Examining What We Know for Sure: Tracking in Middle Grades Mathematics

Lee V. Stiff
Janet L. Johnson
Patrick Akos

Tracking has been used throughout educational systems for decades, ostensibly to benefit both the students who are capable of more rigorous coursework and students who might find such work too challenging. Many educators believe that to do otherwise would be a disservice to both groups of students. Proponents of tracking insist that by separating the classrooms into slow and fast learners, teachers can better focus their instruction and adjust the pace to match students' abilities (Hopkins 2009). This chapter will chronicle one large school district's challenges and successes in connecting research, practice, and policy to meet the mathematics education needs of its students. Lessons learned—or failed—should help other school districts better understand what they know and don't know about access to high-quality mathematics.

Lately, more and more research indicates that although tracking benefits those placed in the higher tracks, many students placed in the lower tracks find themselves in an educational downward trajectory that can detrimentally affect their education, and ultimately, their lives. After students have been tracked, they usually remain in the high or low track where they were initially placed, and the achievement gaps between the two become greater over time (Wheelock 1992; O'Connor, Lewis, and Mueller 2007). In fact, evidence suggests that removing tracking and teaching all students as if they were high achievers does not "drag down" high achievers, but rather pulls up the performance of average students (Garrity 2004). Indeed, assigning students to lower-ability groupings depresses students' learning regardless of students' ability levels (Hallinan 2003).

Few would argue that students who are tracked high in math will learn more rigorous math content than they would if they were tracked low. But, what about the students who are tracked low? What quality of math content do they learn? And, if we do track students, what should the criteria for high and low tracks be? Indeed, should students ever be tracked out of high-quality math offerings?

One group of researchers analyzed data to determine the effects of tracking on students with similar math abilities and found that when high average (C+) students were placed in low-, middle-, and high-track courses in middle school, the percents of students who success-fully completed two college-prep math classes in high school were 2 percent for the low track, 23 percent for the middle track, and 91 percent for the high track (Burris, Heubert, and Levin 2006). In other words, students' placement in the top math track created greater success for students in their future schooling.

But, more surprising, even when content mastery is a criterion for determining course placements, other criteria are frequently used to make tracking decisions. In fact, research has shown that non-Asian minorities are less likely to be placed in higher-level courses than other, equally qualified students (Vanfossen, Jones, and Spade 1987; O'Connor, Lewis, and Mueller 2007). For example, Stone and Turba (1999) reported that in one California school district, of the students who demonstrated the ability to be admitted into algebra, only 51 percent of the blacks and 42 percent of the Latinos were admitted, whereas 100 percent of the Asians and 88 percent of the whites were.

In one statewide study, educators who did not have easy access to academic achievement data to determine how to track students unabashedly admitted to using demographic factors to make such decisions. Specifically, school counselors, when asked if they used academic data when advising students for course enrollment or academic interventions, reported that they used academic and behavioral data to inform themselves about how to serve students better. However, when asked to describe that data, many described free or reduced lunch status as academic data. A few school counselors reported that, because they lack demographic data about socioeconomic status, they had to rely on race to identify students who had barriers to learning and therefore would benefit from counseling services or other referrals for interventions (Johnson et al. 2005).

Clearly, it appears that students' ethnicity or economic status can trump performance data when one decides how to place students into high-quality courses. In all likelihood, using a combination of demographic factors makes it possible for educators unknowingly to track students by race. Undoubtedly, mathematics placement decisions based on such demographic information negatively affect, if not create, the achievement gap and diminish future learning opportunities.

Otherwise-capable students placed into low math tracks have shown a decrease in their mathematics self-efficacy (Akos, Shoffner, and Ellis 2007; Callahan 2005). Combined with inappropriate instruction and teachers' beliefs about social barriers and the lack of support, students face the prospects of lowered expectations and the resulting lower grades that ultimately affect their long-term college and career choices. Unfortunately, this scenario has disproportion-ately affected minorities (Akos, Shoffner, and Ellis 2007). The deleterious effects of lower self-efficacy can cause anxiety, which has been shown to affect cognition and performance neurologi-cally (Gray, Braver, and Raichle 2002). In other words, when capable students are placed into low math tracks, their performance gets worse. The fact of the matter is, all students benefit from taking rigorous coursework (Hallinan 2003). We know this; yet too often, we ignore it. In fact, although an association exists for all students between taking rigorous high school mathematics and going to college, the relationship is even greater for students whose parents' education did not go beyond high school (Choy 2002).

