Year One Report: Warren A. Alison Elementary School Algebra Project, TRUSD

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EXECUTIVE SUMMARY

During the 2009-10 school year three teachers at Allison Elementary School in the Twin Rivers School District implemented a modified Algebra Project, Inc. curriculum in their grades 4-6 classrooms. This was a pilot project designed to test the feasibility and impact of implementing Algebra Project pedagogy in conjunction with the district's regular math curriculum. The Algebra Project emphasizes approaches to engage students in active learning and to increase the participation of their families in school and math activities. The results of the first year of project implementation were evaluated using a multi-method approach to capture both process and outcomes. It is important to note that due to the small number of teachers and students involved, all results should be considered as descriptive and suggestive, rather than definitive.

Findings include:

- General appreciation from the school principal and district staff for the increased resources made available by the project to enrich students' experiences through field trips and engage their families through events and other outreach events.
- Classroom observations in the participating classrooms noted that students appeared to find the group work and activities in the Algebra Project lessons to be engaging, with over 85% of students demonstrating evidence of active involvement in all three classrooms.
- Student survey results indicate:
    - High levels of agreement that math is important, interesting, necessary for future success, and useful in everyday life
    - Generally positive attitudes about math and indicators that students found their experience in this school year's math lessons to be particularly engaging
    - Strong positive perceptions of their teachers, positive responses to group work and explicitly applying math to everyday life, and specific information about student learning preferences and difficulties
- Teacher research results (reported in detail in a separate report) addressed strategies to increase parent/family participation in their student's math learning and school activities. Their findings emphasize the efficacy of personal interaction (e.g. conversations) between teachers and parents over secondary contact via letters/materials sent home with students in engaging family members.
- Achievement analyses of district-wide benchmark assessments found:
    - Algebra Project students did about the same or, on one assessment, slightly better than students district-wide, overall.
    - When examining subgroups of students, based on their previous year's CST levels, Algebra Project students' performance, again, tended to be similar to that of other students (both district-wide and when compared to a matched set of comparison students) or, in some grade levels and assessments, somewhat better. Among students who had performed at proficient or advanced levels on the previous year's CST, Algebra Project students appeared to outperform comparison groups most often.
    - However, given the small numbers of students, particularly when broken out into performance level sub-groups, it is difficult to know whether the statistically significant differences are actually meaningful, of practical significance, or attributable to the Algebra Project specifically.

In summary, evaluation results indicate that the Algebra Project Pilot is encouraging in terms of parent participation, student engagement, teachers' pedagogical learning, and student achievement. Due to the small numbers of teachers and students, no further generalizations are possible and no causal relationships can be established. A larger study with more teachers and students would permit more definitive results.

WARREN A. ALLISON ELEMENTARY SCHOOL ALGEBRA PROJECT, TRUSD: 2009-10 SUMMARY REPORT

INTRODUCTION

Many educational leaders recommend using more student-centered, inquiry based teaching strategies to encourage students to become more engaged in their school subjects and develop their critical thinking and analytical skills. While this strategy makes intuitive sense, there are also empirical studies that demonstrate its efficacy in supporting student learning.[1] This report outlines the results of implementing a specific teaching approach, based on the Algebra Project Inc. curriculum and pedagogy, in three elementary level classrooms. The Algebra Project focuses on encouraging active learning of mathematical concepts by engaging students in relevant activities that demonstrate the day to day uses of math, providing students with opportunities to "figure out" math concepts rather than simply learning by rote, and by engaging students' families in supporting their students' mathematical thinking and achievement.

This report documents a pilot project limited to three classrooms at a single elementary school. It documents how the three teachers implemented this model for using experientially-based pedagogical materials to supplement district-adopted core materials to promote math literacy. The ultimate goal of this project is to support students in developing readiness for Algebra I by 8th grade, commonly considered a key "gateway" to high school success, and college preparatory mathematics in high school.

The first year of the pilot study was conducted at Warren A. Allison Elementary School, a K-6 school in the Twin Rivers Unified School District (Sacramento, CA) during the 2009/10 academic school year. Activities included curriculum development to adapt Algebra Project Inc. middle and high school materials for use during participating teachers 5th-6th grade math lessons, field trips for participating students, engagement activities for parents, and Family Math Nights and an after school program for 4th, 5th, and 6th grade students, both of which included students in non-participating classrooms.

[1] Wilson, C.D., Taylor, J.A., Kowalski, S.M., and Carlson, J. (2009). "The Relative Effects and Equity of Inquiry-Based and Commonplace Science Teaching on Students' Knowledge, Reasoning, and Argumentation," *Journal of Research in Science Teaching* (47:3).

The University of California, Davis School of Education CRESS Center contracted to collect data (presented below) at the classroom, program and district levels with the intent of informing teachers, parents, school and district administrators, and project funders about the efficacy of the Algebra Project as an intervention that improves students' math performance and engagement.

THE ALLISON ALGEBRA PROJECT

In 2008, three teachers from Warren A. Allison Elementary School, Twin Rivers Unified School District (TRUSD) approached the District, California Teachers Association Institute for Teaching (CTA IFT) and the University of California, Davis CRESS Center (UCD) with a request to explore the feasibility of integrating key components of the Algebra Project Inc.'s (AP Inc.) curriculum into their classroom. The intent, if this approach proves promising, is to consider expansion of the model into other TRUSD classrooms/schools.

In 2009, the District and CTA IFT provided funding to support a two-year teacher-led pilot effort at Allison Elementary that included curriculum development to adapt AP Inc. middle and high school materials for use during participating teachers 5th-6th grade math lessons, field trips for participating students, engagement activities for parents, and an after school program for 4th, 5th, and 6th grade students. CTA IFT provided additional funding to UCD to support teacher-led research activities and to conduct an evaluation of the pilot project. At the request of AP Inc., CTA IFT also provided funds to the Industrial Areas Foundation (IAF) for technical support specific to community organizing activities.

AP Inc. was founded in 1982 by a Harlem-born and Harvard-educated Civil Rights' leader, Dr. Robert P. Moses. Now a nationally recognized school reform model[2] AP Inc.'s approach is to intentionally develop localized, student-centered Algebra Projects (AP) by building coalitions of stakeholders within local communities, particularly those representing historically underserved populations. To learn more about AP Inc., we suggest Bob Moses' 2001 book, *Radical Equations: Civil Rights from Mississippi to the Algebra Project*[3].

The Center for Multicultural Education[4] describes one unique characteristic of the Algebra Project as the:

> . . . Transition Curriculum developed by Robert Moses. Using this procedure, students transition from concrete physical events to abstract understanding and representation through five steps: (a)

2 For example, the California Department of Education references the Algebra Project Inc. as a model program in its online publication: *Taking Center Stage – Act II (TCSII): A Portal for Middle Grades Educators.* Retrieved from http://pubs.cde.ca.gov/tcsii/ch2/algebra.aspx

3 Moses, R.P. and Cobb, C.E. (2001). *Radical Equations: Civil Rights From Mississippi to the Algebra Project*. Boston, MA:Beacon Press.

4 The Algebra Project (2010, July 29). Retrieved from http://education.washington.edu/cme/algebra.htm

experiencing or witnessing a physical event as a group; (b) representing that event through drawings or by creating models; (c) describing the event informally and intuitively, using their own natural and idiomatic language; (d) subsequently translating their idiomatic description into formal, edited English; and, finally, (e) creating a symbolic representation of the event using mathematical language. As an example of how this process works, students are initiated into the program by taking a field trip on a Boston subway, after which they reconstruct their journey using a map which serves as a number line and illustrates key concepts such as "how many," "which direction" (positive and negative numbers), and equivalence (Moses et al., 1989; Silva et al., 1990).

AP Inc.'s work has traditionally focused on the middle and high school grades. The Allison Elementary Algebra Project (Allison AP), in contrast, represents a unique effort to expand the model into the elementary school setting. Given the research that suggests the AP Inc. model successfully supports algebraic reasoning in the upper level grades, (Davis, F.E. et al., 2007; Silva et al., 1990)[5] the collaborative partners are of the belief that starting the program as early as the 5th grade will better prepare students for middle grade mathematics and Algebra 1 by the eighth grade, thus preparing students for college preparatory mathematics in high school, and giving students access to the mathematical knowledge required for college entrance, success in college courses, and lifelong civic engagement. AP Inc. views education as a Civil Right and encourages families and communities to think beyond the math classroom to ensuring a quality education for all students.

