Effects of Standardized Achievement Tests on Mathematics Education

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Effects of Standardized Achievement Tests on Mathematics Education

by

Patricia P. Jurgens

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UNIVERSITY OF NORTH FLORIDA
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Standardized Achievement Tests

Abstract

This research project deals with the effects of standardized achievement tests on elementary-school mathematics. It contains a review of current literature dealing with the decline in mathematics achievement, mathematics assessment, concept development, and the effects of standardized testing. A survey was conducted in seven elementary schools throughout Clay County, Florida. The purpose of the survey was to assess teachers' perceptions of how preparation for the major annual standardized achievement test affects the pacing, sequence, and presentation of their mathematics curricula. Eighty-six teachers from grades one, three, and five completed a limited response questionnaire. The results indicate that a majority of elementary-school teachers try to prepare their students for the standardized achievement test by covering all testable skills by testing time. However, most teachers feel that preparation for this test has a negative impact on their mathematics programs. This implies that the mathematics education of our students may be suffering due to the emphasis on preparing for a standardized achievement test.
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Chapter One

Introduction

Competition seems to be a central focus in American society today. No matter where one goes or what one does, one's age or occupation, there seems to be an emphasis on competition. The world of education is no exception. There is competition at every level and in every phase of education today - from high school students competing to get into the best colleges, to teachers competing for merit pay, and to schools competing on standardized achievement tests.

Pressure on educators to compete comes from many levels. It comes from our national leaders in the field of education who regularly publish results of various standardized achievement tests through the United States Department of Education. For example, The Condition of Education (Center for Educational Statistics, 1986) is an annual publication which reports results of tests such as The Scholastic Aptitude Test, The International Mathematics Studies, and the Congressionally-mandated National Assessment of Educational Progress Tests (p. 22). These reports are constant reminders to teachers as well as to the general public of how the states rank
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educationally and how the schools in the United States rank among the schools of the world.

Pressure on educators to compete can also come from parents, colleagues, and administrators, as well as from various local, state, and federal institutions. The overwhelming message to teachers throughout the country is to "get the scores up."

In addition, there is pressure on educators to establish a good reputation for their schools within the community. The reputation of local schools influences where people purchase their homes. Good schools bring growth and development to their areas. At interschool athletic events, in grocery stores, and wherever parents meet, they discuss and compare schools: which has more computers, which has the best programs, and most of all, which schools rank highest on the standardized achievement tests.

But standardized achievement tests do not show the whole educational picture, and high scores may be giving some schools a false sense of accomplishment and some parents a false sense of confidence. According to Shavelson, Webb, and Burstein (1986), "standardized tests are designed to reflect curriculum over a broad array of schools and districts using different
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...textbooks, syllabi, and instructional methods. Their content and the scores they typically generate cover lightly a variety of objectives within a content area" (p. 53). They "... represent the broadest possible sampling of curricula at a particular grade level in a particular content area" (Wardrop, 1976, p. 118).

Because they represent such a broad and generalized sampling of curricula, it can be argued that standardized achievement tests do not always measure deeper and fuller understanding of the material. They allow students to demonstrate the range of skills and knowledge they were exposed to by testing time, but what they might not show is the students' depth of understanding, the conditions under which the skills were attained, how long the skills will last, or how much "real" learning was achieved.

"Real" learning in this instance is not simply learning skills and knowledge at the surface level. It is assumed here that real learning takes place when new concepts are carefully built upon already fully developed concepts. Skills and knowledge which are attained without the proper conceptual structuring can be quickly forgotten and thus may not qualify as "real" learning.
Although it may be stressful and frustrating, teachers can cover most of the year's material at a surface level by testing time, which in some cases can be as early as March. In doing so, a teacher may be able to effectively raise the students' general knowledge and skill level, if only temporarily, so that the scores will come out "looking good." On the other hand, it would be nearly impossible for teachers to develop the underlying concepts that should accompany all the new skills by testing time.

Teachers may respond to the pressure to "raise the scores" by deciding to cover the material quickly and lightly in order to cover it all by the time the test is given. Concept development may, therefore, receive only secondary emphasis. After all, concept development is usually not only more time-consuming in the classroom, it is more demanding in terms of the planning, preparation, and patience needed to incorporate "hands-on" and application experiences necessary for thorough concept attainment. And, in the end, "real" learning or concept development may not be rewarded when the scores "come out." The scores may more likely reflect the breadth of learning rather than the depth.
Part of today's emphasis on standardized scores has come about because of recent highly publicized national reports, such as *A Nation at Risk* (National Commission on Excellence in Education, 1983), which stated that our public schools are failing to give our students good basic foundations in reading, math, and science. Thus, there is great concern throughout the country over the level of our youths' basic skills. The government is afraid that this country will fall behind others in areas such as defense, space, and industrial technology if basic skills, in math and science in particular, are not drastically improved. Monitoring standardized test scores is one way the government has to determine whether progress is being made in these areas.

