significantly correlated ($p < .01$) with mother's highest education level. All relationships were positive.

Because of the significant main effects for both reading and mathematics for Status and Time and the significant interaction between Time and Developmental Level in mathematics, I ran a correlation analysis for both reading and mathematics to determine whether there were any relationships between the survey variables and the reading and mathematics CBM difference scores by Status and Developmental Level. I used the Spearman's *rho* to determine whether there were significant correlations between the survey subscales (summer reading activity, summer mathematics activity, summer unstructured activity, mother's and father's highest education, and family income), the SSRS Academic Competence, and the reading and mathematics difference scores for each time of testing for fall – spring and recoupment – fall.

Tables 14 and 15 show the relationships between the reading fall – spring and recoupment – fall difference scores, respectively, by Status and Developmental Level and the variables from the Parent Survey and SAC. The mean reading difference scores across all children were fall – spring (M = -2.07, SD = 14.06) and recoupment – fall (M = 6.93, SD = 13.00). The significant negative relationship between Primary students and summer reading and mathematics activity indicates that the more reading and mathematics activity during the summer in which a Primary student is involved, the

Table 14

Fall – Spring Correlations between Covariates and Status and Developmental Level Reading Fluency Difference Scores

	Fall - Spring				
	P	I	LD	NR	Total
SRA	-.380*	.082	-.148	-.051	-.080
SMA	-.343*	.135	-.046	-.071	-.055
SUA	-.318	.124	-.063	.042	.003
TSA	-.526**	.128	-.108	-.131	-.076
FHE	-.209	.038	- .009	-.124	-.073
MHE	-.415*	-.225	-.321	-.321*	-.329**
FI	-.220	.032	.038	-.115	-.065
SAC	-.120	-.142	-.056	-.228	-.138

Note. N = 84. P = Primary, I = Intermediate, Total = all students in the sample, SRA = Summer reading activity, SMA = Summer mathematics activity, SUA = Summer unstructured activity, TSA = Total summer activity, MHE = Mother's highest education, FHE = Father's highest education, FI = Family income, SAC = SSRS Academic Competence.

*$p < .05$, two-tailed. **$p < .01$, two-tailed.

stronger the relationship with a summer reading loss. There is also a significant negative relationship between Primary students and total student summer activity that indicates there is more summer regression with more summer activity among Primary students.The mother's level of education also has a significant negative relationship among Primary,

Table 15

Recoupment – Fall Correlations between Covariates and Status and Developmental Level Reading Fluency Difference Scores

	Recoupment - Fall				
	P	I	LD	NR	Total
SRA	.084	-.092	.048	.046	-.023
SMA	.243	.000	-.069	.235	.071
SUA	.135	-.067	-.048	.091	.011
TSA	.239	-.059	-.048	.239	.030
FHE	.228	-.052	-.086	.135	.053
MHE	.307*	.241	.063	.469**	.260*
FI	.181	.063	-.302	.396*	.090
SAC	.396*	.155	.075	.312*	.252*

Note. N = 84. P = Primary, I = Intermediate, Total = all students in the sample, SRA = Summer reading activity, SMA = Summer mathematics activity, SUA = Summer unstructured activity, TSA = Total summer activity, MHE = Mother's highest education, FHE = Father's highest education, FI = Family income, SAC = SSRS Academic Competence.

**p* < .05, two-tailed. ***p* < .01, two-tailed.

LD, NR, and Total students with student summer reading loss indicating that the higher the mother's education, the more the student summer loss for those developmental levels.

Positive correlations between the recoupment – fall difference scores indicate that higher reading achievement gains during the six weeks of fall instruction are associated with higher scores with the variables in Table 15. The mother's education level has a significant positive relationship with Primary, NR, and Total student gains, with the NR students having the strongest relationship ($p < .01$), indicating that the higher the mother's education level, the higher the student's recoupment score. NR student fall recoupment reading gains also has a positive relationship ($p < .01$) with family income. SAC had significant positive relationships with Primary, NR, and Total Sample recoupment gains. Students whose teachers rated them as more academically competent in the spring had higher recoupment scores the following fall.

Tables 16 and 17 show the relationships between the mathematics spring – fall and recoupment – fall difference scores respectively by Status and Developmental Level and the covariates from the Parent Survey and SAC. The mean mathematics difference scores for the total sample were spring – fall (M = 1.08, SD = 4.95) and recoupment – fall (M = 5.74, SD = 12.90). There were no significant relationships between the mathematics difference scores and the factors in the Parent Survey or the SAC for either the fall – spring or the recoupment – fall scores.

Summary. The anticipated Time x Status interaction was not significant for either reading or mathematics fluency. Thus, it appears that children with LD do not experience differential regression compared to NR peers. Across all children, there was a nonsignificant trend for summer regression for both reading and mathematics. For both reading and mathematics, there was a significant effect for recoupment with children demonstrating higher scores after six weeks of instruction. The significant interaction of

Table 16

Spring – Fall Correlations between Covariates and Status and Developmental Level Mathematics Fluency Difference Scores

	Spring - Fall				
	P	I	LD	NR	Total
SRA	-.023	.116	-.052	.055	.072
SMA	.020	.085	-.068	.181	.084
SUA	.109	.159	.013	.237	.132
TSA	.031	.183	-.014	.226	.132
FHE	-.239	.051	-.144	.044	-.067
MHE	-.049	.016	.008	-.085	-.007
FI	-.171	-.012	-.038	.006	-.050
SAC	-.147	.105	.186	.062	.008

Note. N = 84. P = Primary, I = Intermediate, Total = all students in the sample, SRA = Summer reading activity, SMA = Summer mathematics activity, SUA = Summer unstructured activity, TSA = Total summer activity, MHE = Mother's highest education, FHE = Father's highest education, FI = Family income, SAC = SSRS Academic Competence.

*$p < .05$, two-tailed. **$p < .01$, two-tailed.

Time and Developmental Level for mathematics appeared to be due to the recoupment gains of the Primary students compared to the gains of the Intermediate students. Analysis of the parent survey variables and teacher ratings yielded some counterintuitive

Table 17

Recoupment – Fall Correlations between Covariates and Status and Developmental Level Mathematics Fluency Difference Scores

	Recoupment – Fall				
	P	I	LD	NR	Total
SRA	-.351	.052	-.075	.066	-.050
SMA	.078	-.091	-.153	.107	-.020
SUA	-.222	.039	-.080	-.119	-.094
TSA	-291	.022	-.152	.034	-.069
FHE	.120	.185	.122	.194	.171
MHE	-.110	.146	.171	.087	.087
FI	.299	.176	.087	.284	.198
SAC	.246	.037	.165	.062	.138

Note. N = 84. P = Primary, I = Intermediate, Total = all students in the sample, SRA = Summer reading activity, SMA = Summer mathematics activity, SUA = Summer unstructured activity, TSA = Total summer activity, MHE = Mother's highest education, FHE = Father's highest education, FI = Family income, SAC = SSRS Academic Competence.

**p* < .05, two-tailed. * **p* < .01, two-tailed.

findings. Correlation analysis indicated that Primary students who demonstrated more summer regression were rated as having engaged in more summer reading and mathematics activities. Similarly, children who demonstrated more summer regression had mothers who had more education.

Chapter 5

Discussion

The purpose of this study was to determine whether students with LD demonstrated significantly more regression over the summer and significantly slower recoupment in the fall in reading and mathematics than did students who were NR in the Primary and Intermediate grades. Further, correlates of regression and recoupment were evaluated. Policy initiatives such as NCLB in which achievement scores of children with disabilities are disaggregated for analysis of adequate yearly progress highlight the importance of accelerating the learning of children with LD and other disabilities. Because children with LD, by definition, are achieving at a lower level than their NR peers, they can hardly afford to lose more ground over the summer months. Findings from previous research yielded mixed results on the extent of summer regression for children with disabilities and only one analyzed recoupment of skills when children returned to school in the fall.

The current study was designed to address some of the limitations of past research including (a) comparing children with LD to their non-referred peers to determine if differential regression of reading and mathematics skills occurred, (b) using measures that are sensitive to change (e.g., Allinder & Fuchs, 1991), (c) including younger children to broaden knowledge of the regression phenomenon (Cooper et al., 1996), (d) reducing the amount of instruction that takes place in the regression period under study (Cooper et al., 1996; Heyns, 1978) and (e) assessing the extent to which children recoup their skills when they return to school in the fall.