The Allison AP is a teacher-initiated and teacher-led initiative, however, during the first year of the pilot study CTA IFT provided oversight and staff support. An Advisory Board comprised of key stakeholders, including TR District administrators, the school principal, UCD and IAF staff also met on a quarterly basis.

The Allison AP curriculum represents a new and therefore untested model. While research on the effects of the propriety AP Inc. curriculum have been conducted, up to this time AP Inc. has not worked with younger populations. The Allison teachers and AP Inc. staff worked together over the summer of 2009 to modify several existing AP Inc. curriculum modules to align with California's 5th and 6th grade Content Standards, as well as with the newly adopted district mathematics textbook, Pearson Scott Foresman's enVisionMATH 2009. It should be noted here that the enVisionMATH curriculum appears to be consistent with the AP Inc. curriculum in that it "incorporates a blended approach of traditional and investigative learning techniques that emphasizes problem-

[5] Davis, F.E., West, M.M., Greeno, J.G., Gresalfi, M.S., & Martin, T. (2006). Transactions of Mathematical Knowledge in the Algebra Project (2007). In P. Cobb & N. Nasir (Eds.), *Diversity, Equity, and Access to Mathematical Ideas*. New York: Teachers College Press AND Silva, C. M., Moses, R. P., Rivers, J., & Johnson, P. (1990). *The Algebra Project: Making middle school mathematics count*. Journal of Negro Education, 59, (3), 375-391.

based learning opportunities, visual learning strategies, embedded assessment, and data-driven remediation (Resendez, et al, 2009).[6]

In addition to the curriculum component, AP Inc. requires sites to engage parent and community members. At Allison Elementary, this requirement was met in multiple ways. First, the project offered three family Math Nights, consisting of a meal and activities designed to engage family members (students, siblings, parents, aunts/uncles, and grandparents) in math activities aligned with what the students were learning in their classrooms. Second, parents were encouraged to join their children on one or more project-supported field trips that were linked either to the Allison AP curriculum or to college readiness (field trips included visits to three colleges: Sierra College, University of California, Davis, and California State University, Sacramento) and/or to spend time in the classroom as a volunteer. Third, as mentioned above, IAF was contracted as a community organizer. In addition to spending 6 to 8 days each month in classrooms with Allison Elementary teachers, the IAF organizer conducted trainings, identified parent leaders, and began to develop a network of adults. Because of many changes underway in TRUSD involving potential school closures and campus restructuring, organizing work during the spring focused considerable time on building strategies to influence the District's proposal to close Allison Elementary. While there is no way to attribute the efforts of IAF or the existence of the Allison AP to the resulting outcome, it is likely that those efforts contributed to the fact that, as of the time of this report, Allison Elementary is slated to remain open.

The Allison AP module included one additional component, an After School program. Working with a local musician, teachers provided an engaging ten session Rhythm/African Drumming Unit that linked music and math. This program was open to all 4-6th grade students at Allison and culminated with the musician leading one of the Family Math Nights.

Participating teachers from Allison Elementary had the following assignments for the 2009-10 school year: one sixth grade regular education class, one fifth grade regular education class and one Special Day Class (SDC) containing Mild to Moderate fourth through sixth grade special education students. The three teachers attended a two-week intensive AP Inc. training program in July of 2009 and met with an AP Inc. consultant on a quarterly basis throughout the school year. The participating fifth grade teacher received additional training on AP Inc. curriculum and functions as a lead for other participating teachers. The remaining class serving fifth and sixth grade students at Allison Elementary is a 5th/6th grade combined classroom. The teacher for this classroom elected not to participate in the pilot program, although students were encouraged to, and often did participate in Family Math Nights and in the Allison AP After School program.

[6] Resendez, M.A., Azin, M., Strobel, A. (2009). *A study on the effects of Pearson's 2009 enVisionMATH Program*. Jackson, WY:PRES Associates. Retrieved from http://www.pearsonschool.com

SCHOOL AND DISTRICT BACKGROUND

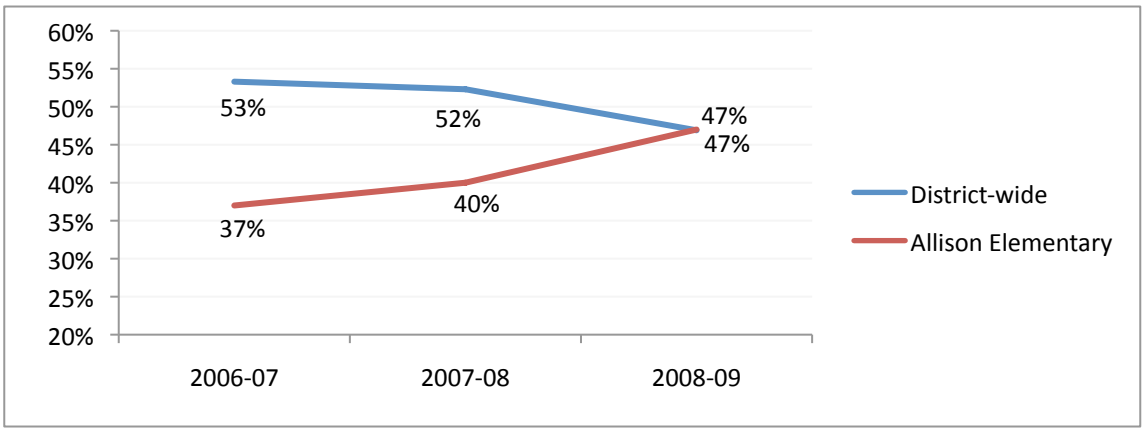
Warren A. Allison Elementary is located within the Twin Rivers Unified School District and in 2009/10 served approximately 370 students in grades kindergarten through six. Allison Elementary is one of 35 elementary schools in the district. The district's student population, as a whole, is diverse and Allison Elementary is no exception (Table 1). About 30% of the students both district-wide and at Allison Elementary are English learners, making parent involvement particularly challenging for families whose primary language is not English. While Twin Rivers USD serves a high poverty population (72% of all TRUSD students qualify for free/reduced price meals), this is even more the case with Allison Elementary's school population with 87% qualifying for free/reduced price meals.

Table 1: Student Demographics

Student Characteristics	**District (%)**	**Allison (%)**
Ethnicity		
White	33.0%	35.1%
Hispanic	31.0%	31.4%
African American	15.5%	15.1%
Asian	9.5%	3.5%
All Other	11.0%	14.9%
Special Programs		
English Learners	28.4%	29.7%
Free/Reduced Price Meals	71.7%	86.8%
Students' Home Language		
English	71.6%	70.3%
Spanish	15.8%	23.0%
Russian	3.7%	3.2%
All other	8.9%	4.2%

Allison Elementary's California Standards Test (CSTs) scores in mathematics for the past three years (2007-2009) have shown a steady increase in students' math proficiency rates (Figure 1). In fact, Allison Elementary's math scores in 2008-09 matched district-wide results and, unlike district-wide results, increased rather than decreased over the three-year period.

Figure 1: Percent Proficient or Above in Math



It is important to note that TRUSD implemented a new mathematics curriculum district-wide during the 2009/10 school year (enVisionMATH), including new district-wide benchmark assessments and pacing guides. Allison Elementary's AP teachers were given permission to deviate from the pacing guides and assessment schedules in order to integrate their AP lessons, although they were still required to cover all the curricular material and administer all the assessments.

METHODS

The evaluation design uses multiple methods to examine the impact of the Algebra Project participation on teacher practice and student achievement.

Qualitative Data Collection

Contextual and process information were provided via the teachers' own classroom research activities, key informant interviews with Allison Elementary's principal and the district Director of Curriculum and Instruction for Math, Science and Physical Education, classroom observations and student surveys.

Quantitative Data Collection

Students' benchmark assessment scores were analyzed to assess how the achievement of students in participating teachers' classrooms compared to that of other 5th and 6th grade students in the district. When the CSTs become available in the fall of 2010 additional analyses will be conducted.