For progress to be made in basic skills, students must develop a strong foundation of fundamental concepts. And, it is the elementary school teachers who assume the responsibility of carefully establishing those fundamental concepts necessary for future learning. This need for careful concept development seems particularly important in mathematics because every new skill or concept introduced is dependent upon the thorough understanding of previous skills and concepts. Sequential skill building and the careful
connection of concepts are essential to students' future success in mathematics.

But, if teachers are under pressure to rush through the curriculum in order to meet testing deadlines, they may not be able to meet their responsibilities properly. They may not take the time to develop the fundamental concepts or the higher level cognitive skills such as analysis, reasoning, or creative problem-solving which the tests do not typically measure. They may spend their time sharpening the testable skills.

Instead of being determined by sound guidelines and the amount of time students need to conceptualize the material, the sequencing, pace and presentation of many elementary-school mathematics programs may be determined by when the standardized achievement test is given. Students, teachers, and essentially our entire society may be paying too high a price to elevate standardized test scores.

The question might be raised regarding the extent to which practitioners concur in this assessment. Therefore, the purpose of this project is to assess elementary-school teachers' perceptions of how standardized achievement tests affect their mathematics programs. Specifically, this project will assess the
perceptions of public elementary-school teachers in Clay County, Florida, with regard to these issues through use of a limited response questionnaire.
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Definition of Terms

**Standardized tests** are commercially prepared norm-referenced tests designed to measure general levels of achievement. They have a fixed set of questions, strict and uniform directions for administration and timing, and objective scoring. Scores attained on standardized tests can be compared with scores from students in the same grade throughout the United States.

**Accountability** is the process of holding educators responsible for student achievement.

**Manipulatives** are objects for handling and experimentation to aid in the development of concepts. Examples of mathematics manipulatives are measuring instruments, counting sticks and beads, play money, and cardboard clocks.

**Concept Development** is the development of logical structures of knowledge and organized patterns of thought. In concept development information is assimilated by intellectually analyzing, organizing, and categorizing it properly within the existing structures of knowledge. The existing structures may need to be modified in order to accommodate the new information.
Problem-solving is the process of choosing appropriate mathematical procedures and computing answers to mathematical problems presented in real-life applications.
Chapter Two

Review of Related Literature

This review of the literature is divided into five sections: (1) Decline in Mathematics Achievement, (2) Mathematics Assessment, (3) Mathematics Concept Development, (4) Effects of Standardized Testing, and (5) Summary. In section one, the decline in mathematics achievement is documented in order to establish the problem. Section two deals with the uses and misuses of standardized achievement tests. It also discusses other methods of evaluation available to assess concept attainment, presumed in this project to be the principal goal of mathematics education. Section three discusses how concepts and mathematical reasoning are developed. Section four reveals ways in which the standardized achievement tests can affect classroom instruction. The summary attempts to tie the previous sections together by showing the relationships among them. This review is not meant to be conclusive. Instead, through a sampling of the literature it attempts to present a general picture of current thought on the issues of standardized achievement tests and mathematics education.
Decline in Mathematics Education

Education has been under severe public scrutiny ever since the National Commission on Excellence in Education released its report, *A Nation at Risk* (1983). The Commission called for sweeping educational reforms in the face of steadily declining test scores. Citing the results of the College Board Scholastic Aptitude Tests between 1963 to 1980, the Commission announced to the nation that the average mathematics scores had dropped almost 40 points in those 17 years. It stated that only one-third of this country's 17 year-olds could solve mathematics problems requiring multiple steps and that one-fourth of all mathematics courses offered in public four-year colleges were now designed for remediation.

The results of a recent series of international mathematics achievement tests given in 1981 and 1982 (National Center for Educational Statistics, 1985) substantiate the Commission's findings. The United States fared relatively poorly among the 20 participating countries - the report indicating that the higher the school grade, the worse the United States' students performed. By the 12th grade they performed in the bottom international quartile on half of their tests.
and on the other half they did not even approach the international mean. Another study (Bennett, 1986) shows similar results, with American eighth graders ranking 13th among 17 countries in mathematics.

According to Fey and Sonnabend (1982), standardized test scores in the lower grades have improved slightly since the early 1960's, while in the upper grades there has been a steady decline. They feel there are several explanations for this problem of declining scores, but that changes in society are a major cause. They list television viewing habits, broken homes, homes where both parents are working with little time to spend with children, and society's general lack of regard for educational achievements as some of the trends affecting education today. Another explanation they give for the decline in mathematical achievement is the recent emphasis on basic skills which has caused elementary teachers to concentrate on computation while neglecting concept development, problem-solving, and higher levels of mathematical reasoning.

Other reports have also implicated the elementary schools in the decline of mathematics achievement at later levels of schooling. At a national mathematics conference, T. H. Bell (in Romberg, 1983) referred to
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the decline in secondary school mathematics and stated, "the root of the problem can be found at the earliest stages of the elementary school . . ." (p. 1). In its recommendations for school mathematics in the 1980's, the National Council of Teachers of Mathematics (cited in Parkay, O'Brian, & Hennesy, 1984) stated that basic skills must expand to include more than computation, and it set problem-solving as its number one priority for the 1980's.

