

***What outcomes count in mathematics education reform?
A longitudinal case study of mathematics reform at
Dr. M.L.King, Jr. Academic Middle School,
San Francisco: Executive Summary¹***

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This study tracked the implementation of an “algebra for all” program in a San Francisco middle school from 1990 through 2006. The school serves a diverse group of 500-550 students in Grades 6-8, including about one third African American, one third Latino, and diverse Asian and Pacific Island students. From 1990-2006, the percentage of students qualifying for free or reduced cost lunch has increased from about 50% to nearly 70%, and percentage of ELL students increased from about 10% to 25%. Special education ranged from 15-20%.

Beginning in 1995, the school discontinued teaching Grade 8 Math and offered Algebra I for all students, including most of those identified for special education. Authors West and Davis visited the school at least annually beginning in 1991, conducted a one year ethnographic study in 2000-01, and followed this up with an analysis of teacher community and student outcomes with the support of this AERA/IES small grant. The data on student outcomes include both student-level tracking into high school of a few cohorts, as well as school-level data from the state tests (both criterion- and norm-referenced).

Findings

Implementation

The school’s program was initiated through a grassroots organizing effort called the Algebra Project, that provides instructional materials, pedagogy, and a community based approach to early mastery of algebra and commitment to college preparatory mathematics in high school. The initial two-week teacher institute in 1991 was supported by the school district, but from then on the school developed its program without district support. At the 1991 institute, several teachers were introduced to the project by founder Robert Moses. One of them later attended the project’s “trainer training,” and facilitated

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the continuing professional development with strong support from the principal. From 1997-99, the program received a small amount of support from the Algebra Project national network for teachers to attend national meetings and conduct local professional development.

The principal and teachers strongly grasped the Algebra Project's philosophy about the importance of early mastery of algebra, and the pedagogy to be applied at any grade level. From 1991-1995, Grade 6 teacher Marian Currell, who had previously served as a district staff developer, and became certified in the Algebra Project's program for "teacher trainers," facilitated a consensus among the mathematics faculty and principal that led them to discontinue offering Grade 8 general mathematics, and to enroll all Grade 8 students in Algebra I and use the text used by high schools in the feeder pattern. Grade 6 and 7 teachers used the project instructional materials (the *Transition Curriculum*, described by a national evaluation panel as a "curricular intervention") if and as they wished, together with district-recommended materials.

The proportion of the math teachers who had been trained in the Algebra Project (an initial two week training, which some teachers repeated if it was available), peaked at 7 out of 8 in 1997-98, but then declined to 0 in 2003-04 (Ms. Currell then became Assistant Principal and was no longer a classroom teacher, and others retired or left for higher paid positions). Some teachers were trained by Currell in institutes for the Bay Area, and some attended institutes in other Algebra Project sites. The probability that a graduating student had been in classes of Algebra Project-trained teachers in Grades 6-8 began at 0 in 1990, increased to .72 for the years 1995-1998, and declined to 0 by 2006.

The three teachers who were trained first functioned as a core group, but practiced an inclusive approach that did not exclude teachers who had not been trained in the project. Most teachers were interested in attending training and did so; but a few did not. The department sought outside mathematicians (some affiliated with the Algebra Project, some not) to assist in professional development. They used existing district professional development programs to further support their own goals.

The school has retained the practice of "algebra for all" 8th graders since 1996, despite the introduction of "high stakes" testing programs and changes in approved texts. It is the only middle school in San Francisco with this practice. The teachers, as a department, continually revisited their curriculum objectives and instruction for Grades 6-8, with the goal that students finish the Algebra I text and perform well on the new end-of-course test.

Student Achievement

Students who graduated in 1996, 1997, 2000 and 2001 who had attended throughout Grades 6-8 were tracked into mathematics courses in San Francisco high schools. In the two cohorts with both Grade 9 and Grade 10 data (1996 and 2000), King graduates were enrolling in the next courses in the college prep track (Geometry in Grade 9, and Algebra II in Grade 10, or equivalent courses) at twice the rate of graduates of other San Francisco middle schools that were demographically similar. For example, the 1996,

27% of King grads were taking Geometry or equivalent in Grade 9, compared with 12% of graduates of other similar middle schools. In 2000, 20% of King grads were doing so, compared to 11%. Teachers were also pleased that their graduates were NOT being placed into the remedial courses offered.

State testing became salient to teachers and schools in the late 90s. The school's Grade 8 performance on the math norm-referenced tests improved the seven years of state use, from 34% of students above the national average in 1998, to 58% in 2004. The school's performance on the end of course Algebra I test (from 1999-2005) was lower than the state by about 10-30 percentage points (% "proficient" or above). This is not surprising since statewide, only the best students were taking Algebra I in Grade 8. The percent tested in the state ranged from 12-35%, where at King nearly all students were taking the test.

In order to create a score that would take into account the higher percentage enrolled at King, we created an adjusted score using a reciprocal regression analysis. The adjusted score showed that King students outperformed the state except for two out of the seven years. Teachers explained the school's lower performance in 2002 as due to the large percentage of ELL Mandarin speaking students, and the slightly lower performance in 2004 as due to their mandated switch to an new Algebra I text.

The school's performance on the state Academic Performance Index, which includes all subjects, fluctuated in the first three years, due to low language arts scores. The school volunteered for the "under-performing schools" program and exited after only one year. The school API has since increased from a low of 628 for 2002 to a high of 725 for 2006. On this index, the school has performed above the median for the 100 most similar schools in the state, from the beginning to the present.

Conclusions

This middle school succeeded in bringing about a reform that has been nationally recommended since the mid90s, but rarely accomplished. The enrollment of all Grade 8 students in Algebra I was achieved with the inspiration and multifaceted intervention that the Algebra Project provided, and through skillful facilitation and use of resources within the mathematics department. It was achieved through a dedicated core group of teachers, and a supportive principal, who used an inclusive approach and kept focused on their goal of early mastery of algebra concepts and continued success in high school mathematics. The Algebra Project network provided a sense of community to project trained teachers and the principal. But the goal was accomplished through local leadership and without intervention from the project's founder Robert Moses, who was working intensively in other sites.

We believe that the group's clear focus on students' completion of Algebra I and continuing success in high school helped them to sustain their effort despite changing local and state mandates. The school was not deterred from their goal by the students' lower test scores on the end-of-course Algebra I test, but revisited their Grade 6-7

curriculum and instruction to transition toward completion of Algebra I in Grade 8. The school discontinued regular Grade 8 math and never re-introduced it.

We note that the school's focus on long-term success (in high school, and even college) is one not supported by current accountability systems for schools that focus on performance at specific grade levels. The growth models that states are beginning to adopt will be helpful in understanding how student achievement develops. However, we believe that research is needed to trace the development of students' mathematics performance and mathematics learning "identities" from middle school through high school. Such research would lead us to a better understanding of how to support the many students who are currently struggling with algebra in high school and college.