If children with LD experience regression and/or limited recoupment of skills then states, schools districts, and schools should determine which supplementary service provides the most beneficial intervention to prevent summer academic regression of students with LD. Although current ESY eligibility requires evidence of "significant" regression, in this season of AYP, any summer regression in students with disabilities may be too much regression. Districts may need to determine whether the IEP-directed instruction of ESY is better instruction for students with LD than the NCLB-provided supplementary summer instruction or district-provided summer school.

Reading

My statistical analysis of the data showed significant effects for each of the main effects (i.e., Developmental Level, Status, and Time). None of the interactions were significant. The main effect for Developmental Level indicated that Primary students read significantly fewer words per minute than did the Intermediate students even though the Intermediate students had material that was more difficult. For Status, students with LD read significantly fewer words per minute than did the NR students. I expected this result because one of the eligibility criteria of students with LD is that they lag behind their NR peers in their academic performance.

For reading, Time (spring, fall, and recoupment) also demonstrated a significant difference across all students. Although the regression from spring to fall was not significant ($p < .10$), the recoupment gains (fall to recoupment) were ($p = .00$). Students gained significantly more reading skills after six weeks of fall instruction. In their meta-analysis, Cooper et al. (1996) found more reading gains than losses. Several authors found significant increases in reading skills over the summer (Cook & Schwarz, 1969;

Crowell & Klein, 1981; Heyns, 1978; Keys & Lawson, 1937; Reece et al., 2000). Heyns (1978), Allinder and Eicher (1994), and Cornelius and Semmel (1982) found significant summer regression. Only Allinder and Eicher (1994) analyzed regression and recoupment and they also found more recoupment than regression.

One possible reason my results differ from the Allinder and Eicher study is because 19% of their sample consisted of students with mild retardation. Although Cooper et al. (1996) stated that IQ made little difference to summer regression, they noted that they did not examine IQ in more extreme ranges that one would expect for children with disabilities. Children in the current study scored, as a group, approximately 8 points higher compared to the sample in Allinder and Eicher's study. The mean weighted IQ score of the students in the current study was 97 compared to Allinder and Eicher's sample average of 89.1. The students in my sample scored .5 SD higher than did the students in the Allinder and Eicher study, which may indicate that IQ does make a difference when measuring student progress. Another possible reason for the difference is that the Allinder and Eicher study took place about ten years ago in a potentially different instructional climate compared to the present day curriculum and instruction.

With respect to past studies that reported summer gains, there were several differences in study design that may explain why I did not find a significant increase in reading skills over the summer. The most likely explanation is that several of the studies (Allinder & Fuchs, 1991; Crowell & Klein, 1981; Heyns, 1978; Keys & Lawson, 1937) included as many as two months of instruction in their summer measure. I allowed a maximum of only six instructional days during my summer measurement. Another possibility is that the studies did not include children with disabilities (Allinder et al., 1992; Crowell & Klein, 1981; Heyns, 1978; Keys & Lawson, 1937; Reece et al., 2000; Scott, 1967; Wintre, 1986). Children with learning disabilities would not be expected to show gains in the absence of instruction.

There were no significant two-way interactions (Time x Developmental Level, Time x Status). There was no significant difference between the regression and recoupment of Primary students and Intermediate students or for LD and NR. Cooper et al. (1996) found that younger readers tended to retain more of their reading skills over the summer and older students demonstrated more regression. That was not indicated in this study. It should be noted that Cooper et al. did not include children as young as those in the current study.

I believed that students with LD would regress significantly more in reading than would the NR students based on the research of the memory retrieval difficulties of students with LD (Swanson et al., 1998; Wong, 1996). They would also recoup more slowly than would the NR students. This study did not support my predictions. The students with LD and the NR students regressed and recouped similarly in reading. Only Shaw (1982) and Allinder and Fuchs (1991) studied the comparative regression of NR students and students with LD. Both studies demonstrated a significant difference in the regression of reading skills over the summer of students with LD and their NR peers. The Shaw study had a much larger sample size (294) than did mine, but the Allinder and Fuchs study had only one student with LD in the smallest group. This interaction was important to this study because of the policy implications that were discussed previously.

I found no significant three-way interactions (Status x Developmental Level x Time) in reading for the summer regression and fall recoupment. Both Allinder et al.

(1992) and Allinder and Fuchs (1991) found a significant three-way interaction between subject x grade x time and placement x grade x time, respectively.

Mathematics

My statistical analysis of the data showed significant effects for two of the main effects (Status and Time) and one significant interaction (Time x Developmental Level). No other effects (Developmental Level, Time X Status, Status x Developmental Level, Time x Status x Developmental Level) were significant. Students with LD correctly completed significantly fewer digits per two minutes than did the NR students. I expected this result because one of the eligibility criteria of students with LD is that they lag behind their NR peers in their academic performance.

There was a significant finding for Time (spring, fall, and recoupment). Although the main effect of Time is not usually discussed in the presence of an interaction, regression is central to this study, and recoupment helps to explain the interaction found in the mathematics data. With respect to the main effect for Time, the regression from spring to fall was not statistically significant ($p = .06$), but the recoupment gains (fall to recoupment) were ($p = .00$). Students gained significantly more mathematics skills after six weeks of fall instruction. Allinder and Eicher (1994) also found significant regression over the summer and significant recoupment after six weeks of instruction. Cooper et al. (1996) found more losses than gains in mathematics. Of the studies not included in their meta-analysis, Allinder and Fuchs (1991) and Reece et al. (2000) found significant regression in mathematics skills over the summer. Reece et al. and Scott (1967) found significant summer mathematics gains.

Most of the studies recorded significant regression, which I did not find. However there was a trend toward significance and the current findings may be limited due to sample size.

There was one significant two-way interaction (Time x Developmental Level) in mathematics. Although Primary students regressed at a similar rate as did the Intermediate students, they recouped their mathematical skills at a faster rate. The gains of the Primary NR students surpassed the Intermediate NR students during the recoupment period, from a fall score of 12.69 to 19.94 digits per two minutes, a gain of 7.25 digits. The fall scores of the Intermediate NR students went from 14.67 to 18.06 digits per two minutes, a gain of 3.39 digits.

There are no studies directly comparable to the current investigation. Allinder and Eicher (1994) did not find any interaction between grade level and time for regression or recoupment in mathematics in their study that included only children with high incidence disabilities. In their meta-analysis of summer regression research, Cooper et al. (1996) did not find significant differences between grades in mathematics in their meta-analysis of studies that included only two studies of children with disabilities. The following two studies were included in the meta-analysis. Allinder, Fuchs, Fuchs, and Hamlett (1992), in a study of elementary grade children, found that grade level had a significant main effect in mathematics; students in grades 4 and 5 regressed significantly, while students in grades 2 and 3 did not. Wintre (1986) found significant differences between time and grade in mathematics computations for elementary students of middle class socioeconomic status. She determined that students in grade 3 regressed significantly in mathematics computations over the summer, but that grades 1, 3, and 5 demonstrated significant summer gains in mathematics concepts.

Based on previous studies, I believed that students with LD would regress significantly more in mathematics than would the NR students and that they would recoup more slowly than would the NR students. This study did not support my predictions. The students with LD and the NR students regressed and recouped similarly in mathematics. Shaw (1982) found significant differences between students with LD and regular students for summer regression, but his findings had low power.

The Parent Survey and Other Research

I designed the parent survey because I expected that summer activities would be related to student summer regression. Crowell and Klein (1981) and Cornelius and Semmel (1982) found that summer instruction made a difference. I believed that activities such as time spent at the library, on educational computer games, and in instructional summer programs could affect students' scores in the fall. I also wondered whether unstructured activities such as time spent at camp, with friends, and on vacation could also influence students' fall scores. I expected to find significant positive relationships between time spent in summer reading and mathematics activities and summer gains in reading and mathematics.

In my repeated measures ANOVAs, I found significant effects for Status, Developmental Level, and Time for reading, for Status and Time for mathematics, and a two-way interaction between Time and Developmental Level for mathematics. I conducted a correlational analysis of the factors from the Parent Survey, the SSRS Academic Competence survey, and the fall – spring and recoupment – fall difference scores to answer Questions 5 and 6. In reading, there were significant relationships between the regression and recoupment scores. The significant factors were summer reading activity, mother's education level, family income, and the student academic competence.