The National Council of Supervisors of Mathematics (cited in Reys, Suydam, & Linquist, 1984) also reacted to the "back-to-basics" movement by voicing its concerns about overemphasis on computational skills. It stated that students should be learning meaningful mathematical skills such as applying mathematics to everyday situations, estimating, predicting, organizing data, and problem-solving. In 1980, this Council urged schools to expand curricula to include more than facts and skills; it stated, "true problem-solving power requires a wide repertoire of knowledge, not only of particular skills and concepts but also of the relationship among them and the fundamental principles that unify them" (p. 22).

More recently, the Mathematics and Sciences Board drew attention to another negative aspect of elementary
In its report (cited in Bennett, 1986) it blamed current mathematics problems on "... a lack of emphasis on mastery: children are presented the same material several times during their elementary years, instead of getting it conclusively and moving on" (p. 26).

So, although standardized achievement scores in elementary mathematics have not been declining, the literature indicates that elementary-school programs are contributing to the decline of mathematical achievement in the upper grades. By concentrating on computation rather than comprehension, teachers are able to maintain students' achievement scores in the elementary grades, but this type of instruction is failing to give elementary students the foundations they need for success in their future mathematics.

Mathematics Assessment

Media stories, according to Garber and Austin (1982), have convinced the public that schools are failing today's students. Wardrop (1976) says that the public has learned through the media that students' performance is dropping, that discipline, drugs, and alcohol are out of control in the schools, and that students are graduating from high school without
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mastering the skills they need for their future. The public, he contends, is paying more and more for education through taxes and is thus demanding that teachers and schools be held accountable. Consequently, concerned parents, needing some way of judging how their children are progressing, are relying on standardized achievement test scores for their answers. They are also relying on standardized achievement tests as a means of assessing teachers and schools by comparing gains in student achievement from year to year and comparing scores among schools. Wardrop argues that if students' standardized achievement test scores indicate that they have gained another grade level each year, the parents and the general public are satisfied that the students are "on track" and that the teachers and schools are performing their duties adequately.

Thinking that the standardized achievement tests alone can provide conclusive information about any aspect of schooling is, however, a misguided and "... simplistic notion . . ." (Houts, 1975, p. 3). In School Effectiveness: A Reassessment of the Evidence (1980), Airasian and Kellaghan reason that because of their broad nature, the standardized achievement tests tend to
reflect general ability and home background rather than actual academic achievement.

According to Wardrop (1976), standardized achievement tests do have value when used wisely - for grouping pupils for instruction, planning curriculum, and tracking students' general areas of strengths and weaknesses over several years. Subkoviak and Farley (1982) state that standardized achievement tests are best used to complement teacher-made and local tests which are based on specific objectives and not to replace them.

However, there is too much reliance on standardized achievement tests as the sole means of assessment in many areas of education. Much of the literature (e.g. Airasian & Madaus, 1983; Cruikshank, Fitzgerald, & Jensen, 1980; & Dede & Freiberg, 1986) suggests there is reason for great concern that standardized achievement tests are trusted and used so widely today in areas for which they were not designed. For example, they were not designed to evaluate teacher and school effectiveness or to be the only means of assessing student achievement. Hoffmann (Jouts, 1975, p. 36) has called standardized test scores "... extremely misleading, and superficial..." and Strenio (1981),
in *The Testing Trap*, says that they have become a "... modern obsession . . ." (p. xv).

The mathematics sections of standardized achievement tests are particularly susceptible to overinterpretation. Quinto (1977), reporting to the National Conference on Testing, stated that the standardized achievement tests "... emphasize rote recall, simple facts, and routing arithmetic" (p. 104). He said that meaningful problem-solving and mathematics using higher levels of thought processes are overlooked on the tests. Schwartz (1975) argues that, despite the fact that the standardized mathematics tests are divided into sections of computation, concepts, and problem-solving, "... within this division, mediocre items probe superficial formulations of mathematical skills . . ." (p. 69) and that concepts are trivialized.

The complex areas of mathematical reasoning and problem-solving are difficult to teach, to learn, and to evaluate. Because of this, the recommendations of the National Council of Teachers of Mathematics (in Reys et al., 1984) stated that written tests alone cannot measure higher-level processes. Instead, they encourage the use of observation and interviews to determine how students attack problems and how they arrive at answers.
Observation and interviews are also recommended by other researchers (e.g., Cruikshank et al., 1980; Riedesel, 1980) as two of the most valuable techniques of mathematics assessment.

Several researchers are trying to devise tests based on tasks that can help measure students' understanding of concepts (Rosskopf, 1975). In this task-oriented research, students are assigned tasks while researchers look for consistent patterns in the approaches the students use to perform them. The repeated use of particular methods by children reveal how their ideas are organized and thus how well they understand and can make use of a concept. Rosskopf explains that researchers such as these are adding to the body of knowledge on mathematical concept development and the testing of mathematical concepts, but there are many questions in this field that are still unanswered. He argues that both concept development and the testing of concepts are enormously complicated procedures.

