TI-RISD MathForward Intervention

2007 Year End Report

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Executive Summary

- MathForward, a collaborative effort between Texas Instruments and Richardson Independent School District, expanded in the district this year to include five junior high schools and two high schools as targets for improvement in their mathematics instruction.

- At the junior high level, students who scored between 50% and 75% on initial district benchmarks were selected to join the MathForward block classes. Given the broader reach of the program this year, finding a valid comparison group posed a challenge, but students who were enrolled in regular, non-AP mathematics classes at the participating schools were used for comparison purposes. The MathForward group generally had a higher percentage of economically disadvantaged students but was otherwise demographically similar to the comparison group at most schools.

- Year-end TAKS results showed that the MathForward students made good gains in terms of their TAKS pass rates and percentage correct, although in general they scored below the overall school average. The seventh grade students performed much better than the eighth graders, as they more closely approached the average at most junior high schools.

- When focused on the performance of the most at-risk students over the past two years (those that had failed the previous year's TAKS), these students performed much better when placed in the MathForward classes where at each school (junior high and high schools) they were more likely to meet the minimum passing standard on the 2007 TAKS.

- In terms of average percent correct on the 2007 TAKS, the MathForward students also showed significantly more growth in their scores than comparable students. This pattern also held for the high school intervention classes.

- The RISD teachers' math knowledge, as measured by pre- and post-intervention CKTM assessments, dropped slightly at year's end. While the average was higher than reported in an assessment from the end of 2005, the drop was unexpected and may be a function of problems in the content focused teacher training offered to the schools.

- Growth in CKTM number operations scale scores was positively associated with the TAKS performance of their students.

- Turning to the stakeholder survey results, Teacher confidence improved since mid-year. The teacher confidence questions are clustered in the Learning Environment domain which at year-end was significantly correlated with student performance data.

- Across the campuses teachers reported that the math content sessions were not helpful. Many thought they were taught at a level too advanced to support pedagogical needs for struggling students.

- Reports of collegial support remained high across the year. All of the teachers agreed that there is an expert available with whom teaching strategies can be discussed.

- Teachers agree that assistance is readily available for implementing the TI Technology. Some disagree that they have sufficient curriculum materials (or materials that are of good quality) to effectively use TI Navigator, while nearly all agree that they could use additional training on the TI Navigator.

- While similarities are seen in teacher use of small group instruction, discussion and student collaboration across the campuses, teacher and student responses portray different classroom cultures.

- Teacher responses to the power block are positive but mixed, with most agreeing that the amount of content covered with the block has increased.

- Teacher attitudes about the value of benchmark data are mostly positive, although it is unclear to some, if the unit diagnostics are aligned to the district curriculum.

- Forest Meadow teachers report the most consistent use across the TI Navigator features (Quick Poll, Learn Check, Screen Capture, Activity Center) and the highest percentage of teachers (2-3 out of 3) using the technology.

- Technology pulse or perceived benefit is highest at Forest Meadow Junior High and Westwood Junior High, with the largest gain since mid-year at Liberty Junior High School. Student performance is significantly higher in classrooms where the teachers report more benefit from using the TI technology.

Year-End Assessment of the RISD-TI MathForward Intervention Model

Overview

During this past year, the Richardson Independent School District and Texas Instruments, Inc. expanded the MathForward intervention to classes across five junior high schools and two high schools in the district. Utilizing a block schedule class design, additional instruction time, more collaboration between teachers throughout the year, focused professional development sessions, and the employment of the TI-Navigator systems, the district sought to increase the passing rate of at-risk students enrolled in these schools. At the junior high schools, students selected for the intervention were primarily those who, coming into this year, scored on average between 50% and 75% on the district's mathematics benchmarks. The intervention at the high school level is more limited in scope and involved a smaller number of students, primarily those who participated in the pilot program last year at Lake Highlands Junior High School. For this reason, our attention will focus on junior high schools rather than the limited sample at the high school level, although numbers will be provided for all schools when available and appropriate.

2007 TAKS Results

A summary of this year's TAKS testing results can give us a better sense of the general context within the participating schools. Table 1 provides comparative data on demographic categories for all 7th and 8th graders at the junior high schools, and all 9th graders at the high schools. Listed in the table are the total number of students at those grades tested this year by school, the schools' ethnic group percentages, and proportion of each school's student body classified as economically disadvantaged. Note the high proportion of minority and economically disadvantaged students taking the TAKS at the junior high schools in the intervention group.

Table 1: Response Totals by Campus for 2007 TAKS testing period
(for schools overall – ethnic group and economic disadvantaged percentages)

Campus	Total tested	Native American	Asian	Afr. Amer.	Hispanic	White	Econ. Dis.
Lake Highlands Freshman Center	532	0%	2%	39%	23%	36%	41%
Pearce High School	476	1%	4%	6%	23%	65%	22%
Lake Highlands Junior High	568	0%	1%	41%	21%	37%	45%
Richardson West Junior High	547	1%	7%	17%	43%	33%	51%
Forest Meadow Junior High	522	0%	4%	45%	23%	27%	58%
Westwood Junior High	567	0%	7%	24%	30%	39%	41%
Liberty Junior High	587	0%	17%	39%	23%	20%	58%

The intervention classes were similar across all of the schools, with students enrolled in 100 minute block classes that employed the TI-Navigator system to assist in instruction. Within the schools, teachers assigned to these classes met frequently to develop and share their knowledge and solve problems, and these teachers also received additional professional development sessions with a math expert from Texas Instruments.

Table 2: Economic disadvantaged and ethnic group percentages across junior high schools and between classes

		Economically Disadvantaged	Asian	African American	Hispanic	White	Total
		Percent	Percent	Percent	Percent	Percent	Count
Lake Highlands Junior High	Comparison Class	55%	2%	55%	25%	19%	183
	Block Class	64%	0%	53%	27%	19%	172
Richardson West Junior High	Comparison Class	58%	5%	21%	50%	22%	216
	Block Class	74%	0%	17%	63%	20%	109
Forest Meadow Junior High	Comparison Class	72%	3%	57%	30%	9%	268
	Block Class	60%	0%	56%	24%	20%	82
Westwood Junior High	Comparison Class	58%	3%	29%	46%	22%	180
	Block Class	60%	1%	31%	51%	17%	98
Liberty Junior High	Comparison Class	62%	15%	36%	27%	20%	273
	Block Class	64%	12%	52%	26%	10%	181

To help assess the effects of the MathForward intervention, a comparison group of students at each school was constructed by selecting students who were not participating in the block classes, were not enrolled in Pre-AP mathematics courses, and who were taught by teachers other than those participating in the intervention. This left students who were not identified by the district benchmarks as being at risk but who also were not enrolled in the highest level math classes. As shown in table 2 above, the block and comparison classes had similar demographic characteristics, although for most schools the intervention group had a higher percentage of economically disadvantaged students (with Forest Meadow being the exception). In all, 642 students were enrolled in the MathForward classes taught by 22 teachers at the junior high schools, along with 60 9^{th} graders taught by five teachers at the high school sites. Additionally, 1120 junior high and 948 high school students not enrolled in Pre-AP mathematics courses were selected from the same schools to serve as comparisons for our analyses.

Turning to the 2007 TAKS results across all of the schools, we can summarize performance generally and for specific subgroups of interest. In table 3 below, the percentage of students in the 7^{th} and 8^{th} grades who met the minimum passing standard can be seen along with the percentage change from the 2006 results for each group at the schools. As can be seen in the table below, there is some degree of variation between the school and among the major ethnic groups within the schools.

Table 3: 2007 TAKS Met Minimum Percentage Pass Rate by Grade for comparison and block classes

Campus			Overall	African American	Hispanic	White	Economically Disadvantaged
7th Grade							
Lake Highlands Junior High		Comparison Classes	67%	58%	67%	89%	60%
		Block Classes	83%	73%	87%	96%	84%
Richardson West Junior High		Comparison Classes	81%	67%	82%	90%	79%
		Block Classes	79%	67%	86%	67%	80%
Forest Meadow Junior High		Comparison Classes	61%	56%	71%	64%	57%
		Block Classes	68%	75%	36%	89%	64%
Westwood Junior High		Comparison Classes	86%	82%	91%	86%	85%
		Block Classes	82%	40%	100%	100%	81%
Liberty Junior High		Comparison Classes	72%	61%	73%	89%	65%
		Block Classes	66%	56%	72%	78%	63%
8th Grade							
Lake Highlands Junior High		Comparison Classes	52%	47%	42%	76%	50%
		Block Classes	38%	41%	33%	40%	41%
Richardson West Junior High		Comparison Classes	73%	78%	68%	82%	72%
		Block Classes	39%	33%	35%	54%	37%
Forest Meadow Junior High		Comparison Classes	54%	54%	43%	79%	49%
		Block Classes	71%	68%	56%	100%	71%
Westwood Junior High		Comparison Classes	78%	58%	82%	95%	72%
		Block Classes	58%	67%	52%	67%	48%
Liberty Junior High		Comparison Classes	75%	54%	74%	93%	68%
		Block Classes	62%	55%	55%	80%	65%
9th Grade							
Lake Highlands Freshman Center		Comparison Classes	70%	47%	65%	94%	52%
		Block Classes	60%	50%	71%	100%	58%
Pearce High School		Comparison Classes	89%	68%	77%	95%	72%
		Block Classes	88%	n/a	100%	75%	100%
Total	7th	Comparison Classes	73%	62%	78%	86%	68%
		Block Classes	76%	65%	82%	89%	75%
	8th	Comparison Classes	66%	56%	63%	86%	60%
		Block Classes	54%	53%	46%	68%	53%
	9th	Comparison Classes	79%	50%	71%	95%	59%
		Block Classes	63%	50%	76%	88%	63%

