Texas Instruments MathForward Intervention

2007 Overall Year End Report

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MathForward 2007 Intervention Report: Year-end Overview

In the school year 2006-2007, the Richardson, TX Independent School District (RISD) assumed management of their MathForward program. Over the past year, Texas Instruments, Inc.'s MathForward intervention helped to change the way mathematics was taught to 7th through 9th grade students in three states across the country. Working with ten junior high and middle schools along with two high school sites, the MathForward program utilized simultaneous modifications in curriculum, training, teaching and technology to improve mathematics outcomes for students enrolled in the classes. While this intervention differed in terms of the personnel delivering the instruction and the degree of implementation across the classes, the program delivered similar, significant results across the sites. The consistency in the replication is striking, and at the end of this year we have seen positive movement towards improving mathematics scores for at-risk students.

Review of RISD 2005-2006 Results

- When the systemic intervention was applied to middle school math students who had previously failed the state math test (TAKS), the result was a 33% pass rate, vs. 19% for a comparison group from a similar campus.
- Average scores increased at a time when comparison groups and the district as a whole experienced a decline in scores.
- Effect size of the TI MathForward systemic intervention is very strong.
- The positive effect is shown in four statistical analyses, including regression discontinuity analysis, a "gold standard" methodology.
- Teachers reported many positive effects on their classes. A number of suggestions were made for improving the interventions

Overview of 2006-2007 Results

Implementation steps in each of the four participating districts varied somewhat from last year's pilot at RISD, and from each other. These issues, as well as the non-comparability of test scores across states, and relatively small numbers of students in the "new" pilot site districts preclude a meta-analysis of this year's data. However, the variation across the sites also allows us to naturally test how robust the intervention might be when aspects of the program change.

Because RISD's pilot year practice was to assign students to MathForward who had not reached proficiency on last year's state test, our researchers drew a distinction in analysis of this year's data between students who were below proficiency in the previous year, and those who were above proficiency. The researchers also eliminated from most analyses the pre-Advanced Placement (pre-AP) students who were enrolled in MathForward in RISD, again to make the data sets more comparable.[1]

Creating an appropriate comparison group from each district's data was an additional challenge. In each district, our researchers created demographically similar groups who attended other classes, with other teachers,

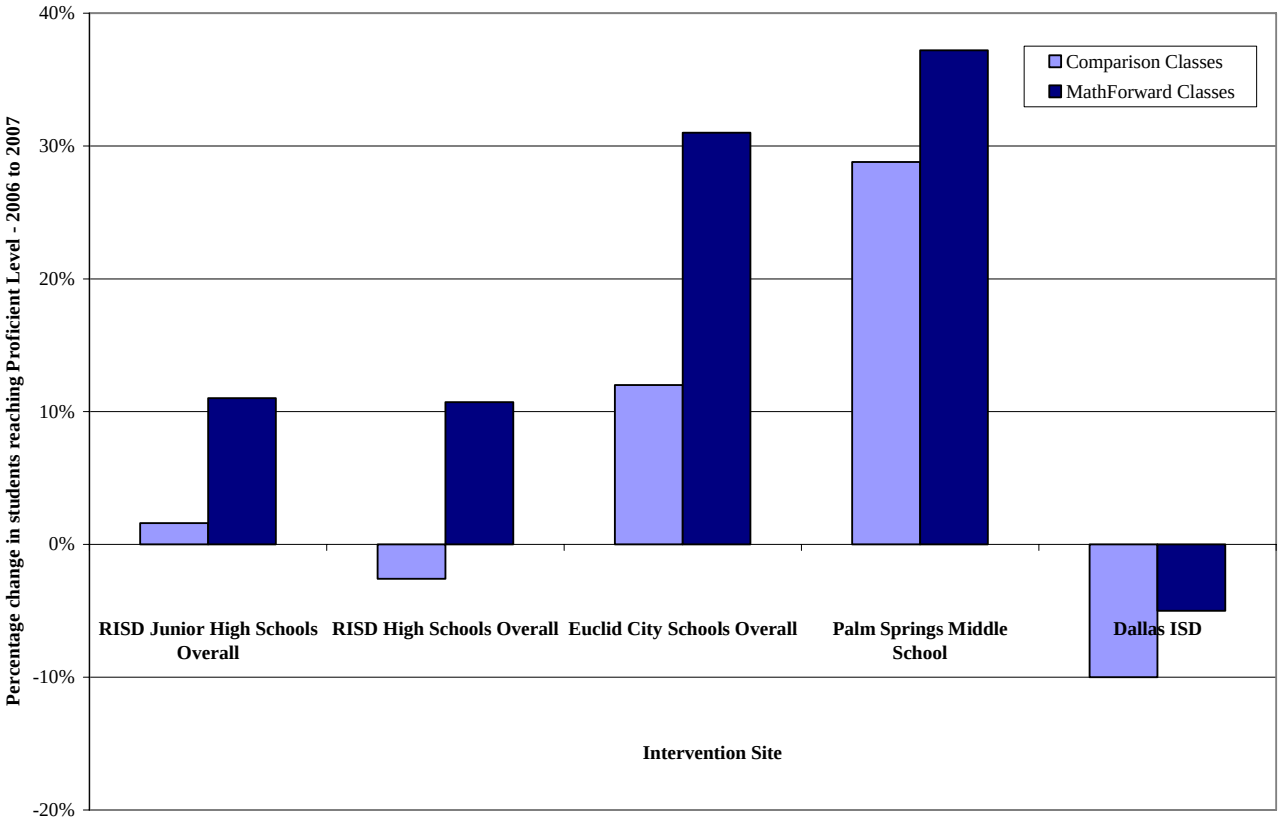
[1] The full report on RISD also examines gains in percent correct responses and uses a somewhat different strategy with a more complex system of comparison groups. While the findings are parallel and consistent, they are not relevant to the results reported here.