Tracking students has at least two major flaws. First, tracking has little or no benefit for students, especially those placed in the lower tracks. Second, tracking disproportionately affects minority and low-socioeconomic-status students irrespective of their prior achievements. A standard review, conducted by the school's counseling department of a large school district in North Carolina, noticed the flaws associated with tracking in mathematics. The counseling department realized that school counselors could not properly perform their duties without the benefit of relevant information about students and cooperation among school counselors, math teachers, and administrators. The department recognized that it needed a venue to bring school personnel together. So, in response to the need, the department created a forum of experts in school counseling, mathematics education, and the proper use of data, which would address tracking issues in middle and high school.

The forum, known as the School Counseling/Math Collaborative, examined existing students' performance and access realities of course taking in mathematics; best practices in teaching math and school counseling, and the need to share them; and the need to learn, develop, and use research-based school counseling practices. Moreover, the collaborative addressed the need for objective criteria for identifying students who would likely succeed in rigorous math courses. In addition to and in support of the collaborative, EDSTAR Analytics, an education consulting and evaluation firm, conducted Data Academies for the school district. Each Data Academy worked with school-based teams consisting of school counselors, math teachers, and administrators to help them use data to improve students' performance and close achievement gaps in mathematics. Each Data Academy typically had a cohort of seven schools.

A Data Academy confronted issues about using data, both subjective and objective, to understand how best to serve the needs of all students. Specifically, each Data Academy addressed issues related to instructional practices, school and district policies affecting math achievement and access, and school personnel's attitudes and beliefs about students' performance in mathematics.

The Data Academies supported the school district's study for two years. In the first year, Data Academy facilitators met twice each month in full-day sessions with planning teams from the district to review how best to support the schools in the district. Also, each school-based team met one day each month with Data Academy facilitators and received on-site support twice a month. Early in the second year, school-based teams met with their Data Academy facilitators for one full day to review their schools' data and implementation plans. Subsequently, Data Academy facilitators furnished onsite support once a quarter or as needed.

What follows recounts many of these Data Academies' findings, including information or insights about the beginnings of tracking, the impact of tracking decisions, the role data plays in making tracking decisions, and outcomes associated with tracking students.

Tracking in Middle Grades Mathematics

In the aforementioned large school district in North Carolina, school counselors wanted to use students' achievement data and scholarly research to align services and opportunities better for students. As they started using achievement data and research findings, they became aware of

the role mathematics learning plays in students' overall success in school. In particular, they discovered that performance in algebra affected graduation and dropout rates. Counselors also realized that they needed to examine assumptions about how they tracked students in mathematics. For example, many school counselors assumed that students who had scored at or above grade level on the North Carolina end-of-grade (EOG) assessments automatically tracked into the top middle school math classes. However, when they examined students' data, they saw that this was hardly true. Consequently, school counselors realized that collaboration among math teachers, school administrators, and themselves was important for addressing the effects of tracking associated with closing achievement gaps, offering more rigorous coursework for all students, and increasing graduation rates.

When Does Math Tracking Begin?

In this particular North Carolina school system, students leave elementary school in grade 5 to begin middle school in grade 6. From kindergarten to grade 5, students take the same math courses. On entering middle school, their math experiences begin to diverge because of tracking. Most students tracked into Math 6 or Advanced Math 6. Very few students skipped sixth-grade math altogether and took prealgebra or algebra. Interestingly, Math 6 and Advanced Math 6 used the same curricular materials. The districts' math educators typically described the difference between Math 6 and Advanced Math 6 like this: Advanced Math 6 is designed to prepare students for the most rigorous math sequences in middle grades and high school. It teaches for conceptual understanding and engages students in using higher-order thinking skills. Although rigor exists in Math 6, expectations for students are lower, because the district does not expect these students to take the more advanced math coursework in middle school or high school.

Once students were tracked low, no evidence showed that any student got the opportunity to move into the higher track. For every school in the district, the negative effects of the initial tracking decisions continued beyond grade 6. That is, if students were tracked low in grade 6, then they would be tracked low in grade 7 unless individual teachers recommended changes. However, no placement policy existed that would indicate how students might improve their standing in the tracking scheme. Hence, depending on the middle school, 0 to 2 percent of students placed in Math 6 took prealgebra in grade 7, whereas 70 to 90 percent of students placed in Advanced Math 6 routinely took prealgebra in grade 7. Math6 students typically took Math 7—a continuation of Math 6—with the same expectations from teachers.

