

# Macmillan/McGraw-Hill

## Science: A Closer Look 2008

The Macmillan/ McGraw-Hill Company is a leader in the educational community known for its development of successful classroom materials based upon a solid foundation of research. The development of Macmillan/McGraw-Hill's *Science: A Closer Look* continues in that strong tradition. For any science program to be effective, it must provide a consistent instructional format and design that creates a firm foundation upon which student success is built. Macmillan/McGraw-Hill's *Science: A Closer Look* program was developed following that model based upon current educational research.

Macmillan/McGraw-Hill's *Science: A Closer Look* program is an elementary science program written to meet the demands and expectations of the National Science Education Standards and address the Benchmarks for Science Literacy. If students are to succeed on their local and state science assessments, they must be prepared in both the content being assessed and in the format of the assessment. By identifying the key benchmarks and developing specific lessons to meet those expectations, Macmillan/McGraw-Hill's *Science: A Closer Look* can insure content coverage and student success.

This document summarizes our research efforts and is divided into four parts:

1. A bibliography of the research that was reviewed and studied and which provided the foundation for our instructional pedagogy and lesson structure.
2. A summary of our field study data conducted on the prior Macmillan Science series which provided a basis in the development of *Science: A Closer Look*. This verification data supports the instructional methodology and program design.
3. A review of results of the long term implementation studies on how the Macmillan/McGraw-Hill and its support of staff development initiatives translated into teacher and student success as measured by public release of state test data in the St. Louis Public Schools.
4. A review of State Test Score Results from Districts using Macmillan/ McGraw-Hill Science. This program's effectiveness provided the foundation for the design of *Science: A Closer Look*

# Part I

## Bibliography of Research Sources

*The following citations were reviewed by our author and editors as part of the development of Macmillan/McGraw-Hill's **Science: A Closer Look**. The academic studies, educational research reports, and professional articles listed below helped to inform and guide the development process. These studies form the underpinnings of our instructional methodology and learning pedagogy.*

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## Part II.

# Executive Summary Research and Field Study Results

*The following section provides a summary of the field test site results that were gathered as part of the validation on the effectiveness of the instructional model utilized in **Science: A Closer Look**. These studies were conducted by an independent educational research firm and the results were provided to Macmillan/McGraw-Hill publishing.*

## Field Studies:

### Background

The field studies measured the effectiveness of the instructional model used in an elementary science program published by the McGraw-Hill School Division.

Teachers who participated in this study administered grade appropriate chapter pre tests prior to teaching chapters from *Macmillan/McGraw-Hill Science*. Post-tests were administered after using the materials in an effort to assess student progress. The results of these tests are included in this report.

Throughout this report, the primary measure of student performance is the "Gap Reduction Percentages" or "GRPs". GRP reflects the degree to which students have succeeded in closing the gap between the average pre-test score and a perfect score, as reflected by the post-test. Specifically, GRPs are calculated using the following formula:

$$\text{GRP} = \frac{\text{Average post-test score} - \text{Average pre-test score}}{\text{Perfect score} - \text{Average pre-test score}}$$

### **100% - Average pre-test score**

A GRP of 0% means that student performance did not improve from pre-test to post-test. A GRP of 50% means that students have closed half the gap between the average pre-test score and a perfect score. For example, an average pre-test score of 50% that is followed by an average post-test score of 75% yields a GRP of 50%; in other words, the gap between the average pre-test score and a perfect score closed by half. Of course, a GRP of 100% means that the gap between the average pre-test score and a perfect score has been eliminated.

The GRP was formulated to measure performance because percentages change, a more typical measure, is unduly influenced by a pre-test score. For example, a post-test score of 90% yields a percentage change of only 12 percent if the pre-test score was 80. By contrast, a post-test score of 40% yields a percentage change of 33% if the pre-test score was 30%. In these examples, a ten percentage point increase yields a very different and potentially misleading percentage change figures. The GRP attempts to eliminate this variability which occurs because of high pre-test scores minimize the possibility of significant percentage changes, while low pre-test scores all but ensure them.

Consider another example, average pre- and post- test scores of 20% and 80%, respectively, yield a percentage change of 300 percent and a GRP of 75 percent. Average pre- and post-test scores of 60% and 90% respectively, yield a much lower percentage change of 50 percent, but the same GRP of 75 percent. The latter is true because in both cases, the gap between average pre-test score and a perfect score closed by three-quarters.

#### **Results:**

In total, 2,913 students completed pre- and post- test: 232 students in seven Grade 1 classrooms; 868 students in ten Grade 2 classrooms; 598 students in eight Grade 3 classrooms; 648 students in Grade 4 classrooms; 455 students in seven Grade 5 classrooms; and 112 students in two Grade 6 classrooms.

### **Field Test Parameters**

<b>Grade</b>	<b>Number of Classrooms</b>	<b>Number of Students</b>
<b>1</b>	<b>7</b>	<b>232</b>
<b>2</b>	<b>10</b>	<b>868</b>
<b>3</b>	<b>8</b>	<b>598</b>
<b>4</b>	<b>13</b>	<b>648</b>
<b>5</b>	<b>7</b>	<b>455</b>
<b>6</b>	<b>2</b>	<b>112</b>

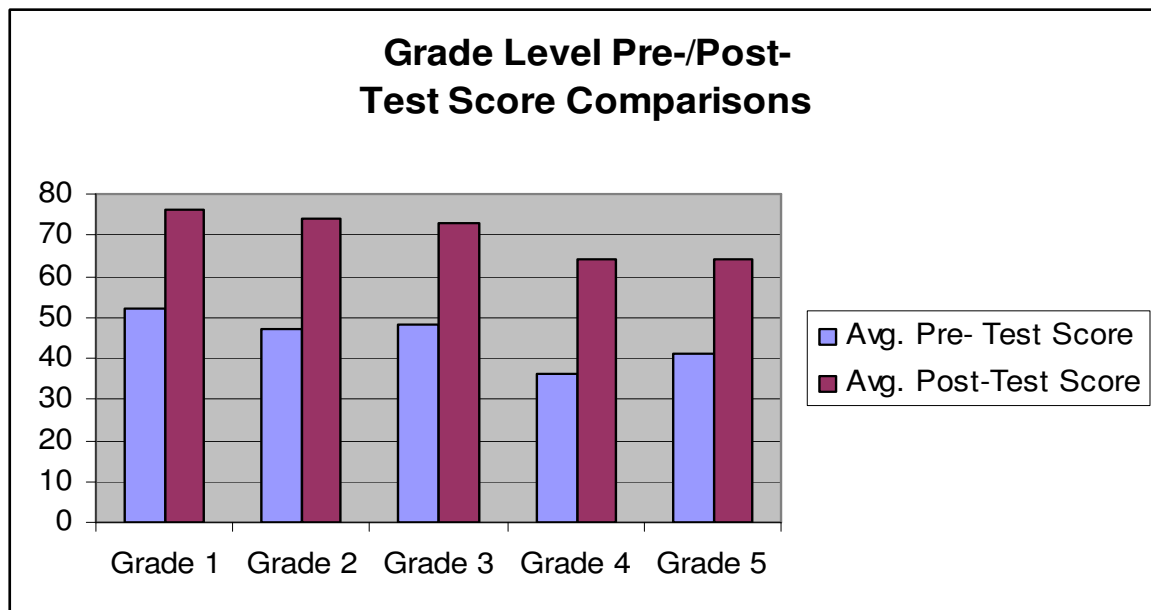
Seven public schools participated in this project: three in urban communities, two in suburban communities; and two in rural communities. The schools were located in six states: California, Georgia, Illinois, Missouri, New York, and North Carolina

Of the 2,913 students who participated, 48% were boys, 52% were girls; 26% are minorities; and 14% receive free or reduced-cost lunch.

## Top Line Results

- ◆ Research results indicate that test scores increased among students using MMH Science
- ◆ Eight out of ten students earned higher scores after using MMH Science
- ◆ Scores improved among both boys and girls
- ◆ Scores improved among minority and non-minority students
- ◆ Scores improved among students who reviewed free/reduced-cost lunch
- ◆ Overall the gap between average pre-test score and perfect score closed by 46%, or stated differently, on average, scores increased by 59% after using MMH Science.

