



Bridging the Gap:

Equity in Systemic Reform

A Pocket Panorama of

Ohio's Systemic Reform:

Discovery, 1995–1999

Ohio's Systemic Reform of Science
and Mathematics Education

Discovery
Inquiry-Based Learning in the Classroom

Bridging the Gap:

Equity in Systemic Reform

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Ohio's Reform of Mathematics and Science Education

In 1991, Ohio was one of the first ten states to receive funding from the National Science Foundation (NSF) for a Statewide Systemic Initiative—*Discovery*—to reform science and mathematics education. Guided by the Ohio Board of Regents and the Ohio Department of Education and supported by the General Assembly, *Discovery* serves as a catalyst to enhance the teaching and learning of mathematics and science across Ohio.

In 1996, another NSF grant, *Bridging the Gap: Equity in Systemic Reform*, focused on assessing and evaluating the progress of Ohio's reform of science and mathematics education. The assessment involved Ohio's urban and isolated rural districts where there may be fewer opportunities to learn quality science and mathematics.

In 1997 and 1999, Ohio's General Assembly provided continuation funds for *Discovery* and SUSTAIN with mandates to expand the reform to elementary and high schools, to assist principals and other administrators in facilitating school-wide reform, to improve the college education of all teachers of science and mathematics, and to build collaboratives between urban districts and urban universities.

In 1999, *Discovery's Pocket Panorama* provides a five-year retrospective of Ohio's reform of mathematics and science education. Changes in teaching practices, in student learning, and in principal support are provided for the current year and across the years. Evidence is provided that students in *Discovery* classrooms, compared to other students in the same schools, achieve higher on the Ohio Proficiency Tests in Mathematics and Science. Ohio's reform of mathematics and science education is a success story—thanks to Ohio's policy makers, parents, and educators.

The Story of Reform

In 1995, a study to assess the progress of *Discovery* was begun. The findings, published annually in the **Pocket Panorama**, document accomplishments as well as continuing challenges. One challenge is to narrow any achievement gaps among groups of students while improving learning by all students. Another is to broaden the reform to all grades and academic levels of science and mathematics education, including teacher preparation through SUSTAIN. A third challenge is to expand the reform beyond individual teachers' classrooms to entire schools by involving administrators and parents.

Ohio's reform of science and mathematics education involves a mix of systemic, state, and local initiatives. All have a focus on teacher professional development, and many have adopted *Discovery's* model of sustained activities for teachers. In addition, all have a focus on equity, providing opportunities for all students in Ohio to have high-quality mathematics and science instruction.

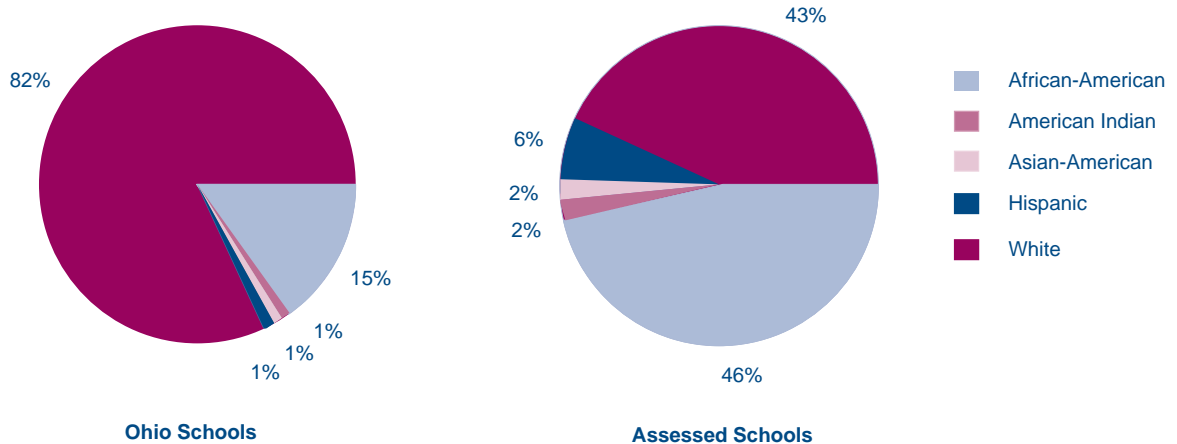
Although individual student scores on Ohio Proficiency Tests are not readily available, *Discovery* has sought to base its success on improved passing rates in mathematics and science. This year actual passing rates on the Proficiency Test, as well as differences between the projected passing rates of students in *Discovery* classes and those in other classes, using *Discovery's* Inquiry Tests, are included. Further, student achievement data are provided for the five-year period of *Discovery's* assessment.