and in Palm Springs Middle School in other schools enrolled in the same grade level class, but who were not part of MathForward[2].

General Patterns

The chart below shows the performance of the students in the MathForward classes, charting the change in the percentage of those students scoring at the Proficient level across the intervention sites from the 2006 year end assessments to 2007. For comparison purposes, similar students are also represented so we can see how their performance changed as well. At all of the sites, more MathForward students moved into the Proficient level and this change in terms of percentage growth of proficient students is significant across all of these sites. Also of note, the direction and general pattern of effects is essentially the same across all sites. Such a result from any one site is quite promising, and yet to have this pattern replicated generally across the board reflects possibly a more robust and reliable influence, a conclusion that would not be possible to draw from a single study.

Percentage change in proportion of students scoring at proficiency from 2006 to 2007: MathForward classes versus Comparison Classes



The comparison students are selected from non-AP classes and are generally similar in terms of starting point on the mathematics assessment and general demographic characteristics such as economic disadvantage and ethnic background.

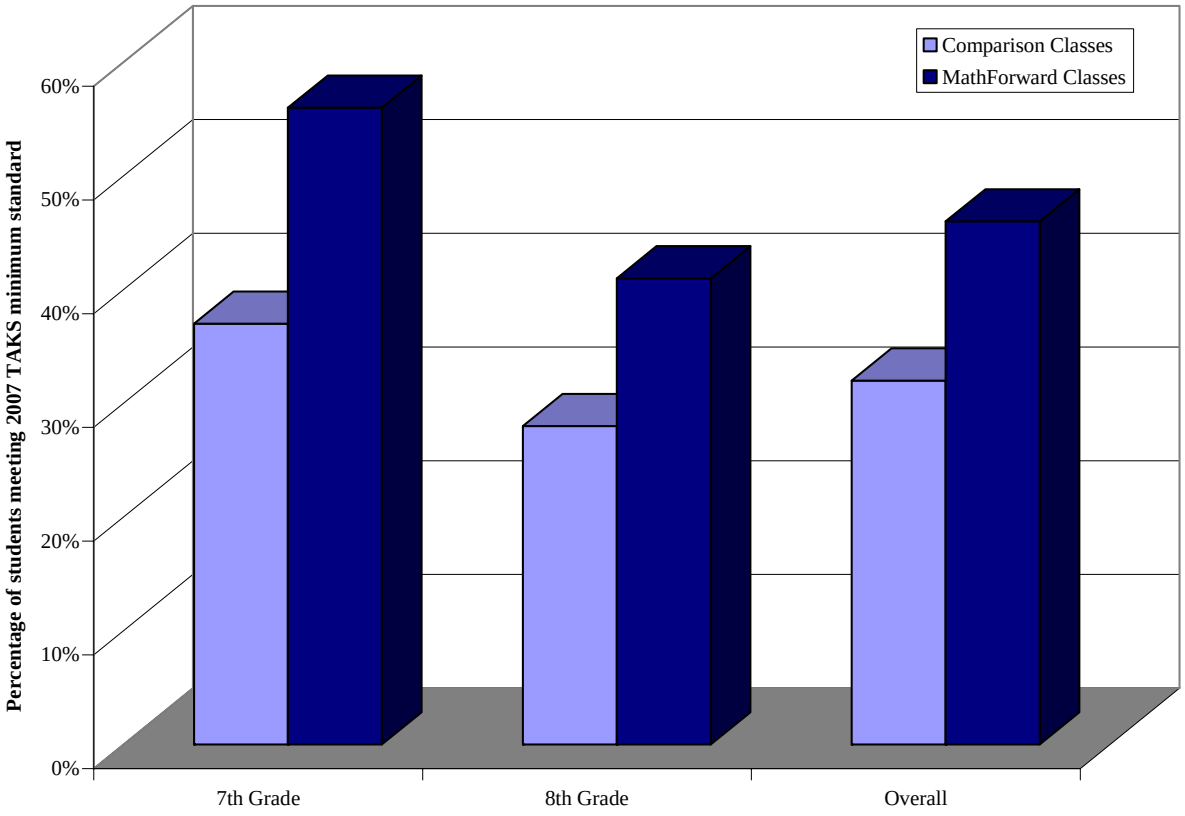
[2] Again, in the RISD analysis, the spread of the program presents additional challenges, resulting in a more complex comparison group strategy. See the detailed report for discussion.

Details of each district are discussed below, and additional analyses of test scores and percentage gains, with significance tests, are included in the detailed reports for each district. In general, the observed gains are statistically significant, despite relatively small *n*'s in the first-year districts' pilot programs. DISD is a partial exception, and is discussed separately below.

RISD

The grade 7-8 MathForward program at RISD was expanded from one school last year to five schools this year. In addition, class composition was intentionally more heterogeneous this year: students were selected because they performed between 50% and 75% on the incoming district benchmarks, and then other slots were filled in with students above that range, including some pre-AP students. Recall that last year the pilot program was confined to students who had failed the state test in the previous year. The District took over management of MathForward this year, and implementations clearly benefited from the year of experience with the program. However, note that, due to teacher turnovers, all but three of the teachers in the program were new to it this year. Results for RISD's junior high schools are summarized in the chart below.