Tables 14 - 17 show that, surprisingly, there were only three significant relationships between student summer activity (educational or unstructured) and the student scores in reading or mathematics: higher ratings on summer reading, mathematics, and total summer activity of Primary students had a negative relationship with student gain over the summer. This result is counterintuitive since it would be expected that higher levels of academic activity would be associated positively with summer gains. Given that this result is limited to Primary students, it may be that parents of younger students who suspect their children are struggling with reading (and hence would be expected to show regression) provide them with more summer activities related to reading. Another counterintuitive finding was the negative relationship between reading regression and mother's level of education. However, the expected positive relationships were found for reading recoupment scores and mother's education, family income and student academic competence. The results for family income support Heyns' (1978) findings. She also reported that parent education was significantly related to student achievement during times of schooling and non-schooling, although parent education had more effect during times of schooling. In general, the pattern of correlations suggested a lack of relationship between regression and recoupment and the measured correlates. This was more apparent for mathematics than reading.

Limitations and Future Research

There were several limitations to this study. First, the response rate from parents permitting their children to participate in this study was low; therefore, the sample size was small, especially in the Primary group. The small sample size increased the possibility of a Type II error. The sample size could also cause a decrease in the variance, a decrease in the power of the analysis, and a decrease in the effect size. These limits on reliability of results limit the generalizability of the findings. A future study should include an a priori power analysis to determine the number of students needed in each cell to provide a stronger test of regression and recoupment of young children with and without disabilities. Of the two studies most like this study, Allinder and Eicher (1994) also had a small sample size ($n = 75$), but the students were divided into fewer cells which would increase the power of their study. Another researcher with a study similar to the current study, Shaw (1982), had a much larger sample size ($n = 166$ students with LD), increasing the power of his study.

A second possible limitation is the Parent Survey. The survey was developed for this study to assess levels of summer activity and may not have had the necessary psychometric properties to reliably assess the construct. There were no significant correlations from the parent survey with the total fall mean reading score, although the SSRS student academic competency survey was moderately correlated ($r = .569$, $p < .01$) to the fall mean reading score. The test-retest reliability was strong ($r = .794 - .855$).

Finally, the results may have been more reliable had the measures been administered throughout the summer and analyzed via growth curve analysis (Willett, 1994). This approach would also address the possible effect of children's unfamiliarity with CBM procedures. Children may have scored lower in the spring because of the novelty of the task. This potential problem was partially mitigated by taking the average of two probes, but it cannot be ruled out as a possible influence.

There have been many studies in the past to evaluate the regression of students' skills over the summer. Early researchers were concerned about the effects of summer vacation or lack of instruction on various levels of IQ. Few researchers have analyzed the effects of vacation on students with disabilities, especially students with LD. Although significant regression and differential regression was not determined in this study, a significant difference in achievement between students with LD and NR students was established. Future studies must focus on the students with disabilities and how to reduce the size of the achievement gap that was demonstrated in this study and the studies of others. Summer instruction may be the key to reducing that gap and future research should focus on the most beneficial summer instruction. In an age where proficiency is mandated, those in the field of education need to know how to increase the basic skills of all students.

Conclusion

The primary findings of this investigation are that (a) there was a trend toward summer regression in both reading fluency and mathematics calculation, (b) there were significant effects for recoupment in both academic domains, (c) there were no differential regression effects for children with learning disabilities and children who were not referred in either domain, and (d) children in the Primary grades exhibited increased mathematics recoupment compared to Intermediate children. As noted throughout this chapter, the results both support and challenge previous findings.

Although there is a professional belief that children lose skills over the summer, this belief is not strongly supported by the present findings. Surprisingly, children with LD do not experience a differential disadvantage with summer loss. However, the main effect of Status in both the reading and mathematics analyses confirms that children with LD end the school year at a much lower level than non-referred children, and this may be reason enough to support summer programs in an attempt to close the achievement gap. The results of the correlational analyses of summer activity and student academic competence failed to yield many insights as to possible influences on summer regression. Scaling issues and sample size may have worked against interpretable findings.

The strengths of the study include reliable and sensitive measurement, definition of summer break that does not include school year academic instruction, inclusion of both referred and non-referred children for differential analyses, selection of first and second grade children to form the younger group, and inclusion of a measure to identify possible correlates. Future work could build on these strengths and improve upon the design by increasing sample size to increase power and improving the design of the summer survey. The issue of summer regression is far from settled. The current results suggest that children with LD have less to lose over the summer because of their low performance in the spring. Although this is not new information, the extent of the achievement gap in comparison with peers on the same measures at the same point in time and the fact that this discrepancy begins quite early provides important data to fuel support for well conceived summer instruction for children with learning disabilities.

Appendix A

Literature Review of Studies with No Documented Statistical Significance

Earlier researchers did not include evidence of statistical significance of their findings. Although the results added to the understanding of the purpose of this research, the studies were not included in the literature review because without a level of significance, it is not known whether the results are meaningful. I have discussed studies with no tests of statistical significance in this section.

Descriptive Studies

The studies discussed in this section focused only on summer growth or regression. The majority of authors (Bruene, 1928; Elder, 1927; Morrison, 1924; Soar & Soar, 1969) examined only the effects of the summer break on students' academic skills. Two researchers (Morrison, 1924; Patterson & Rensselaer, 1925) analyzed the effects of summer vacation on the abilities of students as measured by their IQ to determine whether there were gains or losses in ability over the summer. Two authors (Kolberg, 1934; Kramer, 1927) explored the effects of the level of students' IQ and the academic gains or losses they experienced over the summer. Other authors (Bruene, 1928; Patterson & Rensselaer, 1925) explored the effects of the level of students' IQ and the academic gains or losses they experienced over the summer.

Early studies. One of the first researchers to analyze the effect of intelligence on summer retention, Morrison (1924) studied the effects of summer vacation on students' achievement and their ability to learn. The Haggerty Intelligence Examination was administered to 123 students in grades 4-8. The Haggerty Reading Examination was administered to grades 1-3, the Thorndike-McCall Silent Reading Test to grades 4-8, and the Woody McCall Mixed Fundamentals to grades 2-6. The author found that, following the summer vacation, there were gains in intelligence across all grades tested. In reading, grades 1 through 3 demonstrated small gains, and in grades 4 through 6, small gains were found in grades 4 and 6, and small losses (no more than one point) were found in grades 5, 7, and 8. Gains in grade 2 and losses in grades 3, 4, 5, and 6 were observed in arithmetic. Morrison concluded that in the fall, students came back able to do better on intelligence tests, with less achievement in arithmetic, and little change in reading. The following authors also analyzed changes in ability and achievement over summer break.

Patterson and Rensselaer (1925) studied the effects of the summer vacation on students' mental ability and how well they retained their skills in reading and mathematics. The Haggerty Intelligence Examination, Delta 2, the Thorndike-McCall Silent Reading Test , and the Woody-McCall Mixed Fundamentals were administered to 149 students in grades 4 through 8. Students were divided into groups according to their IQ: 110 and above (Supernormal), 90-110 (Normal), and below 90 (Subnormal). Students were tested in June and then again in September. The median scores from the test results for each grade and ability group were used to determine gains or losses.

Patterson and Rensselaer (1925) found small losses in reading across all grades. In arithmetic, students in fourth and fifth grades experienced small losses; however, sixth, seventh, and eighth grades demonstrated small gains. Every grade had higher intelligence scores in September with the lower grades showing the largest increase. As the grade level increased, the gain decreased. The Normal group had the largest gain in intelligence, and the Subnormal group had the smallest gain. Only the Subnormal group gained in reading, with the Supernormal and Normal groups experiencing small losses. In arithmetic, all ability groups regressed slightly. Summer vacation seemed to have a beneficial effect on intelligence, it had little effect on reading, and it was detrimental to arithmetic. The Normal group of children gained the most on intelligence tests, the Supernormal less, and the Subnormal least of all. The authors stated that some of the groupings were small and therefore the findings may not be trustworthy.

Elder (1927) studied the effects of summer vacation on the silent reading ability of 42 third, 46 fourth, 55 fifth, and 60 sixth graders using Monroe's Standardized Silent Reading Test. Form 2 was administered in May and Form 1 was administered in September. Their results were based on differences in the standard B scores from May to September. Over the summer, third grade students averaged a growth .47 of a school grade, fourth grade students averaged a growth of .84 of a school grade, fifth grader students averaged a growth of .22 of a school grade, and sixth graders averaged a growth of .36 of a school grade. Not all students experienced a gain over the summer, but the authors found no patterns to the gains or losses. Students who had high scores in May were just as likely to gain or regress as students with low scores.

Bruene (1928) studied the effects of summer vacation on fourth, fifth, and sixth grade students. She questioned whether students lost achievement over the summer, whether teachers needed to review in the fall, and whether summer school affected students with different levels of intelligence. The Stanford Achievement Test, Form A, was given to 69 students in May, Form B was given to the same students in September. The losses and gains were expressed in the average amount of a school year of September norm above or below the May norm.