## Test Comparisons: Grade Level Pre-/Post- Test



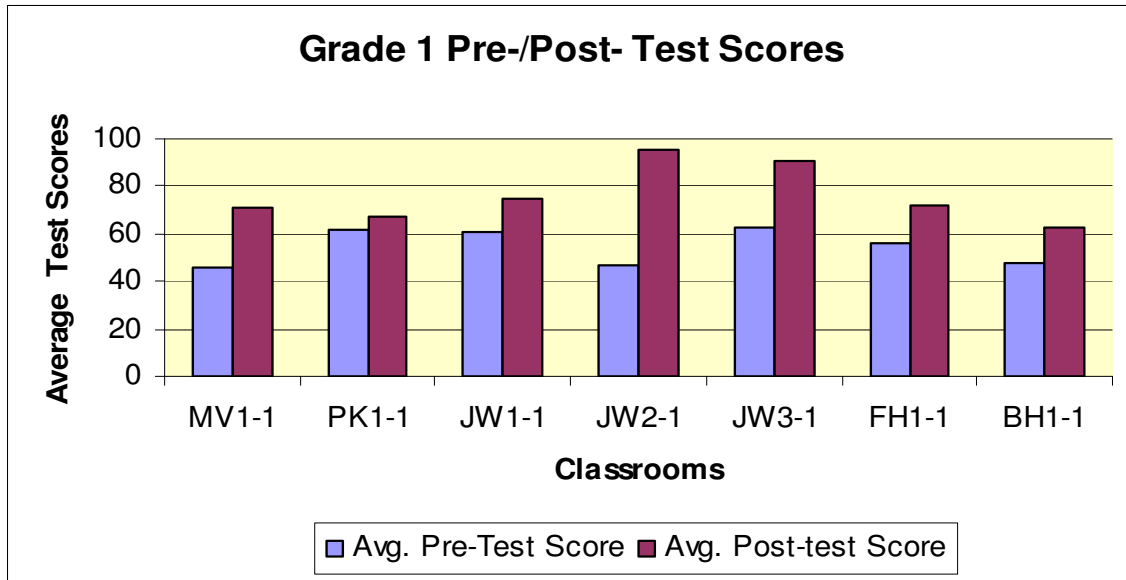
## Individual Grade Results

### Grade 1 Results

Two hundred thirty-two students in seven Grade 1 classrooms completed pre-post tests. Students were tested on Chapters 1 through 9

An analysis was performed on the pre-and post- tests scores to determine the magnitude of the gap that was closed from the pre-test to the post-test; that is, how far from a perfect score

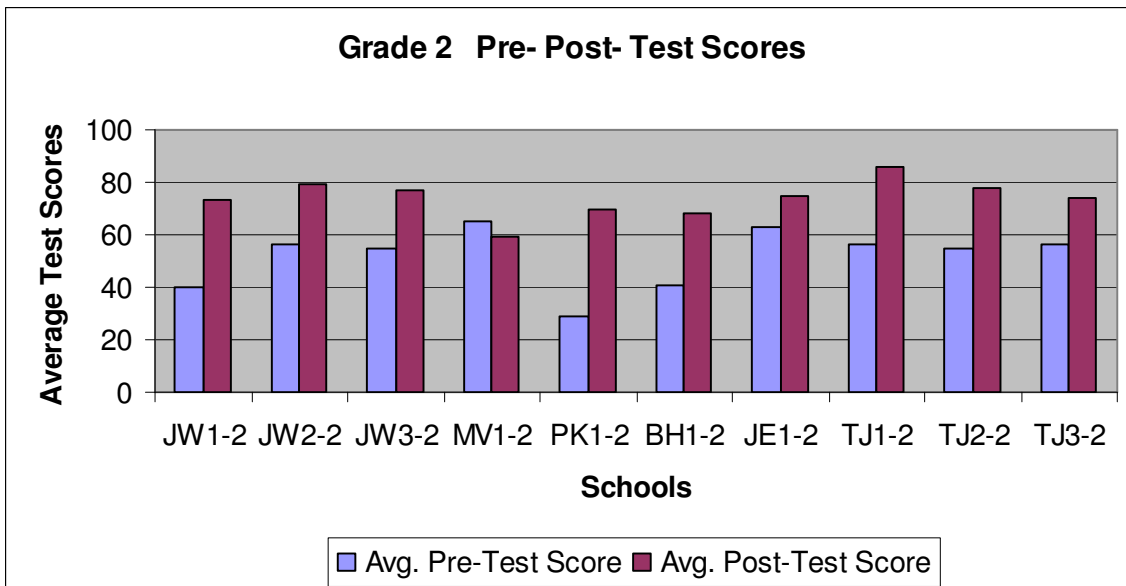
students were before instructions compared to how far they were after instruction. The results from each classroom are listed in individual tables.



## Grade 2 Results

Eight hundred sixty-eight students in ten Grade 2 classrooms completed pre-post tests. Students were tested on Chapters 1 through 12

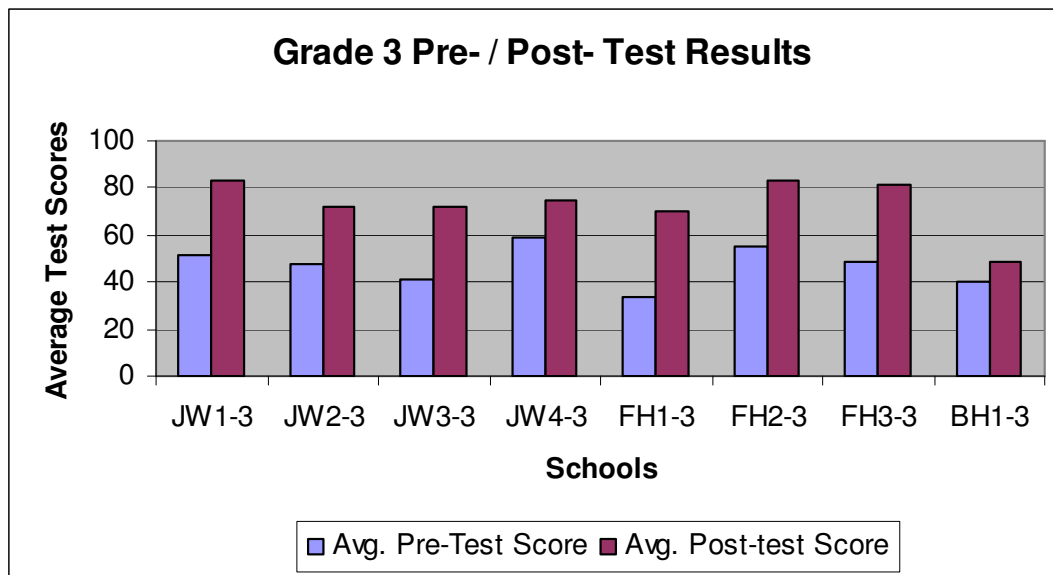
An analysis was performed on the pre-and post- tests scores to determine the magnitude of the gap that was closed from the pre-test to the post-test; that is, how far from a perfect score students were before instructions compared to how far they were after instruction. The results from each classroom are listed below. **In one class, the gap between the average pre-test score and a perfect score closed by 68 percent.**



### Grade 3 Results

Five hundred ninety-eight students in eight Grade 3 classrooms completed pre-post tests. Students were tested on Chapters 1, 2, 7 through 12 and 14.

