



# THE ALGEBRA PROJECT

*“Math literacy is the key to 21<sup>st</sup> century citizenship.”*

**Board of Directors:** Khari J. Milner, Chair; LaDon James, Vice Chair; Margaret Burnham, Secretary; BJ Walker, Interim-Treasurer; Danny Glover; James Donaldson; Herbert Brown II, Robert Moses, President.

FINAL PROJECT OUTCOMES REPORT – NSF AWARD #DRL-0822175 (submitted 11/30/2014)

In this research, the Algebra Project studied a cohort model designed to “harness the peer culture” and accelerate mathematics learning for students who enter high school performing in the lowest quartile on the math portion of state tests.

At six high schools, cohorts of ~20 students took math together with the same teacher for Grades 9-12. They used rigorous materials designed by mathematicians and teachers to engage low performing students through a unique pedagogy, and enable them to graduate on time ready to take college math courses for credit. The project’s classroom materials are designed to engage students who have experienced academic failure, who enter Grade 9 with conceptual foundations different from those of average- to high-performing students. Its materials and pedagogy build cognitive *and* noncognitive skills together.

Research included (a) preliminary studies at Edison High School, “little Haiti”, Miami; and (b) a multi-site study of cohorts implemented “from scratch” in five demographically different high schools in Ypsilanti, MI; Mansfield OH; Eldorado, rural Illinois; and Los Angeles (Table 1). Nearly all students performed BELOW “proficient” in math on the Grade 8 state test.

## Intellectual Merit

Graduation: In 4 of 5 schools in the multi-site study, Cohort students had 4-year graduation rates (federal formula) above 70% (from 71-80%) (Table 2). In 3, their graduation rates were 11-32% higher than the non-project students, matched for race, gender, math proficiency and language status. At the 4<sup>th</sup> school, rates were similar (~75%). But this Cohort comprised the lowest performing students in a class of 97, so they appear to have “caught up” with their peers. At the 5<sup>th</sup> school, graduation rates were similar and low: 43% (Algebra Project) versus 41%. But here the Cohort kept changing -- only 7 students were present for 3-4 years. Five graduated, approximating the <70% rates of the other Cohorts.

Growth in Mathematics Proficiency: (a) Concept of Function: Mathematicians Ed Dubinsky (FIU) and Robin Wilson (CSU/Pomona) studied Algebra Project Cohort students’ development of the function concept at three schools. Cohort students acquired the concept at a level similar to college students, and even as well as some teachers in training (Dubinsky & Wilson, 2013). (b) Proficiency on State Tests in Ohio: At Mansfield High, the Algebra Project and nonAlgebra Project students entered Grade 9 averaging the same math proficiency: in both groups only 17% were ≤ “proficient”. Cohort student’s proficiency rose from 17% in Grade 8 to 82% in Grade 10, and averaged 30.2 points ( $\pm 2$ ) compared with only 19.3 ( $\pm 2$ ) points for *all* noncohort students, and 20.6 ( $\pm 2$ ) points for a noncohort sample matched on race, gender and Gr 8 top score.

Development of Student Attitudes: Student progress was *best* in the 3 sites where most Cohort students also participated in the afterschool program of the Young People’s Project (YPP). In YPP they were

mentored by College Math Literacy Workers to design, conduct, and debrief after school workshops 1-2x/week for Grade 4-7 students in the community. YPP assisted students to gain positive attitudes toward mathematics and mathematics achievement.

**Broader Impact** The Algebra Project's broad goal is to demonstrate to the nation how students in low income communities can achieve in mathematics to the level needed today for citizenship and family-supporting jobs. This project had an impact both locally and nationally, and in universities as well as schools. For example, a model materials development site was created at FL Hamer Freedom High School in Bronx, NY, where internationally-known Cornell Geometer David Henderson collaborated with two teachers to implement an innovative sequence in algebra-geometry. Mathematician colleagues at both Ohio State U/Mansfield and Southern Illinois Univ. are starting STEM institutes. At U. Michigan SOE, Mark Thames implemented an NSF study of the explicit and implicit teaching strategies used by Bob Moses, teaching low performing rising 9<sup>th</sup> graders in a lab setting for 2 weeks each of 3 summers. Educators and mathematicians attended from around the country. The Algebra Project collaborated with the Educational Testing Service to host national meetings to discuss project research and expansion, attended by researchers and national leaders (Math for America, 100k STEM Teachers in 10 Years; NACME, Children's Defense Fund), as well as teachers, administrators and community activists. Math for America Fellows interned in a Cohort classroom in Los Angeles, and videos of teaching there were beamed to hundreds of students in other countries as part of Univ of Southern California's digital teacher education course. At OSU/Mansfield, Algebra Project national teacher development specialists co-taught a teacher preparation course with OSU faculty. The district also asked them to conduct teacher professional development district-wide K-6 for 2010-13.

