Untracking Earth Science

Enrolling all students in advanced 8th grade science puts them on the track to school success.

Sherry P. King, Seth Weitzman, and Larry Keane

The Mamaroneck Union Free School District is a high-achieving, suburban school system in Westchester County, New York. Like other racially, ethnically, and economically integrated school systems, we face the ongoing challenge of helping all students—particularly minority students and English language learners—reach high levels of achievement. Given our resources, professionalism, and commitment to changing the status quo, we believe that our school system has the capacity to achieve this goal.

Insisting on Excellence for All

During the last five years, Mamaroneck has undertaken a systemic approach to improving academic performance for all students, emphasizing minority student achievement in particular. To that end, we have

- Significantly enhanced school facilities—for example, building state-of-the-art science laboratories in the middle schools and high schools.
- Studied reports from the Trends in International Mathematics and Science Study (TIMSS).
- Introduced a new math curriculum that focuses on problem solving.
- Established a task force to determine ways in which minority students can gain access to the most rigorous courses.
- Participated in a consortium of 11 schools in the tri-state area studying minority achievement.

In 2001, as part of our architectural redesign, the school system created Hommocks Middle School, serving students in grades 6–8, to replace the traditional junior high school. In one of several study sessions that the board of education held with middle school staff members, the board encouraged the middle school administration to continue to increase opportunities for students to take a more rigorous course of study. After hosting many community conversations and open study sessions, the board assured school administrators that engaging students in
challenging classes was a higher priority than getting higher results on state tests or making the school look good in the local newspaper.

The middle school staff took up the board’s challenge, recognizing that students can only succeed in high school if they leave middle school prepared to do so. Middle school placement decisions dictate entry into advanced high school courses, and subsequently influence college choices. Lost opportunities during the middle school years can place students on a lower track that may last a lifetime.

**Development of Inequity**

The first step toward raising standards for all students was understanding the patterns that discouraged middle school students from pursuing more rigorous courses of study. In our case, these patterns dated back to the early 1980s, when the Regents Action Plan in New York State required middle and junior high schools to offer high school classes to a minimal number of accelerated 8th grade students. In response, the district offered our most accomplished 8th grade students a Regents Earth Science course traditionally offered to 9th and 10th grade students in high school.

For the next few years, approximately 25 percent of 8th grade students—typically white and affluent students—enrolled in the class. The average grade of our students on the course’s culminating Regents exam was about 95 out of 100. Scores below 85 were a rarity, and veteran science teachers could not remember a single student ever failing. During the last decade, the percentage of 8th grade students enrolled in Regents Earth Science gradually increased from 25 percent to almost 66 percent.

This success, however, was accompanied by a pernicious, unanticipated consequence: It created homogeneous groups of students who attended most of their classes together. The district’s middle-grades school used a block schedule that enabled teacher teams to adjust the duration of an instructional period and to regroup students. Because of this schedule, even though only Earth Science and honors mathematics were officially tracked, students taking the same advanced math and science classes usually remained together in English and social studies classes. Hence, the school was divided into two camps—one largely white, affluent, and academically high-achieving, and the other largely minority, lower-income, or in special education.

**The Pathway to Greater Equity**

Several years ago, as the board of education engaged the community in conversations about minority achievement, science teachers and administrators at the newly constituted Hommocks Middle School began thinking outside the box. They noticed that the average score on the Regents examination had remained in the 90s even though the number of Earth Science students had more than doubled over the course of a decade. They decided to take the next step and admit all but the most seriously disabled students to the rigorous Earth Science course.

One year later, 366 8th grade students—95 percent of the 8th grade class—took the Regents
Earth Science examination, compared with 217 students, or 66 percent of 8th graders, the year before. The average score on the Regents Earth Science test declined just six points, from 91 to 85. The results for special education students were remarkable. All students classified as special education in mainstream science classes sat for the examination, and 98 percent passed with a score of at least 55, which is the score required for high school credit. At the higher score of 65 required for a Regents Diploma, the passing rate was 93 percent. Opening the doors of opportunity to everyone was a success for our students.

Two components contributed to the success of the Regents Earth Science Initiative: (1) district support, and (2) the work of the middle school staff in making comprehensive instructional changes to support the success of all students.

**Support at the Top**

District leaders strongly supported the Regents Earth Science Initiative. Realizing that administering the Regents Earth Science exam to all students would lower the average score, the board held widespread discussions within the community to confirm that community members were willing to accept lower scores as a side effect of dramatically increasing the number of students taking the more rigorous course. In the end, a 29 percent increase in the percentage of 8th graders tested more than compensated for the six-point drop in average scores.

In addition, the district provided the following specific support services:

- Hiring a full-time teacher assistant certified in teaching Earth Science who visited classes, assisted individual students, and taught a support class every other day to students needing more time on task.
- Using Title I funds to provide extra-help classes before and after school.
- Assigning a Spanish-speaking teacher assistant to help English language learners, and purchasing Spanish-language curriculum materials.

