Imagine a classroom . . . where all students have access to high-quality, engaging mathematics instruction . . . . The curriculum is mathematically rich, offering students opportunities to learn important mathematical concepts and procedures with understanding . . . Students . . . draw on knowledge from a wide variety of mathematical topics, sometimes approaching the same problem from different mathematical perspectives or representing the mathematics in different ways until they find methods that enable them to make progress. . . . Alone or in groups and with access to technology, they work productively and reflectively, with the skilled guidance of their teachers. Orally and in writing, students communicate their ideas and results effectively. They value mathematics and engage actively in learning it. (NCTM 2000, p. 3)

At the core of this vision is educational equity: the concept that all students, regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to learn mathematics. Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access to challenging mathematical ideas for all students (NCTM 2000).
Unfortunately, curriculum practices in many schools prevent a large contingent of students from receiving a quality mathematics education. The most notorious of these practices is tracking, or grouping students by perceived ability level. An eighth-grade class of mathematical "whizzes" may tackle high school algebra or geometry while eighth graders in another class are still learning how to work with fractions, decimals, and percents (Loveless 1998). Tracking has proven to be especially harmful for poor and minority students. These students are the ones most likely to end up in the low tracks (Oakes and Wells 1998).

According to the National Research Council (NRC), low-track classes should help students catch up (NRC 2001). Students should have opportunities to move out of the low track as quickly as possible. But there is evidence that low-track classes put much less emphasis on the higher-order knowledge and thinking skills associated with future success (Loveless 1998). Less powerful learning environments typically have a poor curriculum, low expectations, and less experienced teachers, so the disparity between students on fast and slow tracks grows over time (NRC 2001; Oakes and Wells 1998).

Tracking is still predominant in our schools, yet there has been a call for high standards for all students. Can tracking coexist with this calling? Oakes and Wells (1998) and Kohn (1998) maintain that there are still deeply held beliefs about intelligence, racial differences, social stratification, and privilege. These are very real obstacles to removing tracking and that teachers would have to teach a less demanding curriculum (Oakes and Wells 1998). The lack of success in eliminating tracking at these schools demonstrates the need for support and cooperation of teachers, students, administrators, and parents.

**IMPACT OF TRACKING IN MY CLASSROOM**

When I began teaching mathematics in 1988, my first assignment was at a high school in Albuquerque, New Mexico, with a very diverse population of students. I initially taught geometry and basic mathematics. There was a clear distinction between students in the college-prep geometry classes and the low-track basic mathematics classes. The geometry students worked hard every day in class and made an effort to complete homework each day as well. Most of the basic mathematics students were low achievers and apathetic about learning. Homework was done by only a few students; class work was done poorly, if at all. The curriculum for the basic mathematics students was designed to review the mathematics these students had not mastered in previous years and consisted primarily of work with fractions, decimals, and percents. The basic mathematics classes were challenging for me and seemed pointless for my students. I was perplexed about what to do and did not have any solution at hand.

The next year I transferred to another high school in Albuquerque, where the goal was to prepare a larger percentage of low-income, underrepresented students for college. Most of the school's poor Latino population was tracked into lower level basic mathematics and algebra classes, and there was no mechanism in place to provide opportunities for these students to prepare for college. When confronted with this issue, many of the mathematics teachers in my department felt more drill and practice was appropriate for these students and did not consider making the curriculum more challenging and purposeful for them. The aim of the low-level algebra sequence was to slow the pace for these students so they would work through the equivalent of algebra 1 in two years. If the intent was good, the result was not. Students in these classes still performed poorly, and most eventually dropped out of school. More than 50 percent of the students dropped out of these classes by the end of the year. Many students were capable, but the curriculum failed to serve their needs.

After a few years of frustration with these classes, I decided to dedicate myself to making meaningful change at this level. I was convinced that removing tracking was the solution, believing that low-achieving students would be more successful when they had higher-achieving students to serve as role models in their classroom. Many of my colleagues were opposed to such a move and were fearful of the impact these low-achieving students would have on the regular-tracked students. Unable to convince them that the removal of tracking would benefit all students, I abandoned the prescribed low-level algebra curriculum and began to incorporate ideas and strategies that aligned with the vision of NCTM. I began using problem-based strategies that provided opportunities for students to generate and collect data and to interpret and make predictions about the data they collected. They learned to use graphing calculators to find and explain their solutions. Eventually, during
the course of the year, students exhibited positive changes in their attitudes about learning mathematics. Fewer students dropped out of the classes as they became more engaged in their mathematics learning. But this was not enough. Many of these students were still locked in the low track that had been designated for them and simply returned to the routine of drill and practice the following year.