Yet, Harkness (1986) laments that even with such efforts, "many schools still cling to the bizarre assumption that . . . the quick and dirty testing of isolated skills and little bits of isolated knowledge
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actually measures learning" (p. 6). Similarly, Newman (1985) comments that " . . . in the face of complexity, what can be measured will be measured and that in time, what is measured becomes normative" (p. 106).

Mathematics Concept Development

Concept development and problem-solving, according to Reys et al. (1984), are the most important skills in mathematics. Mathematics, they argue, is more than just the arithmetical computation many people believe it to be. Instead, they describe it as a study of patterns and relationships, a way of thinking, an art, a language, and a tool. Children need to be instructed in the orderliness and consistency of mathematics, not confused by disconnected skills and facts.

In addition, to be meaningful, elementary-school mathematics lessons must include many "hands-on" experiences and "real-world" applications. Children cannot learn mathematics through lectures, drills, and practice alone. Instead, these authors describe the importance of "building bridges." Bridges, they say, are needed to link classroom mathematics instruction to the real world, to link models with symbols and concepts, and to link different concepts together. The
development of these bridges is essential for meaningful learning and retention in mathematics.

To build creative problem-solving skills, they suggest that students need to be given challenging problems in which the strategies for solving them are not always obvious. Crucial to this procedure is giving students enough time to focus on the problem, to think it through, and to analyze relationships within the problem. For students to attempt this high-level thinking, they need encouragement and an unhurried atmosphere. True problem-solving, once developed in this manner, is retained longer than factual knowledge which can be memorized quickly and then forgotten just as quickly. Because of the cumulative nature of mathematics, retention is of the utmost importance, and this retention is dependent upon meaningful learning.

According to Lesh and Landau (1983), researchers in the field of mathematics education are working on ways to improve the sequence and transitional steps involved in mathematics instruction. Studies are being conducted which attempt to trace the development of concepts in order to learn how primitive concepts are formed and what factors influence their development into mature understandings.
Carpenter and Moser (in Lesh & Landau, 1983) explain that concepts develop over time and that concrete solution processes are eventually replaced by abstract processes. But, time must be devoted to concrete handling and manipulating of objects for the primitive concepts to develop. Abstraction should not be forced too early. After primitive concepts have been formed and replaced by abstract processes, higher levels of solution processes are developed by increasing the level of abstraction and increasing the choices of strategies. Eventually, a level of abstraction is reached where the process has become internalized and the child no longer needs to manipulate objects to understand and solve the problem.

As students climb from one concept to another, Karplus, Pulos, and Stage (in Lesh & Landau, 1983) emphasize the importance of following a well-defined instructional sequence and using manipulative aids. These, they argue, are the key to a more effective mathematics program. In another study, Jurascheck (1983) found that even junior-high students stood a better chance of understanding their mathematics lessons if manipulative materials were used. But, too often, he
found that junior-high classes consist entirely of lecture and seatwork.

Copeland (1984) discusses different levels of "knowing" in mathematics. "Knowing how to" is not the same as "knowing," he contends. Knowing how to solve a mathematical problem involves mechanical steps that have been memorized; it is based on recall. Knowing is more complicated; it is the understanding of why the steps were performed. It is based on conceptualization, abstraction, and assimilation. Teachers, he feels, must teach for understanding, not just for technical skill.

In a recent report, Romberg (1984) describes mathematics instruction today as a routine of correcting yesterday's homework, assigning new work, and starting tomorrow's homework. Concepts and skills are taught in a "piece-meal" fashion, "... divorced ... from reality and inquiry. Essential characteristics of mathematics such as abstracting, inventing, proving, and applying are often lost" (p. 15). His report urges that in the future, mathematics teachers use more concrete materials in their instruction, that they prepare lessons more carefully, and that more time be spent in class developing concepts and working on problem-solving.
Effects of Standardized Achievement Tests

The one negative effect of standardized achievement tests that is repeated throughout the literature (e.g., Airasian & Madaus, 1983; Brady, 1977; Soar, Medley, & Coker, 1983) is the narrowing of the curriculum to what will be on the test. Airasian and Madaus (1983) blame this effect on the sanctions and rewards connected with test scores. In their opinion, if teachers feel that their careers are going to be affected by standardized achievement test scores, they will do whatever is necessary to insure adequate score increases within their classes.

Teachers can restrict or narrow the curriculum by avoiding difficult concepts and instead focusing lessons on knowledge and skills that are easy for students to learn and that are likely to be on the standardized achievement test. As stated by Soar et al. (1983), "... if teacher evaluation is based on standardized achievement tests and if teachers' futures depend on how well their students score on these tests, it seems inevitable that the simpler objectives will be taught at the expense of the more complex ones" (p. 243).