**Changes in Instructional Practices**

Perhaps the central component in the success of the Regents Earth Science Initiative was the change in mainstream classroom practices. Our four Earth Science teachers, their teaching assistant, and special educators worked together during the summer and during weekly planning sessions throughout the school year to create hands-on laboratories in which students could discover scientific principles. By emphasizing the hands-on experiences inherent in the curriculum, using technology creatively, collaborating with one another, and monitoring student progress, they were able to differentiate instruction and engage almost all students.

**Hands-On Experiences**

The hands-on approach to the curriculum lends itself to serving the needs of all students in heterogeneous classes. For example, to classify rocks and minerals, students actually handle the rocks and create the categories, a process that engages students who need concrete experience to master the abstract concept of classification. In another assignment, students
record the phases of the moon for two months by going outside and observing the moon—another activity that all students can engage in regardless of their particular strengths or weaknesses. In a third unit, students are required to watch the local weather station and record information. When they subsequently study weather, students gain a deeper understanding of the direction of the warm and cold fronts that they saw as arrows on the television weather screen.

**Creative Use of Technology**

Technology supplements hands-on experiences to support student learning. At one time, teachers had students write the answers to teacher-generated questions on small whiteboards and hold the boards up so that the teacher could see the responses and quickly assess students' understanding of a topic. Now teachers use an interactive technology called *Edugame* for this real-time formative assessment of student learning. Students answer questions using handheld devices so that only the teacher knows which students answered correctly or incorrectly. This strategy provides a safe environment for students to share what they know and provides teachers with reliable information.

Another kind of technology that supports all students in their learning is *scientific probes*—thermometers that are connected to computers. In a unit on the transfer of energy, the probe measures minute changes in water temperature and provides instant read-outs and graphs. This opens the door for students who might have been excluded from doing “real” science because of the challenges involved in the graphing portion of the curriculum. In this particular unit, the important learning lies in the discussion of the graph, not its creation. Therefore, the technology maintains the integrity of the instruction while removing barriers for students who otherwise might not be able to engage in a high level of classroom participation.

By far the most popular use of technology for students takes place in the technology course that all New York 8th graders are required to take. The course's earthquake unit, which supports the science curriculum, begins with a study of the principles of engineering, the nature of an earthquake, and its aftermath. Students build three- or four-story structures using balsa wood with steel plates as floors to give the structures realistic weight. They then place the structures on a simulator that replicates the destructive forces of an earthquake from 1 to 9 on the Richter scale. As students build the structures, use the earthquake simulator, and determine the origins and travel time of the earthquake waves, they reinforce the math skills and reference table-reading skills that they will need to use on the Regents Earth Science exam.

**Teacher Collaboration**

The strong collaboration among our regular education, special education, and ESL teachers benefits all students. For example, special educators have created guided outlines with missing words to support students through the necessary lecture portions of the class. Using the outlines, students must pay enough attention to fill in the blanks, but they aren't required to capture the entire lecture. Not surprisingly, a wide range of students—not just special education students—choose to use these guides.

Similarly, special education and regular education teachers have developed guided reading
outlines for each chapter with questions to support note taking from the text. Any student who finds these outlines helpful can use them. In this way, all students have the scaffolding they need to achieve the same high standards.

**Careful Monitoring of Student Progress**

At the midpoint of each marking period, the science department chair and an assistant principal meet with Earth Science teachers and create a list of students with C, D, or F grades. As a team, they carefully analyze reasons students are not succeeding and look for patterns. For example, early in the first year of the initiative, the team noticed that a large number of English language learners populated the list. In response, the school assigned the Spanish-speaking teacher assistant to the program and obtained Spanish curriculum materials.

**What We Learned**

Mamaroneck’s initiative to place almost all 8th graders in accelerated Earth Science was important for the future of these particular students, but it also demonstrated that such a goal is reachable. Believing that all students can reach high standards, expecting them to do so, and supporting them in getting there is hard but achievable work. It depends on a community that believes that opening the gates of selective courses will enhance learning for all students and not disadvantage those who are accustomed to being in a more elite group.

The initiative required financial support in the form of an additional teaching assistant and second-language materials, but the cost was not large. Mostly, we needed teachers who were willing to get to know every student, to take collective responsibility for every student's success, and to modify their own teaching styles as many times as necessary to help every student learn.

Perhaps the most lasting benefits of bringing more students into the challenging curriculum were social and emotional. Although some ability grouping remains, the rigid social system separating the academic have-nots throughout the day has evolved into a more inclusive structure. Raising expectations has improved students' sense of competence and ability to succeed in school.

In the second and third years of our initiative, the work has remained challenging. But even though we still need to provide high levels of support, we now know that all students can achieve at higher levels than we ever imagined.

*Sherry P. King* (sking@mamkschools.org) is Superintendent of Mamaroneck Public Schools, New York. *Seth Weitzman* (weitzman@mamkschools.org) is Principal and *Larry Keane* (keane@mamkschools.org) is Assistant Principal of Hommocks Middle School, Mamaroneck, New York.

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