The 15 fourth graders gained slightly in reading (+0.06) and regressed in arithmetic fundamentals (-0.44) and arithmetic reasoning (-0.10). The 26 fifth graders gained in reading (+0.06) and regressed in arithmetic fundamentals (-0.52) and arithmetic reasoning (-0.07). The 28 sixth graders also gained in reading (+0.23) and regressed in arithmetic fundamentals (-1.07) and arithmetic reasoning (-0.04). All three grade levels gained in reading skill and regressed in arithmetic, although the regression in arithmetic reasoning was small. Bruene (1928) speculated that the gains in reading were due to the fact that all students read during the summer for recreation and pleasure, but that arithmetic skills were not practiced, and therefore, students regressed.

Bruene (1928) also analyzed the change in achievement over the summer by the students' IQ scores. She gave no information of how these scores were determined, but the students were divided into two groups, those with IQs of 110 and above and those with IQs of below 110. The higher the IQ, the more the students retained or gained in reading skills over the summer. However, in arithmetic computation and reasoning, the lower IQ group retained more of their skills. She summarized that summer vacation had a negative impact on mathematics skills, but a positive impact on reading. Students with more ability retained their reading skills, but students with average ability retained their mathematics skills. And, finally, teachers should spend review time in the fall on arithmetic computation. The following author also studied the effects of ability on the retention of academics over the summer.

In 1927, Kramer studied the effects of summer vacation on the reading and mathematics skills of 150 fifth grade students who were divided into groups according to their ability. In June and September of the following school year the teachers administered the Illinois Examination to Group X with IQs of 110 and above, Group Y with IQs of 88-109, and Group Z with IQs less than 87. The median difference score of the two tests of each group was used to measure the change in skill over the summer. Overall, the students lost only 7 percent of their skills in mathematics, with Group X losing 5 percent, Group Y losing 4.5 percent, and Group Z demonstrating no overall change. In reading, most students gained slightly over the summer. Group X gained 10 percent, Group Y regressed slightly, and Group Z gained 3 percent. Kramer stated that the expected large losses in mathematics did not occur and, therefore, schools should not spend large amounts of time in fall review.

Kolberg (1934) studied the effects of summer vacation on retention of history facts with students with varying IQs. Using the Terman Group Test of Mental Ability to determine IQ, Kolberg divided the 163 students into seven groups based on groupings of ten IQ points from 70-79 to 130 and above. The test used to measure retention was the Van Wagenen American History Scales, Information Scale S2. Although students were older (seventh graders) and the subject was history, the findings were meaningful to a study of the summer retention of students with disabilities.

Student scores gradually increased from a loss of 1.50 (median difference in pre- and post-test scores) in the 70-79 ability group to a 3.75 gain in the 130 and above ability group. The exception was the 100-109 ability group which gained 4.07 points over the summer. A scatter diagram showed the correlation of IQ and amount of retention was not as great as it seemed (.19 $\pm$.05), indicating there was little evidence of a relationship between intelligence and retention. Even when the levels of difficulty of the test were taken into consideration, the analysis showed no tendency for one IQ group to retain more than the others. On the easiest questions, the students with the highest IQs actually gained less. On the most difficult questions, the students with the higher IQs gained nothing and the students with the lower IQs lost. Kolberg (1934)stated that an analysis of the hardest questions seemed to be the truest measure of retention because of the ceiling effect of the easier scores. These results demonstrated that although higher and lower ability students regressed during the summer when the information is difficult, the higher IQ group lost less. However, the relationship between ability and retention was small.

Soar and Soar (1969) studied the reading and arithmetic growth of fifth grade students over the summer. They wanted to ascertain how summer growth compared with school year growth. They also analyzed the effects of teacher-pupil behavior in the classroom to determine how it affected students' academic growth in subject matter over the summer. The vocabulary, reading, and arithmetic concepts and problems subtests of the Iowa Tests of Basic Skills were administered to measure achievement, and several observation programs were used to evaluate teacher-pupil behavior during the fifth grade year. All 189 students were Caucasian, but the participants included a broad span of socioeconomic levels. Tests were administered fall and spring of fifth grade and the fall of sixth grade to compare summer growth with school year growth. Difference scores were used to determine the difference in skills across three separate time periods: the first school year, the intervening summer, and second school year.

Although no significance levels were reported, students demonstrated a summer growth in vocabulary of four months, three and a half months in reading, three months in arithmetic concepts, and nearly five months in arithmetic problems. Gains over the summer were shown in all four subjects, although Soar and Soar (1969) cautioned that the summer months included the last spring month and first fall month of school, and that the following school year began with a review of the previous year's material. Through their analysis of the teacher-pupil behavior and pupil summer growth with ANOVAs, Soar and Soar found that indirect teacher control produced significantly more vocabulary learning during the summer, but the emotional climate of the preceding years' classroom did not appear to have a significant effect. For arithmetic concepts, the interaction of low hostility-indirect control was related to the greatest growth. The authors stated that their data seemed to support previous studies which demonstrated that more able, self- directed students experienced more growth, and material that was more abstract was more easily retained.

In summary, the early researchers were interested in the effects of summer vacation on ability and academic skill. Morrison (1924) and Patterson and Rensselaer (1925) found gains in IQ scores after the summer vacation. Reading gains were found by Morrison in students in first through fourth grade, by Elder (1927) in students in third through sixth grade, by Kramer (1927) in "bright" and "dull" fifth grade students, and by Soar and Soar (1969) in students in grade five. Reading regression was discovered by Morrison in fifth grade students and by Kramer in "average" fifth grade students.

In mathematics, Morrison and Soar and Soar (1969) found gains mathematics skills in second and fifth grade students respectively. Patterson and Rensselaer (1925) and Kramer (1927) discovered regression in mathematics skills in fourth and fifth grade students and in "bright" and "average" fifth grade students, respectively, but Kramer found no change in mathematics skills of "dull" fifth grade students. More students gained or demonstrated no change in reading skills after summer vacation; however, the results for mathematics were mixed, with an equal number of studies showing gains and losses.

Intervention Studies

The authors of the studies in this section focused on summer regression of skills and the interventions that might slow that regression. There is no theme for the early studies. The focus of the three studies are summer work, study, and play groups, summer school, and summer work packets. Most of the studies after the 1960s analyzed the effectiveness of summer programs.

Early studies. Garfinkle (1919) studied the summer activities of students to determine whether students who worked, played, or studied all summer had the least amount of regression, and Noonan (1926) examined the difference of the summer regression scores to determine the effectiveness of summer school programs.

In reading, Noonan (1926) found small gains in fifth and sixth grade students. Garfinkle (1919) found large losses in arithmetic accuracy, and Noonan found that all students regressed in mathematics, but that summer school reduced the regression. In the following section, I will discuss these studies in more detail.

Garfinkle (1919) used natural interventions to determine the effects of summer vacation on the arithmetic skills of fifth, sixth, and seventh grade students. The students were divided into three groups based on their summer activities; a play group made up of students who did not work or study, a work group made up of students who were employed, and a study group made up of students who attended summer continuation school to make up a grade. The Courtis Test in Fundamentals, Series B, Form 1, was administered in June, and Form 2 was administered in September. Garfinkle found that in accuracy, the play group lost the most over the summer, the study group demonstrated a smaller loss, and the work group had no regression. Seventh graders regressed the most in accuracy, about two years, and fifth graders regressed the least on material with which they were more familiar. The author explained that the students in the work group kept their minds active all summer, which is why they did not regress. The summer continuation school ended four weeks before school began again in the fall, so the study group had time without instruction in which to regress.

In 1926, Noonan studied the influence of summer vacation on the reading and arithmetic abilities of fifth and sixth grade students. Pre- and post-tests were administered to 222 students who attended summer school and 581students who received no extra training. In June, the tests given included the Thorndike Reading Scale Alpha 2, Part 2 (understanding of sentences), the Thorndike Visual Vocabulary Tests A-2-X and B-X (word knowledge), the Woody Multiplication Test (multiplication), and a series of arithmetic problems. In September, the same tests or tests of equal difficulty were used.

Both the summer school group and the non-summer school group demonstrated a small gain in the understanding of sentences. In multiplication, the summer school group had no change in the median score and the non-summer school group regressed slightly, and on the arithmetic problems test, there was no change in accuracy or speed and accuracy for either group. The tests were considered together and individual tests were weighted according to the author's beliefs of the difficulty of the items in each test. There was an overall regression of .5 for the group that attended summer school and an overall regression of 1.5 for the students who did not attend summer school. Noonan (1926) summarized that the summer vacation had little effect on either group's ability to read or compute.