FINDINGS

It is important to stress that all evaluation findings are exploratory and descriptive. Qualitative data collection is focused primarily on describing the background and process of implementing the Algebra Project (AP) at Allison Elementary and its influence on participating teachers' practices than with comparing AP teachers to others. In terms of achievement

analyses, with only three participating teachers, and only two in regular classrooms, it is impossible to establish causal links between program participation and student achievement.

KEY INFORMANT INTERVIEWS

Key informant interviews were conducted to provide background information on district and school practices and perceptions around mathematics instruction and professional development, in general, along with how Allison AP activities were incorporated into district and school practice.

TRUSD DIRECTOR

The Director of Curriculum and Instruction for Math, Science and Physical Education was interviewed in January 2010 to provide the district perspective on the background and implementation of the Algebra Project at Allison Elementary. At the time of the interview, she had served in her position for a year and a half and was deeply involved in implementing the District's new math adoption, *enVisionMATH*. She reported that the new adoption was the result of the District's need for a program with a strong focus on building students' understanding of mathematical concepts versus student memorization of facts. She felt the new adoption would provide the necessary support and resources for teachers and contained a strong technology component. She also noted that the new curriculum has a component designed to assist principals in observing and monitoring classroom implementation (commonly referred to as "classroom walk-throughs"). She was pleased, at least at the point in time at which was interviewed, that the District Assessments had not displayed an "implementation dip" due to the new adoption.

The Director provided detailed information about the District's benchmark assessment system. The assessments are designed with "smart" wrong answers, meaning that by examining a student's wrong answer, the teacher can identify the specific problem or skill where the student needs additional support. For example, they can determine if the student forgot a step in the process, failed to understand the concept, etc. The District enters the assessments results into the data system and provides teachers with access to the reports and training on interpreting the results. The Director noted that the Pacing Calendar utilized by the AP teachers at Allison Elementary was not aligned to the District Benchmarks Assessment Calendar. The District, however, supported the AP teachers' use of a Revised Pacing Calendar and allowed the Benchmarks to be administered out of sequence. Special education students' participation in benchmark assessments is determined by the teachers and the department (one participating AP teacher teaches a special education class).

The Director felt that teachers within TRUSD had all the tools available that they need to be effective in math instruction; noting that the District provides ample professional development opportunities for teachers who wanted to

improve their skills. However, she also noted that there are barriers and difficulties around teachers' use of professional development opportunities, including union rules and district fiscal limitations.

The Director felt the Allison AP teachers had greater than average resources due to the CTA IFT funds that provided teachers with extra planning time, curriculum resources and support to implement the program and also noted the AP resources allow for community and parent involvement activities which may also be effective supports for student learning.

While the Director stated that she did not have enough information to make a judgment about how the Allison AP might augment or improve upon the newly adopted curriculum, it appeared to the interviewers that the goals of the new curriculum to encourage active student learning are consistent with the overall goals of the project.

PRINCIPAL

Allison Elementary's Principal was interviewed near the beginning of the project (Dec. 2009) and again at the end of the school year (May 2010). The principal was asked to discuss changes in math instruction, teacher collaboration, and parent/community involvement over the course of the project. This school year (2009-10) is the third year that the Principal has been at Allison Elementary. She noted that while school wide performance in math has been steadily improving meeting the needs of their English Language (EL) learners is particularly challenging. Last school year (2008/09), although the math scores of EL students increased, the subgroup did not meet the statewide target. The Principal indicated that the newly adopted math curriculum (*enVisionMATH*) has EL strategies embedded in every lesson. The principal also said that she felt that the AP group work and collaboration activities were appropriate strategies for the EL Learners because these two strategies had the potential to reduce the feelings of intimidation experienced by students and allow all students to become more involved in the math lessons. The Principal reported that overall, she felt that Allison Elementary's teachers had all the tools they needed to be effective in Math instruction.

Overall, the principal had a positive response to the AP project. When asked, in her second interview, if the AP teachers had effectively intertwined the AP and *enVisionMATH* curriculum, the Principal stated that the teachers did the best they could to work with the two new programs simultaneously. Although teachers were incorporating AP principles into their regular math curriculum, she could see a distinction between the two programs during her classroom observations. She felt the only difference between classrooms implementing the enVisionMATH curriculum and those integrating both the enVisionMath and AP modules was that concepts were not taught sequentially in the AP classrooms; however, all teachers covered all of the standards contained within the pacing guides. The Principal noted that during her classroom observations, the students in the AP classes seemed to display greater levels of engagement and participation and higher rates of work completion compared to other classes on campus. The Principal appreciated that the AP project provided participating teachers with the support and fiscal resources to take their students on field trips and host

community events and reported that these events had been effective in engaging both parents/guardians and their students in math. Overall, the principal is pleased with the results of the AP project, stating, "As a pedagogy, it is exciting!"

CLASSROOM OBSERVATIONS

Two classroom observations (one in January and one in April 2010) were conducted in each of the three participating teachers' classrooms for a total of six observations of implementation of an Algebra Project lesson. Each observation, coinciding with the length of the lesson, lasted for at least an hour and focused on observation of teachers' instructional, engagement, motivation, assessment, feedback and classroom management strategies as well as routine classroom procedures and processes.

In all of the observed AP lessons, students spent at least half of their time engaged in small group work. Smaller percentages of time were devoted to whole group discussions, inquiry (e.g., question/answer and reflection activities) and individuals working on their own. Teachers were not observed lecturing during any of the AP lessons.

As noted, during the observed classes the evaluators primarily observed students working in groups, each comprised of four to six students, to complete specific activities within the overall lesson. In the special education (SDC) class, the group sizes varied based on the students' ability to stay focused and collaborate. Teachers in all three classes monitored the progress of the groups and adjusted the assignment as needed.

Within each group, students were assigned roles, which included a Facilitator, Reader, Speaker, Recorder and Materials Person. Central to the group work activities and successful collaboration was the role of the facilitator, who was responsible for managing group behavior, communicating with the teacher, seeking clarifications or asking additional questions. In the SDC, the teacher had slightly modified student roles to include a Facilitator, Recorder, Supply Person and Artist. In this case, the facilitator was expected to lead, manage, instruct as well as explain the requirements of the lesson to the group.

Observers expected to see variations in student engagement, participation and group interaction during the small group work (given the range of academic ability, maturity and grade levels). However, in spite of variations in teacher implementation and classroom procedures and processes, it appeared that over 85% of students remained engaged during the AP lessons. The observers attribute this level of engagement to the complex and organized nature of the group work and collaboration and to the explicit and consistent use of student-centered versus teacher-directed practices. The AP philosophy embodies the idea that students should take ownership of their own community building and mathematics learning, which is then modeled in the classroom activities.

The evaluators also observed that the small group work assignments allowed the teacher to more effectively monitor students' learning. By having a student facilitator assume the role of leading and managing the group, the teacher had the 'luxury' of time to gauge students' understanding and observe their thinking about the concepts being covered.

Finally, the evaluators observed that the majority of students, with some notable exceptions, appeared to be comfortable discussing, exploring and "making sense" of mathematical concepts amongst themselves. The increased opportunities to dialogue provided within the small group context appeared to give students the chance to puzzle out the relationships between concepts and draw on background knowledge, personal experiences and previously learned concepts.