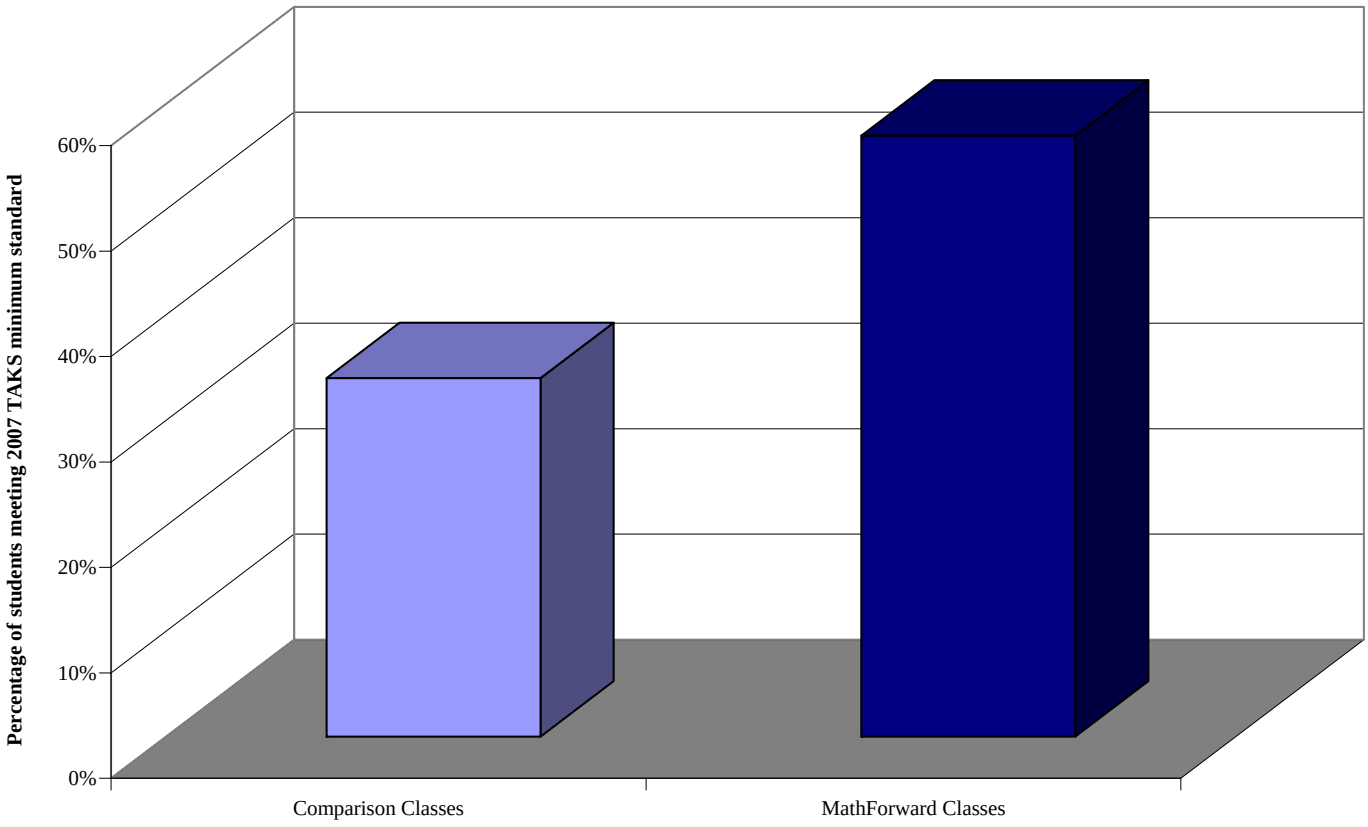
Percentage of RISD Students who failed to meet 2006 TAKS Minimum Standard who met 2007 TAKS Minimum Standard: MathForward versus Comparison Classes



The overall 46% state test pass rate (for students who did not pass the state test last year) represents an improvement when compared to last year's 33% pass rate, as well as a gain when compared to the comparison group. Supplementary analysis which examined the score gains (with normal curve equivalent conversions) by school confirms significant positive differences in all schools but one, and also points to a slight year-to-year decline in district-wide scores, both in 2006 and in 2007. Thus the positive trend in the middle school MathForward program is even more remarkable because it reversed the district-wide trend in both years.

The 9th grade Algebra high school program, while only a small-scale pilot project, also showed promising gains. These are summarized in the chart below:

Percentage of RISD High School Students who failed to meet TAKS Minimum Standard in 2006 who met 2007 TAKS Minimum Standard: MathForward versus Comparison Classes