Discovery's ability to describe the reform accurately and with increasing detail depends upon the goodwill and cooperation of the many principals, teachers, and students who respond to our questionnaires and visits. Our ability to continue the reform depends on the people of Ohio. We thank all Ohioans for their continued cooperation and support!

Where Is Progress Assessed?

Because *Discovery's* goal has been to improve science and mathematics education for all students, it has based its assessment in schools that enroll large numbers of low-income, urban students. The sample contains high proportions of minority students.

Figure 1: Comparison of Student Demographics in Ohio and in the Schools Assessed

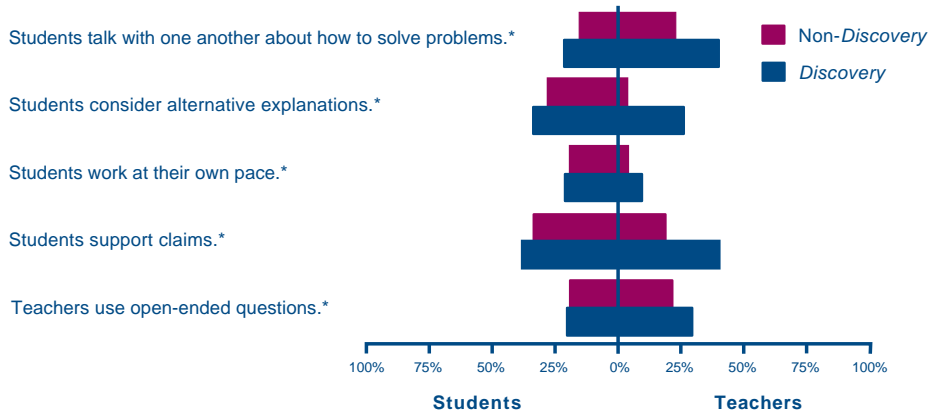


Note: Percentages may not add to 100% due to rounding.

How Are Classroom Practices Changing?

Comparisons between the responses of teachers who have participated in *Discovery*'s sustained professional development and those of teachers who have not show differences in classroom instruction. *Discovery* teachers more frequently use teaching methods related to increased student understanding. In both groups, teachers' responses are supported by those of their students.

Figure 2: Students and Teachers Responding “Very Often” to Use of Effective Classroom Practices in Mathematics and Science

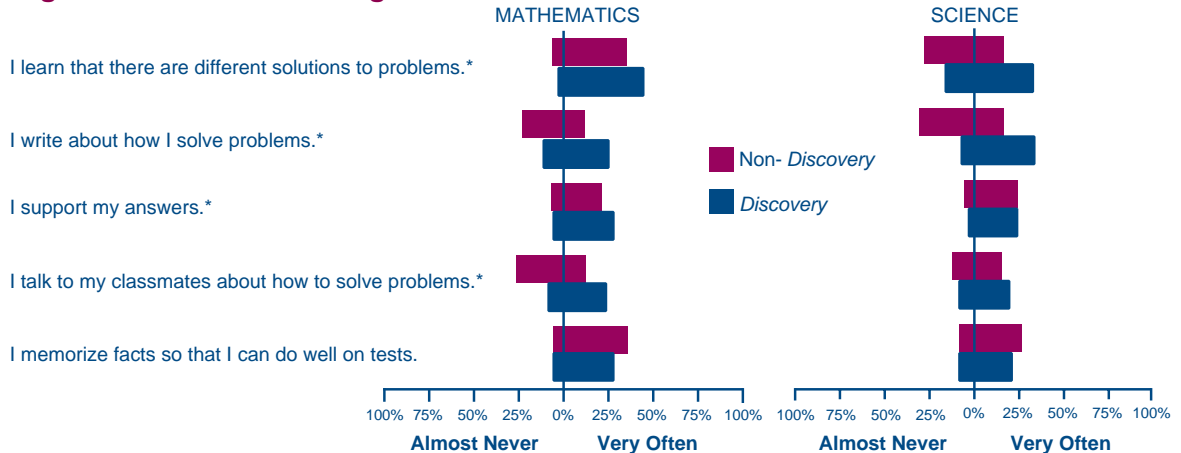


Note: *Indicates teaching practices associated with improved student learning in mathematics and science.

How Are Students Learning?

Students of *Discovery* mathematics and science teachers, compared with students in Non-*Discovery* classes, more often learn about different solutions to problems, write about how to solve problems, support answers, and talk with classmates about how to solve problems. Students also memorize facts for tests less often in *Discovery* than in Non-*Discovery* classes.