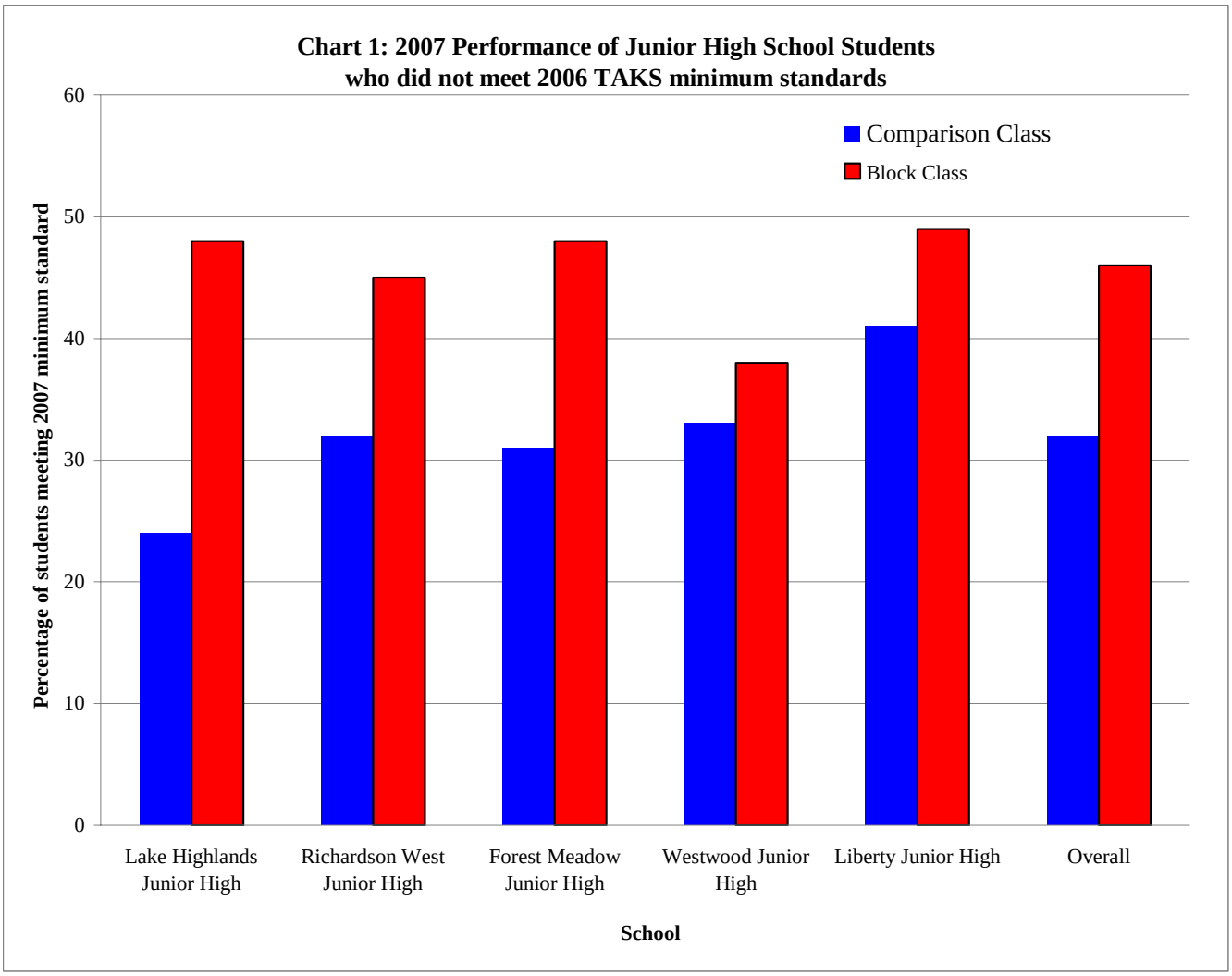
As table 3 illustrates, the intervention led to relatively better results for the 7th grade classrooms where the percentage of MathForward students meeting the minimum passing level approached or exceeded that of comparable students. In the eighth grade the comparison classes have a passing percentage that is greater at most schools, and in the ninth grade the pilot program at the high school level shows some promise. Finding an apt comparison group for these students is somewhat problematic, however, given that the most at-risk students were those primarily targeted for the intervention.

The next table attempts to give a more appropriate contrast. A comparison of results across campuses for combined 7th and 8th grade students who had data over the past two years is informative since the intervention was focused on students who did not pass the 2006 TAKS, or who were deemed at-risk for not passing this year.

Table 4: 2007 TAKS Math Performance by Students who did not meet 2006 minimum standard by school and class grouping across the junior high sites

			Did not meet 2007 TAKS minimum standard	Met 2007 TAKS minimum standard	Total
			Percent	Percent	Count
Lake Highlands Junior High	Comparison Classes	2006 Not Met	76%	24%	33
		2006 Met	13%	87%	82
	Block Classes	2006 Not Met	52%	48%	44
		2006 Met	13%	87%	91
Richardson West Junior High	Comparison Classes	2006 Not Met	68%	32%	19
		2006 Met	14%	86%	163
	Block Classes	2006 Not Met	55%	45%	58
		2006 Met	12%	88%	41
Forest Meadow Junior High	Comparison Classes	2006 Not Met	69%	31%	71
		2006 Met	13%	87%	105
	Block Classes	2006 Not Met	52%	48%	25
		2006 Met	15%	85%	52
Westwood Junior High	Comparison Classes	2006 Not Met	67%	33%	9
		2006 Met	7%	93%	136
	Block Classes	2006 Not Met	62%	38%	29
		2006 Met	7%	93%	54
Liberty Junior High	Comparison Classes	2006 Not Met	59%	41%	29
		2006 Met	9%	91%	174
	Block Classes	2006 Not Met	51%	49%	69
		2006 Met	18%	82%	90
Overall	Comparison Classes	2006 Not Met	68%	32%	161
		2006 Met	11%	89%	660
	Block Classes	2006 Not Met	54%	46%	225
		2006 Met	14%	86%	328

Table 4 shows the 2007 performance of students who either met or did not meet the minimum passing standard on the TAKS in 2006. Students are grouped by school, class assignment, and whether or not they met the TAKS minimum passing standard in 2006, and percentages are then reported in terms of 2007 TAKS performance. In all of the schools, students who had not met the minimum standards in 2006 were much better off in 2007 if they were enrolled in the block class participating in the intervention. Chart 1 below illustrates this in a graphic fashion.

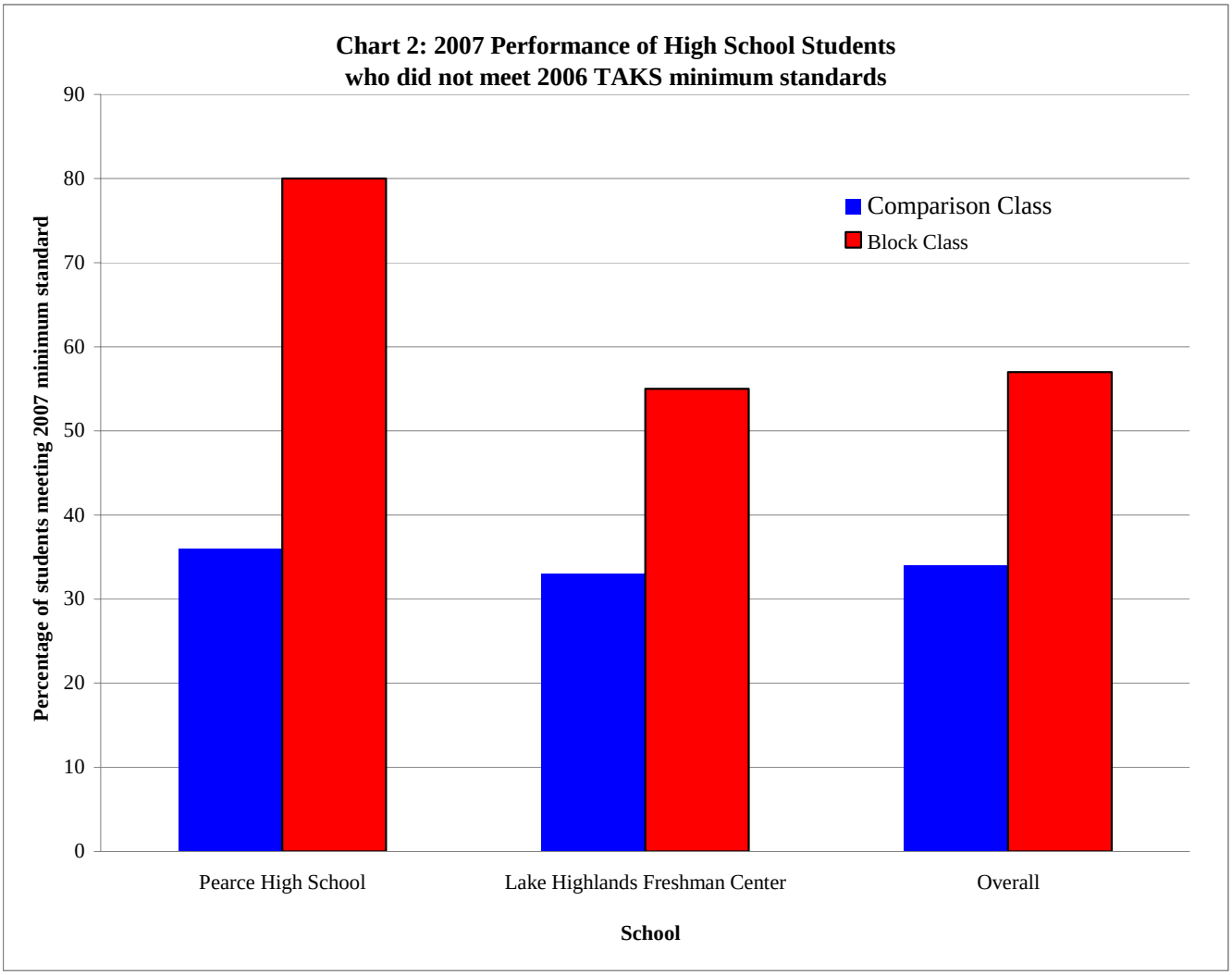


The high school sites also show a similar promising pattern, and while it is a small extension the expansion of the program past the junior high school level seems to work as well. Table 5 shows a pattern similar to the one illustrated above in table 4, with a much greater percentage of at-risk students meeting the minimum standard for passing the 2007 TAKS.

Table 5: 2007 TAKS Math Performance by Students who did not meet 2006 minimum standard by school and class grouping at the high school sites

			Did not meet 2007 TAKS minimum standard	Met 2007 TAKS minimum standard	Total
			Percent	Percent	Count
Pearce High School	Comparison Classes	2006 Not Met	64%	36%	39
		2006 Met	3%	97%	383
	Block Classes	2006 Not Met	20%	80%	5
		2006 Met	n/a	100%	3
Lake Highlands Freshman Center	Comparison Classes	2006 Not Met	67%	33%	95
		2006 Met	7%	93%	267
	Block Classes	2006 Not Met	45%	55%	42
		2006 Met	13%	88%	8
Overall	Comparison Classes	2006 Not Met	66%	34%	134
		2006 Met	5%	95%	650
	Block Classes	2006 Not Met	43%	57%	47
		2006 Met	9%	91%	11

Note that there was a difference in assignment methods here as students who had participated in the block classes last year at Lake Highlands Junior High School were included in block classes at Lake Highlands Freshman center. Chart 2 below illustrates this consistent pattern at the high schools in a graphic form.