Some other counterproductive tactics teachers can use to raise test scores are discussed by Kennedy
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(1985). During the test teachers can read items very slowly, hint at answers by altering the tone of their voices, repeat questions, help individuals by giving verbal or nonverbal signs of approval or disapproval, and help the class by giving lengthy explanations. In addition, teachers can alter their schedules in the weeks before the test by stopping regular lessons and using instructional time to drill and coach specific test material.

There are still other methods teachers can use to raise standardized achievement test scores. For instance, instructional time may be used to coach students on test-taking skills (Steelman & Powell, 1985); excessive time during the year may be spent on skill sheets with problems parallel to those on the actual test (Perrone, 1975); and the curriculum may be accelerated (Leinwand, 1985), resulting in the introduction of skills and concepts to students before they are cognitively prepared to deal with them.

Leinwand (1985) addresses the problem of curriculum acceleration in a publication designed for teachers, which suggests the importance of this topic to them. He claims that there is pressure on teachers to move quickly through the mathematics curriculum in order to
cover all testable skills before the standardized achievement test is given. Consequently isolated skills are introduced without linking them to concepts, and concepts are introduced without linking them to previously learned concepts and without the aid of concrete manipulatives. When lessons are approached this way, students come to believe that mathematics is a set of meaningless rules. He warns that they can become frustrated, anxious, and angry if they are asked to use a concept in an abstract form before the concept has been internalized. To quote Maier (1985), "For many, school mathematics is, as Churchill put it, an 'Alice in Wonderland World' - at its worst, strange and fearful, at its best, nonsensical and bewildering" (p. 38).

To the credit of some teachers, Kennedy (1985) notes that after the standardized achievement tests have been given, there can be an effort to spend whatever time is left on weaving the skills and knowledge touched on during the previous months into patterns, and hopefully, concepts. Other teachers, though, feeling that they have already covered the material for the year, do not teach after the test.

Parents, leaders in education, and administrators have hoped that, through accountability systems such as
standardized testing, teachers would be motivated to improve their teaching techniques and that the general quality of education would improve. Instead, the pressures associated with this "... unidimensional view of school effectiveness ..." (Dede & Freiberg, 1986, p. 78) are preventing good teaching in our schools by encouraging teachers to "train" students rather than truly educate them (Dede & Freiberg, 1986) and by forcing them to resort to unprofessional techniques in order to raise test scores.

Summary

Mathematics achievement at higher levels of schooling has been declining over the past several years and consequently the government, the public, school administrators, researchers in mathematics education, and teachers are all reacting. The government is reacting by urging educators to raise their standards, by monitoring progress through standardized achievement tests, and by publishing test results. The concerned public, feeling that schools and teachers should be held accountable and misguidedly equating higher standards with higher standardized test scores, is reacting by judging schools and teachers through the results of these tests. Researchers are reacting by working to
discover exactly how children learn mathematics and by developing new and better teaching and evaluating techniques.

Teachers have been made aware by researchers of proper teaching techniques, the importance of careful concept development, and the critical issue of problem-solving. But, dealing on a daily basis with the pressures of the administration and the public, they usually succumb to the pressures and concentrate their efforts on building the skills necessary for raising test scores. Thus, research is ignored and high educational standards which could lead to success in upper levels of mathematics by our youth are compromised in order to satisfy the more immediate demand placed upon teachers--to "raise the scores."
A survey will be conducted to assess elementary-school teachers' perceptions of the effects of standardized achievement tests on their mathematics programs. The survey will be in the form of a limited response questionnaire consisting mainly of yes-no questions. It will be administered to first, third, and fifth-grade classroom teachers in public schools throughout Clay County, Florida. The major annual standardized achievement test used in these schools is the Stanford Achievement Test which is typically given in the spring.

According to the Clay County Chamber of Commerce (1985-1986), "Clay is one of the fastest growing counties of its size in the nation. Its population has grown from 32,000 in 1970 to more than 79,000 in 1985" (p.20).

Orange Park, the suburban town adjacent to Jacksonville, is the largest town in the county, with a population of 44,000 as of 1985. Many Orange Park residents commute daily to businesses in downtown Jacksonville. Approximately 22% of its population is affiliated with one of the two nearby air bases. Most
of the Navy personnel residing in Orange Park are from the senior ranks of the military. Other population centers in Clay County are Green Cove Springs, which is the County Seat and agricultural center, and Middleburg, which is a rural residential area.

Because of its diverse socio-economic population, Clay County seems to be an appropriate setting for this survey. Out of the 13 public elementary schools throughout the county, care will be taken to include schools serving various socio-economic groups in both rural and suburban settings.

Teachers in grades one, three and five will be surveyed in order to sample teachers' perceptions at various elementary levels. By involving a wide spectrum of schools and teachers at various levels, it is expected that generalizations concerning teachers' perceptions about standardized testing can be made.
Chapter Four

Results

The purpose of this survey was to assess elementary-school teachers' perceptions of how the major annual standardized achievement test influences their mathematics programs. Surveys were distributed to 100 first, third, and fifth grade teachers throughout Clay County. Eighty-six were completed and returned. Of the 86 participating teachers, 12 are teaching above-average mathematics classes, 20 are teaching average classes, 11 are teaching basic classes, and 43 are teaching non-leveled mathematics classes. All questions on the survey referred to the standardized achievement test given in the spring.