Figure 3: Student Learning Activities

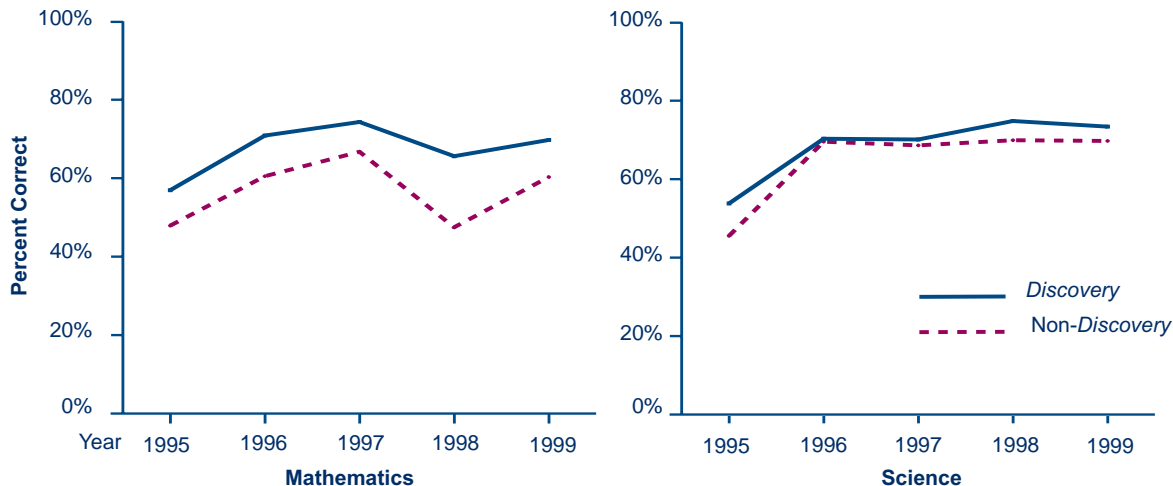


Note: *Indicates teaching practices associated with improved student learning in mathematics and science.

Has Students' Mathematics and Science Achievement Increased During the Five Years of *Discovery's* Assessment?

From 1995 to 1999, eighth graders show significant increases in actual test scores on the *Discovery* Inquiry Tests in Mathematics and Science. With the exception of 1996 and 1997 science scores, students in *Discovery* classes had significantly higher test scores than those in *Non-Discovery* classes.

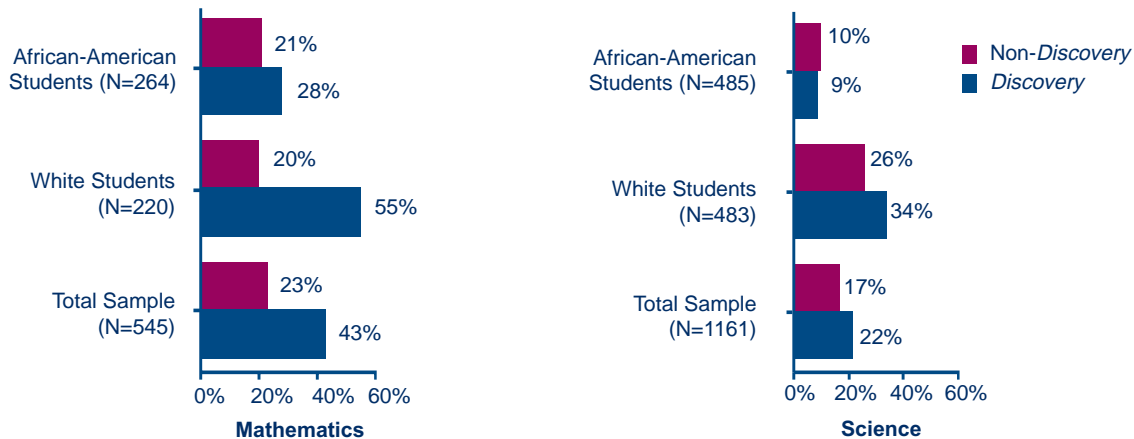
Figure 4: Changes in Eighth-Grade Students' *Discovery* Test Scores, 1995–1999



How Do Eighth-Grade Students in *Discovery* Classes Perform on Ohio Proficiency Tests?

After a decade of mathematics reform, more eighth-grade students in *Discovery* than in *Non-Discovery* classes pass the Ohio Proficiency Test in Mathematics. Ohio's reform in science education has a shorter history, and the results are less dramatic.