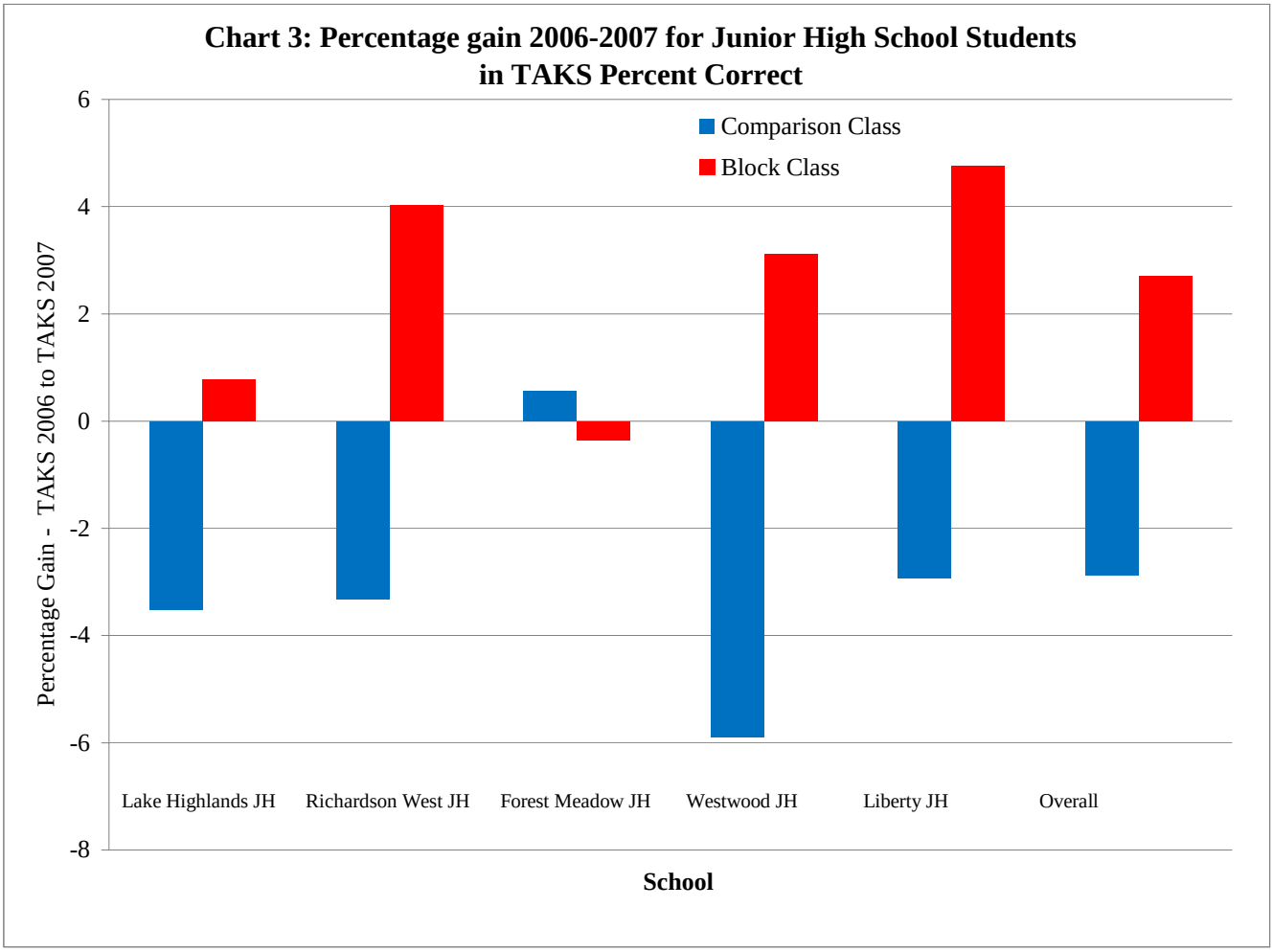
A comparison can also be made across schools contrasting gains in the percentage of correct responses made by students in the block classes and those in regular (non-AP) mathematics classes. Again, using the students where data are available from both 2006 and 2007, the change in percent correct on the TAKS assessment was calculated for each student in the block and comparison classes. The averages for the groups were then compared, summarized below in table 6.

Table 6: Average TAKS Percentage Correct Growth from 2006 to 2007 for Block and Regular Mathematics Classroom Students across schools

School	Block versus Comparison Classes	Average	Standard Deviation	Number of Students
Lake Highlands Junior High	Comparison Classes	-3.52	13.20	115
	Block Classes	0.78	13.31	135
	Total	-1.20	13.41	250
Richardson West Junior High	Comparison Classes	-3.32	11.32	182
	Block Classes	4.02	13.63	99
	Total	2.40	12.22	148
Forest Meadow Junior High	Comparison Classes	0.56	15.50	176
	Block Classes	-0.35	15.40	77
	Total	0.28	15.44	253
Westwood Junior High	Comparison Classes	-5.89	10.86	145
	Block Classes	3.11	11.68	83
	Total	-2.61	11.95	228
Liberty Junior High	Comparison Classes	-2.93	13.92	203
	Block Classes	4.76	14.96	159
	Total	0.45	14.87	362
Total	Comparison Classes	-2.88	13.28	821
	Block Classes	2.70	14.03	553
	Total	-0.63	13.85	1374

The results in Table 6 show that students in the block classes made gains at four of the schools, while students in comparison mathematics classes at four of the schools lost ground on this year's test. Only Forest Meadow Junior High deviates from this trend, where relative gains by 8th grade block classes

were offset by a slightly larger deficit in the 7th grade. Interpreting gain scores can be problematic given pre-existing score differences in the groups at the start of the school year, as the Block class students started out with lower initial scores. Using an Analysis of Covariance (ANCOVA) test, the relative gains illustrated by these groups could be assessed while statistically controlling for any initial differences[1]. When the 2006 percentage correct TAKS total for each student is used as a covariate, the ANCOVA analysis revealed that the Block Class Students gained significantly more in their TAKS scores over the year ($\mathbf{F}_{(1,1353)} = 13.08$, $\mathbf{p} < .001$). Chart 3 illustrates the pattern graphically.

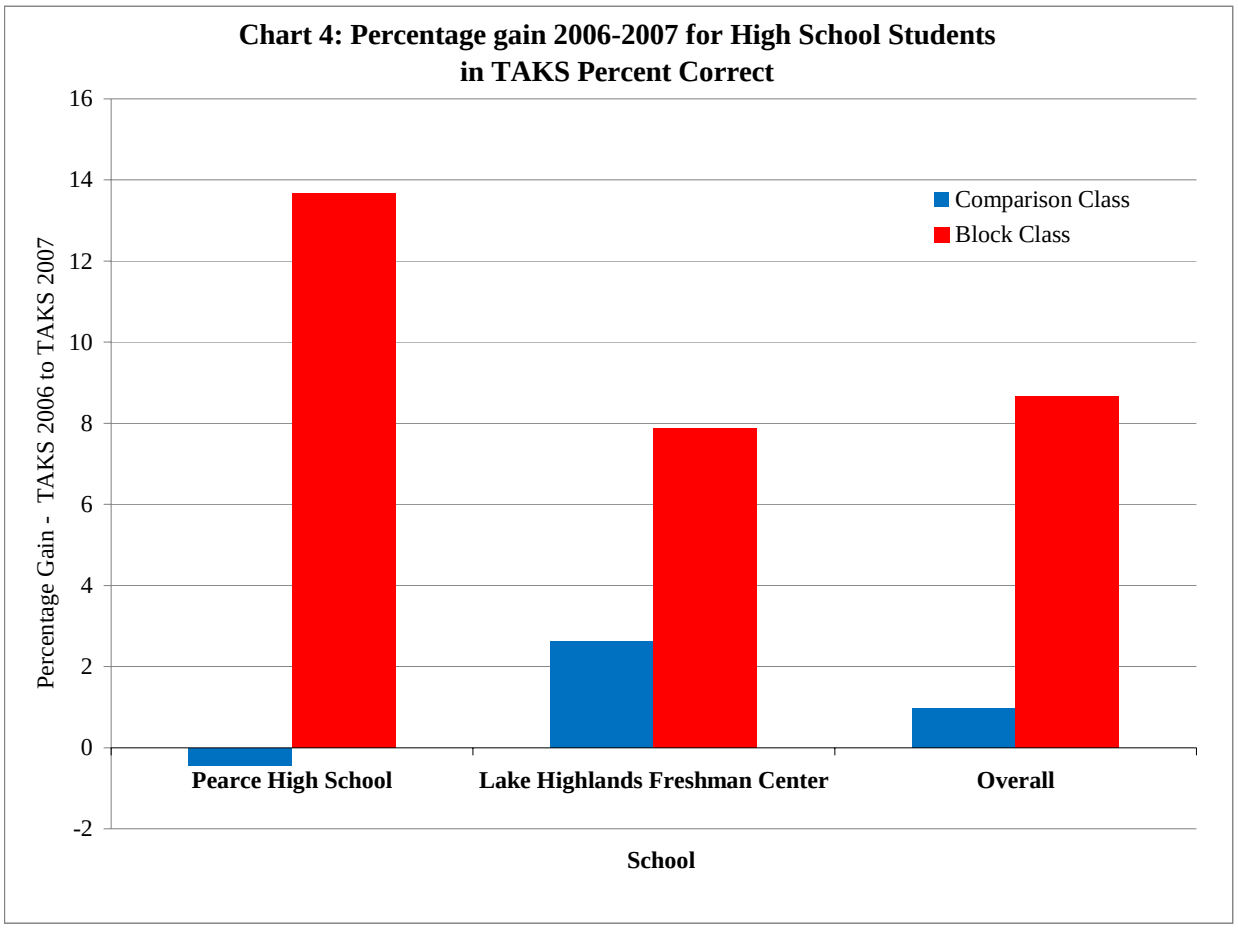


This analysis can also be repeated for the high school sites, and while the any results from this small sample should be taken as preliminary, they show promise and illustrate the same pattern seen at the junior high school level. Table 7 and chart 4 below show the average correct percentage comparison for the two participating high schools. Utilizing the same ANCOVA analysis strategy, these reported differences also are statistically significant when the initial starting level is controlled for through the use of the 2006 TAKS correct percentage as a covariate ($\mathbf{F}_{(1,837)} = 8.102$, $\mathbf{p} = .005$).

[1] To verify the suitability of an ANCOVA analysis strategy, the null hypothesis assumption that the error variance of the dependent variable is equal across groups was not rejected; $\mathbf{F}_{(19,1354)} = 1.505$, $\mathbf{p} = .075$ for junior high schools and $\mathbf{F}_{(3,838)} = 1.591$, $\mathbf{p} = .19$

Table 7: Average TAKS Percentage Correct Growth from 2006 to 2007 for Block and Regular Mathematics Classroom Students across high schools

School	Block versus Comparison Classes	Average	Standard Deviation	Number of Students
Pearce High School	Comparison Classes	-0.45	9097	422
	Block Classes	13.67	11.66	8
	Total	-0.19	10.17	430
Lake Highlands Freshmen Center	Comparison Classes	2.63	10.72	362
	Block Classes	7.88	9.15	50
	Total	3.26	10.67	412
Total	Comparison Classes	0.97	10.43	784
	Block Classes	8.68	9.63	58
	Total	1.50	10.56	842



Teacher Content Knowledge

The TI-RISD intervention also focused on improving teacher knowledge, using professional development opportunities and collaborative sessions to assist the mathematics teachers. The impact in this area can be seen in the teachers' scores on the Content Knowledge for Teaching Mathematics (CTKM) project assessment (Ball, Bass, & Hill, 2003) that was administered prior to this year and then again after the TAKS testing period. Table 8 lists the CKTM averages for the 20 mathematics teachers participating in the intervention program who had complete data from the beginning of the school year in 2006 to the end in 2007, along with the growth illustrated on each CKTM domain. Note that the CKTM scores are represented in standard deviation units and are normalized in line with a national sample of mathematics teachers who completed the CKTM measures over the last three years. The average score is calibrated to zero, and scores can be negative or positive in value, representing results that would be below (negative) or above (positive) average. As part of a different study (Winick, Lewis and Toenjes, 2005 – *Study of Mathematics Practice, Policy and Instruction in the Richardson Independent School District*), mathematics teachers across RISD's junior high schools completed the CTKM, and at that time were essentially at the average level (.0001 for the Number Operations Scale and .0008 for the Patterns, Functions and Algebra Scale). While some of the teachers from that initial study are not included here and new teachers have also joined to be part of the present sample, these numbers help to place this year's results in a broader context.

