Comparative Analysis of Science Achievement in Michigan School Districts Using Science and Technology for Children® (STC®)

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BACKGROUND
In June of 1998 a preliminary study was made of the achievement results of districts that had adopted STC. Since that time those districts that were early adopters of STC have had continued experiences with the program, and other Michigan districts have fully adopted or widely incorporated the units into their curriculums.

Given the increasing emphasis on science achievement, an update of the progress of the early adopting districts and the newly adopting districts could prove useful in evaluating how STC impacts student achievement. Thus, the question we are seeking to answer is: What has been the impact on science achievement for students who use STC?

Understanding the Michigan Educational Assessment Program (MEAP) for Science
The Michigan Educational Assessment Program (MEAP) for Science is given annually to all public school 5th graders in Michigan. This comprehensive exam utilizes constructed responses (written answers), multiple-choice, and a laboratory investigation. Scores are calculated on the basis of proficiency. A student is considered proficient if he or she obtains a satisfactory score on the five measures of scientific literacy as defined in the Michigan Standards. The results in this report are the official scores used by Michigan officials to measure district and student achievement in science. However, there are many variables that are not fully controlled in this evaluation process, given that this assessment is administered to over 180,000 children in more than 500 K-12 districts.

METHODOLOGY
The sample from these 15 districts constitutes approximately 8% of Michigan 5th graders. In analyzing the results, each STC district has been compared to the mean percentage of students deemed proficient throughout the State of Michigan. To provide a more detailed perspective, districts have been categorized by the percentage of children who qualify for free and reduced lunch (source data for free and reduced lunch comes from the Standard and Poor's State School Report data). The mean for districts throughout Michigan is 15.0%. This allows a comparison of the data with some factorization for the socioeconomic status of the sample districts.

Potential limitations to this study
It has been difficult to ascertain the depth and breadth of use of the STC units in every district. For example, Troy and Traverse City use almost all of the STC units in grades ranging from 1st to 6th grade. Ann Arbor uses many of the units, but teaches some topics through a locally developed curriculum. Other districts did not respond to inquiries, or left incomplete information.

Shelby Public Schools is a very small district. Its population being tested at grade 5 is always small (usually under 100), but in 2001 it was a particularly small group. As a result, even a few students can skew the percentage deemed proficient.

TEST RESULTS

Table 1 reports the results of schools that are generally considered to have high socioeconomic status (SES). This determination is made by the number of students who qualify for a free and reduced lunch. Many professional families live in these districts and the district spending per pupil is well above the state average. Bloomfield Hills, Troy, and Utica are wealthy suburbs just north of Detroit. Grand Haven, Rockford, and Saline are small towns located near a major metropolitan area.

Table 1 – Michigan 5th Grade Science Results From High SES Districts

District/Year of Test	2001	2000	1999	1998	1996
Michigan State Average	41.0	43.6	37.5	40.4	26.9
Bloomfield Hills	70.2	70.0	69.3	63.6	47.2
Grand Haven Area Schools	55.6	52.0	48.0	48.9	32.2
Rockford	63.9	68.5	60.9	65.9	37.2
Saline	54.0	53.6	48.5	42.3	38.9
Troy Public Schools	74.6	78.5	62.7	74.1	51.3
Utica Community Schools	48.5	48.1	47.6	56.0	36.4

Table 2 reports the results of districts that have a much wider range of socioeconomic backgrounds. The frequency of free and reduced lunch falls close to, or above, the state mean and in most cases the average percentage of students qualifying for free and reduced lunch would be three to five times the rate of Table 1. These districts receive less from the state than those in Table 1 and thus spend less per pupil. Ann Arbor is a very diverse moderate-sized city and is home to the University of Michigan. L'Anse Cruse and South Lake are suburbs of Detroit. Shelby and Traverse City are small towns in rural parts of Michigan.