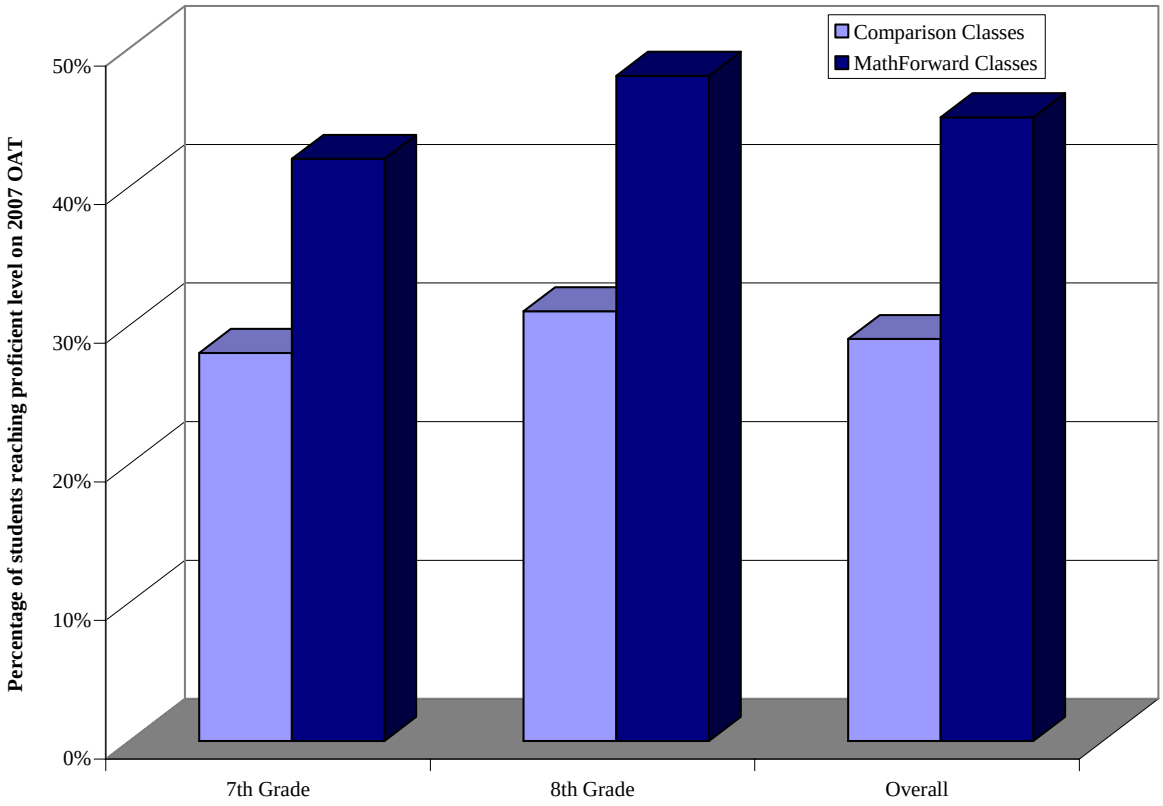


Over the two high schools involved in the pilot, the chart shows that 57% of MathForward students who failed the state test in 2006, attained proficiency in 2007. By contrast, the comparison group had a 34% pass rate. This suggests that MathForward can be scaled to high school math.

Euclid City School District

The Euclid pilot intervention included selected classes in grades 7 and 8 at two middle schools. The program followed the standard guidelines for MathForward, except that teachers did not receive direct instruction in math content knowledge. Proficiency rate comparisons for both schools are summarized in the chart below.