Table 8: CKTM Averages and change from 2006 to 2007 in Richardson ISD overall

LMT Dimension	Average	Standard Deviation	Range
2006 Numbers and Operations domain	.2679	.809	2.62
2007 Numbers and Operations domain	.2294	.800	2.85
Growth in Numbers and Operations score, 2006-07	-.1244	.829	3.22
2006 Patterns, Functions, and Algebra domain	.3118	.686	2.02
2007 Patterns, Functions, and Algebra domain	.3953	.584	2.05
Growth in Patterns, Functions, and Algebra score, 2006-07	-.0228	.430	1.72

Focusing on this year, on average no growth was seen on the content knowledge scales over this time period, with the average scores falling by year's end. This may related to a number of factors highlighted in the teacher surveys, reported below. Gains in the Numbers Operations Scale were positively correlated with the percentage of students in a teacher's class meeting the minimum TAKS standards ($\mathbf{r}_{(19)} = .43$, $\mathbf{p} = .033$) and a positive trend was also seen between gains in Number Operations and the class average percentage correct ($\mathbf{r}_{(19)} = .37$, $\mathbf{p} = .058$). The following charts graphically illustrate these associations. No associations were found between the Patterns, Functions and Algebra Scale Score and student outcomes, but for comparison graphs of those findings can be found in the appendices section.

Chart 3: Association between CKTM Number Operations Scale Score and Met Minimum TAKS Standard

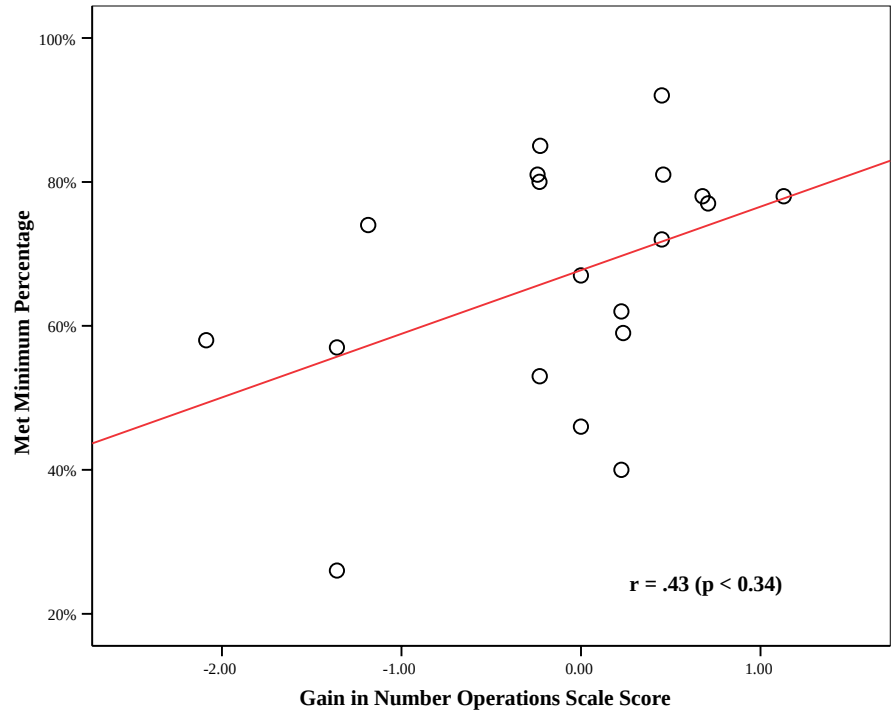
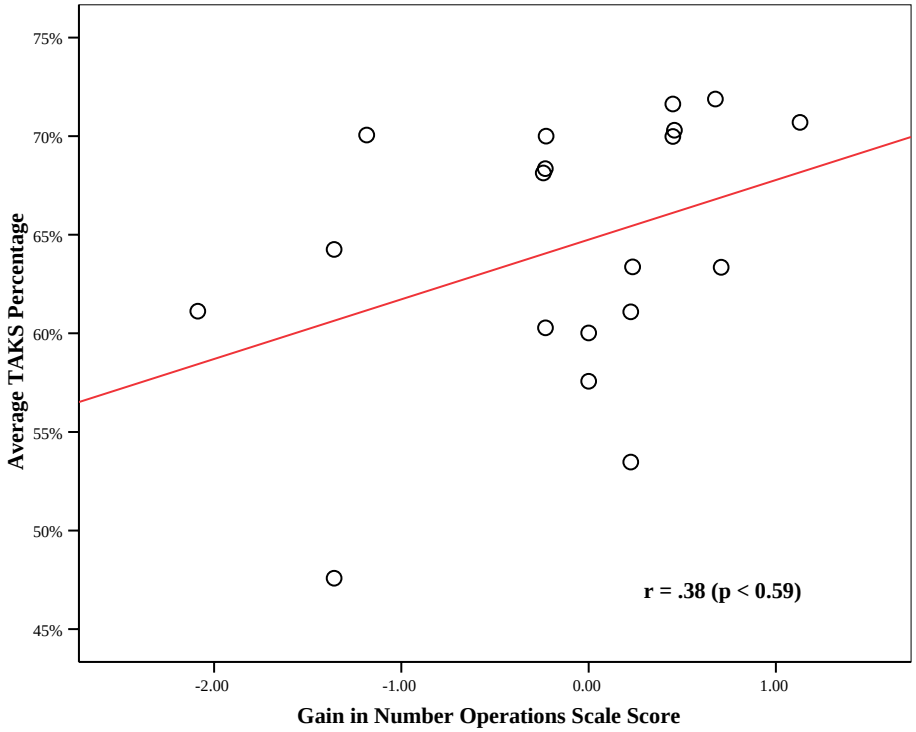


Chart 4: Association between CKTM Number Operations Scale Score and average TAKS correct percentage



The patterns in growth measures for Number Operations show a positive trend with teachers scoring higher or showing more growth on the domains also having classes with a higher percentage meeting the minimum passing level on the TAKS.

Teacher Perceptions - Overview

Thirty-five classrooms across five junior high campuses participated in the MathForward Program from the Richardson Independent School District (RISD), and all the stakeholders connected to these classes (students, parents and teachers) were asked to complete a year-end survey. Five junior high schools and two high schools completed a mid-year survey, while only 16 teachers, 367 students, and 157 parents from four of the junior high schools completed the year-end survey. At each point teacher, parent and student feedback were collected on the intervention components. Summarized below are findings from the junior high sites in RISD. Attached separately are reports for each site.

Teacher Confidence
Teacher confidence improved since mid-year. Changes can be seen at Westwood Junior High, Forest Meadow Junior High and Liberty Junior High where teachers who previously reported not being able to teach grade level math agreed at year-end that they could. Maintaining order in the classroom continues to be a problem at most campuses. Westwood Junior High may be the exception.

In terms of expected student outcomes, the percentage of teachers at Richardson West Junior High and Forest Meadow Junior High who were confident that students would master grade level content as measured by the year-end state mathematics test rose from mid-year to year-end.

The teacher confidence questions are clustered in the Learning Environment domain which at year-end was significantly correlated with student performance data. Learning Environment domain averages at the schools correlated significantly with percentage of students in each class who met the minimum TAKS passing standard ($\mathbf{r}_{(15)} = .58$, $\mathbf{p} = .013$) and with the classroom average correct percentage ($\mathbf{r}_{(15)} = .46$, $\mathbf{p} = .044$).

Math Content Support
Across the campuses teachers reported that the math content sessions were not helpful. Many thought they were taught at a level too advanced to support pedagogical needs for struggling students. While some improvement is noted at one site from mid-year to year-end, it is not clear that the sessions improved during the year. Lake Highlands Junior High School appears to have found the sessions most useful; half of the teachers at mid-year found value in the meetings.

Collegial & Administrative Support
Reports of collegial support remained high across the year. All of the teachers agreed that there is an expert available with whom teaching strategies can be discussed.

Most campuses report feeling valued by their administrators, although the reviews by teachers at Westwood Junior High School remain mixed. At mid-year many teachers reported that their

administrators did not understand the demands of teaching the TI Intervention, while only a fourth of the teachers responding at year-end suggested the same. Specific requests for additional support from the district include:

• Refrain from placing students with behavioral problems in the block classes.
• Make a serious decision about the dress code.
• Provide more planning time to create Learn Checks, work on lesson plans and activities.
• Assure good content coverage prior to implementation
• Provide opportunities to share teaching strategies
• Limit the block classes to 20 students

Technological Support
The teachers responding to the year-end survey agree that assistance is readily available for implementing the TI Technology. In fact, Betty Gasque received enthusiastic reviews.
Some disagree that they have sufficient curriculum materials (or materials that are of good quality) to effectively use TI Navigator, while nearly all agree that they could use additional training on the TI Navigator. Additional requests include:

• Assistance in the room at the beginning of the year to troubleshoot
• A pull-out planning day every six weeks
• TI Navigator teachers placed physically close to one another
• More specific outlined curriculum, step-by-step planning of a lesson from start to finish
• More lessons and lessons better aligned to TEKS that also meet lower level student needs
• Additional training on Activity Center
• Answer keys to notes and homework

Support listed as most critical to student performance includes monthly updates, TI Activity Navigator ideas, Betty Gasque and the support and ideas from teachers at other schools in the full day session. Table 9 captures the averages in the support domains across the schools. The numbers are derived from the year-end survey where teachers responded to a 5 point likert scale. A lower score denotes disagreement that support exists, whereas a higher score suggests agreement that particular support is present.

Table 9: Teacher Development and Support Indicators
Year End 6-07

School	Type of Support			
	Technical	Math Content	Collegial	Administrator
Forest Meadow Junior High	3.92	2.25	3.92	4.33
Westwood Junior High	3.38	3.17	3.88	2.50
Liberty Junior High	3.95	2.44	4.25	4.0
Richardson West Junior High	3.0	1.38	4.19	3.75

Pedagogy
While similarities are seen in teacher use of small group instruction, discussion and student collaboration across the campuses, teacher and student responses portray different classroom cultures. For example, Liberty Junior High teachers report being more focused on lecture, drill and practice than other sites. Liberty Junior High also is the only school where teachers mostly agree that it is important that they appear to know everything about math and technology in class. The students at Liberty Junior High do not show the enthusiasm of other RISD students for the way math is being taught. Even so, the percentage reporting enthusiasm has risen from 44% at mid-year to 56% by year-end with a larger percentage of students noticing an improvement in their grades over mid-year.

At Richardson West Junior High several teachers disagree that students regularly explore multiple solutions in class, apply concepts to real world problems or explain the steps they use to solve a problem. Discussion is critical and rooms are not organized for lecture. Both teachers and students describe a classroom culture that is less lecture-based and more team oriented than other RISD junior high campuses.

Westwood Junior High and Forest Meadow teachers more consistently report learning that is based upon students being able to explain, compare and apply their work. At Westwood student reports suggest that class time is more focused on learning facts, definitions and formulas. At Forest Meadow a higher percentage of students report knowing the learning goals, feel comfortable asking questions and report trying to solve real world problems than other RISD junior high sites.

The Power Block
Teacher responses to the power block are positive but mixed, with most agreeing that the amount of content covered with the block has increased. Of the four sites responding to the year-end survey, Richardson West Junior High teachers are most likely to agree that the block has made a real difference in how students approach difficult problems, where Forest Meadow Junior High shows the most concern about the session being too long to keep students focused. Richardson students also provide the most positive feedback on the block.

Assessment
Teachers report that unit benchmarks are aligned to the district curriculum and the district curriculum is aligned to the state mathematics standards. It is unclear to some, if the unit diagnostics are aligned to the district curriculum. Less than half agree that standardized tests accurately measure what students are taught in math class.

Teacher attitudes about the value of benchmark data are mostly positive, although some, mostly at Liberty and Westwood Junior High, suggest that the data they receive is not based upon district benchmark data.

Technology Use and Pulse (Perceived Benefit)
Forest Meadow teachers report the most consistent use across the TI Navigator features (Quick Poll, Learn Check, Screen Capture, Activity Center) and the highest percentage of teachers (2-3 out of 3)

using the technology. Depending on the type of activity, 56% to 82% of the teachers report using TI Navigator with the largest use occurring during Problem Solving. Please refer to Tables 2 and 3 for summary data on technology use.