As Table 1 indicates, 88% of the teachers stated that they try to cover all areas of the mathematics curriculum that will be on the standardized achievement test by the time the test is given. However, 64% said they do not feel there is enough time prior to the test for students to master the new skills.

Fifty-nine percent of the teachers do not feel that preparation for the test allows them to set a comfortable pace for their mathematics classes. Sixty-six percent said that preparation for the test does not
allow sufficient time for concept development in new skill areas.

In response to questions five and six, which relate to "hands-on" activities, 92% of the teachers said they believe that "hand-on" activities in mathematics are important in their grade levels. However, 80% feel that preparation for the test does not allow sufficient time for "hands-on" activities.

Ninety-eight percent of the participants stated that it is sometimes necessary for them to introduce new skills and concepts out of sequence in order to prepare students for the test. Furthermore, 79% said that preparation for the test does not allow sufficient time for application (word) problems in each skill area.

In response to question nine (see Table 2 and Figure 1), 56% of the teachers said that preparation for the test, overall, has a negative effect on their mathematics programs, 24% said that it has a positive effect, and 20% said it has no effect. Figure 2 illustrates how teachers of different levels feel about the overall effect of preparation for the standardized achievement test. For example, the highest percentage of teachers who feel an overall negative effect are the teachers of basic classes (82%), followed by non-
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leveled (60%), then average (50%), and finally above- 
average (25%).

In addition to filling out the surveys, many 
teachers wrote additional comments. Six teachers 
commented that they thought the test should be given 
closer to the end of the school year. For additional 
comments please refer to Appendix B.

There were no discernible patterns in the responses 
to the questions in conjunction with number of years 
teaching experience or current grade level being taught.
Table 1
Teachers' answers to survey questions one through eight.

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<th>Average</th>
<th>Above Average</th>
<th>Total Percent</th>
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<tr>
<td>1. try to cover all areas of math curriculum that will be on test, by testing time</td>
<td>yes 38</td>
<td>9</td>
<td>18</td>
<td>11</td>
<td>88%</td>
</tr>
<tr>
<td></td>
<td>no 5</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>12%</td>
</tr>
<tr>
<td>2. there is enough time prior to test for students to master new skills</td>
<td>yes 13</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>no 30</td>
<td>9</td>
<td>15</td>
<td>5</td>
<td>64%</td>
</tr>
<tr>
<td>3. preparation for test allows for a comfortable pace in math class</td>
<td>yes 12</td>
<td>0</td>
<td>8</td>
<td>8</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>no 31</td>
<td>11</td>
<td>11</td>
<td>4</td>
<td>59%</td>
</tr>
<tr>
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<td>n/a 1</td>
<td></td>
<td></td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>4. preparation for test allows sufficient time for concept development</td>
<td>yes 12</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>34%</td>
</tr>
<tr>
<td></td>
<td>no 31</td>
<td>10</td>
<td>17</td>
<td>6</td>
<td>66%</td>
</tr>
<tr>
<td>5. &quot;hands-on&quot; activities are important at your grade level</td>
<td>yes 40</td>
<td>10</td>
<td>19</td>
<td>10</td>
<td>92%</td>
</tr>
<tr>
<td></td>
<td>no 2</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>6. preparation for test allows sufficient time for &quot;hands-on&quot; activities</td>
<td>yes 8</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td>no 35</td>
<td>8</td>
<td>19</td>
<td>7</td>
<td>80%</td>
</tr>
<tr>
<td></td>
<td>n/a 1</td>
<td></td>
<td></td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>7. must sometimes introduce new concepts or skills out of sequence to prepare students for tests</td>
<td>yes 42</td>
<td>11</td>
<td>20</td>
<td>11</td>
<td>98%</td>
</tr>
<tr>
<td></td>
<td>no 1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>8. preparation for test allows sufficient time for application problems</td>
<td>yes 7</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>no 36</td>
<td>8</td>
<td>16</td>
<td>8</td>
<td>79%</td>
</tr>
</tbody>
</table>
Table 2

Answers to question nine by teachers of different levels

Question Nine: Overall, what effect does preparation for the standardized achievement test have on your math program?
a. a positive effect  b. a negative effect  c. no effect

<table>
<thead>
<tr>
<th></th>
<th>positive effect</th>
<th>negative effect</th>
<th>no effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>not leveled</td>
<td>11</td>
<td>26</td>
<td>6</td>
</tr>
<tr>
<td>basic</td>
<td>1</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>average</td>
<td>4</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>above average</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Totals</td>
<td>21 (24%)</td>
<td>48 (56%)</td>
<td>17 (20%)</td>
</tr>
</tbody>
</table>

Figure 1.
Total percentages of teachers' answers to question nine

[Diagram showing the percentages: 20% no effect, 56% negative effect, 24% positive effect]
Figure 2.
Teachers' perceptions of the overall effect of the standardized achievement test on their mathematics programs

Teachers of above average classes
- 25% negative effect
- 42% positive effect
- 33% no effect

Teachers of average classes
- 20% positive effect
- 50% negative effect
- 30% no effect

Teachers of basic classes
- 9% positive effect
- 9% no effect
- 82% negative effect

Teachers of non-leveled classes
- 14% no effect
- 25% positive effect
- 60% negative effect
As reported in the results, 86 surveys out of 100 were returned. This large number of volunteer participants suggests that the topic is of importance to teachers.