Three new cohorts have started in Mansfield and Miami each. In Los Angeles, several Algebra Project teachers founded a new high school, August Hawkins, that combines Algebra Project pedagogy with Complex Instruction school-wide, across subjects.

**ALGEBRA PROJECT (AP) HIGH SCHOOL COHORTS, CLASS OF 2013**  
**School Demographics**

<u>School</u>	<u>State reported Size of Grade 9</u>	<u>Algebra Project Gr 9 Cohort</u>	<u>% Below Proficient in Grade 8 Math AP (nonAP)</u>		<u>Algebra Project Cohort Demographics</u>			
					<u>Black</u>	<u>White</u>	<u>Latino</u>	<u>Other</u>
Eldorado High School <i>rural S. Illinois</i>	97	42	68%	(10%)	•	98%	•	2%
Mansfield High School <i>mid-north Ohio</i>	334	22	73%	(73%)	73%	14%	•	14%
Ypsilanti High School <i>near Detroit, MI</i>	337	23	90%	(na)	96%	•	•	4%
Crenshaw High School <i>south Los Angeles</i>	514	25	100%	(92%)	75%	•	25%	•
Franklin High School <i>north central Los Angeles</i>	895	42	85%	(89%)	•	5%	95%	•

\*% scoring below “proficient” on mathematics portion of Grade 8 state test

**ALGEBRA PROJECT HIGH SCHOOL COHORTS, CLASS OF 2013**  
**Student Outcomes: Four Year Graduation Rates<sup>1</sup>**

<u>School</u>	<u>Grade 9 Cohort</u> <u>N</u>	<u>Algebra Project</u> <u>Grad Rate</u>	<u>Similar Students<sup>2</sup></u> <u>at Same School</u> <u>Grad Rate</u>	<u>State or District</u> <u>Reported School<sup>3</sup></u> <u>Grad rate</u>
Eldorado High School <i>rural S. Illinois</i>	42	71.4% <sup>4</sup>	na	79.0%
Mansfield High School <i>mid-north Ohio</i>	22	75.0%	50.6% <sup>6</sup>	73.8%
Ypsilanti High School <i>near Detroit, MI</i>	23	80.0%	69% <sup>5</sup>	55.9%
Crenshaw High School <i>south Los Angeles</i>	25	42.9%	40.9%	51.7%
Franklin High School <i>north central Los Angeles</i>	42	65.4%	43.5% <sup>6</sup>	59.7%

**NOTES**

1 All graduation rates are calculated using the federal “adjusted cohort” method which takes the number of graduates in 2013 divided by the 2009 Gr 9 enrollment, minus any students who transferred out of state or in state to schools known to provide a regular high school diploma. For Los Angeles schools, transfers within Los Angeles could be tracked and graduation status determined, but transfers out of state could not be identified and were retained.

2 For each school, a comparison group was created of all other students who entered Grade 9 in Fall 2009), then deleting cases to create a group whose profile matched the AP cohort on Grade 8 math proficiency, race and gender. At Franklin High School, Grade 9 language status was also matched.

3 State or district report for the entire high school (not matched to AP cohort demographic profile)

4 In this school the Algebra Project cohort was composed of the students with the lowest scores in Grade 8 math (see Table 1)

5 State reported 4-year graduation rate for all African American at Ypsilanti High School (AP cohort was predominantly African American students).

Note also that the Algebra Project cohort boys outperformed school rate: 66% compared to 54%. We did not have access to student level data on nonAP students; the high school has been closed.

6 Difference between cohort graduation rate and similar group,  $p < .05$ . No significant difference for Crenshaw. Significance test not appropriate for the two other cases.