Table 10: Technology Use - Teacher Self Report
Year End 6-07

School	Technology Use (Domain Avg.)	Learn Check (Daily Use)	Quick Poll (Daily Use)	Screen Capture (Non-specified Use)	Activity Center (Use Often)
Forest Meadow Junior High	3.75	67%	100%	100%	33%
Westwood Junior High	3.0	0%	50%	75%	50%
Liberty Junior High	3.0	40%	60%	40%	40%
Richardson West Junior High	2.5	0	50%	25%	25%

Derived from the year-end survey where teachers are asked about specific technology use with likert response options per Table 9.

Table 11: TI Navigator Use - Teacher Self Report
Year End 6-07

School	Use During Warm-Up	Use for Main Activity	Use During Problem Solving	% of Teachers Reporting Use
Forest Meadow Junior High	56%	67%	82%	56 – 82%
Westwood Junior High	58%	69%	58%	58 – 69%
Liberty Junior High	60%	44%	49%	44 – 60%
Richardson West Junior High	33%	38%	22%	22 – 38%

Derived from tables where teachers selected the type of activity for which TI Navigator is used and when. Please find specific behavior for nine types of use in the individual school reports.

At Westwood Junior High 58% to 69% of the teachers report using TI Navigator during Warm-Up, the Main Activity or Problem Solving. Half of the teachers report using Quick Poll daily.

Forty-four to 60% of the teachers at Liberty Junior High report using the TI Navigator, with the highest use during Warm-Up.

Richardson West Junior High shows the lowest usage across teachers with only one in four using Screen Capture or Activity Center and none using Learn Check. Twenty-two to 38% of the teachers at Richardson West Junior High report using the TI Navigator with the highest use occurring during the Main Activity.

Technology pulse or perceived benefit is highest at Forest Meadow Junior High and Westwood Junior High, with the largest gain since mid-year at Liberty Junior High School. The Forest Meadow teachers all report being able to modify instructional strategies for individual students based on real-time data collected through TI Navigator. The teachers do not agree that the TI Navigator more successfully engages students who have experienced difficulty in math though.

At Westwood Junior High where technology use is lower, but perceived benefit perhaps higher, teachers view the relationship between technology use and student engagement more positively. Of course, Westwood is the campus where teachers are most optimistic about the classroom environment and thus report the least difficulty with discipline. Table 12 provides summary data on Technology Pulse.

Table 12: Technology Pulse –Teacher Self Report
Year End 6-07

School	Technology Pulse (Perceived Benefit) Domain Averages	Selected Specific Benefits from TI Technology Use		
		Teacher modifies instruction	Student learning is accelerated	Students with difficulty in math are better engaged
Forest Meadow Junior High	3.4	100%	67%	33%
Westwood Junior High	3.6	50%	75%	100%
Liberty Junior High	3.2	40%	40%	60%
Richardson West Junior High	3.2	50%	25%	75%

Column 1 represents the domain average score for a set of nine questions about the value of TI Navigator or the TI technology. A likert scale of 1 to 5 is used where 5 represents strong agreement that a particular benefit is found. Columns 2 through 4 capture the percentage of teachers who agree to have noticed these specific benefits.

Student performance is significantly higher in classrooms where the teachers report more benefit from using the TI technology. Technology Impact domain averages at the schools correlated significantly with percentage of students in each class who met the minimum TAKS passing standard ($\mathbf{r}_{(16)} = .45$, $\mathbf{p} = .041$) and with the classroom average correct percentage ($\mathbf{r}_{(16)} = .48$, $\mathbf{p} = .029$).

Parent Inclusion

Most teachers do not think their students' parents know how to help their child in math. Few, if any of the parents have attended a session to learn about the math program.

Individual Site Year-End Reports

Forest Meadow Junior High 6-07

Five classrooms participated in the study. Three teachers, 20 parents and 72 students completed a year-end survey about their experiences.

Teacher Input

Teacher views of their ability to teach grade level math and of student performance may have shifted since the mid-year survey. One teacher appears less confident, while two are more confident. Maintaining order in class continues to be a challenge, while two of the teachers do not think students accept responsibility for their role in learning.

At Forest Meadow Junior High (FMJH) administrative support is rated high by all the teachers and higher than at other RISD sites. Similar to other sites most of the teachers find the collegial meetings have improved their teaching, while all report that an expert is available with whom to discuss teaching strategies. One teacher reports that the math content sessions have increased his/her understanding. Another writes, "the level of math is too high for middle school". Additional content requested includes "new research (strategies of math teaching)".

Even though technology use at FMJH is high and assistance readily available, all of the teachers desire additional training on TI Navigator. In addition, one teacher requests an assistant in the room at the beginning of the year to troubleshoot, explaining that it is hard to get going with kids whining about not being able to log in as everyone waits impatiently.

In terms of district support teachers request to be physically near other TI Navigator teachers and to have a pull-out planning day every 6 weeks. The support that has been most critical to increasing student performance include monthly updates, TI Navigator activity ideas and perhaps Betty. One teacher writes, "I love Betty!"

The teacher responses characterize a learning environment that consistently uses more advanced pedagogy. Discussion is critical to learning, students explore multiple solutions in class, and regularly explain steps used to solve a problem. Compared to other classroom processes, FMJH students are less likely to solve problems on their own in class, more likely to collaborate in pairs or groups. At mid-year the teachers reported using more advanced pedagogy as well.

Teachers at FMJH are less enthusiastic about the block. Several report that it is too long to keep students focused. These concerns also surfaced in the open-ended responses at mid-year.

The teachers tend to think that benchmark data and real-time feedback have helped them improve student learning. They report that students enjoy "seeing the difference in their scores before and after a unit", that participation has increased and real-time feedback prevents incorrect reasoning from becoming a bad habit". One teacher disagrees, but seems to disagree across the board that the intervention components have been useful.

Teachers are less clear about the benefits of the TI technology than some RISD sites. One agrees that students have more "aha' moments, one agrees that the technology more successfully engages students experiencing difficulty in math. In the open-ended remarks a teacher states, "I honestly cannot imagine going back to teaching without it". The other teachers provide positive feedback mostly relating to immediate assessment and re-teaching.

Technology use at FMJH is high particularly during the problem solving portion of the class. All of the teachers report using Quick Poll daily to check student answers, all report using Screen Capture. One reports using Activity Center often. The teachers report using TI technology to discuss the same object/concept using more than one representation, for class analysis and to encourage student collaboration.

One teacher reports communication with parents about the math program.

Parent Input

Most of the twenty parents who completed the survey agree that their child's performance is better this year. Half agree that they have attended a session to learn about the math program. Far fewer report knowing what they can do to help their child be successful in math (58% verses 82% or higher at other sites).

Student Input

Student responses suggest that technology use and efficacy as well as positive experience of the block is much lower for one of the three teachers. Even so on average at FMJH more students are confident about passing the year-end math test and report that their teacher believes they can learn at FMJH than other RISD sites. A higher percentage of students report knowing the learning goals, feel comfortable asking questions in class and report trying to solve real world problems with math. Roughly sixty percent of the students report using Quick Poll each day or Activity Center often.

In the open-ended comments students mostly provide positive comments about the TI graphing calculator. They suggest that learning math is more fun and exciting and that they learn faster.

Forest Meadow Junior High
(3 teacher responses)

How TI Navigator Is Used	Warm-Up	Main Activity	Problem Solving	Total
a) Collect homework or assignments	3	1	2	6
b) Give an assignment/quiz/test (e.g. Learning Check)	3	2	2	7
c) Send learning materials for students to work with (e.g. apps, models, worked examples, visualizations)	1	2	3	6
d) Send questions/prompts for immediate student response (e.g. Quick Poll)	2	2	3	7
e) Monitor student progress (e.g. look at screen shots of what is on the student device)	1	2	2	5
f) Encourage students to collaborate, discuss answers or develop shared solutions in pairs or groups	1	2	3	6
g) Work with the whole class sharing student data (e.g. class analysis)	1	3	2	6
h) Discuss the same mathematical object/concept using more than one representation	2	2	3	7
i) Modify instruction based on student understanding	1	2	2	5
Total selections	15	18	22	
Average use for class portion	56%	67%	81.5%	

Note: Teachers were asked to place an “x” in the boxes above to note when and how they use TI Navigator. TI Navigator use that is selected by at least 2 out of 3 teachers is highlighted, while percentage use by portion of the block is noted as percentages across the bottom row. Three teachers responding to 9 possible TI Navigator uses provides a denominator of 27 in computing the percentage.

Liberty Junior High 6-07

Nine classrooms participated in the study. Five teachers, 89 parents and 174 students completed a year-end survey about their experiences.

Teacher Input

At Liberty Junior High School collegial and administrative support receive high marks while classroom use of technology has increased. The classroom and learning environments are less optimistic than other RISD campuses, but have improved. At Liberty Junior High (LJH) the math teachers generally report that students do not want to learn math, maintaining order in the classroom is an on-going challenge, and students will not do well on district benchmarks or the year-end state test. In fact, at mid-year two thirds of the teachers did not believe they could teach grade level math successfully to their students, nor were they confident that almost all students in class could learn grade level math. This percentage dropped from 67% at mid-year to 40% at year-end.

The Liberty teachers report positive administrative, collegial and technological support. An expert is readily available to discuss teaching strategies and assistance is available for use of the TI technology. Meetings with colleagues appear to include conversations about alternative teaching strategies and math content, not technology per se; "that's mostly individual". There is some disagreement over the quality of the curriculum materials for TI Navigator. All teachers report that they could use additional training on TI Navigator.

Math content support provides a different picture. Only one of the five teachers appears to have benefited from the sessions. Most report that the sessions have not increased their knowledge; they don't feel comfortable asking questions and would NOT benefit from additional sessions. Comments included: "If you mean Dr. Schar, he totally frustrated me", and "The content of the sessions was not really for lower level struggling students". One teacher remarks throughout how the various sessions helped refresh her/his understanding of math content and teaching strategies that she/he had not used in a number of years; how she was able to learn effective strategies from more experienced teachers.

Liberty teachers report different attitudes about teaching math than other RISD math teachers. At Liberty, all of the teachers agree that lecture, drill and practice are critical to learning in their classes, where at other campuses, one teacher out of several agrees with this statement. A second dimension appears to distinguish Liberty. All but one teacher agrees that it is important that one "appears to know everything about math and technology in class". This is not the case at other campuses. Otherwise, three or four teachers report using discussion, having students apply concepts to real world problems and exploring multiple solutions in class, although less so the later.

Small group instruction and collaborating in pairs or small groups appears important to teacher learning strategies at LJH. While all agree that the Block time has increased the amount students are able to cover in a year, some think it is too long to keep students focused. In the open-ended remarks though, four out of five comment on the increased opportunities for learning.

At mid-year teachers seemed split on the benefits of benchmarking. This split seems to have shifted where 3 out of five teachers find the benchmark data helpful at year-end. While benchmarks are aligned

to the district curriculum and the curriculum to the state standards, it is not clear that unit diagnostics are aligned to the district curriculum. Teacher open-ended comments provide a similar pattern with three mentioning benefits of using diagnostic data, while two do not. One remarks:

> "I do not like to use the diagnostics. They don't do well on what we did yesterday, much less perform successfully on the diagnostics. I think they just make the students feel worse about their abilities."