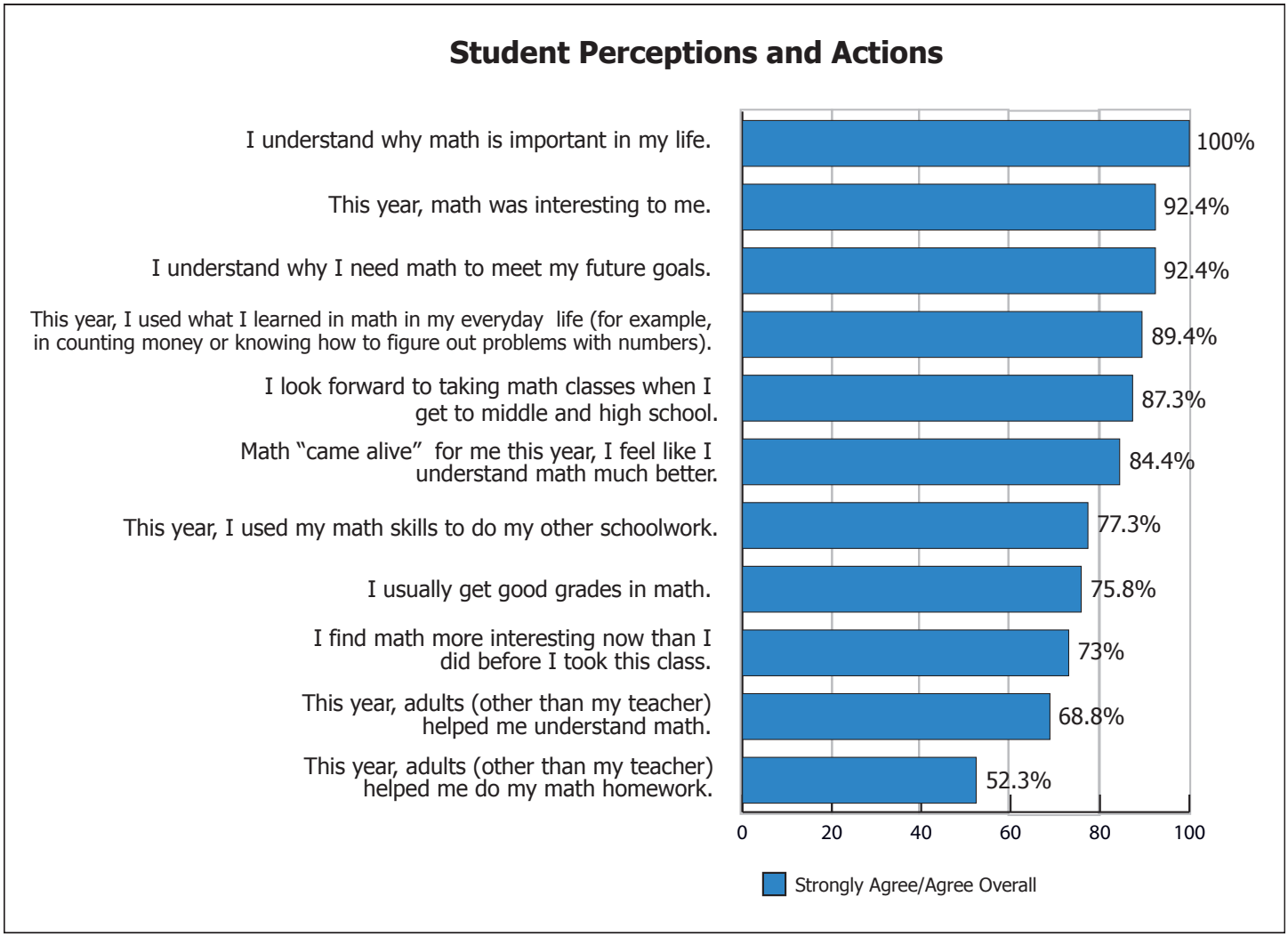
STUDENT SURVEYS

Students were administered a paper and pencil survey at the end of the school year (April 2010) to assess their perceptions of learning and understanding math. Sixty-six students ranging from grades four through six responded to the survey. Students completed the surveys independently in the 5th and 6th grade classrooms, in the SDC class the teacher modified administration procedures to accommodate the needs of her students.

As Figure 2 illustrates, students expressed high levels of interest in math and understanding of why math is an important skill to master. All students agreed or strongly agreed that they understand why math is important in their lives. Over 80% (84.4%) agreed/strongly agreed that this school year's instruction helped them to "understand math much better" and nearly three-quarters (73%) agreed that the found math more interesting now than they had in the past. Since there is no comparison group of students surveyed it is difficult to determine if these students are responding specifically to the Algebra Project component of their classroom instruction, but it is clear that they are fairly enthusiastic about math. Most students (77-89%) report using math, either in their other schoolwork or in everyday life. Over half of the students reported that adults other than their teacher either helped them either "understand math" this year (68.8%) or helped them do their math homework (52.3%).

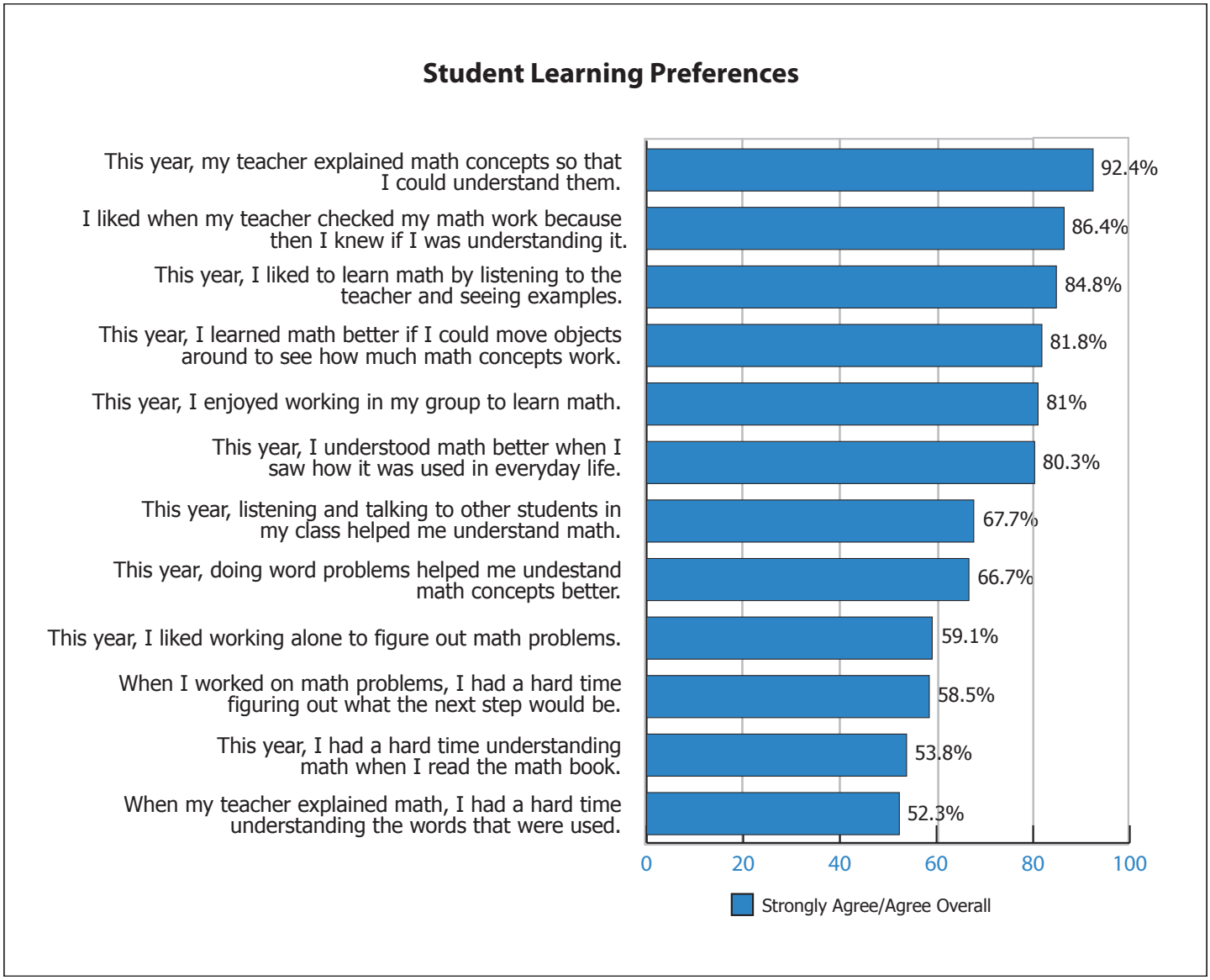
Most students (75.8%) agreed that they "usually get good grades in math." Responses to this item were positively correlated with the "I understand math much better this year" item ($r=.33$, $p=.008$). In other words, students who reported lower math achievement were less likely to agree that they gained math understanding this year. Still, although about 23% of students indicated they do not usually get good grades, among this small group (N=15), 60% (N=9) nonetheless agreed that they had gained understanding over the year. None of the other items in Figure 2 were significantly correlated with the "good grades" item.