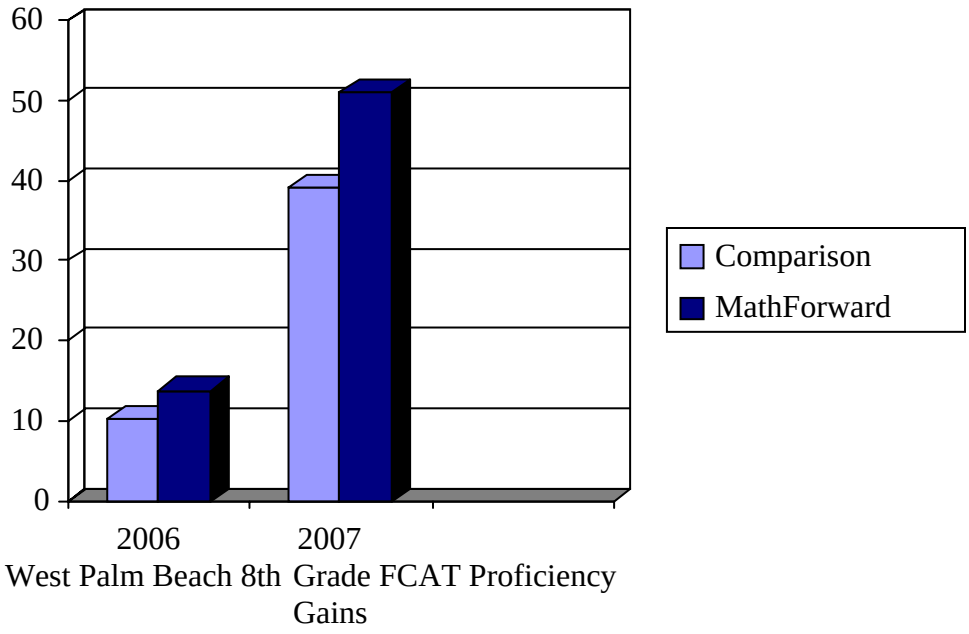
Percentage of Euclid City SD Students who were not Proficient on 2006 OAT who attain Proficiency on OAT 2007: MathForward versus Comparison Classes



This chart shows that the program had a substantial impact on pass rate, in comparison to non-MathForward students in the same schools. Overall, 2007 pass rate of students who were not proficient in 2006 and who were in MathForward was 45%, while the similar comparison group's 2007 pass rate was 29%. Supplemental analysis comparing score gains confirms this effect, and shows its statistical significance. Full details are in the attached report on Euclid.

West Palm Beach School District

In West Palm Beach, MathForward was piloted in the Palm Springs Middle School Grade 8 (pre-Algebra). All classes in the school used a double period (block) for math, so the only difference between MathForward and the control was in the interventions other than increased class time. Note also that in Florida the spring administration of the state test (FCAT) occurs in February, so these results show only the impact of a little more than one semester of MathForward (note also that last year's experience at RISD suggests anecdotally that for first-year teachers, most of the gains may occur in the second semester. However, this effect has not been formally analyzed.) Results are summarized in the graphic below:

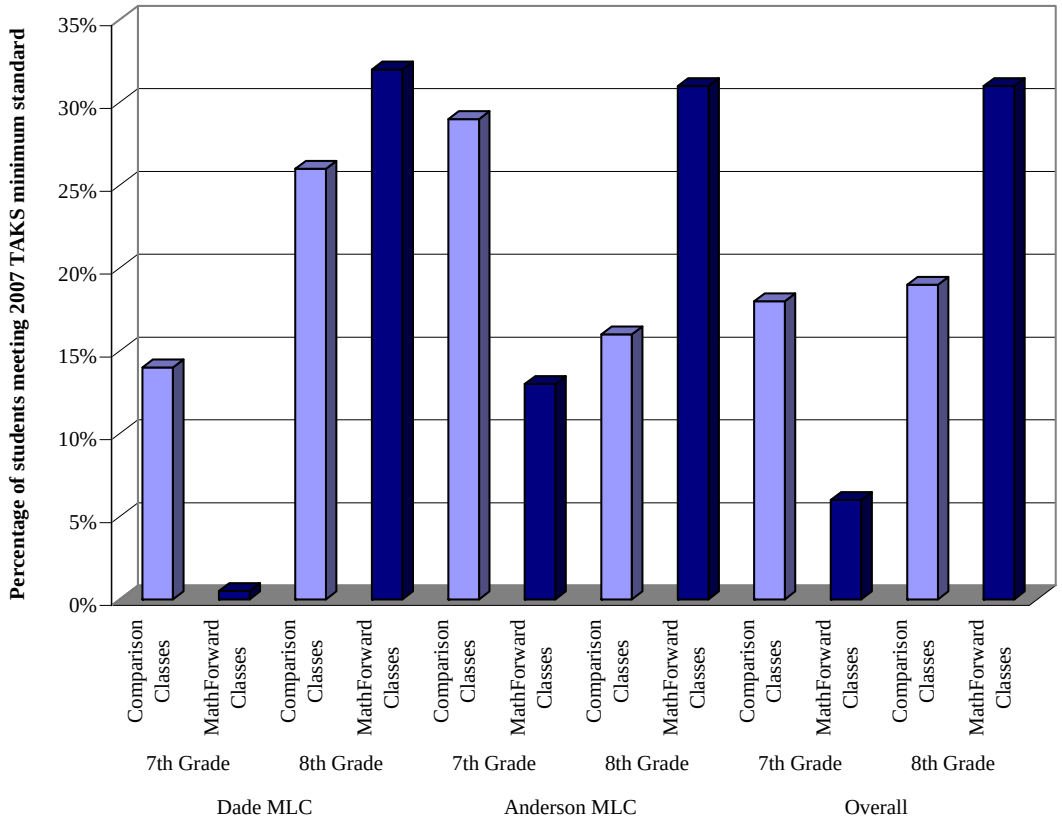


This analysis was performed by the school district itself, and did not follow the control group strategy our researchers used for the other districts. As all pre-algebra students were involved in the intervention at Palm Springs Middle School, for the control group here 469 demographically similar students enrolled in pre-algebra classes in other schools were selected district-wide. Consequently, the control group strategy used in other districts was not used here, and the chart shows non-zero 2006 scores. As shown above, 29% of this comparison group reached proficiency in 2007, while 37% of the MathForward students did so. According to the analysis reported (but not detailed) by the district, the MathForward gain was substantially and significantly larger than that of the comparison group. For all these reasons, the larger gains in proficiency shown by the MathForward students are even more remarkable.

Dallas ISD

The Dallas ISD pilot program was at two middle schools, for grades 7 and 8. Because the implementation was only partially successful, the pattern of negative and positive findings is particularly instructive. Consequently, we will discuss the results for the two schools separately, rather than combining them. The chart below shows the results.

Percentage of DISD Students who failed to meet 2006 TAKS Minimum Standard who met 2007 TAKS Minimum Standard: MathForward versus Comparison Classes



MathForward programs in 8th grade at both schools showed greater gains in pass rate than a comparison group drawn from within the schools, but not in 7th grade. This is easily explained: while both schools suffered from unusually major implementation issues, overall implementation fidelity was much higher at Anderson. Furthermore, Anderson recruited a teacher from the RISD MathForward program to teach in their school.

Thus, even the negative results in the DISD analysis are instructive. The poor results in a school with a poor implementation, contrasted with the much better results in a school with a somewhat stronger implementation and a teacher from the RISD MathForward program, reinforces our belief that the synergies of MathForward are the main contributor to the growth we have now observed across four school districts.

Fidelity of Implementation

While we did not directly observe the teachers inside their classes during the past year, we can take from their responses on the year-end survey of their own views of the intervention how well they might be implementing the intervention. The MathForward program is based on eight primary focal points for change:

- Expand to 100 minute Power-Block class format
- Technology infusion centered on networked use of TI-Navigator and TI-73 graphing calculators
- Teachers use common aligned assessment strategies
- Implementation of an accelerated curriculum
- Heightened expectations for all students
- Increase Teacher Content Knowledge and Pedagogical Skill
- Increase Administrative and Parental Support of Mathematics Learning
- On-going Professional Development and Coaching

A set of questions that relate to each of these aspects was drawn from the larger teacher survey to form a measure of how fully the teachers were embracing the intervention's goals. Questions responses were scored on a five point likert scale, and responses within each aspect were averaged and then added together.

The teacher responses could then be linked to the average classroom performance for those cases where we can chart outcomes by teacher (primarily in the Richardson ISD). Charts 2 and 3 below show how the fidelity of implementation scores were associated with the percentage of a teacher's students meeting the minimum passing level (chart 2) and the average percentage correct on the TAKS for given teacher (chart 3). In both cases, the implementation scores were significantly positively related to the student performance outcomes.