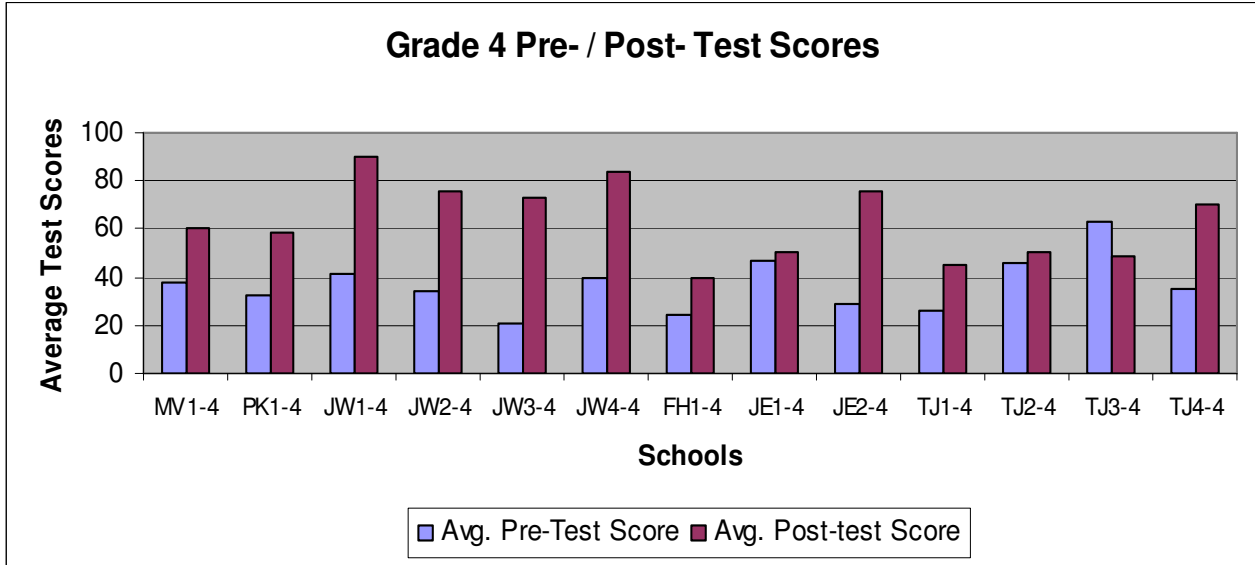
An analysis was performed on the pre-and post- tests scores to determine the magnitude of the gap that was closed from the pre-test to the post-test; that is, how far from a perfect score students were before instructions compared to how far they were after instruction. The results from each classroom are listed below. **In one class, the gap between the average pre-test score and a perfect score closed by 65 percent; in another class, the gap closed by 63 percent; and in a third class, the gap closed by 62 percent.**



### Grade 4 Results

Six hundred forty-eight students in thirteen Grade 4 classrooms completed pre-post tests. Students were tested on Chapters 1 through 9 and 14.

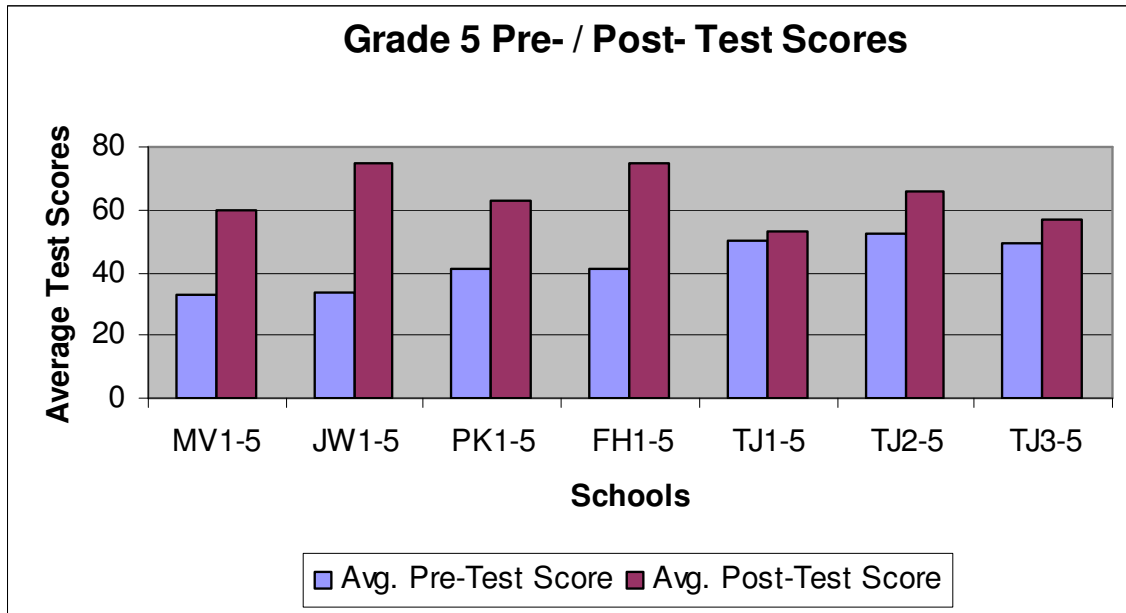
An analysis was performed on the pre-and post- tests scores to determine the magnitude of the gap that was closed from the pre-test to the post-test; that is, how far from a perfect score students were before instructions compared to how far they were after instruction. The results from each classroom are listed below. **In one class, the gap between the average pre-test score and a perfect score closed by 83 percent; in another class, the gap closed by 73 percent.**



### Grade 5 Results

Four hundred fifty-five students in seven Grade 5 classrooms completed pre-post tests. Students were tested on Chapters 2 through 4, 6, 8 through 11, and 13.

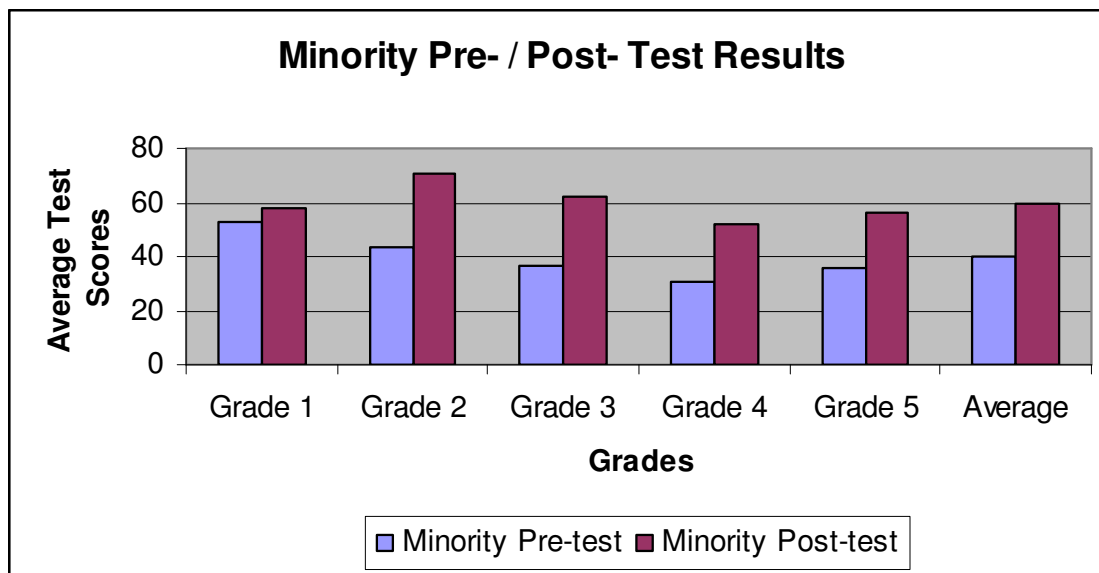
An analysis was performed on the pre-and post- tests scores to determine the magnitude of the gap that was closed from the pre-test to the post-test; that is, how far from a perfect score students were before instructions compared to how far they were after instruction. The results from each classroom are listed below. **In one class, the gap between the average pre-test score and a perfect score closed by 62 percent; in another class, the gap closed by 58 percent.**