Although the vast majority of teachers (88%) stated that they try to cover all areas of the mathematics curriculum that will be on the standardized achievement test before the test is given, 59% said that they must set an uncomfortable pace in order to do so. In other words, the majority of teachers feel they must rush through their curriculum in order to prepare students for the test.

Rushing through the mathematics curriculum may satisfy the goal of raising standardized achievement test scores, but as the majority of teachers reported, it can have an overall negative impact on the mathematics program. For most teachers, it leaves insufficient time for "hands-on" activities, application problems, the mastery of new skills, and concept development. As one teacher commented, "We end up pushing the material down the students' throats."
Insufficient time for concept development is a serious problem. Concept development is the basis of real learning, for without it students are only memorizing isolated facts and skills. Without the proper conceptual structure in which to seat these facts and skills, they can quickly fade from memory.

Future mathematics achievement cannot be built upon isolated facts and skills. Success in future mathematics is dependent upon strong conceptual foundations. Since the majority of teachers feel there is not enough time for concept development, it is questionable whether solid foundations in mathematics are being formed by many elementary-school students.

Analysis of the data indicates that the lower the level taught, the higher the percentage of teachers who feel preparation for the test has a negative effect on their mathematics programs. Nearly all the teachers of basic classes agreed, that although they try to cover all the material by testing time, the students do not have enough time to master the new skills. They also agreed that the pace they must set is uncomfortable and that they do not have enough time for concept development. Yet, students taking basic classes probably need more time to understand and conceptualize
new material. They also need more time for drill and practice and "hands-on" activities. They, most likely, are the group that suffers the most from the policy of pacing the lessons to accommodate the test.

Further analysis shows that, following teachers of low level groups, teachers of non-leveled groups are the next group most likely to feel an overall negative effect. This is likely due to the fact that, in non-leveled classes, teachers must accommodate students at all learning levels—from basic through above-average.

The data on teachers of average classes are also significant. For example, 17 out of 20 stated that preparation for the test does not allow sufficient time for concept development, 16 out of 20 feel there is not enough time for application problems, and all 20 agreed that they must introduce some new concepts and skills out of sequence.

In higher level classes, the students can usually grasp new material more quickly, thus they naturally move through the curriculum at a faster pace. This may explain why a majority of teachers of the above-average classes feel their students can master new skills by testing time, working at a comfortable pace. However, half of these teachers admitted that preparation for the
test does not allow sufficient time for concept development in those new skill areas. Therefore, some of the above-average students may be quickly picking up new skills without the proper conceptual background.

A majority of these teachers of above-average classes stated that there is not enough time for application problems or "hands-on" activities and that at times they must introduce new skills and concepts out of sequence. Introducing new skills and concepts out of sequence can sometimes mean introducing difficult skills and concepts before the students are ready for them. As one teacher commented, "Skills are introduced just for the test that should not be introduced yet!"

At all levels, teachers reported that preparation for the test does not allow sufficient time for application problems. Yet, it is through application problems that students are given the chance to put new skills and knowledge to practical use. This is the area of mathematics that can bring meaning to the discipline. It is for application purposes that we learn mathematics. If this area of the program is neglected and students do not learn to use their skills, mathematics may become meaningless to them.
One can clearly conclude from the data that the emphasis placed on preparing students for the standardized achievement test can have a negative effect on math instruction in the average and basic levels. What is not as obvious, but can be detected after careful analysis of the data, is that there are also harmful effects in the above-average classes. Teachers of all levels feel the lack of time for the crucial processes of concept development and problem-solving.

One might also conclude that teachers and students are in a stressful and frustrating situation. For the teachers, frustration can come from feeling that they must compromise their standards in order to prepare students for the test. For the students, frustration can come from being forced to rush through material without understanding it or having time to apply it.

On the other hand, a minority of teachers (10 out of 86) said that they do not try to cover all the material by testing time. One of these teachers said that the pace is set according to the students' ability to grasp the concepts. However, this teacher also stated that, "I do not set the pace faster, but, do worry about judgement of my performance because of the student scores." This comment illustrates the pressure
some teachers feel to raise the scores, and the dilemma in which it places them.

In other comments, several teachers suggested that the test be given at the end of the school year. This would allow teachers to pace lessons over the entire year and might allow for fuller concept development and application in each skill area.