Figure 2. TRUSD Algebra Project Student Survey – Overall Results (Spring 2010) Student Perceptions and Actions



Students were also asked to respond questions about their learning styles and preferences. Figure 3 illustrates that students generally responded positively to their teachers' explanations (92.4% agreed that they understand the explanations), checking of homework (86.4% agreed they like having their math homework checked), and examples (84.8%) agreed they like to listen to the teacher and see examples).

Figure 3. TRUSD Algebra Project Student Survey – Overall Results (Spring 2010) Student Learning Preferences



Students also responded positively to opportunities to "move objects around to see how math concepts work" (81.8% agreement), working in groups (81% agreement), and seeing how math is used in everyday life (80.3% agreement). While group work was generally positively received, somewhat lower proportions of the students reported that "listening and talking to other students" helped them understand math (67.7%). About 60% (59.1%) agreed that they liked working alone on math problems. Students who like to work alone tended to disagree that "talking with other students helped them understand math better"(r=-.41, p=.001).

About two-thirds of the students agreed that doing word problems helped then understand math better (66.7%). There is a moderately strong (r=.51) and significant (p=.0001) relationship between agreement to the word problem question

and the "using math in everyday life" question, suggesting that teachers may have composed word problems with real life examples.

Nearly 50-60% agreed that they were having problems "figuring out what the next step would be" in math problems (58.5%), understanding math from reading the book (53.8%), and understanding their teachers' words when she explained math (52% agreement). So, in spite of nearly uniform agreement that they could understand their teachers' explanations (92.4% agreement), a little over half of the students seem to indicate having difficulty with the vocabulary. Agreement with the item about having a hard time understanding the teachers' words was negatively associated with students' self-reported grades (r=-.44, p=.0001), with 81% of the students (N=13) who disagree that they usually get good grades reporting having a hard time understanding the teacher's words. Similarly, most (69%) of the students who disagree that they usually getting good grades agreed that they had a "hard time figuring out what the next step would be" in math problems.

Not surprisingly, students who report having difficulty understand the math book tend to disagree that word problems help them understand math (r=.39, p=.001) and tended to agree that they liked to learn math by "listening to the teacher and seeing examples" (r=.31, p=.01). Also, students who "have a hard time figuring out what the next step would be" in math problems tend to disagree that they like working alone (r=-.40, p=.001). All three of the items regarding difficulties (figuring out the next steps, understanding the book, and understanding the teachers' words) are inter-correlated, suggesting that the students having difficulty in one of these areas tend to have problems in all three areas.

In summary, Algebra Project teachers' students indicated generally high levels of interest and enthusiasm for math and positive responses to their teachers and math classroom activities. They report having an appreciation for the importance of math in their lives and generally positive responses to working in student groups. It appears that somewhere around 20% of the students surveyed are still struggling in some areas but it does not appear, on average, to dampen their interest in math significantly.

PARENT PARTICIPATION

Teacher research is a form of inquiry intended to help teachers speak from the authority of his or her own expertise (Hubbard & Power, 1993)[7] about their students' abilities and about their own teaching practices. It is generally considered to be a powerful professional development strategy as it helps teachers to gain understanding from real world observations and dilemmas. The American Educational Research Association also recognizes teacher Research as a valid research methodology.

[7] Hubbard, Ruth Shagoury & Power, Brenda Miller (1993). *The Art of Classroom Inquiry: A handbook for teacher-researchers.* Portsmouth, NH:Heinemann.

In this particular instance, teacher research also served as a tool to examine the impact of the Allison AP participation on teacher practice and student achievement. With the support of the UCD CRESS Center Director of Teacher Research, participating teachers engaged in yearlong process of identifying a question, gathering and analyzing data, and presenting their findings in a co-authored research study. This study, *Learning from parent engagement in the Warren A. Allison Elementary School Algebra Project, 2010* (Gallimore, Rohall, Zacharias, & Bookmyer, 2010) [8] has been produced and shared with the funder as a separate document.

The teachers investigated this research question: Does providing parents with simple skills/strategies to support their child's learning (around a particular challenge) impact their child's academic success? They found that while a small number of students showed evidence of academic improvement that they were able to attribute to the intervention, the overall impact of the intervention was small. The teachers speculated that one possible reason had to do with the way in which parents were asked to participate. They found "that personal and casual contacts (such as face-to-face interactions and phone calls) along with a specific request almost always resulted in higher levels of parent involvement than did formal or "second-hand requests" (such as sending form letters home with students).

Relevant to this report, the findings of the teachers' inquiry coupled with the observations of the evaluation team, project participation logs/sign-in sheets, anecdotal feedback from the school principal and parents themselves suggests that the parent engagement component of the Allison AP was generally effective in that it resulted in high levels of parent participation and engagement in their child's learning.

ANALYSIS OF CUMULATIVE TEST SCORES FOR STUDENTS, TWIN RIVERS ALGEBRA PROJECT PARTICIPATING VS. NON-PARTICIPATING STUDENTS

Again, it is important to note that the limited number of students and teachers involved in the pilot project prevent establishing any causal links between the Allison Algebra Project curriculum and student achievement. Rather, achievement results should be viewed as suggestive and exploratory since data are insufficient to rule out other factors, which could potentially explain the patterns of achievement reported here.

In the absence of 2010 California Standards Test (CST) scores for Twin Rivers students, performance on the district's 2009/10 cumulative tests was used to evaluate the impact of teacher participation in the Allison Algebra Project on student achievement. Two outcome measures were used in this evaluation: student mean scores and the percent of students scoring above the district mean. Scores for students of participating teachers were compared to two groups of

[8] Gallimore, W., Rohall, K., Zacharias, D. & Bookmyer, J. (2010). *Learning from parent engagement in the Warren A. Allison Elementary School Algebra Project, 2010.* Unpublished report produced for California Teachers Association Institute for Teaching.

students: those in a matched comparison group and all other students in the district (not including those in the matched comparison group).

The matched comparison group was selected by dividing participating students by gender, ethnicity, language fluency (EL or not), disability status (Student with Disability or not), and prior year math CST performance level. Among students who matched on demographic and achievement data, priority to the students at schools with a Similar School Ranking and/or 2009 base API closest to that of the participating teachers' school. If needed, the final determining factor was the proximity of the student's CST scale score that of the Allison Algebra Project student being matched. Approximately 3 "matching" students were selected for each Allison Algebra Project student.

Scores for students of participating teachers (Algebra Project) were compared to scores of matched students of non-participating teachers (Matched Students) and to all other Twin Rivers students of non-participation teachers (All Other Students) using an independent samples T-test. Statistical significance at the $p \leq .05$ level was determined after consulting Levene's test for equality of variances. The following charts display the number of students in participant teacher versus non-participant teacher classes for fifth and sixth grades, respectively. Statistically significant differences are noted with **boldface** and alpha superscript.

