ARTICLE

a Mountain of VISION creates a Landslide of ACHIEVEMENT

A Case Study in Raising Standardized Test Scores

Every Algebra and Geometry teacher at Trabuco Hills High School was in a meeting with the principal to discuss our enthusiasm for a new instructional program that we had implemented that year. We shared how we established standards, rewrote curriculum, and created innovative testing methods, and by doing so, we had improved our students' competency. We spoke enthusiastically of our students' increased ability to reason and problem-solve. At the end, our principal was very encouraged, but told us, "We need something to show for it. You can say how you think the students are improving, but we are consistently at the bottom of the district pile when it comes to the standardized tests. We need the numbers to reflect what you are claiming." He was right, and we knew it.

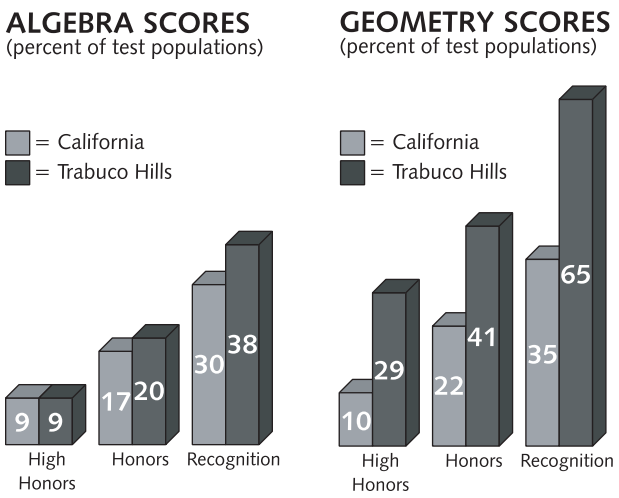
The Golden State Exam (GSE) was to be our next standardized test. These exams are California state tests given in a variety of subjects. They are achievement tests rather than aptitude tests. That is, the questions are more rigorous than what you would find on a basic competency test. Therefore, though any student may take the exams, schools usually reserve them for their top students.

Someone on the team suggested that we give the exam to all of our Algebra and Geometry students. The initial reaction was that our scores were already hurting, so including the lower-end students would only lower our averages. Eventually we decided that if we truly believed in the program and the students as much as we claimed, then we should take the chance. We did.

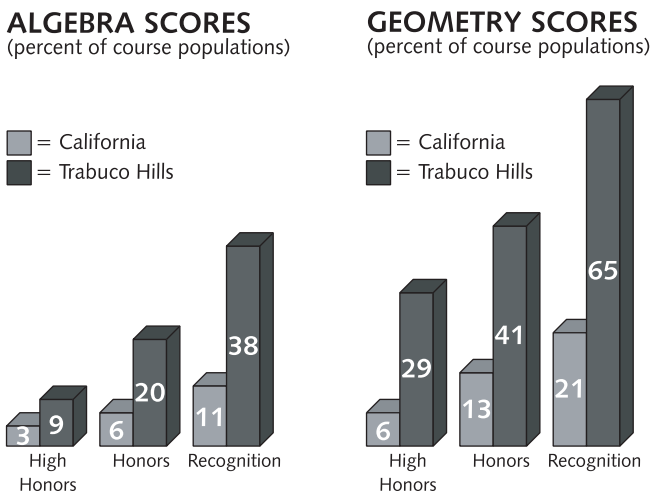
The exams were given in May of 1998. The numbers which our principal was looking for came that October. The State awards one of three distinctions: High Honors, Honors, and Recognition. Each is based on a rubric, and once the tests are graded, the percentage of students achieving each level is reported to the schools. The percentages represent how many students achieved that level "or higher." In other words, the percentage for recognition represents all three levels combined, which is why some of the percentages total more than 100%.

A comparison of the performances of the students statewide versus those at Trabuco Hills is displayed below.

Comparison of Test Population



Comparison of Course Population



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A Mountain of Vision (continued)

Our Algebra students met or exceeded the state at all levels. The Geometry scores were even better. Two out of every three students taking Geometry at our school received an award for being in the top 35% of the state. Nearly one of every three were in the top 10% as shown below. We were stunned. Furthermore, our school finally climbed from the bottom of the district rankings, surpassing two schools and tying with the third. That third school, however, tested less than half of its students, while we tested all of ours. We were now elated as well as stunned.

Les Axelrod of the Curriculum, Standards and Assessment Division of the California State Department of Education said of our results, "Your instructional program is obviously working very well. You outperformed the state 2 to 1." We investigated further and found that our case of testing all students was a rare exception. Only 35% of all Algebra and 60% of all Geometry students in California that year took the Golden State Exam. When we compared the results of the tests to the entire population of each course (rather than to only those that took the exam) the results were even more outstanding.