## Demographic Results

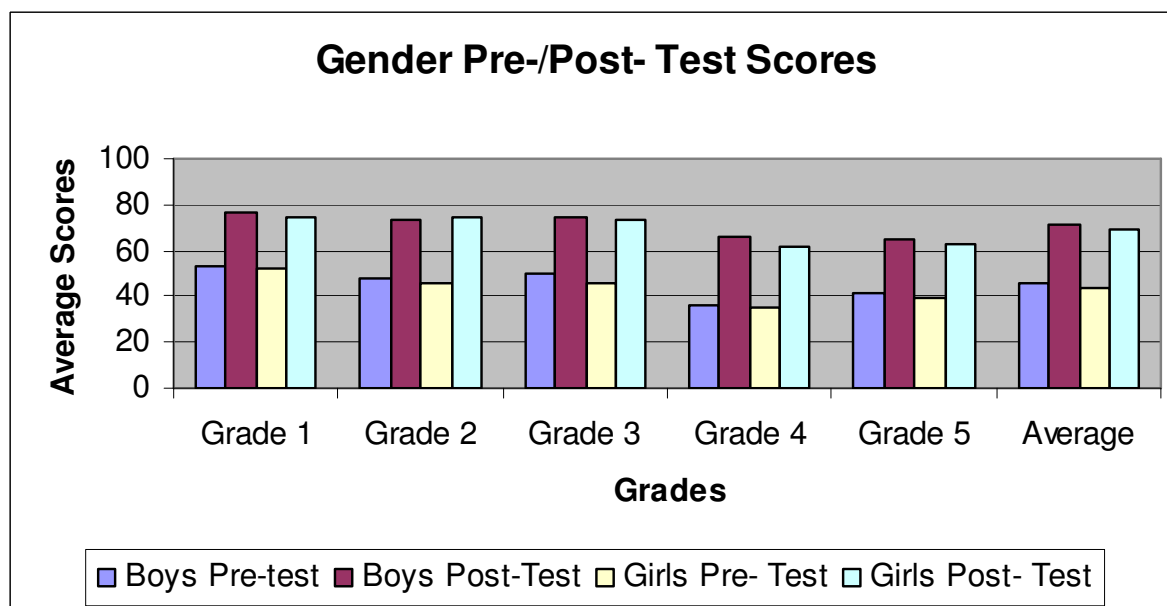
### Test Scores and Race

Improvement from pre-test to post-test for minority and non-minority students was tested. The results are listed for minority students are below.



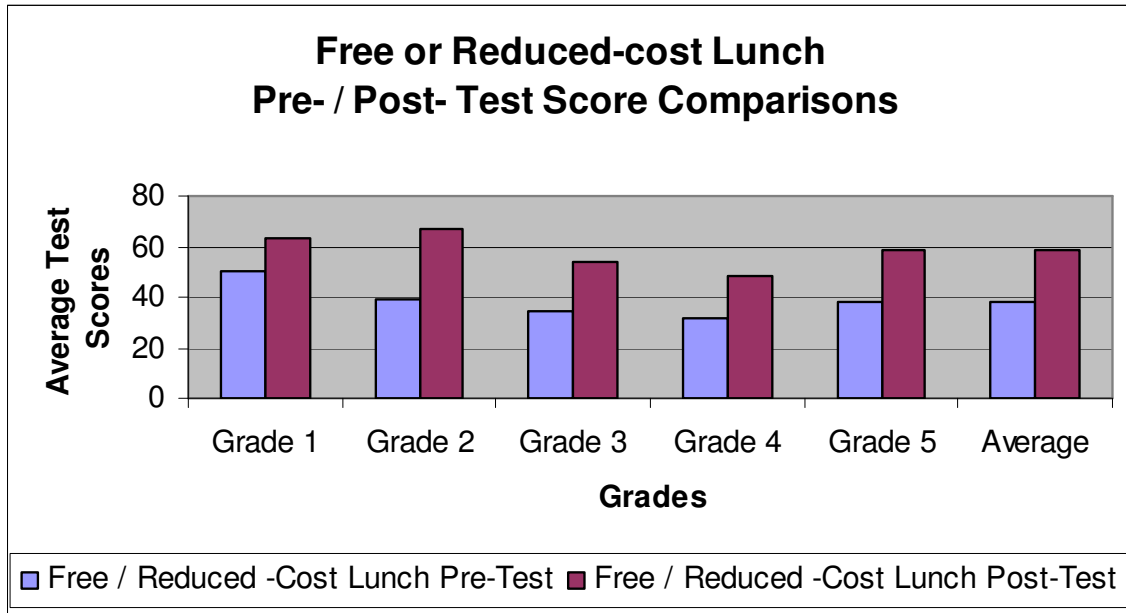
### Test Scores and Gender

Improvement from pre-test to post-test for boys and girls were tested. The results are listed for gender in Table 2.



## Test Scores and Free or Reduced-cost Lunch

Improvement from pre-test to post- test for students who received free or reduced-cost lunch was tested. The results are listed for free or reduced-cost lunch in the table below.





## Part III.

### Efficacy Studies

*The following section provides a review of an independent study conducted in the St. Louis Public School system. The results show that with the implementation of Macmillan/McGraw-Hill Science student achievement in science improved as measured by the Missouri Assessment Program (MAP). An additional benefit was noted as a result of this initial study. Student reading achievement also improved as a result of increase science instructional time. Additional supporting studies are also included.*

#### St. Louis Study

**St. Louis Public Schools  
Higher Scores on the Latest Missouri Assessment Program (MAP)  
Continue Multi-year Improvement in Elementary Schools;  
Science Shows Biggest Improvement of Any Subject**

##### Overview

The results of the latest scores on the Missouri Assessment Program (MAP) tests show that elementary students in the St. Louis Public School district continue to “catch up” to the Missouri State average in science, communication arts, and mathematics. MAP test scores\* of students in SLPS elementary schools have improved at such a fast rate over the past five years that the District will actually meet the state average in all three subjects by next year or the following year just by continuing to improve at this rate.

##### Data

Figures 1 through 3, for Communication Arts, Science and Mathematics, respectively, illustrate just how dramatic this improvement has been. In all three subjects, students in the tested elementary grades of SLPS have improved more than the state average for the past five years, with science achievement being the most improved from 2000 – 2004 followed in order by communication arts and mathematics. The degree of improvement is quantified in Figure 4. Figure 4 shows that elementary students in SLPS improved much more than their

counterparts in the rest of Missouri, and also improved much more than students in the middle and high schools of SLPS.

**Conclusions/Implications**

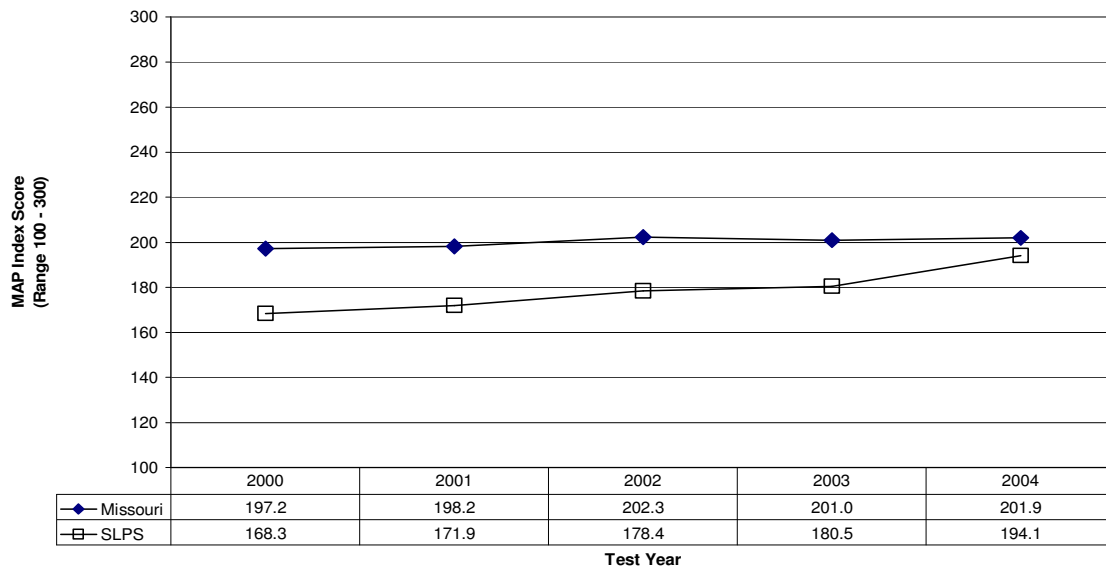
An Urban Systemic Initiative from the National Science Foundation (NSF) to improve Mathematics and Science has been in place in SLPS since 1998-9. Although intended to improve student achievement in K through 12, objective improvement has been confined almost exclusively to the elementary grades (the one exception being a small improvement in middle school mathematics). Similar patterns of improvements being limited to the elementary level have also been reported by other NSF Urban Systemic Initiative sites. These findings suggest that systemic reform of curriculum and teaching in middle and high schools may be too late to provide much help for students already lacking in prerequisite fundamental knowledge, skills and abilities that should have been acquired in previous grades. This hypothesis would be further strengthened in the coming years if the higher-achieving students now emerging from those elementary schools improved by systemic reform practices continue to achieve at higher in middle and high schools.