Chart 2: Percentage of students meeting the minimum passing level by Fidelity Score:

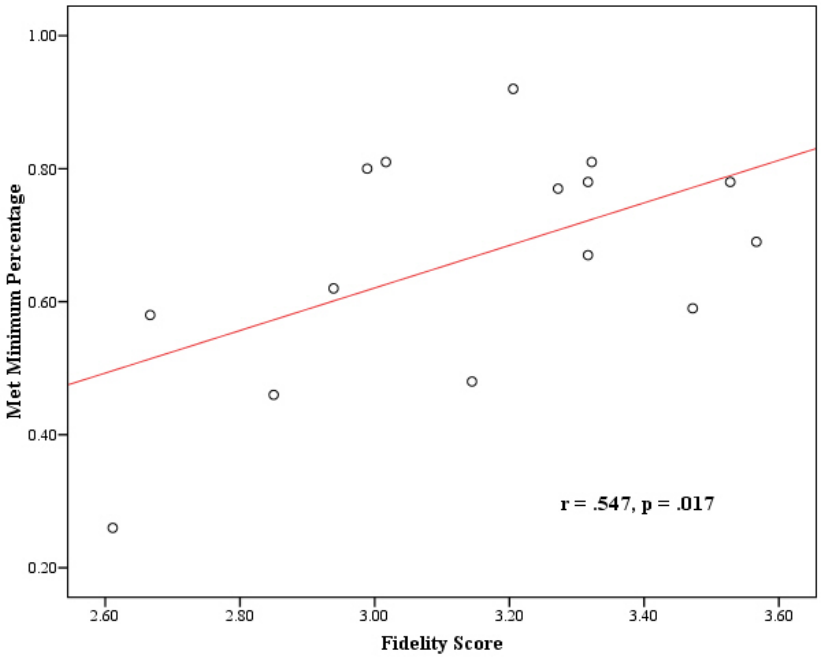
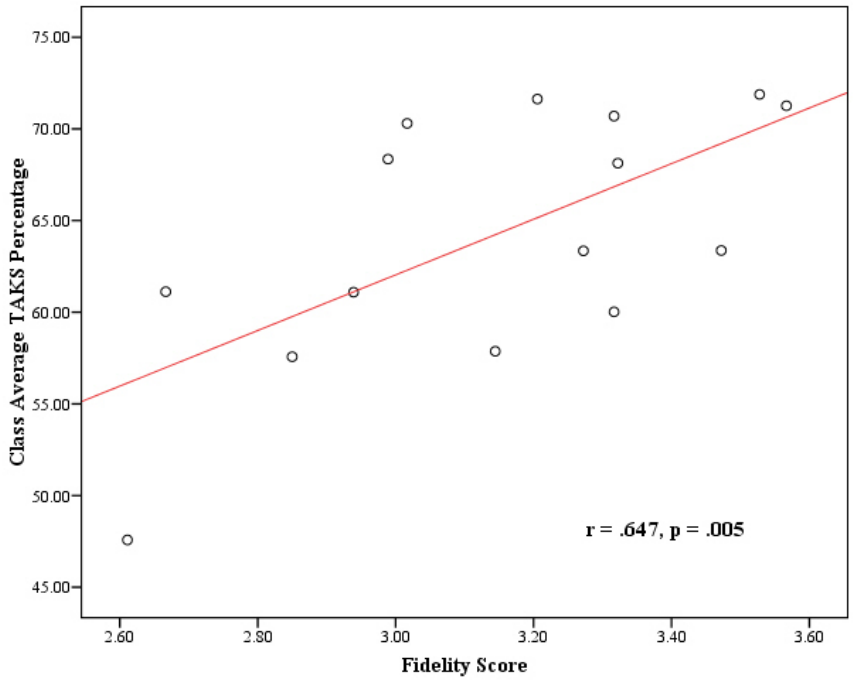


Chart 3: Average Correct TAKS Percentage by Fidelity Score:



Again, while the Fidelity measures are not based on direct observations of the teachers but instead come from their own perceptions and statements regarding the main aspects of the intervention, these scores seem quite useful in terms of how they might predict the students' mathematics performance. In addition, it seems likely that the effectiveness of the intervention follows from how well the teachers are able to enact the key aspects of the MathForward program.