Figure 5: Percent of Grade 8 Students Passing the Ohio Proficiency Tests in 1999

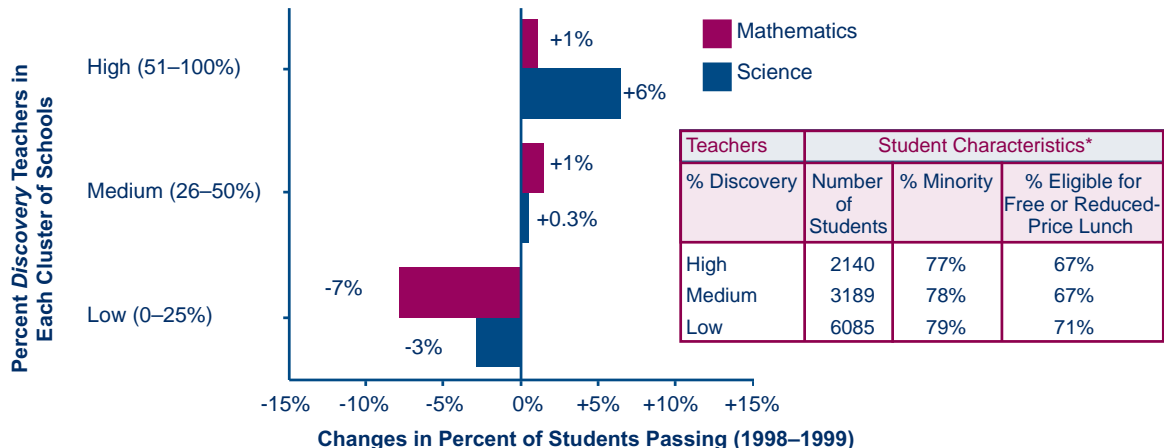


Note: The *Discovery Inquiry Tests* in Mathematics and Science are highly correlated with Ohio Proficiency Tests (.97 for Mathematics and .98 for Science). Because individual proficiency scores are unavailable to *Discovery*, scores from *Discovery Inquiry Tests* have been converted to proficiency test scores.

How Does School-Wide Reform Affect Passing Rates on the Ohio Proficiency Tests in Mathematics and Science?

Comparisons of eighth-grade students' passing rates on actual Ohio Proficiency Tests show the positive influence of a high concentration of *Discovery* teachers.

Figure 6: Changes in Percent of Urban Students Passing the Ohio Proficiency Tests in Mathematics and Science by Percent of *Discovery* Teachers in School, 1998–1999

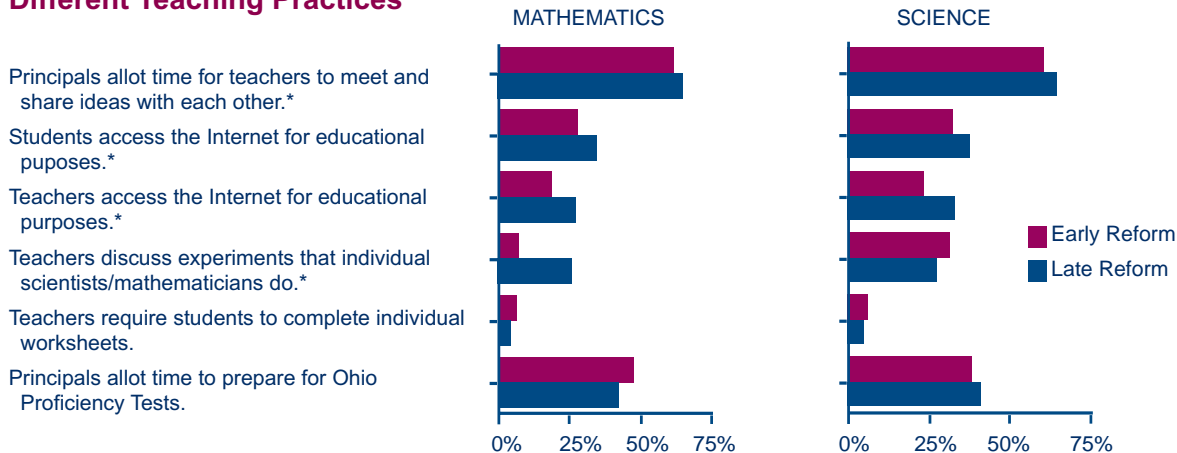


Note: *The average percent of student characteristics in each cluster is based on Ohio Department of Education data.

How Have Principals' Views of Instruction Changed During Ohio's Reform?

For five years, a random sample of principals has responded concerning the importance of teaching practices that enhance student understanding of mathematics and science. Changes in their responses suggest the positive impact of reform.