As indicated by Figure 4, the greatest degree of improvement was seen in elementary school science, with an improvement on MAP of 20.1% from 2000 to 2004. And most of this improvement occurred during Test Years 2002, 2003, and 2004, years that correspond to the adoption of new textual materials in science from McMillan/McGraw-Hill.

**Figure 1: Communication Arts**

**Figure 1: Communication Arts**

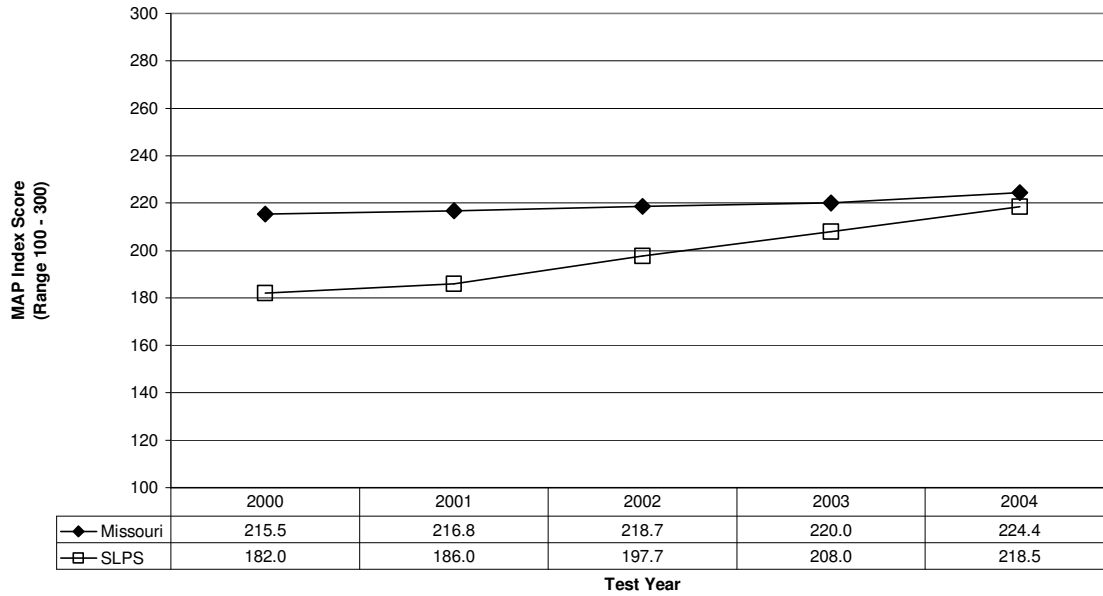
**Grade 3 Test Scores on the Missouri Assessment Program (MAP):  
St. Louis Public Schools vs. Missouri Average for Last Five Years**



**Figure 2: Science**

**Figure 2: Science**

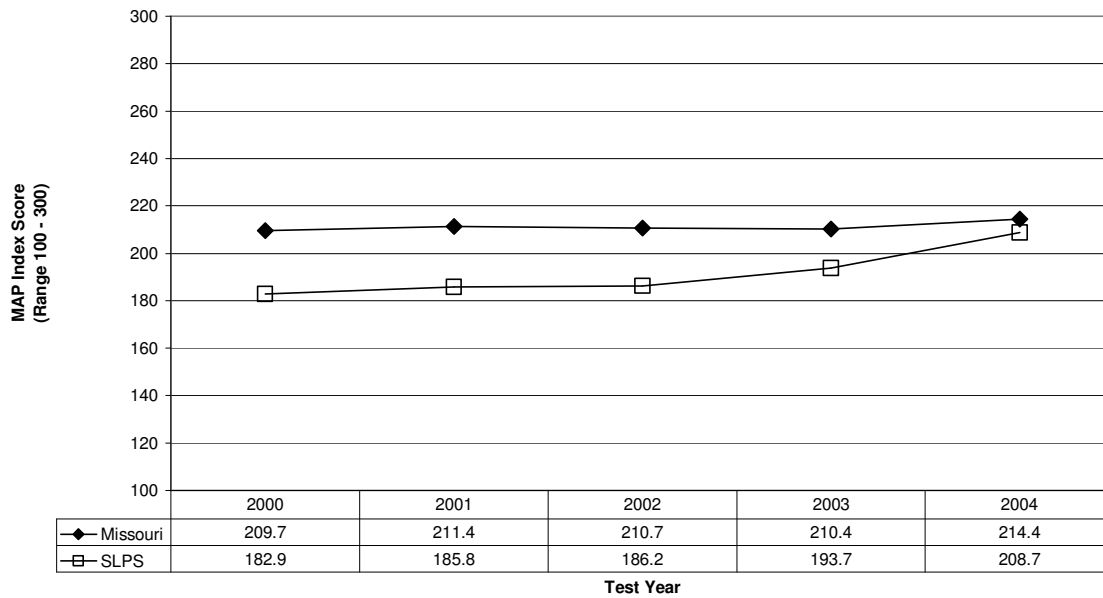
**Grade 3 Test Scores on the Missouri Assessment Program (MAP):  
St. Louis Public Schools vs. Missouri Average for Last Five Years**



**Figure 3: Mathematics**

**Figure 3: Mathematics**

**Grade 4 Test Scores on the Missouri Assessment Program:  
St. Louis Public Schools vs. Missouri Average for Last Five Years**



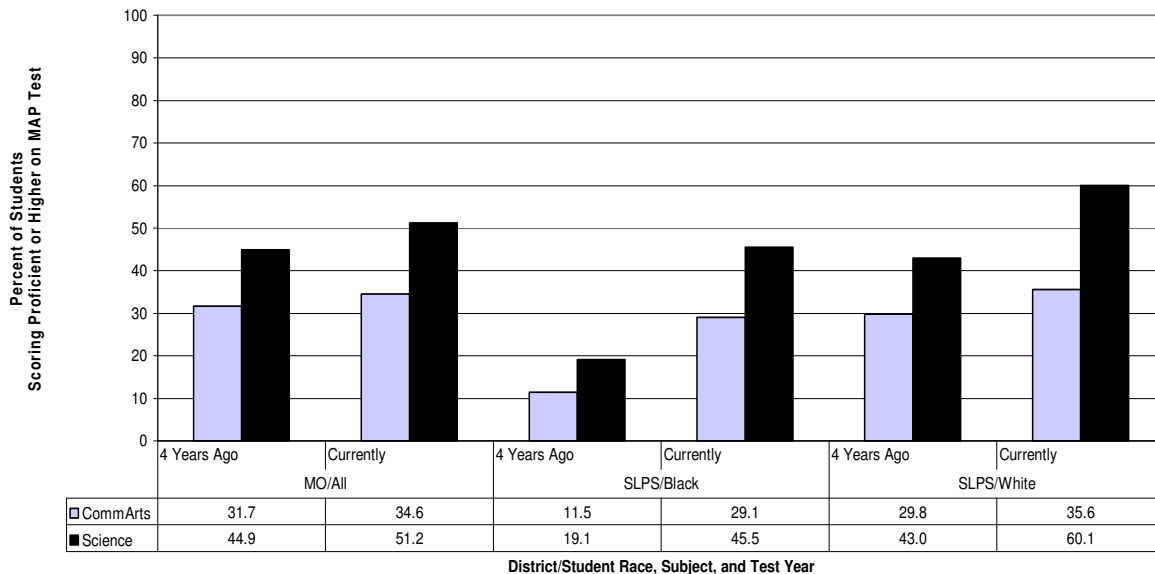
**Figure 4:**

Percent Improvement in MAP Test Index Scores from 2000 to 2004 by Grade and St. Louis Public Schools (SLPS) Compared to the Missouri Average