What Is the Impact of Tracking Decisions?

No districtwide criteria existed for tracking students into sixth-grade math. Each elementary school used its own criteria—some formal, some not—to make placement decisions. Near the end of grade 5, all students take a state standardized EOG assessment in math. A student can score at Level 1, 2, 3, or 4. Students who score Levels 1 or 2 are said to be below grade level; Level 3, at grade level; and Level 4, above grade level. However, although all grade 5 students take the math EOG, fifth-grade teachers must make their sixth-grade math recommendations before the test results are available.

Eighth-grade algebra is arguably the gateway course to rigorous high school science and math. Prealgebra in grade 7 is the prerequisite for eighth-grade algebra. If students are tracked

into Math 6, they probably will not gain access to rigorous high school courses. Hence, the key to rigorous coursework in high school is the sixth-grade placement in math.

To try to understand which students would probably be successful in eighth-grade algebra, we looked at the grade 5 EOG scores in math of the students enrolled in algebra in grade 8. Most students in algebra in grade 8 had, indeed, scored Level 4 on their grade 5 EOG math test. However, many students who scored Level 4 on their grade 5 EOG math assessment did not take algebra in grade 8. In fact, the likelihood that a student scoring Level 4 on the grade 5 EOG math assessment would be tracked high in middle school and go on to algebra in grade 8 differed greatly by the middle school attended, ranging from 20 percent to nearly 80 percent. Overall, fewer than half the students who scored Level 4 on their grade 5 EOG math assessment took algebra in grade 8. Furthermore, the percents of Level 4 students who were tracked high in math and went on to take algebra in Grade 8 differed by race and were statistically significant at a p value of .001 (see fig. 6.1).
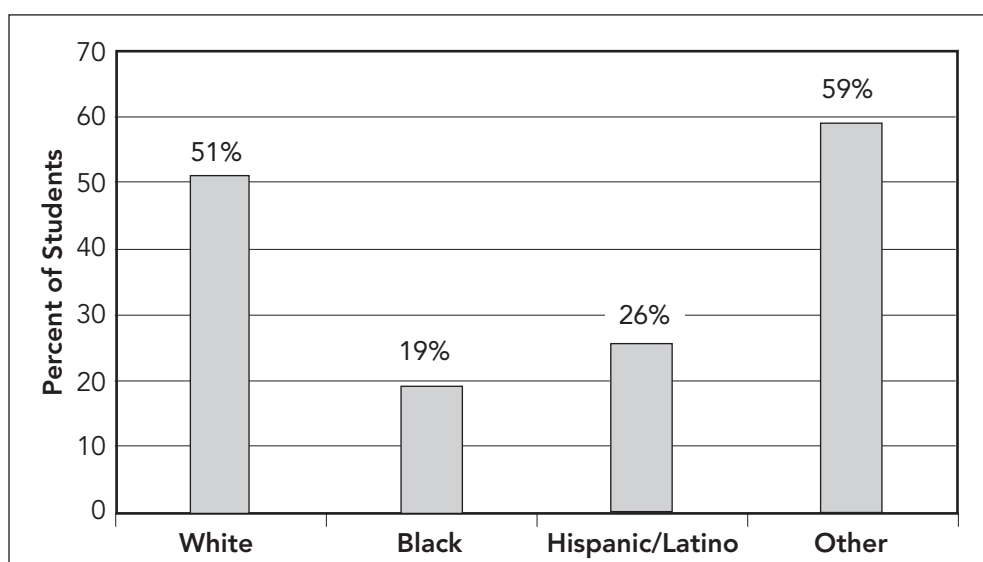

Fig. 6.1. Districtwide percent of grade 5, level 4 students who were tracked high in middle school and went on to grade 8 algebra

Examining the Impact of Tracking

No districtwide policy existed for assigning students to middle school mathematics. However, if such a policy did exist, the question would arise on whether the district should base those assignments on meeting objective criteria or on attitudes and beliefs about students and "what we know for sure." Seven middle schools out of thirty in the district agreed to participate in a study to determine the effects of placing all grade 6 students into a uniformly rigorous, sixth-grade mathematics course called Algebraic Thinking. In essence, they would have only one mathematics track, that of advanced math.