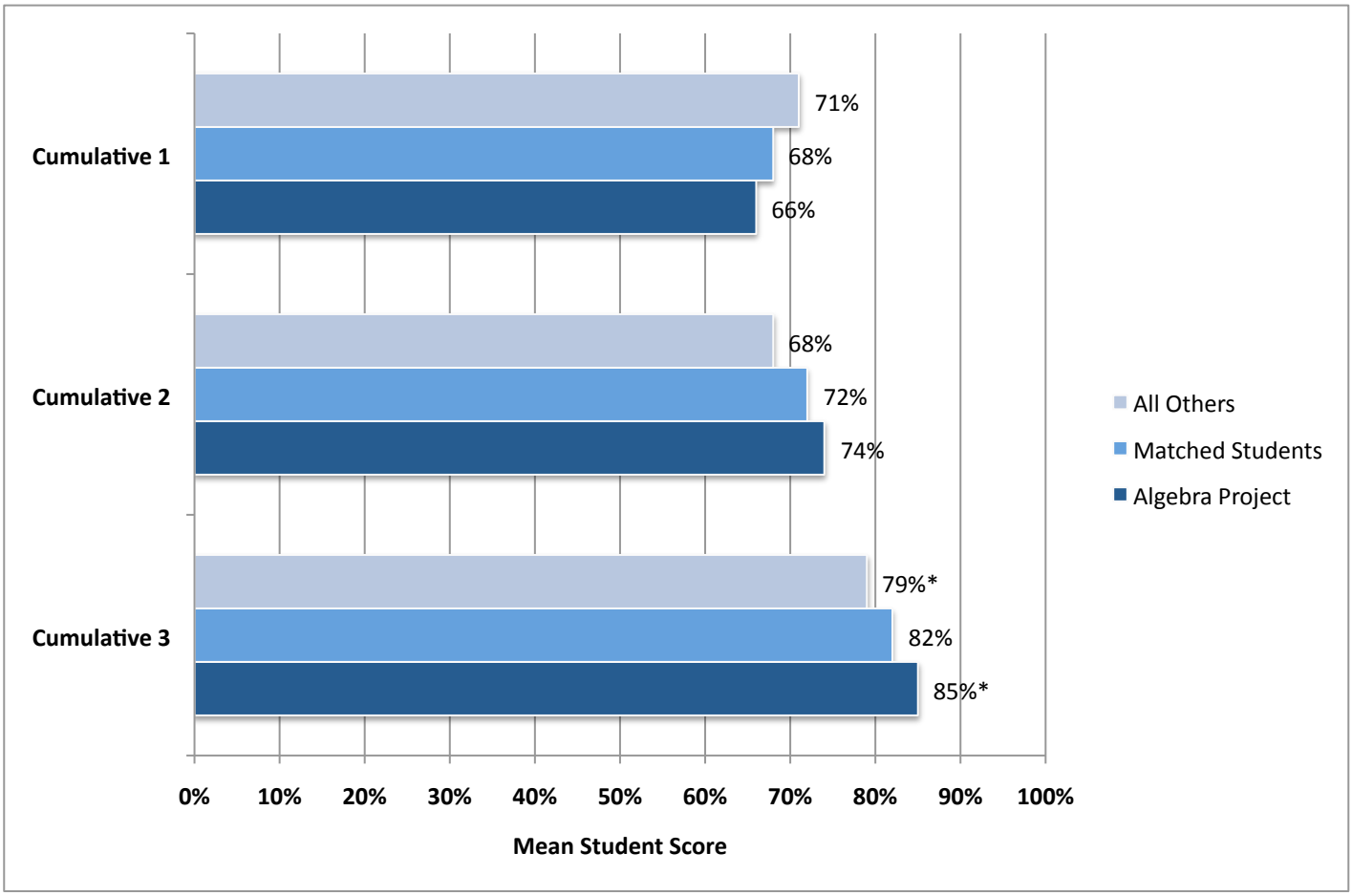
Table 2. District Cumulative Test Data for All Students, Grades 5 and 6

		Cumulative 1			Cumulative 2			Cumulative 3		
		N	Mean Score	% Above District Mean	N	Mean Score	% Above District Mean	N	Mean Score	% Above District Mean
Grade 5	**Algebra Project**	23	66%	39%	26	74%	69%	26	**85%[a]**	65%
	Matched Students	61	68%	54%	61	72%	70%	61	82%	69%
	All Other Students	1792	71%	57%	1801	68%	56%	1854	**79%[a]**	58%
Grade 6	**Algebra Project**	29	73%	55%	29	65%	59%	29	70%	38%
	Matched Students	58	66%	47%	60	68%	52%	60	69%	38%
	All Other Students	1695	71%	57%	1681	69%	58%	1772	69%	38%

[a]statistically significant difference ($p < .05$) using independent samples t-test

Table 2 shows that scores for Allison Algebra Project students are similar to those of other students in the district with the exception of the Grade 5 Cumulative Test, where Algebra Project students scored significantly higher, on average, than other students in the district (but not higher than a matched group of students). See Figure 4 below for illustration.

Figure 4. Grade 5 Cumulative Test Mean Scores



*statistically significant difference (p≤.05)

STUDENT ACHIEVEMENT BY MATH CST PERFORMANCE LEVEL

In order to discern the impact of the program on students with different levels of math competency, scores on summative tests were analyzed according to students' 2008/09 CST math performance level. Due to the small size of the group of Allison Algebra Project students, the five CST performance levels were condensed to three: Far Below Basic and Below Basic were combined, Proficient and Advanced were combined, and Basic remained as its own separate level. These categories highlight the effects of the program for groups that are highly strategic in state and federal accountability measures. The federal AYP (Annual Yearly Progress) measure is based on the percentage of students at Proficient and Advanced; thus, any program that improves content mastery for students at the Basic, Proficient, or

Advanced levels is promising for school and district progress toward making AYP. The state API (Annual Performance Index) is weighted such that schools and districts gain more points for improving the performance of the lowest students (Far Below Basic and Below Basic); thus, any program that improves content mastery for students at the lowest two CST performance levels is promising for school and district API gains. See Table 3 below.

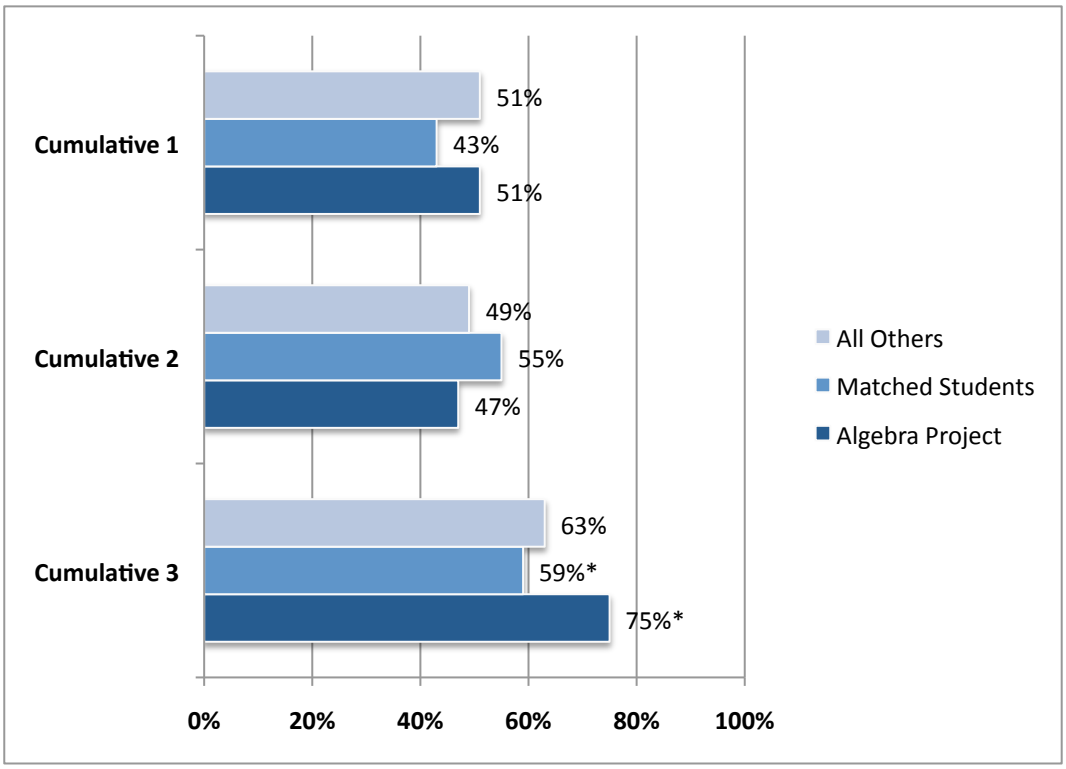
Table 3. Comparison of Cumulative Test Scores for Students with 2009 CST Math Performance Level of Far Below Basic or Below Basic

		Cumulative 1			**Cumulative 2**			**Cumulative 3**		
		N	Mean Score	% Above District Mean	N	Mean Score	% Above District Mean	N	Mean Score	% Above District Mean
Grade 5 FBB/BB	Algebra Project	5	51%	**0%**[a]	6	47%	17%	6	**75%**[b]	33%
	Matched Students	15	43%	13%	14	55%	29%	14	**59%**[b]	29%
	All Other Students	253	51%	**18%**[a]	255	49%	20%	254	63%	28%
Grade 6 FBB/BB	Algebra Project	11	**65%**[c]	27%	11	59%	36%	11	63%	27%
	Matched Students	27	56%	22%	27	60%	30%	27	59%	15%
	All Other Students	383	**54%**[c]	20%	374	51%	21%	381	54%	7%