Table 2 – Michigan 5th Grade Science Results From Moderate SES Districts

District/Year of Test	2001	2000	1999	1998	1996
Michigan State Average	41.0	43.6	37.5	40.4	26.9
Ann Arbor	56.8	54.8	49.5	52.7	38.3
L'Anse Cruse Schools	51.5	62.5	53.4	52.8	46.2
Shelby Public Schools	41.0	51.2	50.5	48.1	31.2
South Lake Public Schools	45.8	55.6	50.0	54.5	20.6
Traverse City Public Schools	61.4	60.1	49.1	53.6	29.0

The data from Table 3 is for districts that, in comparison to the state average, have a high to very high percentage of their students qualifying for free and reduced lunch. These districts have many students who qualify for "At-Risk" funding. As a result, many of these districts receive special grants to provide needed extra support for remedial programs and special services. Therefore, their level of spending would typically be below those High SES districts in Table 1 but would be somewhat greater than those

in Table 2. Crawford-AuSable is a very rural district in the northern section of the state. Muskegon and Saginaw are small cities with aging industrial profiles and suffer from varying amounts of urban decay. Taylor is a suburb of Detroit that is home to many industrial workers.

Table 3 – Michigan 5th Grade Science Results From Lower SES Districts

District/Year of Test	2001	2000	1999	1998	1996
Michigan State Average	41.0	43.6	37.5	40.4	26.9
Crawford-AuSable Schools	32.5	29.7	26.4	36.1	17.4
Muskegon Public Schools	19.6	22.8	23.3	22.0	12.0
Saginaw Public Schools	20.5	21.6	20.6	20.4	9.2
Taylor Public Schools	36.6	31.7	32.1	29.4	15.8

ANALYSIS OF RESULTS

Analyzing these results as they relate to the effectiveness of curriculum and instruction requires that a comparison be done to measure success over a meaningful period of time. One way to do this is to look at the relative improvement of scores over the five-year period. The baseline for this would be the state percentage increase of students deemed proficient from 1996-2001. For example: the 2001 result is 41.0%, the 1996 result is 26.9%. 41.0%-26.9%= 14.1%. Dividing this result by the five years of the test produces an annual percentage increase of 2.82%. Table 4 summarizes our districts under study using this application.

Table 4 – Five-Year and Annual Increases in Science Achievement

District	Five-Year Increase in Achievement (in %)	Annual Mean Increase in Achievement (in %)
Traverse City Schools	32.4	6.48
Rockford Public	26.7	5.34
South Lake Public	25.2	5.04
Grand Haven Public	23.4	4.68
Troy Public Schools	23.3	4.66
Bloomfield Hills Schools	23.0	4.60
Taylor Public Schools	20.8	4.16
Ann Arbor Public Schools	18.5	3.70
Crawford-AuSable Schools	15.1	3.02
Saline Public Schools	15.1	3.02
State of Michigan	14.0	2.82
Utica Public Schools	12.1	2.42
Saginaw Public Schools	11.3	2.26
Shelby Public School	9.8	1.96
Muskegon Public Schools	7.6	1.52
L'Anse Cruse Public Schools	5.3	1.06

The data reveal that 10 of the 15 districts (or 67%) experienced student achievement that was increasing at a faster rate than the state at large. Moreover, this increase was present in all types of the sampled districts: wealthy suburban, small-town schools, average SES, and rural poor.

A further statistical point to consider is the number of districts that showed an increase in their results even when the state mean score went down. If we take the most current year (2001), the state score fell 2.6%. If we examine the STC districts under study, we see that eight actually showed improvement despite having to bear the weight of a statewide decline. This is no easy feat to accomplish.

CONCLUSION
The longitudinal quality of the data has improved substantially since the 1998 report. Given the five years of data available, there is strong evidence to support the efficacy of STC. When districts with widely different demographics show the improvement trends that are in evidence, it provides a strong sense of confidence in the quality of this curriculum.

DISCUSSION
While cross-building comparisons is beyond the scope of this research, it is worthwhile to note that the Traverse City School District (student population: 10,000) has 18 elementary buildings. Thirteen of these are classified as Title I due to lower SES. Out of these 13 buildings, 11 scored above the state average. Moreover, of those students who are designated as requiring special education services, over 50% have passed the MEAP at a satisfactory level.