

EVIDENCE FOR THE EFFECTIVENESS OF THE INTERVENTION

Results of the Field Test. We have assembled a portfolio of evidence that suggests the current AIMA program works. The range of evidence is discussed in this section, and it includes student outcomes, teacher feedback on utility, and impact. In addition, districts and schools already involved with the current AIMA program have expressed a strong desire to continue to participate in the program and to serve as sites for the AIMA-FY field tests; new school districts have expressed interest in using the materials; and we have received direct positive teacher feedback, all reinforcing our goal of developing four more modules to address additional trouble spots in algebra understanding.

Because academic achievement is our major priority, we sought to measure the core academic outcomes of students exposed to our current IES-funded AIMA modules. Our empirical evidence show marked improvement in students' algebra achievement after exposure to the current intervention lessons.

As shown in the results in Table 1, students exposed to the current AIMA modules exhibited substantial increases in performance on module-specific tests. Student gains on the module tests ranged from 0.43 standard deviations for Proportional Reasoning to 1.46 standard deviations for The Coordinate Plane. Across all the tests, the average performance gain was 0.82 standard deviations. Moreover, all of the changes were statistically significant. Although we do not know how these students would have fared if they were not exposed to the AIMA modules, the magnitude of the changes presented in Table 1 suggests that the modules are associated with improvement in algebra performance. It is also notable that the participating students represent populations of students who are under-achieving in mathematics.

Table 1. *Pre-test and Post-test Scores on Module-Specific Tests*

Test	N	Pre-test Mean (S.D.)	Post-test Mean (S.D.)	Change	Standardized Change*
Signed Number Operations	113	70.1% (22.2)	82.2% (18.8)	12.1	0.54
Variables & Expressions	294	45.0% (24.2)	60.8% (25.0)	15.8	0.65
Proportional Reasoning	100	32.2% (23.5)	42.4% (23.3)	10.2	0.43
Patterns	152	45.8% (18.9)	65.7% (21.5)	19.8	1.05
The Coordinate Plane	206	14.6% (12.4)	32.7% (21.6)	18.1	1.46
Inequalities	141	34.2% (16.5)	47.6% (19.6)	13.4	0.81

Notes: All pre-test/post-test changes are statistically significant. ($p < .001$)
*Absolute change divided by the pre-test standard deviation.

To provide some order of magnitude of effect sizes, Cohen (1988) defined effect sizes as "small, $d = .2$," "medium, $d = .5$," and "large, $d = .8$ " (p. 25). The field test data for the AIMA shows an overall effect size (standardized change) of .82 with a range from .43 - 1.46. We shared these empirical data with our AIMA measurement advisor, Stanford University's Dr. Richard Shavelson, for an external review. He concluded that our outcomes show that this appears to be a promising mathematics intervention for improving student algebra learning, especially with our target population of low-performing students. Dr. Shavelson's overall perception of the impact of the AIMA materials on student learning includes the following conclusions:

- Each module showed significant student gains;
- The overall effect sizes are large; and
- The data showed no ceiling effect and, therefore, room for student improvement.

The goal of the AIMA materials is to address students' prior failure to master algebraic concepts and bring them to a proficient level of algebraic understanding. In most cases, we are working with students who score in the bottom quartile in mathematics. The results suggest that these students make significant gains with the AIMA modules that currently exist. Based on these data, we believe that the implementation of AIMA-FY materials over the course of a full school year has the potential to significantly improve students' mathematics achievement.

Teacher Testimony. An online survey of teachers (90% response rate) who field tested the current AIMA materials in their classrooms found overwhelmingly positive responses to the curriculum. Compared to other materials used in the past, 100 percent of respondents considered the AIMA materials better in helping students understand algebra concepts. In a separate communication to the AIMA team, for example, one teacher noted that after using the Signed Number Operations module, "Students were finally convinced of why subtracting a negative is the same as adding. Great examples!" In addition, 100 percent of respondents agreed that they would continue to use AIMA materials if they were available in their school or district.

Table 2. Results of Teacher Survey

Algebra Field Test Teacher Survey questions	Much better than other materials	Somewhat better	About the same	Somewhat worse
1. Compared to curriculum materials I have used in the past, the AIMA materials help students understand how algebra concepts work.	56%	44%	0%	0%

	Much more than other materials	Somewhat more	About the same	Somewhat less	Much less
2. Compared to curriculum materials I have used in the past, the AIMA materials engaged my students in the mathematics I intended them to learn.	64%	36%	0%	0%	0%

	Strongly agree	Agree	Somewhat agree	Somewhat disagree	Disagree	Strongly disagree
3. I would use the AIMA materials if they were available in my district/school.	81%	13%	6%	0%	0%	0%
4. I would find it useful to have a full year of AIMA course materials to use with my intervention and/or algebra readiness students.	81%	13%	6%	0%	0%	0%

Teachers have also observed that students were extremely engaged in the content of the modules. One teacher remarked, “When the bell rang, the students didn’t get up and leave.” Another noted, “I found the materials easy to use and my students stayed interested longer than they do with ‘book work.’” In the online survey, 100 percent of respondents concluded that the AIMA materials were more engaging to their students than other materials used in the past. The AIMA materials are different from most intervention curricula on the market. With the increased need for intervention materials, many publishers produced workbooks and/or repackaged classroom materials to be used in intervention classes. Unfortunately, these materials offer only more of the same instruction that is not working for underperforming students. Other programs simply offer homework supervision and help, while AIMA focuses on building understanding of mathematics concepts. In contrast to commonly used intervention programs, AIMA materials are:

- **Based in Cognitive Research:** AIMA is based on current research on how students learn, and, as a result, all materials are conceptually based, provide appropriate scaffolding (within tasks and across modules), and focus on content areas that are barriers to students’ success in algebra. (For specific examples, see description of the curriculum modules.)
- **Designed for Teacher Learning:** The program’s professional development is based on research on effective teacher learning, including a major focus on teachers developing understanding of both the content they will teach and the pedagogy shown to develop conceptual understanding of mathematics among diverse learners. The program provides ample opportunity for professional dialogue and critical reflection. Supporting materials such as “coach’s notes” are explicit yet flexible. They have been tested and shown to be user-friendly both in presentation and format.
- **Student Friendly and Engaging:** Materials are geared to the student audience in both presentation and format. Instruction and reminders of mathematical content are included throughout to keep students focused, challenged and engaged.
- **Assessment Rich:** The program provides quality assessments correlated to standards and to the instruction, including both formative assessments throughout the materials and summative assessments for use before and after each module.