Another suggestion was to give the test at the beginning of each school year. This would alleviate the problem of pacing for the test. It would also give a more accurate reading of what students really learned, not just temporarily memorized. For the facts and skills that were not conceptualized during the previous year would fade from memory during the summer.

To conclude, the teachers' perceptions developed from this survey substantially support the initial premise of this study. Instead of being determined by sound guidelines and the amount of time students need to conceptualize the material, the sequencing, pace, and presentation of many elementary-school mathematics programs may be determined by when the standardized achievement test is given.
Dear Fellow Teacher,

I need your help. I am asking you to please take five minutes to fill out this short survey which will be used to complete my Master's Degree at the University of North Florida.

There has been a lot of publicity about standardized achievement tests. For my study I want to find out how you, as an elementary school teacher, feel about the effects of standardized achievement tests on your mathematics program.

If you are interested in the results of this survey, a copy will be available for you to review at your school in May.

Thank you very much for your help.

Sincerely,
Pat Jurgens

General Information: Please circle answers.

Number of years teaching: 1-3 4-6 7-10 over 10 years
Grade now teaching: first third fifth
Is math leveled in your grade? yes no
If yes, which level do you generally teach? above average average basic

Note: Questions refer to the standardized achievement test given in the spring. Please circle your response to each question.

1. Do you try to cover all areas of the math curriculum that will be on the test, by testing time? 
   Yes ... No

2. Do you feel there is enough time prior to the test for students to master new skills? 
   Yes ... No

3. Does preparation for the test allow you to set a comfortable pace for your math class? 
   Yes ... No

4. Does preparation for the test allow sufficient time for concept development in new skill areas? 
   Yes ... No

5. Do you believe that "hands-on" activities in math are important at your grade level? 
   Yes ... No

6. Does preparation for the test allow your students sufficient time for "hands-on" activities? 
   Yes ... No

7. Is it sometimes necessary for you to introduce new concepts or skills out of sequence in order to prepare students for the test? 
   Yes ... No

8. Does preparation for the test allow sufficient time for application (word) problems in each skill area? 
   Yes ... No

9. Overall, what effect does preparation for the standardized achievement test have on your math program? (Circle a, b, or c below)
   a. a positive effect   b. a negative effect   c. no effect

Additional comments are welcome in the space below.
Appendix B

Comments of Teachers

- "Test is given months before school lets out. Our text is designed to be used throughout the whole year. We end up pushing the material down the students' throats."

- "I do not set my pace in math according to the SAT. In dealing with a basic group you move at the pace the children set, by their ability to grasp concepts. I feel the attitude by the administration to perform well on these tests causes a negative effect, due to the pressure to rush through concepts, rather than teach for mastery. That pressure causes many to set a pace too quick for basic students. I do not set the pace faster, but do worry about judgement of my performance because of student scores."

- "Because I teach the 'above average' math class - I feel my students are prepared by spring to take the standardized test without much review."

- "I would love to see the test dates moved to a later date to allow time to cover the skills. Scores could be mailed out over the summer even. Another alternative might be to give them early in the year covering the previous year's skills."

- "These answers are based on the fact that I do teach top level. We are paced to complete our books prior to May. All answers could possibly change - some definitely would - if I were teaching lower level."

- "In first grade, it is extremely difficult for my students to master all the concepts presented on SAT by March (when the test is given in Clay Co.). They would be better prepared and less hurried if SAT were given in May."

- "Skills are introduced just for the test that should not be introduced yet!"
"Only negative in that I try to cover material that will be on the test quickly (have not covered it yet in the book) - those who can get it for the test great - those that can't I'll go over it again when we normally cover it."

"It would be better if the SAT was given later in the school year."

"I would rather not feel pressured to speed through the skills just to be ready for test instead of allowing class to pace themselves!"

"I don't prepare my class exclusively for the stand. tests they are given. I feel it is my reponsibility to prepare them to use the skills every day and use them effectively. I don't feel their ultimate goal is a test. I pace my class for 180 days not until the test in the spring."

"Trying to prepare 'basic' students for testing often causes the students to become confused. They need so much time for drill and practice that trying to cover all material is impossible. They are often poor readers also, so there is little time for application."

"Achievement tests should be given only at the end of a school year. Minimal skills achievement tests should also be given at the end of second and fourth rather than the beginning of third and fifth grades."

"Unfortunately, pretest cramming does not reflect what the student actually knows - only what he happens to remember at test time. Much of the "crammed" knowledge is quickly forgotten. It is a shame that the schools have become so competitive to be the top achievers that we have to resort to "cramming" rather than actually measure what the child knows. I'm not against reviewing, only the presentation of new information before hands-on activities or exercises can reinforce the concepts."
"I teach the highest math group out of all 1st grade students. I am able to cover most material prior to the test without any changes in sequence. I don't believe that the preparation for standardized testing affects my teaching style because of the group I work with."

"Having taught both above average and below average in first grade, I feel the testing is done too early in the year for successful completion. We could go back after teaching, but the children do not respond well to this."
References