These results indicated that the more these students studied over the summer, the less regression they experienced; in fact, the group that studied the most made gains in reading and mathematics. The students who studied the least regressed on both tests in reading and the addition facts test in mathematics. In the following studies, the researchers evaluate the effects of summer school, compensatory education, and different school calendars on the summer regression of students.

Studies from the 1960s to the present. Cook (1942) sent work packets home with students to discover whether students who spent a few minutes daily reviewing reading and mathematics problems would have higher scores in the fall than those students who did not review during the summer. Klibanoff and Haggart (1981) studied the differential summer achievement changes between students who received compensatory education and those who did not and the effects of summer school on students who received compensatory education. Cook found that the more time young students spent studying during the summer, the less their regression in mathematics and reading. Klibanoff and Haggart found small gains in reading across all students, and some slight regression in mathematics.

Cook (1942) designed an intervention study for students in the first and second grades to try to lessen the negative effects of the summer vacation on reading and mathematics skills. Work envelopes were prepared for the students so they could spend 15 to 20 minutes per day through the summer maintaining their skills. First grade students were tested during the last two weeks of school using the Gates Primary Reading

Test; second grade students were tested with the Gates Primary Reading Test, the Primary Reading Test of the Metropolitan Achievement Test, and one hundred addition facts from *Test and Practice Pad for Second Grade Arithmetic.* In September, the students were retested using the same tests. Students were interviewed and their work envelopes were analyzed to determine how much time each student spent on the extra work. They were divided into three groups; those students who had studied for 0-3 weeks, those who had studied for 4-7 weeks, and those who had studied for 8-11 weeks.

In both reading and mathematics, students who worked 8-11 weeks of the summer on their work envelopes had the highest scores. Eight first grader students gained in word recognition, sentence reading, and paragraph reading on the Gates Primary Reading Test. Six second graders gained in word recognition, and paragraph reading, but experienced a small loss sentence reading. On the addition facts test, they gained in average number of facts known, from 72 facts in May to 84 facts in September. Of the group of students who studied 4-7 weeks with their work envelopes, the ten first grade students experienced small losses in word recognition, sentence reading, and paragraph reading on the Gates Primary Reading Test. The sixteen second graders had small losses in word recognition and in sentence reading, but gained in paragraph reading. On the addition facts test, they gained eight facts, from 71 in the spring to 79 in the fall. Finally, the seven first grade students who studied only 0-3 weeks experienced the largest losses of the three groups on all three Gates Primary Reading Test subtests. The five second graders also regressed on the three subtests. On the additions facts test, this group was the only group of students to lose skill. In May, their score was 66, and in September it was 45. All three groups demonstrated losses on the Metropolitan Achievement with a direct relation to the amount of time spent studying in the summer.

Overall, Cook found that first and second grade students regressed in reading and mathematics if they did not spend time studying during the summer. The amount of time students spent studying over the summer was had a direct relationship with the amount of time spent studying.

In 1981, Klibanoff and Haggart evaluated data collected for the Sustaining Effects Study (SES), a longitudinal study evaluating the effects of compensatory education on basic skills. The authors' responsibility was to evaluate summer growth and the effectiveness of summer school. There were 39,300 students from 52 schools who took all three tests (Fall 1976, Spring 1977, Fall, 1977) Of those students, 5,600 attended summer school. Form S of the Comprehensive Test of Basic Skills (CTBS) was administered to all students and at- and below-level tests were given to determine the recommended level for each grade at each school. Vertical scale scores were computed for the analyses by using the projected national score distributions from the first year of the study.

Klibanoff and Haggart (1981) analyzed summer gains or losses by subtracting the spring vertical scale scores from the fall vertical scale scores. They grouped the students in several ways; grade level, compensatory education participation, school achievement, socioeconomic status, and race/ethnicity. Overall, they found that gains and losses across all groups were small. All groups demonstrated gains in reading; students who received no compensatory education (non-CE), students with higher socioeconomic status, and racial majority students had higher gains. In mathematics, there was more regression, but it was small and the pattern was different. Only the first and third grade non-compensatory education students had higher scores than their peers who had received compensatory education (CE). Students with lower socioeconomic status and racial minority students regressed less and had higher gains in mathematics. Klibanoff and Haggart found no patterns in summer gains or losses based on the achievement level of the students. The fact that a student performed poorly in school did not predict that he would lose more achievement over the summer. In this study, the authors found insignificant gains in reading and insignificant gains and losses in mathematics.

Klibanoff and Haggart (1981) also studied the effects of summer school on CE and non-CE students. In reading, the non-CE students had higher achievement scores than the CE students whether they did or did not attended summer school. However, the mathematics results were different. The CE students had higher gains and less regression than the non-CE students whether or not either group had attended summer school except for students in first and third grade. In those grades, the non-CE students had higher mathematics scores than the CE students, but there was little difference in the scores. The differences in the reading and mathematics scores do not indicate a significant effect due to summer school attendance.

In summary, Cook (1942) found that the more time first and second grade students spent in summer study, the more academic skills they retained over the summer. Klibanoff and Haggart (1981) found only small gains in reading across all groups of students and more regression in mathematics among students who did not receive compensatory education.

Summary

Morrison (1924) and Patterson and Rensselaer (1925) studied changes in ability over the summer vacation and found gains in IQ scores after the summer vacation. Kolberg (1934) found little relationship between ability and summer retention and Bruene (1928) found that the higher the IQ, the more retention, except in arithmetic. Reading gains were found by Morrison in students in first through fourth grade, by Elder (1927) in students in third through sixth grade, by Kramer (1927) in "bright" and "dull" fifth grade students, and by Noonan (1926) in fifth and sixth grade students. Klibanoff and Haggart (1981) found small gains in reading across all students. Cook (1942) found reading gains in first and second grade students only if they studied during the summer. Reading regression was discovered by Morrison in fifth grade students and by Kramer in "average" fifth grade students.

In mathematics, Morrison (1924) found gains in second grade students, Patterson and Rensselaer (1925) and Kramer (1927) found regression in fourth and fifth grade students and in "bright" and "average" fifth grade students, respectively, but Kramer found no change in mathematics skills of "dull" fifth grade students. Garfinkle (1919) found large losses in arithmetic accuracy, and Noonan (1926) found that all students regressed in mathematics, but that summer school reduced the regression. Cook (1942) found that, in mathematics, the more young students studied over the summer, the more they gained, and Klibanoff and Haggart found some slight regression in mathematics.

Overall, researcher found that more students gained or demonstrated no change in reading skills after summer vacation; however, most of the students regressed in mathematics.

Appendix B

Parent Consent Form for Average-Achieving Students

PARENT CONSENT FORM

Academic Gains and Losses in Reading and Math
over the Summer in Elementary Students

As the parent of ______________________________(child's name), I state that my son/daughter may participate in a program of research to be conducted by Patti Boyles in the College of Education at the University of Maryland, College Park.

The purpose of this research is to assess whether children experience academic gains and losses in reading or math over the summer.

I understand that my child will be tested in reading and math once this spring, once at the beginning of the next school year, and once six weeks after school resumes in the fall. Each testing session will last no more than ten minutes and will occur during the school day. The reading sessions will be audio taped to ensure scoring accuracy. During each testing session, my son/daughter will read two passages for one minute each and work two math sheets for two minutes each. I understand that I will be asked to complete a summer activity survey about my child before school begins in the fall. This information will be used to determine if children's summer activities play a role in academic gains and losses. I also understand that I may be asked to complete the survey a second time so Mrs. Boyles can determine the consistency of parent responses. Also, for the purpose of this study, this spring, my child's teacher will complete a brief academic competence survey comparing my child to peers on reading, math, motivation, and classroom behavior. Mrs. Boyles is interested in knowing if teacher perceptions are related to children's academic gains and losses.

All information collected in this study is confidential to the extent permitted by law. I understand that the data obtained from the survey and the tests will be grouped with data of other children for reporting and presentation, and that my child's name will not be used.

This project represents no more than minimal risk.