Technology use appears to vary at LBJ. Teachers use Learn Check and Quick Poll, as well as Navigator to share student data with the whole class or to discuss the same mathematical concept using more than one representation. According to the teacher self reports, TI Navigator is used most frequently at LJH for warm-up (60% use), verses for main activity (44%) and problem solving (49%).

Technology pulse at LJH is mixed with some teachers reporting that they are able to modify instructional strategies based on real time data or that the feedback has accelerated learning, but less than half report this. Teachers seem to find the most benefit from the TI technology in terms of covering more material in depth, more "aha" moments by students, increased participation and/or motivation, as well as use of the real-time feedback. The one especially negative teacher admits, that he/she is" still learning how to use the technology" and "hopes to incorporate it more successfully next year", but that it "does keep them on track." Others notice changes in student performance, especially by those who really try.

The technology pulse for teachers (adjusted) moved from 2.99 at mid-year to 3.2 at year-end.

One of the five teachers report that parents understand what they can do to help their child in math. None of the parents have seen the TI Navigator in use or attended a session to learn about the math program.

In terms of what the district or school can do better to support the math program, several teachers comment on the inappropriateness of students with behavioral problems in the block classes. "They interfere with those who want to learn." Teachers write in the closing section again about behavioral problems presenting additional challenges when utilizing the TI Navigator system.

Teachers request more planning time to create Learn Checks, work on lesson plans and activities. One writes, "The district needs to make a serious decision about the dress code. It would help to be able to teach".

Requested support from TI includes more specific outlined curriculum, step by step planning of a lesson from start to finish and more training on Activity Center.

The support listed as most critical to the project includes tech support for when there are failures, monthly meetings with TI, individual observations with the district specialist, and meetings with Betty ("They were GREAT")

Parent Input

More parents completed surveys at LBJH than other RISD schools. Parent assessment of the learning environment and their child's performance is slightly lower than other intervention schools, while student outlook is similar. Three-fourths of the parents are confident their child will pass the year-end test in math this year. While 71% of the parents at LBJH report that their child's performance is better this year than last. Finally, the parents at LBJH mostly believe that they know how to help their child be successful in math.

Student Input

Liberty math students do not show the enthusiasm of other RISD students for the way math is being taught this year. A larger percentage of students report behavioral problems in class, technology use is lower and team-work is less likely. If we view LBJH student perceptions at year-end verses mid-year, some changes can be seen. For example, those enthusiastic about the way math is being taught has risen from 44% to 56% and a larger percentage of students have noticed improvements in their grades.

The student open-ended remarks are mixed in all of the classes with two classes leaning to the positive, one to the negative and two split. At mid-year four classes tended to the negative.

Perhaps these comments capture student perceptions of the math program at year-end and the challenges that LBJH faces:

> I don't really if it has changed learning math for me because learning math is anything I don't know care where I or who I learn things from
>
> It help me by doing problem if I know about and learn about this year
>
> It has not I just do my problems on the calculator and move on
>
> It helps me because it's hands on and I like to type. And knowing that I can learn and type that what's up.

At mid-year less than a third of the students reported using the TI Graphing calculator daily. Students were asked at year-end about specific Navigator use. Less than a third reported using Learn Check each day, half reported using Activity Center often. While half or more of the students at other RISD sites agreed that learning math is easier using the TI calculators, 30% agree at LBJH.

Liberty Junior High
(5 teacher responses)

How TI Navigator Is Used	Warm-Up	Main Activity	Problem Solving	Total
a) Collect homework or assignments	2	1	2	5
b) Give an assignment/quiz/test (e.g. Learning Check)	5	2	1	8
c) Send learning materials for students to work with (e.g. apps, models, worked examples, visualizations)	1	2	2	5
d) Send questions/prompts for immediate student response (e.g. Quick Poll)	3	3	4	10
e) Monitor student progress (e.g. look at screen shots of what is on the student device)	3	2	2	7
f) Encourage students to collaborate, discuss answers or develop shared solutions in pairs or groups	1	2	4	7
g) Work with the whole class sharing student data (e.g. class analysis)	4	3	2	9
h) Discuss the same mathematical object/concept using more than one representation	4	4	3	11
i) Modify instruction based on student understanding	4	1	2	7
Total selections	27	20	22	
Average use for class portion	60%	44%	49%	

Note: Teachers were asked to place an “x” in the boxes above to note when and how they use TI Navigator. TI Navigator use that is selected by at least 2 out of 3 teachers is highlighted, while percentage use by portion of the block is noted as percentages across the bottom row. Five teachers responding to 9 possible TI Navigator uses provides a denominator of 45 in computing the percentage.

Richardson West Junior High 6-07

Six classrooms participated in the study. Four teachers, 50 parents and 103 students completed a year-end survey about their experiences.

Teacher Input

Teacher confidence has improved somewhat at Richardson West Junior High (RWJH). While one teacher at mid-year agreed that he/she could successfully teach grade level math, three of the four agreed to being able to do so at year-end. The teachers are still uncertain about which strategies work best for struggling students and only one expects students to do well on district diagnostics or on the state math test. The teachers do not generally believe that the standardized tests accurately measure what students are taught in math class.

Maintaining order in the TI block classes continues to be a problem for most teachers. Only one teacher reports that students accept responsibility for their role in learning.

The teachers feel valued by the administration; some think that the administrators understand the demands of teaching the TI Intervention. Teachers are positive about collegial support, but negative about math content support. No one agrees that the math content sessions have been beneficial.

One of the teachers would like additional training on TI Navigator, two suggest that the curriculum materials are inadequate. Other support requests for TI include lessons better aligned to TEKS and lower level students, more lessons and wires that do not break so easily.

Most of the RWJH math teachers suggest that discussion is critical to learning in their class, their rooms are not organized for lecture and students often collaborate in pairs. Some ask students to apply concepts to real world problems or to regularly explain steps used for solving a problem. The teachers don't feel that they must be the experts in math and technology.

Furthermore, teachers are enthusiastic about the block time. All agree that it has made a real difference in how students approach difficult problems. One teacher writes, " I love the increased time! Lower level students show more understanding." One teacher asks for smaller block classes, classes limited to 20.

The impact of the technology on learning is perhaps less clear to teachers, although most agree that the TI Navigator more successfully engages students who are experiencing difficulty in math. One teacher does not seem to find benefit in the technology. Review of the self-report data on how Navigator is used shows much lower usage at RWJH than other RISD sites. The technology is mostly used to send questions/prompts or to monitor student progress. The teachers write about the impact of the TI technology on their teaching:

> It has helped me reach all of my students, especially during Quick Polls

> I wasn't comfortable with it at first but it has helped with time management and discovery learning

It has allowed more opportunities for students to discuss common mistakes, methods for solving etc.

As for the impact on learning one writes, “with this first class it has only helped with their interest”. Another comments that providing students with another representation of the objectives, increases student chances for success.

Again, all teachers but one agree that benchmark data has helped them improve student learning. It is unclear to the teachers if the unit diagnostics are aligned to the district curriculum. The teachers write that the unit diagnostics data does not generally impact their teaching. Since most students have not mastered the TEKS on the diagnostic, one teacher reports that she teaches all the objectives anyway. Another suggests that there is not enough data to impact teaching or simply that the data is not helpful. Teachers are appreciative of the real-time feedback. They write that they are better able to assess the quiet student, have the ability to re-teach and can immediately assess student needs.

As at most other RISD campuses teachers report keeping parents informed, but none of the parents have seen TI Navigator or attended any session about the math program. Most teachers do not think parents know what to do to help their child in math.

Finally in writing about the support from this project that is most critical to increasing students performance teacher respond: time, and meeting with other teachers.

Parent Input

Parents believe that they know what their child must do and how they can help them be successful in math. Almost half suggest that they have been to a session to learn about their child’s math program, even though the teachers do not agree that there is such an opportunity. Seventy-six percent expect their child to pass the year-end state mathematics test.

Student Input

More students at RWJH than other RISD sites tend to be excited about the way math is being taught this year and are confident that their teacher knows how to help them.

The student responses also describe a math classroom setting that has less lecture and is more discussion and team oriented than most other RISD sites. This appears to be reflected by the way TI Navigator is used. At RWJH students are more likely than other sites to use Screen Capture to compare work and Activity Center to receive new problems.

The students are more excited at RWJH than other sites about the TI calculator. Sixty-eight percent agree that it helps them learn new concepts. The open-ended comments are mostly positive. Students write that ”seeing what they are doing” is helpful and that sometimes they “can find the mistakes they are doing by themselves”.

While the lowest percentage of students expect to go to college at RWJH, a significantly larger percent than other sites agree that they have noticed improved grades in math this year and that they understand math better this year.

Similar to the teachers, the students are also more excited about the block at this site than others. Eighty-four percent suggest it has helped them do better, verses 56-67% at other sites.

Richardson Junior High
(3 teacher responses)

How TI Navigator Is Used	Warm-Up	Main Activity	Problem Solving	Total
a) Collect homework or assignments	1	0	1	2
b) Give an assignment/quiz/test (e.g. Learning Check)	2	0	0	2
c) Send learning materials for students to work with (e.g. apps, models, worked examples, visualizations)	1	1	0	2
d) Send questions/prompts for immediate student response (e.g. Quick Poll)	2	3	3	8
e) Monitor student progress (e.g. look at screen shots of what is on the student device)	1	3	2	6
f) Encourage students to collaborate, discuss answers or develop shared solutions in pairs or groups	2	1	1	4
g) Work with the whole class sharing student data (e.g. class analysis)	2	1	0	3
h) Discuss the same mathematical object/concept using more than one representation	0	3	0	3
i) Modify instruction based on student understanding	1	2	1	4
Total selections	12	14	8	
Average use for class portion	33%	38%	22%	

Note: Teachers were asked to place an “x” in the boxes above to note when and how they use TI Navigator. TI Navigator use that is selected by at least 2 out of 3 teachers is highlighted, while percentage use by portion of the block is noted in percentages across the bottom row. Three teachers responding to 9 possible TI Navigator uses provides a denominator of 27 in computing the percentage.

Westwood Junior High 6-07

Six classrooms participated in the study. Four teachers, 18 parents and 90 students completed a year-end survey about their experiences.

Teacher Input

At Westwood Junior High (WJH) School the teachers' survey responses suggest that the learning environment is different from other RISD sites in several ways: 1) Discipline is not an on-going challenge for most, 2) teachers view students as accepting responsibility for their role in learning and that 3) all teachers report that their students are able to learn grade level math. Administrative support is low compared to other sites and technology pulse is high.

The teachers are split on their views of administrative support with two agreeing there is support and two disagreeing strongly. Three of the four teachers rate collegial and technological support positively, while one is dissatisfied. Two of the teachers agree that they would benefit from additional training on the TI Navigator.

Reviews of sessions with the mathematician are more positive than for most other junior high sites. While teachers are mostly uncomfortable asking questions, some report increased understanding from the sessions. This is an improvement from mid-year where three out of four rated the sessions negatively.

At WJH the teachers do not feel that it is important to "appear to know everything about math and technology in class". Furthermore, they describe a classroom culture where discussion is critical, students solve problems on their own and apply concepts to real world problems. Teachers report that students explore multiple solutions during class and often collaborate in pairs. The student views of the classroom environment suggest that learning time is more focused on learning facts, definitions and formulas.

While the teachers agree that more content can be covered during the block, it is unclear to them, if it makes a difference to students' approach to difficult problems. Several comment on not feeling rushed when answering student questions and posing questions during the block. One teacher continues to find the format too long.