Our students outperformed the state by nearly 4 to 1 in Algebra and by over 3 to 1 in Geometry!
The question now being pondered by the members of the team is "What aspects of the instructional program contributed to these results?" An examination of our program and its results offer some insight.

VISION PLANNING

The birth of this program began almost a year prior to the Golden State Exams. As with most educators, the Algebra and Geometry teachers felt that the students could apply themselves better; however, we also believed that we could do a better job teaching.

With this belief, the team began with a vision-planning model that is often used in the business world: Brainstorm, Prioritize, and Categorize. The brainstorming session started with a direct, yet simple question, "What do you expect your students to know by the end of the year?" Rather than trying to remember what is in the textbook, we focused on what we consciously valued and wrote our responses on the board. The teachers of the successive courses were then asked, "What do you expect students to know coming into your class?" Their responses were added to the list.

To prioritize this list, we asked another question, "Which topics would you be most embarrassed if your students didn't know?" We intentionally limited our list to the top ten to focus our attention on what we saw as most important. We then categorized them by common threads and discussed how they might fit into each course.

THE ACTION PLAN

Once all the teachers agreed upon the common vision, we designed the blue print for the year. First, a final exam was written for each course. This gave us a very clear idea of the expectations we held for each concept. Next, a syllabus was created for each course, paying attention to the pace of the topics. In Algebra, we condensed the early lessons dealing with solving basic linear equations. Most students had seen these concepts before, and it seemed silly to us that they received more attention than the tougher, newer concepts of exponential functions and quadratic equations. In Geometry, we chose to weave area and volume throughout many units, rather than springing it on the students all at once near the end of the course.

Once the final exams and the syllabi were in place, we chose and/or created projects and challenge problems for each of the topics. The projects were chosen for their value in raising the level of questioning, engaging student interest, offering context to the topics, and revealing underling mathematical concepts.

We also designed a new testing format. The details of our "progressive testing" are discussed in "Nuts-n-Bolts." The pertinent points of this testing system are its cumulative format and emphasis on problem solving.

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A Mountain of Vision (continued)

IMPLEMENTATION

The vision and action planning all took place over several days during the summer (for which the teachers were paid). The challenge came in making this program work in the classroom for the ten months of the school year. Fortunately, teamwork carried us and the program throughout the year.

Communication was highly regarded among the team. The teachers from each course met once a week at lunch. Over sandwiches and soda, we discussed what worked and what didn't. We adjusted the pace and instruction according to how the students were performing. Although we shared ideas for lessons and projects, teachers were free to use whatever instructional methods they thought best. We stayed on the same track by giving the same tests and quizzes. The content of the tests was reached by consensus so nobody was taken by surprise. This spirit of collaboration, flexibility, and commitment to the vision were the crux of our implementation.

THE ANALYSIS: What Worked

So what components of this experience most promoted the increase in test scores? Opinions may vary, but here is our analysis.

The most important aspect of the program was setting high standards for a limited number of topics. This produced tremendous focus for the teachers. Other contributing factors were: revisiting topics, raising the level of questioning, teaching for conceptual understanding, and emphasizing problem solving. Also, the new pace and sequence of topics in each course allowed time for the more difficult topics to be taught before the state exams were taken. Furthermore, collaboration exposed the teachers to a variety of new methods and philosophies.

So how much influence did the use of math projects have on the increase in test scores? We believe that the projects had tremendous influence on the success of the program, but only because they served as an effective means to the goals stated earlier. That is, projects raised the level of questioning, emphasized problem solving, offered context and engaged student interest. Yet, these things may be accomplished by other means as well. Therefore, even as educators who strongly advocate the use of math projects, we will always be reluctant to claim that they are the best or only way to teach. However, in this case study, we believe projects were an integral component of the success of the program. (Many of the projects published in the first volume of *The Math Projects Journal* were used in this curriculum.)

THE LESSONS: What You Can Do

We understand that not many teachers have the resources available to implement the same type of program detailed in this report. However, we at *The Math Projects Journal* have always offered what we felt "you can use in your classroom today." So here are some ways that you can apply the principles learned from our experience.

1) When beginning a new unit, choose the 3 to 4 topics you believe to be most important. Emphasize these topics throughout the unit, and de-emphasize (or eliminate) the others.
2) Raise the level of questioning. Ask critical thinking and analysis-based questions that will encourage students to look for the underlying concepts.
3) Modify existing tests or write your own. Make an attempt to assess your students' reasoning ability and conceptual understanding of the topics as well as their knowledge of facts and algorithms.
4) Make your tests and lessons cumulative. Keep hammering on the important topics.
5) Use problems and activities that offer context to the topics.
6) Be patient. It will take time for your students to respond and show improvement.
7) And yes, use math projects whenever you feel they will be beneficial.

Hoping to reproduce these results, we at *The Math Projects Journal* and our respective schools will continue implementing the principles that we believe brought our students such great success. We will keep you posted.