The school district's Curriculum and Instruction department supported the seven schools'

participation in the study. The school system wanted to start with a small group of schools, using them as a pilot to examine teaching Algebraic Thinking. The Curriculum and Instruction department provided professional development and instructional support.

Since many teachers had not previously taught in the advanced track, the Curriculum and Instruction department instituted professional development designed to help teachers differentiate their instruction for a wide range of students' abilities, add scaffolding to lessons to support learning, and create rigorous lessons with the goal of teaching for conceptual understanding. The department arranged planning periods so that teachers could collaborate. They often made gifted- and special-education teachers available to help classroom teachers achieve their instructional goals by bringing in more professional development and appropriate curricular materials. A few of the middle schools had an Advancement via Individual Determination program, which is designed to help minority and low-income students succeed in rigorous classes.

At the end of the year, after students had completed a year of Algebraic Thinking, we wanted to see how their sixth-grade math teachers would place them in math in grade 7. We wanted to compare their academic success, as measured by standardized math tests, to that of students from the nonparticipating middle schools who, purportedly, were tracked homogenously by ability. We were also interested in seeing how grade 6 teachers' math placement decisions compared to those of grade 5 teachers. Students from the seven participating middle schools were the study group; the districts' remaining middle schools composed the control group.

How Is Data Used to Track Students?

For the seven middle schools that participated in examining tracking outcomes, grade 5 teachers completed paperwork as usual, recommending students for their sixth-grade math placement, not knowing that all students would take Algebraic Thinking regardless. As indicated above, teachers made their recommendations before standardized EOG math test scores were available. When EOG math scores became available, we compared teachers' predictions of students' EOG math scores to students' actual EOG math scores, by school and by race.

The school district required parents to read and sign the recommendation forms, acknowledging their agreement with the placement decisions. If a parent had concerns, he or she could write comments on the recommendation form. The parent could even sign a waiver that would override the teacher's recommendation if the parent believed that the child should be placed differently.

Fifth-grade teachers from 85 elementary schools completed course placement recommendations for students in the study group. Some of the study group schools were magnet schools and served students from many different elementary schools. We created electronic files recounting information from the placement recommendation forms. That information included teachers' predictions of students' standardized math test scores, math placement recommendations, and an indication of whether parents had signed waivers asking that their child be placed higher than recommended. We compared the growth (i.e., the improvement in test scores) on the EOG math assessments of sixth-grade students attending the seven middle schools in the study to that of similar students not in the study, by race and achievement level. We also compared course enrollment patterns of Level 4 students enrolled in Advanced Math 6 to that of Level 4 students enrolled in Math 6.

We contrasted grade 5 teachers' recommendations for students in the study group to those from grade 6 teachers for the same students the following year. We were especially interested in comparing the students who scored high yet received low-track recommendations from grade 5 teachers. After comparing teachers' recommendations, we surveyed and interviewed school counselors and teachers about what they believed to be true regarding the math placements and recommendations they made. We also surveyed and interviewed grade 5 teachers to determine what criteria they used in making placement recommendations.

Informal focus groups and a Web-based survey were used to determine what school counselors believed about the process of middle school math placements and what assumptions counselors made about students during the process. We also surveyed high school counselors and deans of student services about whether official or unofficial school or district policies existed regarding course enrollment related to middle school math placements.

Outcomes Associated with Tracking

To determine significance for the comparisons we were making, we used repeated-measures analysis of variance at a *p* value of .001, because we wanted to observe and compare the same students over time.

Fifth-Grade Teacher Predictions Compared to Actual Scores

Comparing teachers' predictions to actual EOG test scores, we found that teachers correctly predicted students' performance for about 60 percent of their students. For the nearly 40 percent of students for whom teachers made incorrect predictions, teachers equally overestimated and underestimated students' performance. However, estimates were not equally correct across ethnic groups. Teachers incorrectly predicted lower scores than non-Asian minority students actually received at statistically significant greater rates than they did for Asian or white students. Table 6.1 gives the percent of correct predictions for each demographic group and illustrates that teachers more accurately predicted the scores of Asian and white students than those of non-Asian minorities.

Table 6.1
Predicted Performance of EOG Level 4 Students on Grade 5 EOG Mathematics Assessment

Ethnic Group	Total Number	Percent of Total Number Correctly Predicted
White	1427	65%
Non-Asian Minority	892	54%
Asian	125	70%
Total	2444	61%