The study is not designed to help my child personally, but to help the investigator learn more about student summer academic gains and losses. I am free to ask questions and my child may withdraw from participation at any time and without penalty. I may contact:

Contacts: Patti Boyles
Doctoral Candidate
120 Charles I. Boyle Road
Queen Anne, MD 21657
(410) 758-3426

Faculty Advisor: Deborah Speece, Ph. D.
College of Education
1308 Benjamin Building
University of Maryland
College Park, MD 20742
(301) 405-6482

Check one: My child **MAY** participate _______ My child **MAY NOT** participate
____

NAME OF STUDENT ____

SIGNATURE OF PARENT ____

DATE ________________________

Address of parent for the survey ______________________________________
____

Phone number for survey follow-up ______________________________________

PLEASE RETURN ONE SIGNED COPY TO YOUR CHILD'S TEACHER AND KEEP ONE FOR YOUR RECORDS.

Parent Consent Form for Students with LD

PARENT CONSENT FORM

Academic Gains and Losses in Reading and Math
over the Summer in Elementary Students

As the parent of ______________________________(child's name), I state that my son/daughter may participate in a program of research to be conducted by Patti Boyles in the College of Education at the University of Maryland, College Park.

The purpose of this research is to assess whether children experience academic gains and losses in reading or math over the summer.

I understand that my child will be tested in reading and math once this spring, once at the beginning of the next school year, and once six weeks after school resumes in the fall. Each testing session will last no more than ten minutes and will occur during the school day. The reading sessions will be audio taped to ensure scoring accuracy. During each testing session, my son/daughter will read two passages for one minute each and work two math sheets for two minutes each. I understand that I will be asked to complete a summer activity survey about my child before school begins in the fall. This information will be used to determine if children's summer activities play a role in academic gains and losses. I also understand that I may be asked to complete the survey a second time so Mrs. Boyles can determine the consistency of parent responses. Also, for the purpose of this study, this spring, my child's teacher will complete a brief academic competence survey comparing my child to peers on reading, math, motivation, and classroom behavior. Mrs. Boyles is interested in knowing if teacher perceptions are related to children's academic gains and losses. I also give permission for Mrs. Boyles to review my child's school records to obtain the most recent reading, math, and aptitude scores. This information will be used to describe the children as a group.

All information collected in this study is confidential to the extent permitted by law. I understand that the data obtained from the survey and the tests will be grouped with data of other children for reporting and presentation and that my child's name will not be used.

This project represents no more than minimal risk.

The study is not designed to help my child personally, but to help the investigator learn more about student summer academic gains and losses. I am free to ask questions and my child may withdraw from participation at any time and without penalty. I may contact:

Contacts: Patti Boyles
Doctoral Candidate
120 Charles I. Boyle Road
Queen Anne, MD 21657
(410) 758-3426

Faculty Advisor: Deborah Speece, Ph. D.
College of Education
1308 Benjamin Building
University of Maryland
College Park, MD 20742
(301) 405-6482

Check one: My child **MAY** participate _______ My child **MAY NOT** participate _________

NAME OF STUDENT ____

SIGNATURE OF PARENT ____

DATE __________________________

Address of parent for the survey ____

____

Phone number for survey follow-up ____

PLEASE RETURN ONE SIGNED COPY TO YOUR CHILD'S TEACHER AND KEEP ONE FOR YOUR RECORDS.

Script for Consent of Students

Script for Consent of Students

"Hi. My name is Mrs. Boyles and I am doing a study on children's math and reading skills. Your parents said you could work with me, and now you get to decide. If you say yes, we'll work for about ten minutes on reading and math activities. You'll read to me for about two minutes and then do two math pages for two minutes each. We'll do it now, we'll do the same thing as soon as you come back from summer break when you're in (second, third, fourth, or fifth) grade, and then we'll do it again six weeks after that. Only I will see your papers, not your teacher or anyone else. You can always say no, now or later. Would you like to work with me today?"

Appendix C

Reading and Mathematics Probes and Protocols

Directions for Administration of CBM Reading Probes

Administration:

1. Record the participant information on the score sheet (name, ID#, school, teacher, date, etc...)
2. Place the reading passage in front of the student so that they can see the story.
3. Read aloud the directions that correspond to the passage the student is to read:

Passage 1:

Say to the Student:

> **You are going to read this story titled () out loud. This story is about... (*Turn the reading passage over, face down).***
>
> **Try to read each word. You can use your finger to keep your place. If you come to a word you don't know, I'll tell it to you. You will read for one minute. Be sure to do your best reading. Are there any questions? (*Turn the passage right-side up)*. Put your finger on the first word. Begin.**

4. Start timing the one-minute time period when the student begins reading.
5. If a student comes to the end of the passage before the time is up, point to the beginning of the passage and say to the student, "**Begin again**."
6. After one minute, say "**Stop**" and place a bracket ( ]) next to the last word read. Then say to the student, **"Thank you for reading."**

Passage 2:

Say to the Student:

> **Now you are going to read a different story titled () out loud. This story is about ...**
>
> **Ready? (*Wait for the child's attention then show them the next passage)*. Put your finger on the first word. Begin.**

When the child finishes, say, "**Thank you for reading**."

Scoring

1. Follow along on the EXAMINER'S COPY of the of the passage marking the words that are read incorrectly. Use the symbols shown at the top of the EXAMINER'S COPY to record mispronunciations, substitutions, omissions, and reversals. Write what the child said above each error.
2. Count the total number of words the student attempted and the number of total errors. Record these on the EXAMINER'S COPY for each passage.
3. Subtract the number of total errors from the number of words attempted and record the number of words read correctly.

See Scoring Procedures for more detailed information on scoring.

Scoring Procedures for CBM Reading Probes

The most important piece of information is the number of words read correctly. Reading fluency is a combination of speed and accuracy.

I. WORDS READ CORRECTLY

Words read correctly are the words that are pronounced correctly, given the reading context. **When counting up the total number of attempted words do not count proper nouns (particular name, place or thing) in the total word count, these words are underlined. If they are misread, cross them out but do not count them as an error.**

a. The word "read" must be pronounced "reed" when presented in the context of "He will read the book", not as "red".

b. Repetitions are not counted as errors.

c. Self-corrections are not counted as error (put s/c above the word). The student can go back and correct the word.

d. Additions are not counted as errors.

II. WORDS READ INCORRECTLY

The following types of errors are counted: (a) mispronunciations (marked as /), (b) substitutions (marked as /), (c) omissions (marked with a circle around the word), and (d) reversals (marked as z). Further, words not read within 3 seconds are counted as errors.

Above each error use the scoring marks (slash, oval, and reversal sign) for each error. Write what the child says above each error.

a. **Mispronunciations** are words that are misread; *dog* for *dig*.

b. **Substitutions** are real words that are substituted for the stimulus word; e.g., *dog* for *cat*, *was* for *were*.

c. **Omissions** are words skipped of not read; if a student skips an entire line, each word is counted as an error.

d. **Reversals** are two adjacent words that are read out of order.

III. 3-SECOND RULE

If a student is struggling to pronounce a word or hesitates for 3 seconds, the student is told the word and it is counted as an error. There may be instances when a child does not begin reading at the beginning of the passage. When this occurs, repeat the prompt "Begin" and point to the first word. If the child doesn't begin then

start your timer while providing the first word. Record the first word as an error.

IV. RE-READ RULE

If a child completes the passage in less than one minute have them begin again. Say, **"Begin Again,"** and point to the first word of the passage.

V. PRONUNCIATION

The student is not penalized for different pronunciation due to dialect, articulation, or second language preference. For example, if the student consistently says "/th/" for "/s/" when making the "s" or "c" sound. This is a professional judgment and should be based on the student's responses and any prior knowledge of the student's speech patterns. Ask the child a word that contains the sound in question in order to determine whether that sound should be recorded as an error.

Curriculum-Based Measurement Student Copy Reading Probe (2nd Grade Level)

The Tea Set

"If I buy yours, I will have a tea set," said Frances.

"You said you didn't want it," said Thelma. "And anyhow, I don't want to sell it now."

"Why not?" said Frances.

"Well," said Thelma, "It is a very good tea set. It is plastic that does not break. It has pretty red flowers on it. It has all the cups and saucers. It has the sugar bowl and the cream pitcher and the teapot. It is almost new, and I think it cost a lot of money."

"I have two dollars and seventeen cents," said Frances. "That's a lot of money."

"I don't know," said Thelma. "If I sell my tea set, then I won't have one anymore."

"We can have tea parties at my house then," said Frances. "And you can use the money for a new doll."

"Well, maybe," said Thelma. "Do you have your money with you?"

"I'll run home for it," said Frances.