Grade	Subject	District	MAP Index Score		
			Year 2000	Year 2004	% Improve
Three/Four	Comm. Arts	SLPS	168.3	194.1	15.3
Three/Four	Science	SLPS	182.0	218.5	20.1
Three/Four	Mathematics	SLPS	182.9	208.7	14.1
Three/Four	Comm. Arts	Missouri	197.2	201.9	2.4
Three/Four	Science	Missouri	215.5	224.4	4.1
Three/Four	Mathematics	Missouri	209.7	214.4	2.2
Seven/Eight	Comm. Arts	SLPS	154.8	153.9	-0.6
Seven/Eight	Science	SLPS	136.5	134.9	-1.2
Seven/Eight	Mathematics	SLPS	134.4	144.3	7.4
Seven/Eight	Comm. Arts	Missouri	190.8	191.2	0.2
Seven/Eight	Science	Missouri	169.3	168.6	-0.4
Seven/Eight	Mathematics	Missouri	167.6	173.4	3.5
Ten/Eleven	Comm. Arts	SLPS	154.2	142.5	-7.6
Ten/Eleven	Science	SLPS	135.4	127.1	-6.1
Ten/Eleven	Mathematics	SLPS	135.8	129.3	-4.8
Ten/Eleven	Comm. Arts	Missouri	182.9	185.2	1.3
Ten/Eleven	Science	Missouri	166.2	167.4	0.7
Ten/Eleven	Mathematics	Missouri	162.2	171.1	5.5

\*NOTE: MAP scores are presented as Index Scores ranging from 100 to 300. Scores were calculated by the formula developed by the Missouri Department of Elementary and Secondary Education (DESE) for purposes of comparing scores among different demographic groups and among different schools.

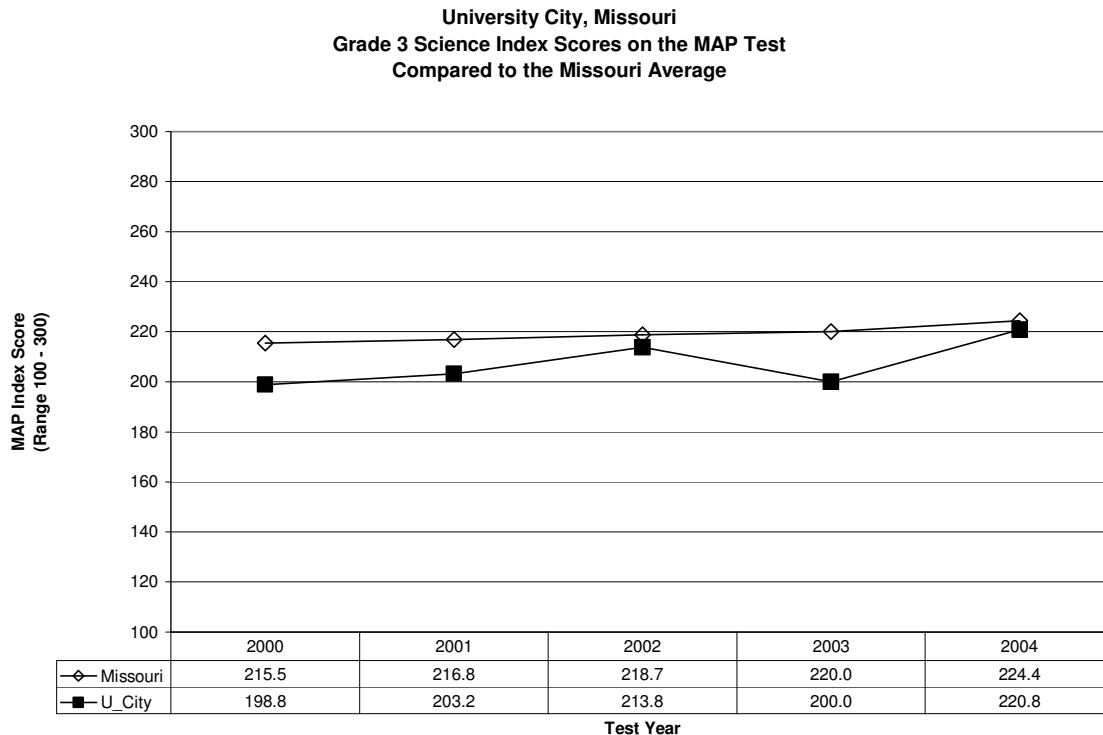
**Science & Reading Improvement in Grade 3  
by St. Louis Public Schools (SLPS):  
MAP Test Results Currently (2004) and Four Years Ago (2000)  
Compared by Students' Race and to the Missouri (MO) Average**



## Section 2:

### Supporting Study: University City, MO Study

University City, MO. University City is an “inner” suburb of St. Louis. Being an “inner” suburb, it has about the same urban demographics as the St. Louis City Schools, at about 80% African American students, but it is only about 10% the size of St. Louis City school district. For instance, it tested just under 350 students in Grade 3 Science on the state MAP test in 2004, compared to about 3500 who took the test in St. Louis City public schools. 2003-4 was the first year of their adoption of *Macmillan/McGraw-Hill Science*, and it was implemented by a new staff person who had previously worked (through Washington University) providing professional development in science to teachers in St. Louis City schools. You can see the results of the new texts and new emphasis on Science in the elementary schools: the District’s Grade 3 students shot up on the 2004 MAP test in Science to just a few score units below the state average. Data from following years of testing will be required in order to determine whether this improvement constitutes a continuing trend or not.



## Part IV.

### State Test Score Results (Science 2005 Edition)

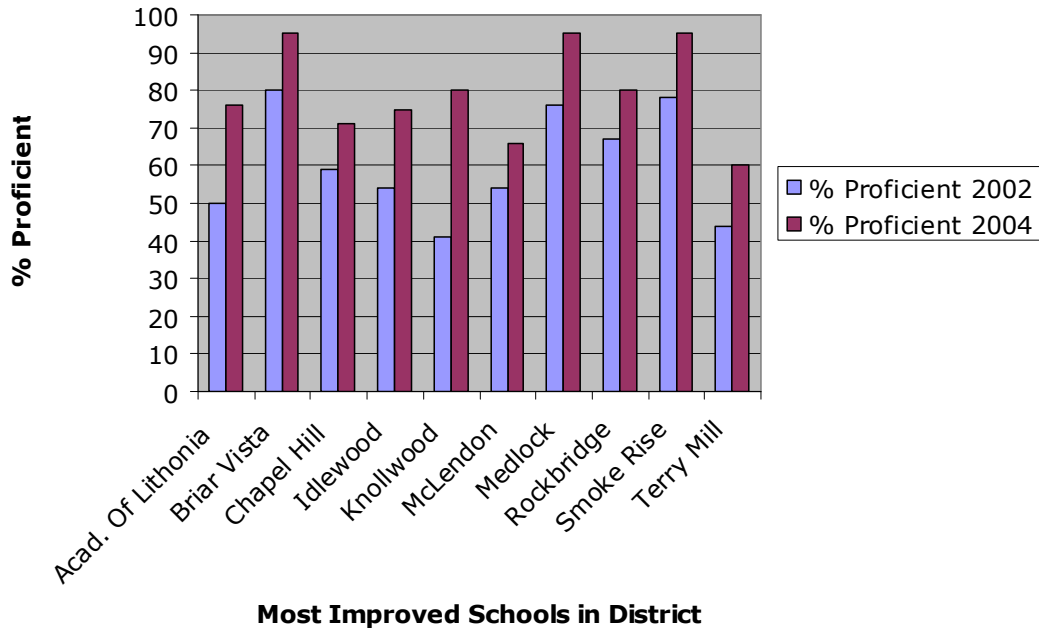
*The following section provides a summary of the on-going student achievement results being gathered as part of a long-term program validation study. These studies are being conducted by independent researchers whose purpose is to study the effectiveness of the Macmillan/McGraw-Hill Science instructional model in actual classroom use. The studies are designed to measure the effectiveness of the basal science program by comparing the results of published state science test data. Identification of scores prior to the implementation of Macmillan/McGraw-Hill Science are compared to the state science test results after implementation. These results are on-going in nature and are being revised on an annual basis.*