[a,b,c]statistically significant difference (p≤.05) using independent samples t-test

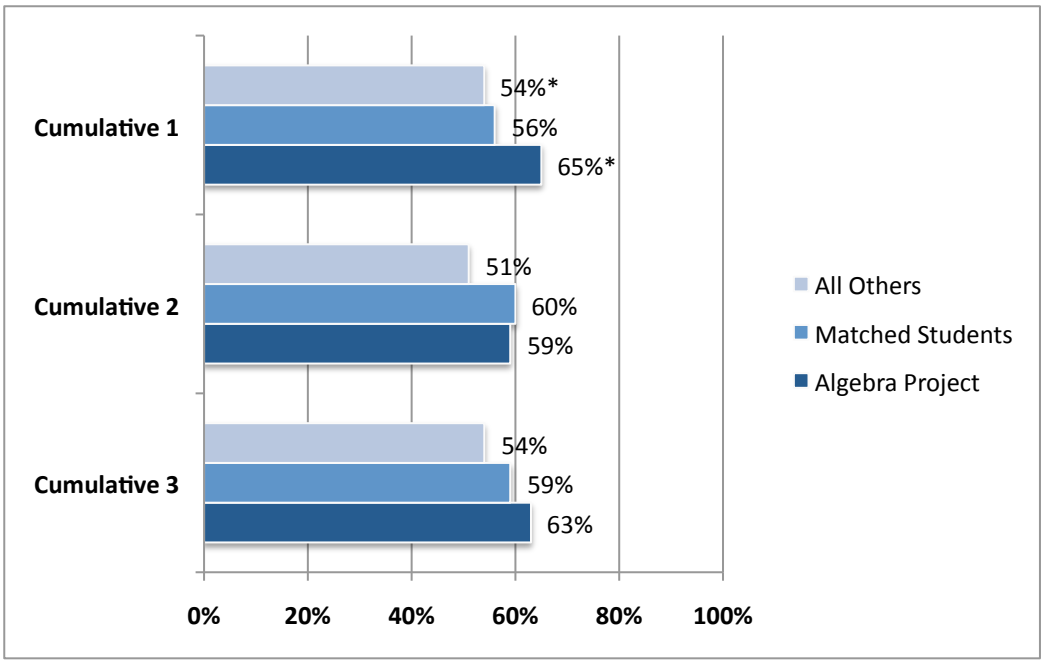
Table 3 shows that scores for Far Below Basic and Below Basic Allison Algebra Project students are similar to those of other Far Below Basic and Below Basic students in the district on Cumulative 2, however, on Cumulatives 1 and 3, some significant differences arise. Grade 5 students earned a similar average score on Cumulative 1 as their peers; however, non-matched students were significantly more likely to score above the district mean. Interestingly, Grade 6 Algebra Project students earned a higher mean score on Cumulative 1 than the rest of the district (non-matched group), but the proportion exceeding the district mean score was not significantly greater than that of other students (matched or unmatched). On Cumulative 3, 5th grade Allison Algebra Project students earned a significantly higher average score than the group of matched students, however, their score was not significantly different from Far Below Basic and Below Basic students district-wide (Figures 5 and 6).

Figure 5. Grade 5 Cumulative Test Mean Scores for Students with CST Math Level of Far Below/Below Basic



*statistically significant difference (p≤.05)

Figure 6. Grade 6 Cumulative Test Mean Scores for Students with CST Math Level of Far Below/Below Basic



*statistically significant difference (p≤.05)

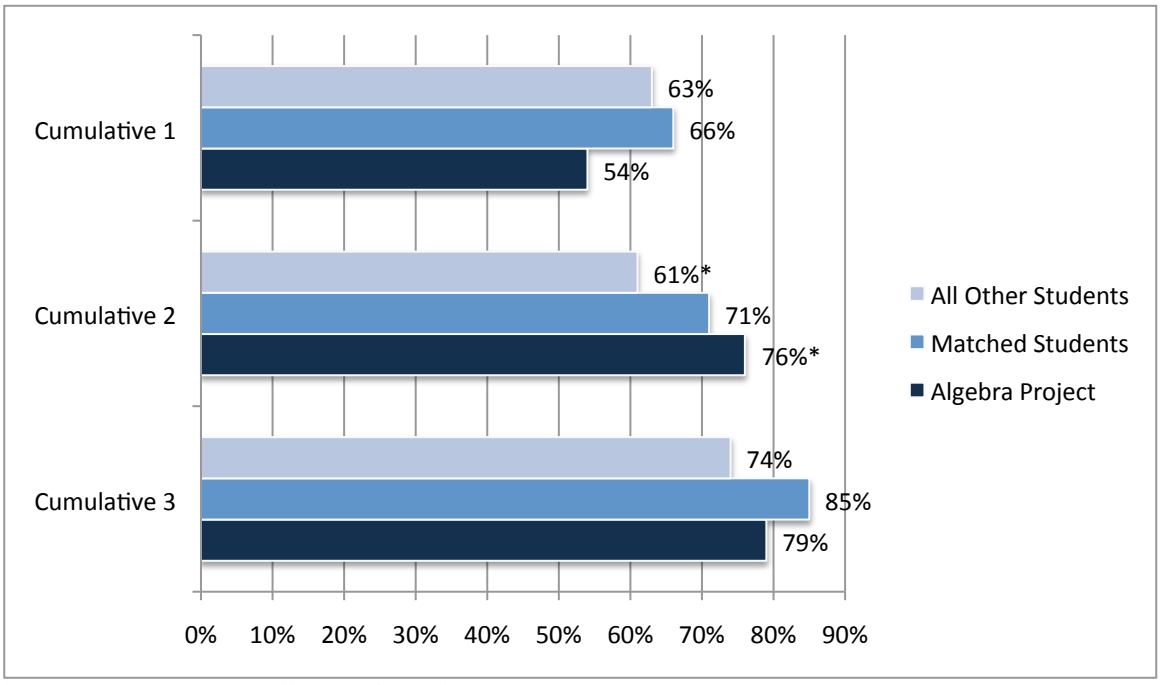
Table 4. Comparison of Cumulative Test Scores for Students with 2009 CST Math Performance Level of Basic

		Cumulative 1			Cumulative 2			Cumulative 3		
		N	Mean Score	% Above District Mean	N	Mean Score	% Above District Mean	N	Mean Score	% Above District Mean
Grade 5 Basic	Algebra Project	7	54%	14%	7	76%[a]	71%	7	79%	43%
	Matched Students	19	66%	42%	19	71%	68%	19	85%	74%
	All Other Students	361	63%	39%	342	61%[a]	39%	350	74%	42%
Grade 6 Basic	Algebra Project	4	66%	50%	4	56%	50%	4	**58%**[b]	0%
	Matched Students	10	63%	30%	12	58%	33%	12	65%	17%
	All Other Students	408	69%	47%	386	67%	50%	404	**67%**[b]	26%

[a,b] statistically significant difference (p≤.05) using independent samples t-test

Table 4 shows that among grade 5 students who scored Basic on their prior year Math CST, those in the Allison Algebra Project scored significantly higher than a their peers district-wide on Cumulative 2, though not significantly higher than the group of matched students. See Figure 7 for illustration.