Curriculum-Based Measurement Student Copy Reading Protocol (2nd Grade Level)

CBM #8/Grade 2

Student:		Teacher:
School:		Date:
Grade:		Examiner:
# attempted	# of errors	# read correctly

Instructions
You are going to read this story titled The Tea Set out loud. This story is about Frances wanting to buy Thelma's tea set (place the reading passage in front of the student, face down). Try to read each word. You can use your finger to keep your place. If you come to a word you don't know, I'll tell it to you. You will read for one minute. Be sure to do your best reading. Do you have any questions? (Turn the passage right side up). Put your finger on the first word. Begin.

The Tea Set

"If I buy yours, I will have a tea set," said Frances. 11

"You said you didn't want it," said Thelma. "And anyhow, I don't 22
want to sell it now." 27

"Why not?" said Frances. 30

"Well," said Thelma, "It is a very good tea set. It is plastic that does 44
not break. It has pretty red flowers on it. It has all the cups and saucers. It 61
has the sugar bowl and the cream pitcher and the teapot. It is almost new, and 77
I think it cost a lot of money." 85

"I have two dollars and seventeen cents," said Frances. "That's a lot of 97
money." 98

"I don't know," said Thelma. "If I sell my tea set, then I won't have 112
one anymore." 114

"We can have tea parties at my house then," said Frances. "And you 126
can use the money for a new doll." 134

"Well, maybe," said Thelma. "Do you have your money with you?" 144

"I'll run home for it," said Frances. 150

Procedures for Administering Mathematics Fluency Probes

Mathematics fluency probes may be administered individually or to a group of students. Place the mathematics fluency probe face down on the desk of each student. Say to first and second grade students, ***"There are different types of problems on the page. Some are addition and some are subtraction. Look a teach problem carefully before you answer it."*** For third and fourth grade students say, ***"There are different types of problems on the page. Some are addition, some are subtraction, some are multiplication, and some are division. Look at each problem carefully before you answer it."***

Then for all students say, ***"When I say 'start,' turn the page over and begin answering the problems at the top of the page. Start on the first problem on the left on the top row*** **(POINT).** ***Work across the page and then go to the next row. If you can't answer the problem, make an 'X' on it and go to the next one. Are there any questions? Begin."*** After two minutes, say ***"Stop. Put your pencils down."*** If you are administering a second probe, repeat the above directions.

Scoring Mathematics Problems Using Correct Digits

Figure 1. Traditional Scoring of Mathematics Problems

Traditional setting
1 point for correct answer
0 points for incorrect answer

Addition	Subtraction	Multiplication	Division
25	69	42	71
+ 16	- 38	x 13	5) 356
41	31	126	35
		42	06
		546	5
			1

Figure 2. Scoring using Correct Digits in Addition and Subtraction

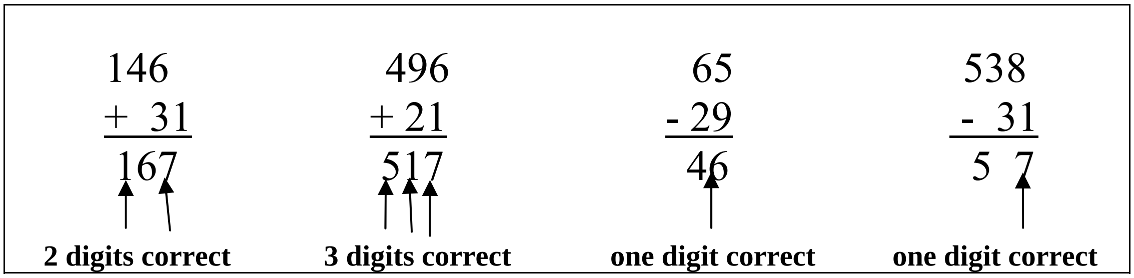


Figure 3. Example of Multiplication Correct Digit Scoring

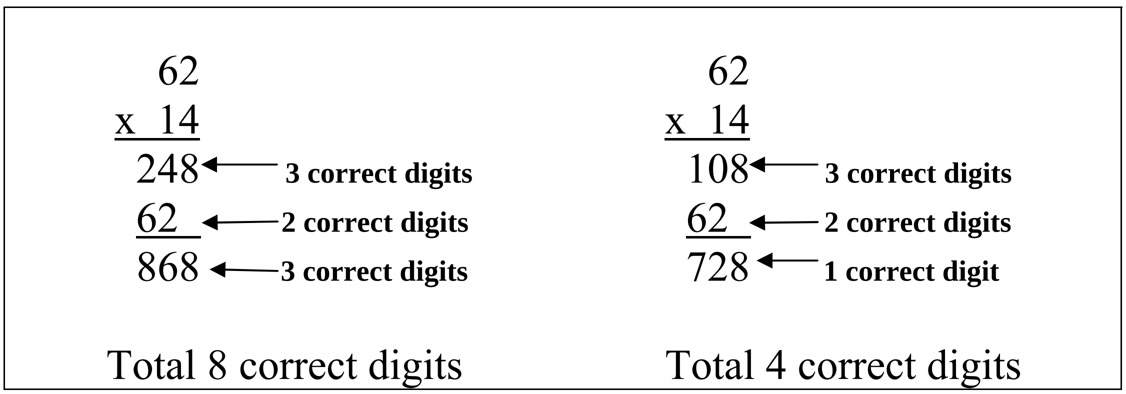
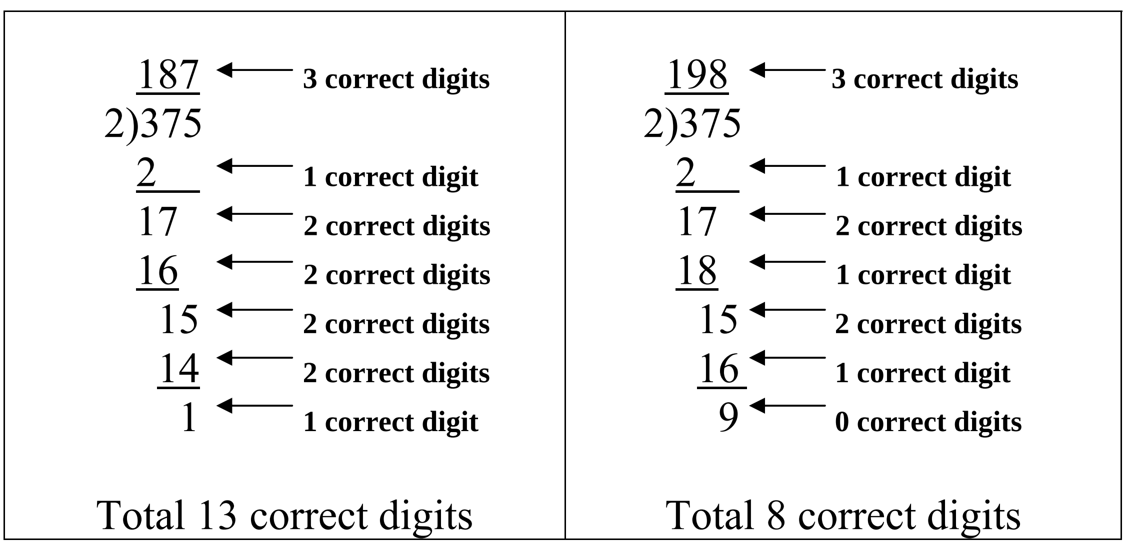


Figure 4. Example of Division Correct Digit Scoring



Curriculum-Based Measurement Student Copy Mathematics Probe (2nd Grade Level)

Student Name______________________________ Date________________________

21 +27	**9 -1**	**39 + 4**	**8 + 7**	**13 42 + 15**
22 - 4	**19 - 7**	**75 - 27**	**17 - 8**	**12 - 7**
17 - 8	**85 + 42**	**5 3 + 6**	**7 + 6**	**20 - 7**
36 - 0	**9 + 8**	**15 - 7**	**0 + 12**	**72 - 21**
80 - 9	**1 + 9**	**34 + 8**	**6 + 9**	**483 - 41**

Parent Survey

Parent Survey

The following questions refer to your child who is involved in the study of summer gains and losses of academic skills in reading and math over the summer. An accurate account of your child's summer activities is necessary so that I can determine if the summer activities are important to academic gains or losses over the summer. Please answer each question as accurately as you can and return this survey in the enclosed self-addressed stamped envelope as soon as possible. Your responses are strictly confidential and will not be shared with anyone outside the research team. If you have questions, please contact Patti Boyles at (410) 758-3426.

___________________________ Child's first and last name

Please check the box that indicates how much time your child spent in each activity this summer.

