

Thinking Outside of the Rhombus

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In a high stakes testing environment, such as the one that exists in New Jersey today, school districts are confronted with mathematics scores that do not make the “grade” for their high school students. Since the High School Proficiency Assessment (HSPA), which is given to New Jersey’s eleventh graders, requires students to have a solid understanding of algebra one and geometry, curriculum experts in school districts have recognized that students must take algebra one in ninth grade. This presented a problem for students who were previously taking a pre-algebra course in ninth grade. Many of those students were not meeting with success in that course, so having them take algebra one without the appropriate foundation would be fruitless.

As stakeholders brainstorm solutions to ensuring a foundation to support algebra instruction in ninth grade, various solutions are suggested: increasing time on task by doubling mathematics periods, offering or requiring summer preparation programs, augmenting teachers’ professional development and restructuring the middle school mathematics program. After instituting these and other solutions, mathematics test scores show some improvement.

However, there always seems to be a core group of students, who, despite the best efforts of parents, teachers and administrators, show little or no improvement in their mathematical knowledge. Those students enter ninth grade and are unable to successfully complete algebra one. This was the case in the South Plainfield Public Schools in 2004-05 school year. In order to help the 10 to 15 percent of students who could not pass algebra, we knew that we would have to go beyond traditional solutions; we would have to try something that would be new to our teachers and that would engage our students. With this decision came the realization that we would have to support this endeavor with training and equipment for the teachers and students.

Concurrent with this decision, the NJSSI program administered by Rutgers University released its request for proposals. After examining the grant, the Assistant Superintendent for Curriculum and Instruction determined that it supported curriculum and professional development options that showed promise for a non-traditional intervention to support the hardest to teach students. The Cognitive Tutor Algebra One program, developed at Carnegie Mellon University, was selected for the grant proposal. The Cognitive Tutor program combines three days of classroom instruction with two days of computer based learning each week. The program would require extensive professional development of instructional and technological strategies. It would also require purchase of a classroom set of computers. The support of the NJSSI grant provided funds for purchase of the curriculum and professional development, which were augmented through matching funds from the district. The computers were purchased using a generous special purpose grant from the NJ Treasury Department, spearheaded by Senator Barbara Buono.

Once the curriculum, professional development and computers were in place, students were selected for the intervention. Students were selected using three criteria: mathematics score on the Grade Eight Proficiency Assessment (GEPA), final grade in the eighth grade mathematics course and teacher recommendations. This pool of students was made up of those who were not

successful using the traditional teaching methods. The pool of 50 students (25 males and 25 females) contained those with IEPs (27), various ethnicities (9 Hispanic, 5 African American, 2 Pacific Islander, 1 American Indian, and the remainder White), English language learners (1 student) and students in poverty (9). Only 7 students had a score of proficient on the GEPA. Four classes of the Cognitive Tutor Algebra One program were instituted in the 2006-2007 school year. Four teachers, including two special education teachers, received extensive training during the summer of 2006. The selected teachers attacked the tasks with great enthusiasm and dedication, which was reflected in the success of their students. Of the 50 students who began in the program, 43 passed the course for an 86% success rate. The 86% passing rate held for students who were proficient on the GEPA as well as for those who were partially proficient.

Based on this success, teachers and administrators instituted Cognitive Tutor Geometry in the 2007-2008 school year. Of the 50 students who began with Cognitive Tutor Algebra One, 33 continued into the geometry course. Some of the original students moved on to a traditional geometry course, some graduated and a few others moved away. By the midpoint of the school year, only 4 of the 33 did not have a passing average, which yields an impressive passing rate of 88%. Of the 29 who have a mid-year passing average, 23 were students who were partially proficient on the GEPA and 14 were students with IEPs.

While this intervention met with tremendous success, one concern should be noted, that is the amount of content covered during the year. Students who were in the Cognitive Tutor Algebra One program during the first year did not cover the same amount of content as those in a basic algebra class. While this was a concern for some, it was not for the authors. The alternative for these students would have been zero mastery of content in a traditional algebra class, a failing grade and putting their proficiency on the HSPA in doubt. Through enhanced instructional strategies and computer-based instruction that triggered increased student engagement, the majority of the students mastered a core body of algebraic knowledge, and they were able to move toward mastery of geometry concepts. While a long-term analysis is certainly warranted, the results have been promising to date.