Figure 7. Grade 5 Cumulative Test Mean Scores for Students with CST Math Level of Basic



*statistically significant difference (p≤.05)

Table 5. Comparison of Cumulative Test Scores for Students with 2009 CST Math Performance Level of Proficient/Advanced

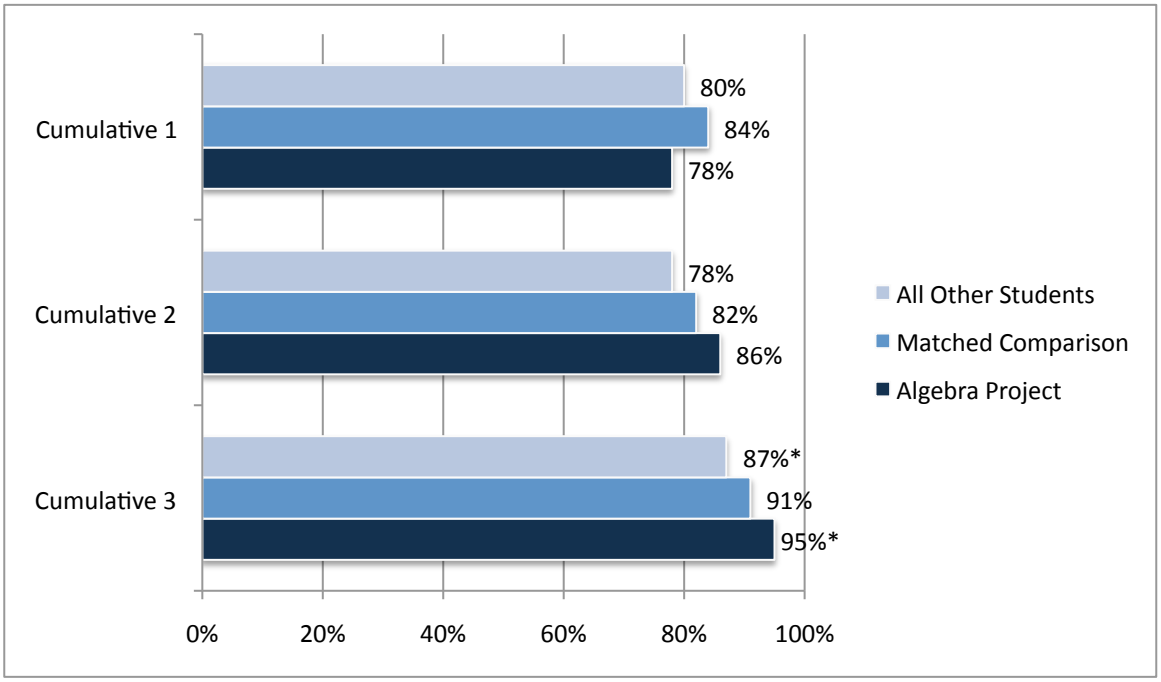
		Cumulative 1			**Cumulative 2**			**Cumulative 3**		
		N	Mean Score	% Above District Mean	N	Mean Score	% Above District Mean	N	Mean Score	% Above District Mean
Grade 5 Proficient/ Advanced	Algebra Project	10	78%	70%	10	86%	**90%[a]**	10	**95%[b]**	**100%[cd]**
	Matched Students	27	84%	85%	28	82%	93%	28	91%	**86%[c]**
	All Other Students	978	80%	77%	978	78%	**76%[a]**	978	**87%[b]**	**76%[d]**
Grade 6 Proficient/ Advanced	Algebra Project	7	**91%[ef]**	100%	7	**77%[gh]**	**100%[i]**	7	78%	57%
	Matched Students	21	**81%[e]**	86%	21	**84%[g]**	90%	21	82%	81%
	All Other Students	712	**84%[f]**	86%	680	**83%[h]**	**89%[i]**	701	82%	67%

[a,b,c,d,e,f,g,h,I] statistically significant difference (p≤.05)

Among grade 5 students who scored Proficient or Advanced on their prior year Math CST, those in the Allison Algebra Project scored significantly higher than their peers district-wide on Cumulative 3 (though not significantly higher than the group of matched students). Notably, all (100%) of the 5th grade Proficient or Advanced Algebra Project students scored above the district mean on Cumulative 3, a significantly higher proportion than among matched students or other students district-wide. Although on Cumulative 2, the 5th grade Proficient and Advanced students had a higher mean score than both matched students and other students district-wide, the difference was not statistically significant. Nevertheless, a significantly higher proportion of Allison Algebra Project students scored above the district mean for Cumulative 2 than other students district-wide (Figure 8).

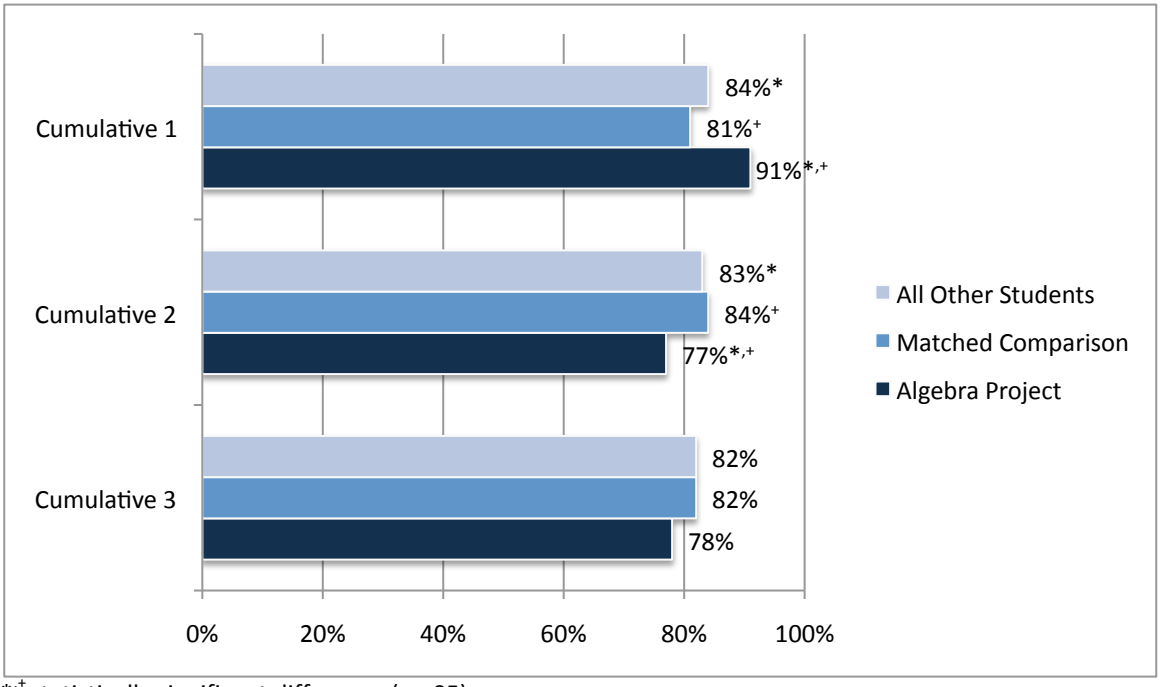
Among grade 6 Proficient and Advanced students, those in the Allison Algebra Project scored significantly higher than both the matched students and all other students district-wide on Cumulative 1. Results from Cumulative 2 are interesting; while Proficient and Advanced Algebra Project students earned a mean score that was significantly lower than that of matched students or other students district-wide, a significantly higher proportion of the Algebra Project students scored above the district mean than their peers district-wide. One possible conclusion from this finding is that, though the Allison Algebra Project may not have lead to maximized overall mastery of the topics tested in Cumulative 2, it did effectively provide access to the material for all students, such that a greater proportion of students were likely to demonstrate an above average level of mastery (Figure 9).

Figure 8. Grade 5 Cumulative Test Mean Scores for Students with CST Math Level of Proficient or Advanced



*statistically significant difference (p≤.05)

Figure 9. Grade 6 Cumulative Test Mean Scores for Students with CST Math Level of Proficient or Advanced



*,+ statistically significant difference (p≤.05)

In summary, among grade 5 students, those in the Allison Algebra Project excelled on Cumulative 3: their overall average score was higher than their peers district-wide, and within CST Performance Level groupings, Algebra Project

students who scored Far Below Basic or Below Basic, and Proficient or Advanced earned higher average scores than the group of matched students. Among grade 6 students, those in the Allison Algebra Project demonstrated somewhat stronger achievement on Cumulative 1, where students with CST Performance Levels of Far Below Basic or Below Basic, and Proficient or Advanced earned a higher mean score than their peers district-wide.

Although the Allison Algebra Project seems to positively impact some students according to some measures, additional data is needed to fully assess the impact of the project. Specifically, an increased sample size (more students involved in the project) would allow the comparison of subgroups of interest – such as English learners and various ethnic groups. Also, the analysis would be more definitive if similar tests were compared – namely CST 2008/09 compared to CST 2009/10. Expanding the program to additional classrooms and continuing it through the 2010/11 school year will allow a more thorough and accurate analysis of the program's effectiveness at improving student achievement in math.