The teachers value the benchmark data, real time feedback and the use of diagnostics. They agree that the benchmarks and unit diagnostics are aligned to the district curriculum and the curriculum to the state math standards, but not that the standardized tests accurately measure what students are taught in class.

The teachers do not report using Learn Check daily to collect homework at WJH. Rather they seem to use Learn Check for quizzes. They use Screen Capture to compare student work and Quick Poll to check answers. Some use Activity Center to distribute new problems. The activities the teachers suggest they pursue most on the TI Navigator are monitoring of student progress, modifying instruction, sending prompts for response and giving quizzes. Even so, only two teachers agree that they are able to modify instructional strategies for individual students based upon real-time data.

In the open-ended responses the teachers write that technology has changed student behaviors: students are apt to take more time solving a problem, accept more responsibility for their work and enjoy math more. The use of TI technology has allowed teachers to "use different methods based on student analysis" and use warm-up to assess student understanding before beginning a lesson. One teacher reports being new at using the TI system, commenting: "my skills are limited."

Two of the teachers agree that the parents have seen the TI Navigator in use. They do not generally think that parents understand how to help their child in math.

As for support, a teacher asks again for answer keys. Another requests more training from TI. One writes that the full day Friday/Saturday sessions are great and that good content prior to implementation and opportunity to share teaching strategies comprise the kinds of district support that make a difference to success in teaching math. Support from the project that has been most critical to increasing student performance includes "support and ideas from teachers at other schools in the full day session". Finally, one teacher remarks that the "Quick Polls were frequently not so quick, missing from one to two students" and that "Activity Centers did not flow nearly as well with kids as with a room of teachers, but were still good."

Parent Input

Two to seven parents completed a survey for each class. Eighteen percent of those attended math night or another session to learn about their child's math program.

Student Input

By the students view two of the four teachers use more small group, technologically based learning environments, while one uses less technology. Compared to other RISD schools WJH students report class time that is more focused on learning facts, definitions and formulas.

Half the students suggest that Learn Check and Quick Poll are being used daily in class, and over half report that they are more excited about learning math since using the TI calculators.

The percentage of students that have noticed an improvement in their grade this year jumped from just over 60% at mid-year to 75% at year-end. Seventy-seven percent report that they understand math better this year.

Open-ended student remarks about use of the TI graphing calculator are positive for three of the four teachers, mixed for the fourth. Students mostly report that the TI graphing calculator has made learning math easier and more fun, particularly when "work gets complicated or hard to understand" on ones own.

At mid-year there were more student comments about others not seeing their grade, learning by going over problems and understanding why ones answers are different from other students.

Westwood Junior High
(4 teacher responses)

How TI Navigator Is Used	Warm-Up	Main Activity	Problem Solving	Total
a) Collect homework or assignments	3	1	0	4
b) Give an assignment/quiz/test (e.g. Learning Check)	3	2	3	8
c) Send learning materials for students to work with (e.g. apps, models, worked examples, visualizations)	3	2	2	7
d) Send questions/prompts for immediate student response (e.g. Quick Poll)	1	4	3	8
e) Monitor student progress (e.g. look at screen shots of what is on the student device)	4	3	3	10
f) Encourage students to collaborate, discuss answers or develop shared solutions in pairs or groups	0	4	3	7
g) Work with the whole class sharing student data (e.g. class analysis)	2	3	2	7
h) Discuss the same mathematical object/concept using more than one representation	2	2	2	6
i) Modify instruction based on student understanding	3	3	3	9
Total selections	21	25	21	
Average use for class portion	58%	69%	58%	

Note: Teachers were asked to place an “x” in the boxes above to note when and how they use TI Navigator. TI Navigator use that is selected by at least 2 out of 3 teachers is highlighted, while percentage use by portion of the block is noted as percentages across the bottom row. Four teachers responding to 9 possible TI Navigator uses provides a denominator of 36 in computing the percentage.

Appendix A: Additional Charts

Chart 5: Association between CKTM Patterns, Functions, and Algebra Scale Score and Met Minimum TAKS Standard

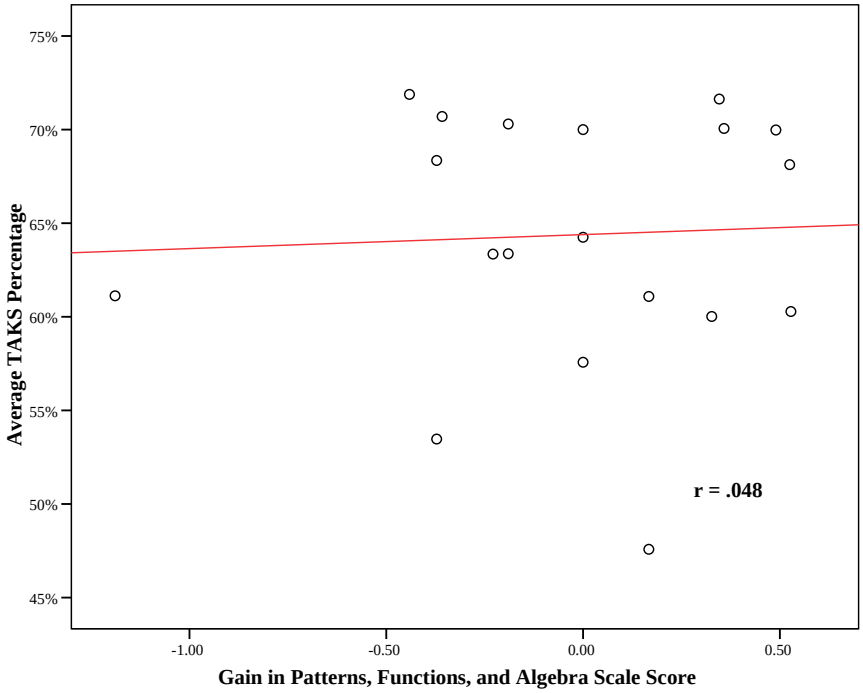
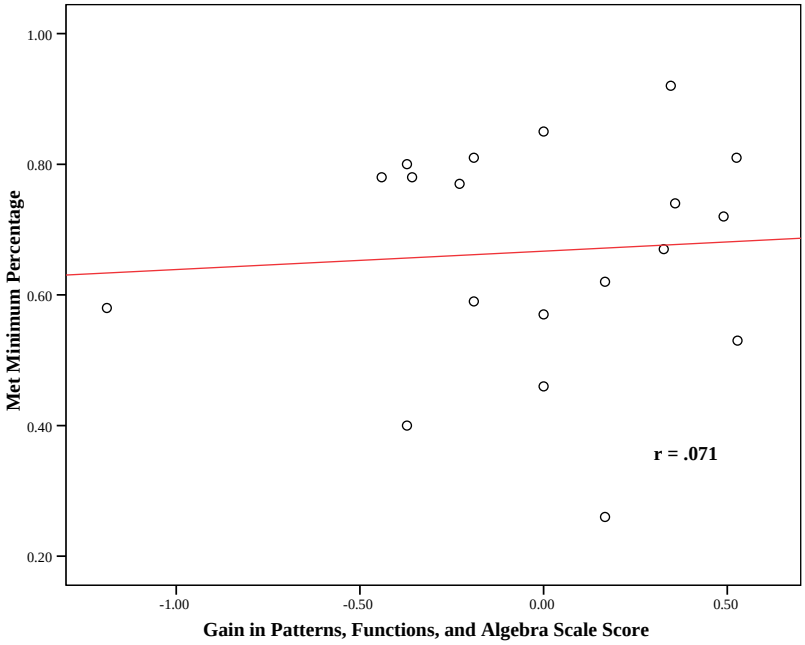


Chart 6: Association between CKTM Patterns, Functions, and Algebra Scale Score and average TAKS correct percentage



Appendix B: Teacher Perception Survey

Identifying Components of Effective Mathematics Programs

Teacher Consent Form

Texas Instruments Inc. is partnering with your school to improve math education. The attached survey asks you to reflect on the teaching and learning of math in your classroom. The survey is part of a larger study designed by university researchers to help TI and others in the learning community identify and understand the many components of middle school math education. Over the next week, teachers, parents and students participating in the study will all be asked to assesses their (or their child's experience) of math this year.

At the end of the study, a report will be sent to the district office and information will be sent to the schools' principals and mathematics specialists for dissemination.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Some tracking identification tied to assessments of mathematics knowledge and practices will be kept by the researchers to allow for future program evaluation. After deciding to participate, you are free to withdraw your consent and discontinue participation at any time without penalty. The procedures here involve no or minimal risk to the participants. If you have any questions regarding the research, please feel free to contact Mara Winick (mara_winick@redlands.edu) or Jeffrey Lewis (jeff_lewis@pitzer.edu or 909-792-9380).

Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, may withdraw your consent at any time and discontinue participation without penalty, may receive a copy of this form, and that you are not waiving any legal claims, rights or remedies.

Name _____

Signature _____ Date _____

Teacher & Student Practices for Learning Math
The Texas Instruments School Partnership
April 2007 Survey

Please respond to the statements below by circling your level of agreement or disagreement.	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly Agree**
1. Learning Environment					
a) Students in my class want to learn math.	SD	D	U	A	SA
b) I can successfully teach grade level math to almost every student in class.	SD	D	U	A	SA
c) I know which strategies work best for teaching struggling mathematics students.	SD	D	U	A	SA
d) I am confident that almost every student in my class can learn grade level math.	SD	D	U	A	SA
e) I am confident my students will do well on the district benchmarks.	SD	D	U	A	SA
f) I am confident that my students will master grade level content, measured by the year-end state mathematics test.	SD	D	U	A	SA
2. Classroom Environment					
a) Maintaining order in my TI block class(es) is an on-going challenge.	SD	D	U	A	SA
b) My students feel comfortable asking questions in math class.	SD	D	U	A	SA
c) My students accept responsibility for their role in learning math.	SD	D	U	A	SA
d) Students in my class know the learning goals for each unit of study.	SD	D	U	A	SA
3. Pedagogy (New Items)					
a) Lecture, drill and practice are critical to learning in my class.	SD	D	U	A	SA
b) Our class time is mostly focused on learning facts, definitions and formulas.	SD	D	U	A	SA
c) My students regularly formulate problems on their own.	SD	D	U	A	SA
d) My students regularly explain their reasoning for a solution.	SD	D	U	A	SA
e) Discussion is critical to learning in my class.	SD	D	U	A	SA
f) My students regularly apply concepts or skills to real world problems.	SD	D	U	A	SA
g) Students often explore multiple solutions during class.	SD	D	U	A	SA

Please respond to the statements below by circling your level of agreement or disagreement.	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly Agree**
4. Grouping (New Items: B-D)					
a) Small group instruction is especially effective for my students.	SD	D	U	A	SA
b) I usually design the daily warm-up for a whole-class activity.	SD	D	U	A	SA
c) Students often collaborate in pairs or groups during the main activity in class.	SD	D	U	A	SA
d. My classroom is arranged for lecture during much of the block class.	SD	D	U	A	SA
5. Assessment (New/edited items)					
a) Our unit benchmarks for assessing student growth are aligned to the district curriculum.	SD	D	U	A	SA
b) Our unit diagnostics are aligned to the district curriculum.	SD	D	U	A	SA
c) The district curriculum is aligned to the state mathematics standards.	SD	D	U	A	SA
d) Our math teachers agree on what students should be able to do to meet grade level standards.	SD	D	U	A	SA
e) Standardized tests accurately measure what students are taught in math classes.	SD	D	U	A	SA
f) Benchmark data has helped me improve student learning.	SD	D	U	A	SA
g) The immediate availability of benchmark data is especially important to my teaching.	SD	D	U	A	SA
h) The feedback I receive on student learning is based upon district benchmark data.	SD	D	U	A	SA

i) Please explain how the use of unit diagnostic data impacts your teaching.

j) Please explain how the use of real time feedback changes student learning.