#### **State Studies include:**

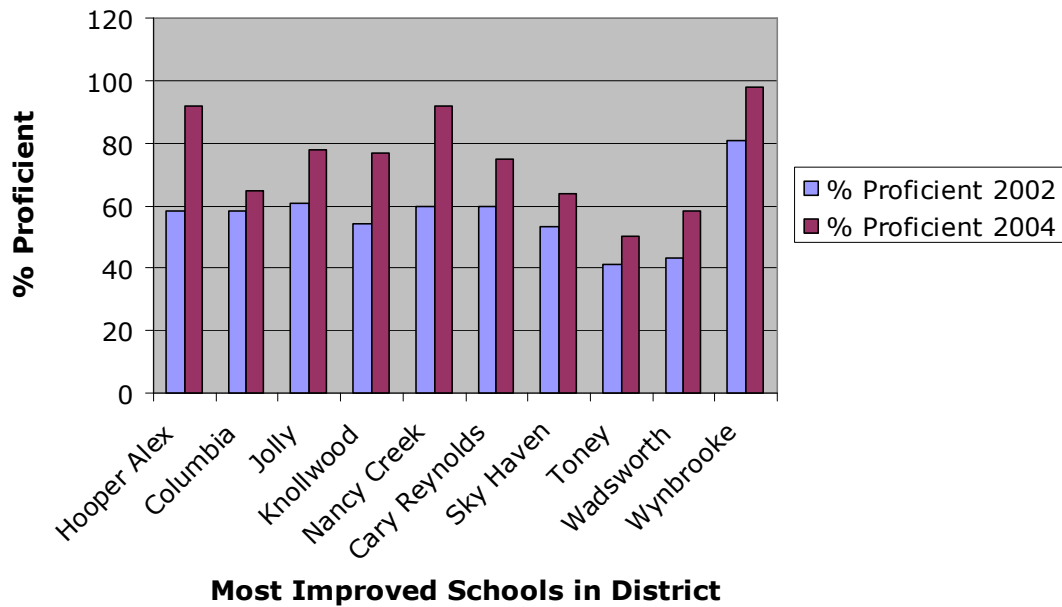
##### **Georgia**

**Implemented Macmillan/McGraw-Hill Science in 2002. Georgia State Science Test is the CRCT**

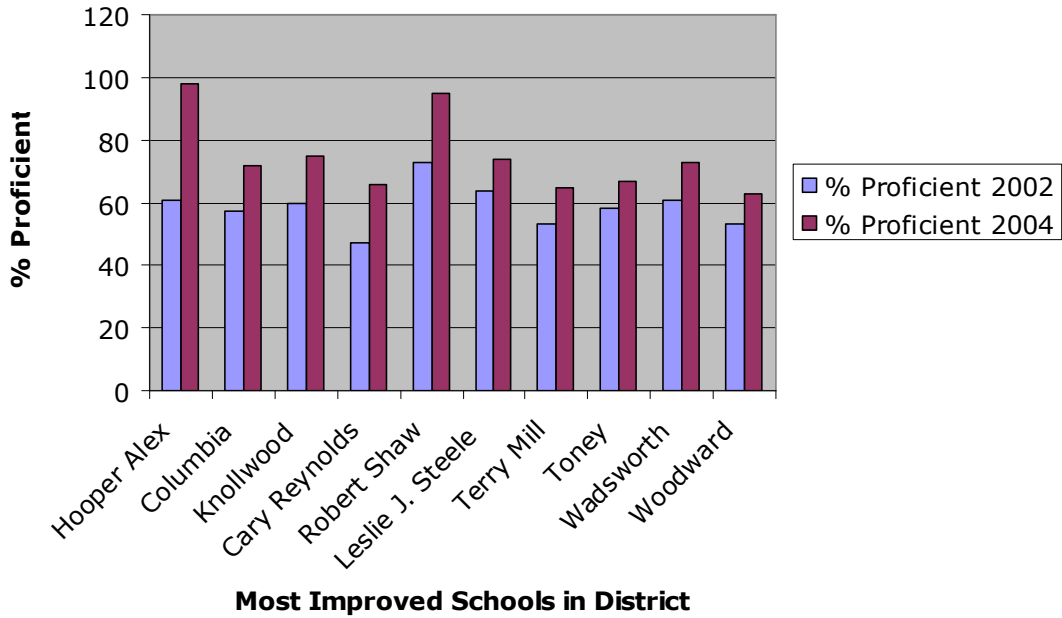
## Georgia-Dekalb- Grade 3 Science



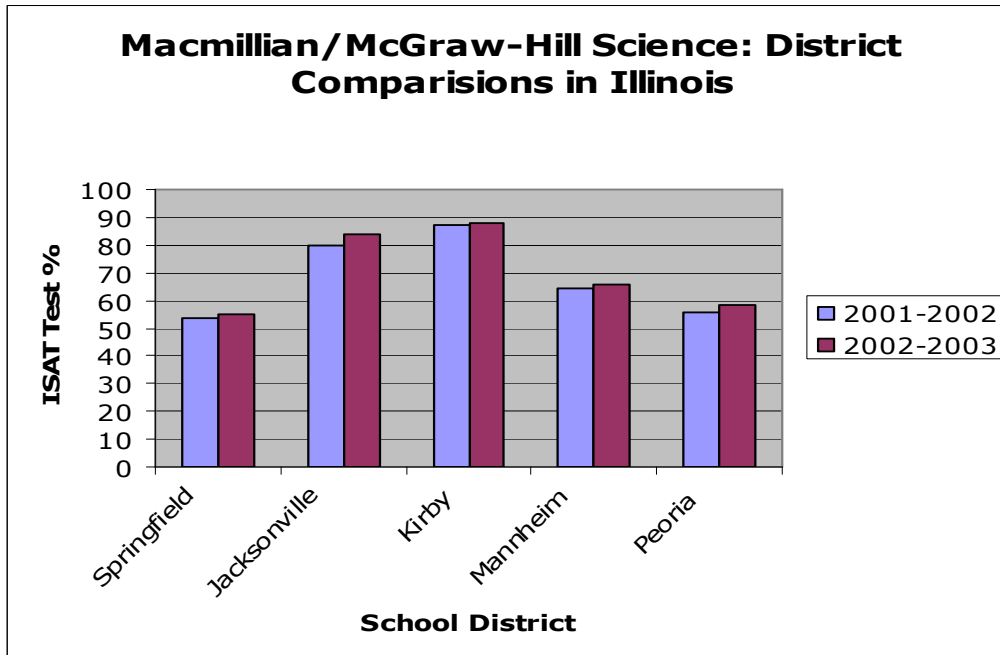
## Georgia-Dekalb- Grade 4 Science



## Georgia- Dekalb- Grade 5 Science



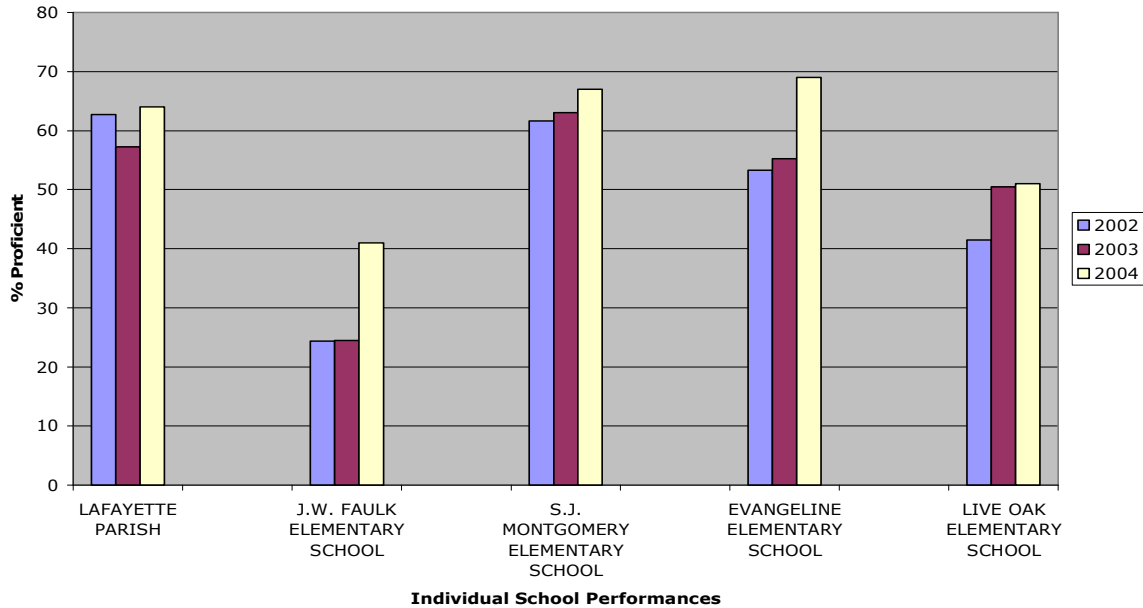
**State Studies include: Illinois  
Implemented Macmillan/McGraw-Hill Science in 2002.**





**State Studies include: Lafayette Parish, Louisiana  
 Implemented Macmillan/McGraw-Hill Science in 2003.  
 Louisiana State Science Test is the LEAP 21**

**Lafayette, Louisiana Grade 4 Science Proficiency**

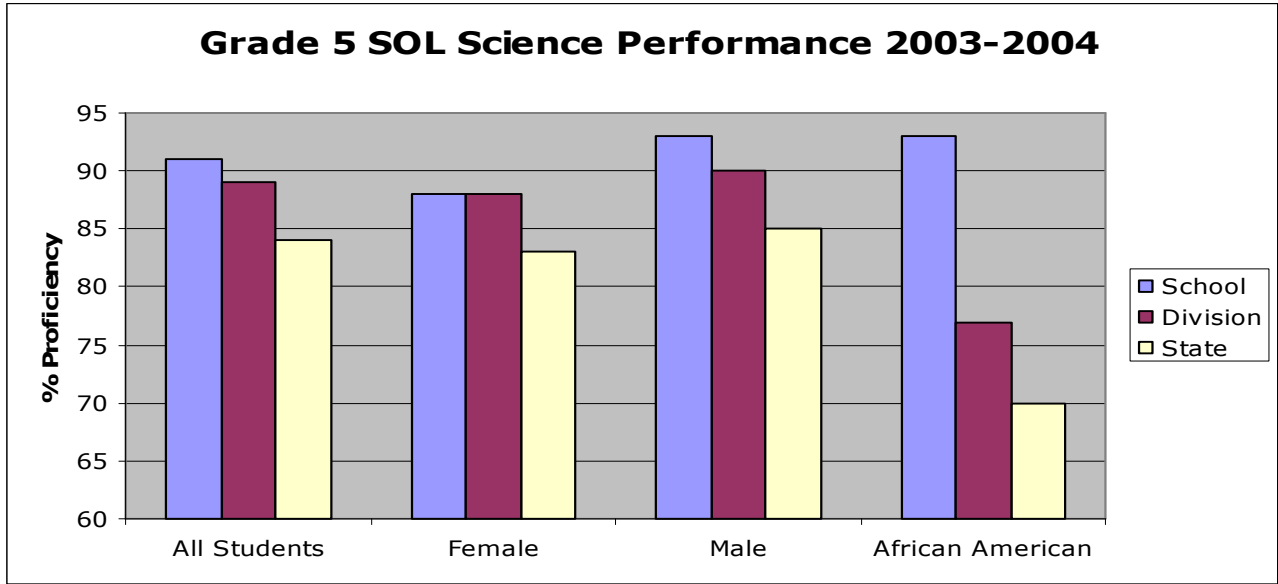


**State Studies include: Virginia Beach, Virginia  
 Proficiency Study- Demographic Data  
 Implemented Macmillan/McGraw-Hill Science in 2003.  