Activity	Daily	2-3 times a week	Weekly	Not at all
1. Did your child attend summer school for **math**?				
2. Did your child visit the library this summer?				
3. Did your child work on hobbies this summer?				
4. Did your child attend any academic assistance programs for **math** this summer (for example –Sylvan Learning Center, Huntington Learning Center)?				
5. Did your child use computer games to study **reading** this summer?				
6. Did your child play video games this summer (Nintendo, Playstation)?				
7. Did your child attend any other religious or community-related activities this summer?				
8. Did your child attend summer school for **reading** this summer?				
9. Did your child play with other children this summer?				
10. Did your child play alone this summer?				
11. Did your child do **math** activities with a parent or siblings this summer?				
12. Did your child watch TV this summer?				
13. Did your child use computer games to study **reading** this summer?				
14. Did your child attend any other camps this				

Activity	Daily	2-3 times a week	Weekly	Not at all
summer (for example – nature, religious)?				
15. Did your child **read** independently this summer?				
16. Did your child do **math** activities independently this summer?				
17. Did your child use computer games to study **math** this summer?				
18. Did your child **read** with a parent or siblings this summer?				
19. Did your child attend any recreational camps this summer (for example – soccer, baseball)?				
20. Other (please specify):				

The following information will be used to describe the group of students as a whole and to understand if these factors are important to summer gains and losses. Again, this information will be confidential.

21. What is the approximate total yearly income of the child's household? (Circle the number before your answer)
    1. Less than $10,000
    2. $10,000 - $19,999
    3. $20,000 - $29,999
    4. $30,000 - $39,999
    5. $40,000 - $49,999
    6. $50,000 - $59,999
    7. $60,000 - $69,999
    8. $70,000 - $79,999
    9. $80,000 - $89,999
    10. Over $90,000

22. What is the highest grade the student's father achieved? (Circle the number before your answer)
    1. Some high school
    2. High school graduate
    3. College coursework
    4. College graduate
    5. Graduate coursework
    6. Graduate degree

23. What is the highest grade the student's mother achieved? (Circle the number before your answer)
    1. Some high school
    2. High school graduate
    3. College coursework
    4. College graduate
    5. Graduate coursework
    6. Graduate degree

Telephone Script

"Hello. Is this the parent of (child's name)? My name is Patti Boyles. You gave permission for your child to participate in a study that began last spring about academic reading and math losses over the summer. Two weeks ago, I sent you a survey about (child's name) summer activities. I didn't receive the survey back from you. Could I ask you the questions over the phone? This will take about four minutes." Read the survey verbatim. "Thank you for your time."

References

Allinder, R. M., & Eicher, D. D. (1994). Bouncing back: Regression and recoupment among students with mild disabilities following summer break. *Special Services in the Schools, 8*, 129-142.

Allinder, R. M., & Fuchs, L. S. (1991). The effects of summer break on math skills of learning disabled and low-achieving students. *B. C. Journal of Special Education, 15*, 269-275.

Allinder, R. M., Fuchs, L. S., Fuchs, D., & Hamlett, C. L. (1992). Effects of summer break on math and spelling performance as a function of grade level. *The Elementary School Journal, 92*, 451-460.

Alper, S., & Noie, D. R. (1987). Extended school year services for students with severe handicaps: A national survey. *Journal of the Association for Persons with Severe Handicaps, 12*, 61-66.

Armstrong v. Kline, 476 F. Supp. 583 (3rd Federal Judicial Circuit 1979).

Battle v. Commonwealth (3rd Circuit 1980).

Bruene, E. (1928). Effect of summer vacation on the achievement of pupils in the fourth, fifth, and sixth grades. *Journal of Educational Research, 18*, 309-314.

Cook, J. J., & Schwarz, R. H. (1969). A look at some assumptions in special education. *Education and Training of the Mentally Retarded, 4*, 149-156.

Cooper, H., Nye, B., Charlton, K., Lindsay, J., & Greathouse, S. (1996). The effects of summer vacation on achievement test scores: A narrative and meta-analytic review. *Review of Educational Research, 66*(3), 227-268.

Cornelius, P. L., & Semmel, M. I. (1982). Effects of summer instruction on reading achievement regression of learning disabled students. *Journal of Learning Disabilities, 15*, 409-415.

Crowell, K. C., & Klein, T. W. (1981). Preventing summer loss of reading skills among primary children. *Reading Teacher, 34*, 561-564.

Deno, S. L. (1985). Curriculum-based measurement: The emerging alternative. *Exceptional Children, 52*, 219-232.

Elder, H. E. (1927). The effect of the summer vacation on silent reading ability in the intermediate grades. *Elementary School Journal, 27*, 541-546.

George, D., & Mallery, P. (2001). *SPSS for Windows Step by Step: A Simple Guide and Reference* (3rd ed.). Boston, MA: Allyn and Bacon.

Germann, G., & Tindal, G. (1985). An application of curriculum-based measurement: The use of direct and repeated measurement. *Exceptional Children, 52*, p. 244-265.

Heyns, B. (1978). *Summer learning and the effects of schooling*. New York, NY: Academic Press.

Heyns, B. (1987). Schooling and cognitive development: Is there a season for learning? *Child Development, 58*, 1151-1160.

Individuals with Disabilities Education Act, 34 C.F.R. § 300.309 (1997).

Katsiyannis, A. (1990). Extended school year policies: An established necessity. *Remedial and Special Education, 12*(1), 24-27.

Keys, N., & Lawson, J. V. (1937). Summer versus winter gains in school achievement. *School and Society, 46*, 541-544.

Kolberg, O. W. (1934). A study of summer-time forgetting. *Elementary School Journal, 35*, 281-287.

Kramer, G. A. (1927). Do children forget during vacation? *Baltimore Bulletin of Education, 6*, 56-60.

Marston, D. B. (1989). A curriculum-based measurement approach to assessing academic performance: What it is and why do it. In M. R. Shinn (Ed.), *Curriculum-based measurement: Assessing special children* (pp. 18-78). New York, NY: The Guilford Press.

Marston, D. B., & Magnusson, D. (1988). Curriculum-based measurement: District level implementation. In J. L. Graden, J. E. Zins & M. J. Curtis (Eds.), *Alternative edcuational delivery systems: Enhancing instructional options for all students.* (pp. p. 137-172). Washington, DC: National Association of School Psychologists.

Morrison, J. C. (1924). What effect has the summer vacation on children's learning and ability to learn? *Educational Research Bulletin, 3*, 245-249.

National Center for Education Statistics. (Retrieved February 15, 2004). from http://nces.ed.gov/

Nolet, V. W. (1998). *Curriculum-Based Assessment Materials and Procedures (Training Module No. 2)*. Bellingham, WA: Applied Research and Development Center, Western Washington University.

Patterson, M. V. W., & Rensselaer, N. Y. (1925). The effect of summer vacation on children's mental ability and on their retention of arithmetic and reading. *Education, 46*, 222-228.

Reece, J. L., Myers, C. L., Nofsinger, C. O., & Brown, R. D. (2000). Retention of academic skills over the summer months in alternative and traditional calendar schools. *Journal of Research and Development in Education, 33*, 166-174.

Scott, L. F. (1967). Summer loss in modern and traditional elementary school mathematics programs. *California Journal of Educational Research, 18*, 145-151.

Shaw, T. V. (1982). *Retention of selected reading and arithmetic skills by learning disabled pupils and non-disabled pupils over summer vacation*. (ERIC Document Reproduction Service No. ED 229-960).

Soar, R. S., & Soar, M. M. (1969). Pupil subject matter growth during summer vacation. *Educational Leadership, 2*, 577-587.

Speece, D. L., & Case, L. P. (2001). Classification in context: An alternative approach to identifying early reading disability. *Journal of Educational Psychology, 93*, 735-749.

Stainback, W. C., Stainback, S. B., & Hatcher, C. W. (1983). Developing policies for extended year programs. *The Association for the Severely Handicapped Journal, 8*, 5-9.

Swanson, H. L., Cooney, J. B., & O'Shaughnessy, T. E. (1998). Learning disabilities and memory. In B. Y. L. Wong (Ed.), *Learning about Learning Disabilities* (2nd ed.). San Diego, CA: Academic Press.

Willett, J. B. (1994). Measuring change more effectively by modeling individual growth over time. In T. Husen & T. N. Postlethwaite (Eds.), *The International Encyclopedia of Education* (2nd ed.). Oxford, UK: Pergamon Press.

Wintre, M. G. (1986). Challenging the assumption of generalized academic losses over summer. *Journal of Educational Research, 79*, 308-312.

Wong, B. Y. L. (1996). *The ABCs of Learning Disabilities*. San Diego, CA: Academic Press.