6. Please help the researchers understand how and when you use TI Navigator by placing "X" in all boxes that apply and by completing the "other" sections.

How TI Navigator Is Used	When TI Navigator Is Used			
	Warm-Up	Main Activity	Problem Solving	Other Please list:
a) Collect homework or assignments				
b) Give an assignment/quiz/test (e.g. Learning Check)				
c) Send learning materials for students to work with (e.g. apps, models, worked examples, visualizations)				
d) Send questions/prompts for immediate student response (e.g. Quick poll)				
e) Monitor student progress (e.g. look at screen shots of what is on the student device)				
f) Encourage students to collaborate, discuss answers or develop shared solutions in pairs or groups				
g) Work with the whole class sharing student data (e.g. class analysis)				
h) Discuss the same mathematical object/concept using more than one representation				
i) Modify instruction based on student understanding				
j) Other (please describe):				

k) Please explain how the use of TI technology has changed your teaching, if at all.

l) Please explain how the use of TI technology has changed student performance, if at all.

Please respond to the statements below by circling your level of agreement or disagreement.	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly Agree**
7. Technology Use					
a) I use the TI graphing calculator daily to help students understand mathematics content.	SD	D	U	A	SA
b) I use the TI Navigator every day in class.	SD	D	U	A	SA
8. Technology Impact (New: D, G, K; drop 1 or 2 items)					
a) I am able to modify instructional strategies for individual students based on real time data collected through the TI Navigator.	SD	D	U	A	SA
b) Real-time feedback from the TI Navigator is increasing students' willingness to work through complex items.	SD	D	U	A	SA
c) Real-time feedback from the TI Navigator has improved classroom dialogue.	SD	D	U	A	SA
d) Student willingness to learn new concepts has increased with the use of the TI technology.	SD	D	U	A	SA
e) When I use the TI technology in my classroom fewer behavioral problems arise.	SD	D	U	A	SA
f) Students definitely have more "aha" moments when using the TI Navigator.	SD	D	U	A	SA
g) The TI Navigator more successfully engages students who have experienced difficulty in learning math.	SD	D	U	A	SA
h) The use of real-time feedback from the TI Navigator has accelerated learning in my class.	SD	D	U	A	SA
k) Use of the TI Navigator has allowed our class to cover more material in depth.	SD	D	U	A	SA
9. The Block Class (C is new)					
a) The block time has increased the amount of content students are able to cover during the year.	D	D	U	A	SA

b) The block time has made a real difference in how students approach difficult problems.	SD	D	U	A	SA
c) The block time is too long to keep students focused on math.	SD	D	U	A	SA
d) Please comment on any changes you have noticed in student performance as a result of the 100 minute power block.					

Please respond to the statements below by circling your level of agreement or disagreement.	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly Agree**
10. Parental Involvement (New: C-E)					
a) I frequently communicate learning expectations to parents.	SD	D	U	A	SA
b) My students' parents know what their child must do to be successful in math.	SD	D	U	A	SA
c) My students' parents attend math night or another sessions to learn about their child's math program.	SD	D	U	A	SA
d) My student's parents have seen the TI Navigator in use.	SD	D	U	A	SA
e) My students' parents understand what they can do to help their child be successful in math.	SD	D	U	A	SA
f) Please share comments made by parents regarding the TI intervention model.					
11. Administrative Support					
a) Our administrators understand the demands of teaching the TI Intervention.	SD	D	U	A	SA
b) I feel valued by the administration at this school.	SD	D	U	A	SA
11. Collegial Support					
a) Our teachers meet weekly to plan lessons and discuss teaching strategies for meeting the needs of all learners.	SD	D	U	A	SA
b) Teacher meetings are used to align the curriculum we teach with the district math standards.	SD	D	U	A	SA
c) There is an expert available with whom I can regularly discuss teaching strategies.	SD	D	U	A	SA

d) The weekly planning sessions with colleagues have improved my teaching.	SD	D	U	A	SA

e) How, if at all, have the meetings with colleagues changed what you know about math?

f) How, if at all have the meetings with colleagues changed the way you teach math?

Please respond to the statements below by circling your level of agreement or disagreement.	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly Agree**
12. Math Content Support (New: D)					
a) Content sessions with the mathematician have increased my mathematical understanding.	SD	D	U	A	SA
b) I feel comfortable asking questions in the sessions with the mathematician.	SD	D	U	A	SA
c) Training with the mathematician occurs in time for me to use the information.	SD	D	U	A	SA
d) I would benefit from additional math content sessions.	SD	D	U	A	SA

e) How, if at all, have the math content sessions changed what you know about math?

f) How have the math content sessions changed the way you teach math?

g) What other math content, if any, would you like included in the math content sessions or weekly planning meetings with colleagues.

13. Technological Support (New: D)

a) The curriculum materials I have for use with the TI Navigator are of good quality.	SD	D	U	A	SA
b) Assistance is readily available to me for implementing the TI technology.	SD	D	U	A	SA
c) I have sufficient curriculum materials to effectively use TI Navigator in my class.	SD	D	U	A	SA
d) I could use additional training on TI Navigator.	SD	D	U	A	SA

e) What kinds of additional support from TI would make a difference to your success in teaching math?

f) What kinds of additional support from the district would make a difference to your success in teaching math?

g) What types of support from this project have been most critical to increasing student performance in your classrooms?

h) Finally, is there any other information that you would like to share with the researchers about the TI project

Thank you for taking the time to help math educators learn from one another.

Appendix C: Student Perception Survey

Student TI School Partnership Survey
Student Consent Form

The attached survey asks you to reflect on your experience of learning math this year. The survey is part of a larger university study and school partnership with Texas Instruments to improve middle school math education. Over the next week, teachers, parents and students will all be asked to complete a similar survey.

While information from this study will be sent to the principal and mathematics specialists as well as the district office, the source of the information remains confidential. No student or parent can be identified.

If you have any questions regarding the research, please feel free to contact Mara Winick (mara_winick@redlands.edu) or Jeffrey Lewis (jeff_lewis@pitzer.edu or 909-792-9380).

By signing below, you indicate that you have read and understand the information above and that you willingly agree to participate. You may withdraw your consent at any time and discontinue participation without penalty, and you may request to receive a copy of this form. Finally, your consent does not waive any legal claims, rights or remedies.

Name _____ Signature _____ Date _____

Please understand that there are no wrong or right answers to the survey.

Please respond to the statements below by circling your level of agreement or disagreement.	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly Agree**
1. Learning Environment					
a) I am excited about the way math is being taught this year.	SD	D	U	A	SA
b) My teacher knows how to help me if I am having difficulty in learning math.	SD	D	U	A	SA
c) I like trying to solve tough math problems.	SD	D	U	A	SA
d) My teacher believes that I can learn grade-level math.	SD	D	U	A	SA
e) I am confident that I can pass the year-end state mathematics test.	SD	D	U	A	SA
2. Classroom Environment					
a) Students often behave badly in math class.	SD	D	U	A	SA
b) I feel comfortable asking questions in math class.	SD	D	U	A	SA
c) How much I learn in math class is mainly up to me.	SD	D	U	A	SA
d) I know the learning goals each day for my work in math.	SD	D	U	A	SA
3. Pedagogy					
a) Our math teacher lectures most days in class.	SD	D	U	A	SA
b) Our class time is usually focused on learning facts, definitions and formulas.	SD	D	U	A	SA
c) I often solve problems on my own in class.	SD	D	U	A	SA

d) My teacher expects me to explain the steps I use to solve a problem.	SD	D	U	A	SA
Please respond to the statements below by circling your level of agreement or disagreement.	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly Agree**
e) My math teacher encourages the class to talk about what we are learning.	SD	D	U	A	SA
f) We often try to solve real world problems with math information.	SD	D	U	A	SA
4. Grouping					
a) We often work in teams of two or small groups in math class.	SD	D	U	A	SA
5. Technology Use					
a) Our teacher uses Learn Check each day to collect our homework.	SD	D	U	A	SA
b) We use Quick Poll each day to send our answers to the teacher.	SD	D	U	A	SA
c) We use Screen Capture in class to compare our TI calculator screens.	SD	D	U	A	SA
d) We often use Activity Center to receive new problems to work on in class.	SD	D	U	A	SA
6. Technology					
a) The TI calculator helps me learn new concepts in class.	SD	D	U	A	SA
b) Fewer students behave badly in math class when we use the TI calculators.	SD	D	U	A	SA
c) Learning math is easier for me with the TI calculator.	SD	D	U	A	SA
d) I am more excited about learning math since using the TI calculators.	SD	D	U	A	SA
e) Use of the TI calculator helps me talk more about my work in math class.	SD	D	U	A	SA
f) Please explain how use of the TI graphing calculator has changed learning math for you, if at all.					
7. The Block Class					
a) The block time has helped me do better in math class.	SD	D	U	A	SA
8. Outlook					
a) I have noticed that my grades are better in math this year.	SD	D	U	A	SA
b) I understand math better this year.	SD	D	U	A	SA
c) I can help others learn in math class	SD	D	U	A	SA
d) I will graduate from high school.	SD	D	U	A	SA
e) I plan to go to college.	SD	D	U	A	SA

Appendix D: Parent Perception Survey

Identifying Components of Effective Mathematics Programs
Parent Consent Form

The attached survey asks you to reflect on the math education your child is receiving this year as part of the Texas Instruments School Partnership. Over the next week, teachers, parents and students will be asked to complete a similar survey. While the study includes several components you may be most familiar with the increased block time for math.

The information from this study will be sent to the principal, school mathematics specialists and the district office. Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. If you have any questions regarding the research, please feel free to contact Mara Winick (mara_winick@redlands.edu) or Jeffrey Lewis (jeff_lewis@pitzer.edu or 909-792-9380).

By signing below, you indicate that you have read and understand the information above and that you willingly agree to participate. You may withdraw your consent at any time and discontinue participation without penalty, and you may request to receive a copy of this form. Finally, your consent does not waive any legal claims, rights or remedies.

Thank you for helping to improve math education for all children.

Child's Name _____ Parent Signature _____ Date_____

Parent Math Survey-April 2007
The Texas Instruments School Partnership

Please respond to the following statements by circling your level of agreement or disagreement.	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly Agree**
1) I frequently receive information about my child's performance in math.	SD	D	U	A	SA
2) The teacher knows how to help my child if he/she is having difficulty in learning math.	SD	D	U	A	SA
3) The teacher expects my child to learn grade level math.	SD	D	U	A	SA
4) I am confident that my child will pass the year-end state mathematics test.	SD	D	U	A	SA
5) I expect my child to graduate from high school.	SD	D	U	A	SA
6) My child performance in math is better this year than last.	SD	D	U	A	SA
7) My child is excited about learning math this year.	SD	D	U	A	SA
8) I feel comfortable speaking with the teacher about my child's performance in math.	SD	D	U	A	SA
9) I know what my child must do to be successful in math.	SD	D	U	A	SA
10) I have attended math night or another session to learn about my child's math program.	SD	D	U	A	SA
11) My child plans to go to college.	SD	D	U	A	SA
12 I know what I can do to help my child be successful in math.	SD	D	U	A	SA

Please complete the below, then fold and return to the drop envelope in your child's math class.

Math teacher name _____ School name _____ Grade level ____