I remained determined to enhance the mathematics learning for as many of these students as possible. After a few years, Standards-based curricula became available. These curricula were designed around the vision of the NCTM’s *Curriculum and Evaluation Standards for School Mathematics*:

Students should be exposed to numerous and various interrelated experiences that encourage them to value the mathematics enterprise, to develop mathematical habits of mind, and to understand the role of mathematics in human affairs; . . . they should be encouraged to explore, to guess, and even to make and correct errors so they gain confidence in their ability to solve complex problems; . . . they should read, write, and discuss mathematics; and . . . they should conjecture, test, and build arguments about a conjecture’s validity. (NCTM 1989, p. 5)

One of these curricula was written in the spirit of these NCTM Standards by advocating for a heterogeneous learning environment, or classrooms without tracking. Developed as a collaborative effort by mathematicians and teacher educators, this Standards-based, four-year curriculum was field-tested during 1989–1994 (Green 1997). In 1997, I convinced my administrators that our school should pilot this curriculum, which made it possible to integrate the low-track algebra students with students of different mathematical maturity and development levels in the same classroom and provided an opportunity for students to collaborate with each other on challenging mathematics problems.

In this curriculum, students explore complex, central problems organized into units. Each unit integrates the use of graphing calculators with algebra, geometry, trigonometry, and other mathematics topics in ways that allow students to learn important mathematical concepts and skills in addition to various problem-solving strategies (Alper et al. 1996). Because the units combine multiple branches of mathematics, students can see how important ideas are related to each other. Since many of the central problems of the units may take six to eight weeks to solve, students undertake several smaller problems along the way. These central problems may have connections with history, science, and literature. Many are based on practical, real-world problems such as maximizing profits for a business or studying population growth. Others are more fanciful and may involve a baseball pennant race or a circus act. Solving problems such as these provides opportunities that are often lacking in traditional curricula (Alper et al. 1996; Green 1997).

Several positive results came from piloting this curriculum. First, I observed that students of different ability levels could explore open-ended problems together and actually learn from one another’s ideas and solution strategies. Second, it became apparent that many of the students in the pilot program who would have been enrolled in low-track algebra classes engaged in the study of mathematics and enrolled in more mathematics classes. A greater percentage of these students continued taking mathematics classes through their senior year than did students enrolled in the traditional algebra 1–geometry–algebra 2 sequence (see Table 1). Third, average ACT scores of eleventh graders were higher in the Standards-based curriculum than in the traditional curriculum. Finally, a strong parental base formed and began to advocate for the curriculum and for the children. As a result, parents initially resistant to the curriculum began to examine it more carefully.

Since the 1997 pilot year, student enrollment in this curriculum has increased steadily. From two classes offered during the pilot year, more than a dozen classes were offered in the fall of 2003. In 2005, six schools in the Albuquerque area and a dozen more throughout New Mexico offered this program to their students.

**FINAL REMARKS**

The question about tracking is still on the table. Does student learning and achievement increase when schools opt for heterogeneous classrooms? One thing is certain: When schools opt for heterogeneous grouping in classrooms, it is important to utilize a curriculum designed for that purpose. A heterogeneous classroom coupled with a curriculum written to engage all students is the ideal, as it promotes access to genuine mathematics for a larger pool of students than does a system based on ability-level tracking. The pilot curriculum implemented at my school has a richness that will challenge the brightest student, yet the concreteness of the curriculum allows all students to do meaningful mathematical work.

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**Table 1**

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<th>Pilot Results</th>
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<td><strong>Standards-Based Students</strong></td>
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<td>60% enrolled in a fourth-year mathematics class</td>
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<td>Average ACT score: 19.9</td>
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Educators must make prudent decisions that will begin to honor student diversity as well as academics. All students should be allowed to demonstrate their “genius within” by being expected to participate in challenging and rigorous mathematics. No student in high school should be doomed to two years of arithmetic with little opportunity to do anything substantial.

What are the true benefits of heterogeneity in our classrooms? Put simply, it may be the life experiences students can share with one another that are not just valid but valuable. Students get less of an education when they segregate themselves for the purpose of academic enrichment. Perhaps it is just a question of time before more and more teachers, administrators, and parents begin to question and challenge the predominant, inequitable curriculum that exists in our schools. Only then will the vision of a quality mathematics education for all be realized.

REFERENCES