 Virginia State Science Test is the SOL**

Virginia Beach student scores compared to State Average after one year of use.

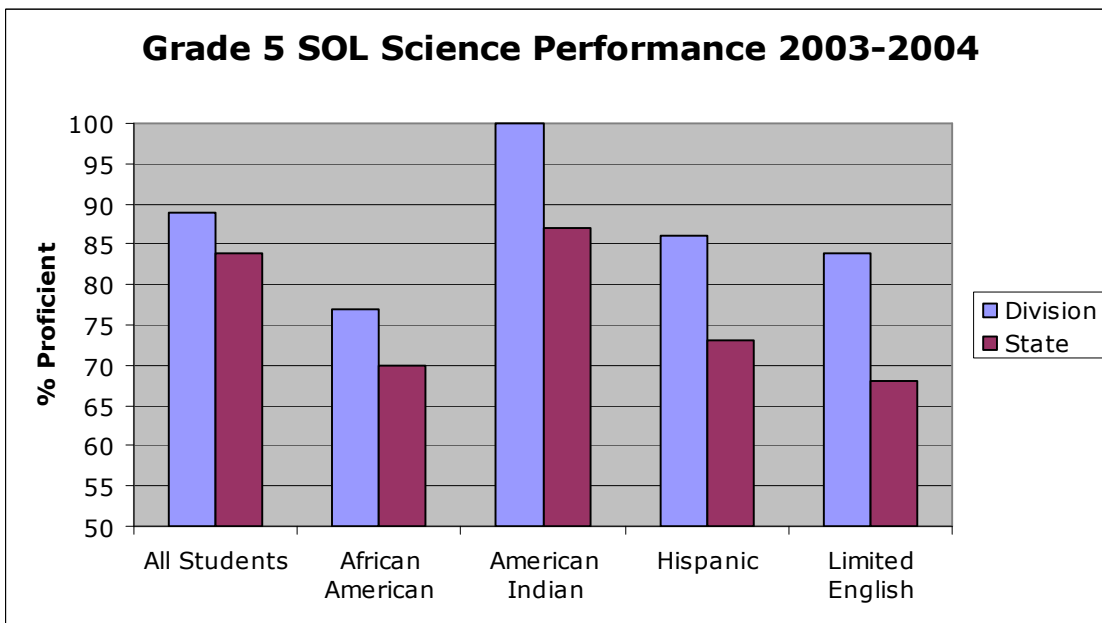
**VIRGINIA BEACH SOL 2003-2004**

<b>GRADE 5</b>			
	<b>School</b>	<b>Division</b>	<b>State</b>
All Students	91	89	84
Female	88	88	83
Male	93	90	85
African American	93	77	70



Virginia Beach, VA demographic comparisons to state average after one year of using Macmillan/McGraw-Hill Science.

<b>GRADE 5</b>		
	<b>Division</b>	<b>State</b>
All Students	89	84
African American	77	70
American Indian	100	87
Hispanic	86	73
Limited English	84	68



**State Studies include: Texas  
Comparisons of Comparable Districts: Macmillan/McGraw-Hill  
Science to Leading Competitor  
Texas State Test: TAKS**

**TEXAS ASSESSMENT OF KNOWLEDGE  
AND SKILLS (TAKS)- Science  
STATE/DISTRICT PROFICIENCY RESULTS  
2004**

<b>District-Competitor</b>	<b>% Proficient</b>	
Amarillo-Lubbock	76	60
Houston-Dallas	61	56