Figure 7: Changes in Percent of Principals Responding “Very Often” to Use of Different Teaching Practices

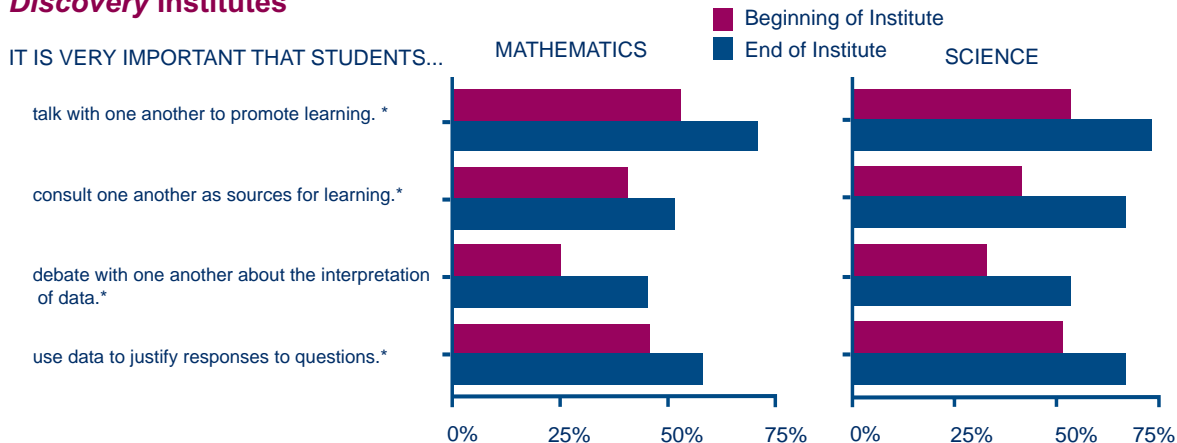


Note: *Indicates teaching practices associated with improved student learning in mathematics and science.

How Can Principals Facilitate School-Wide Reform?

As Ohio moves toward school-wide reform, *Discovery* offers institutes for principals to assist school leaders in understanding and implementing the reform of science and mathematics education. After attending a *Discovery* Institute, principals understand that students learn most effectively by investigating ideas and constructing their own knowledge.

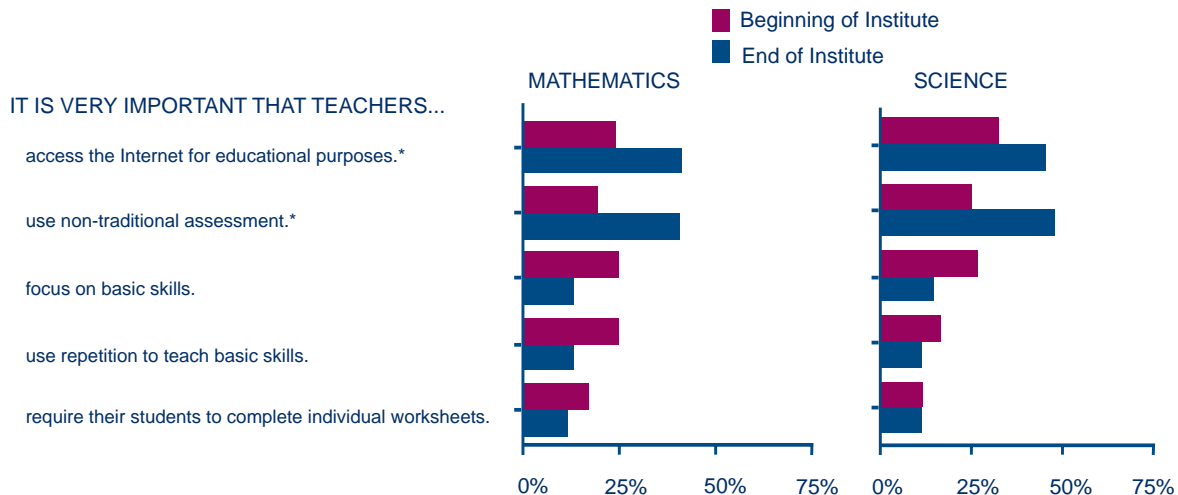
Figure 8: Principals' Views of Student Learning at Beginning and End of *Discovery* Institutes



Note: *Indicates learning strategies associated with improved student learning in mathematics and science.

After attending a *Discovery* Institute, principals also encourage teachers to use teaching practices associated with improved student learning.

Figure 9: Principals' Views of Teaching Practices at Beginning and End of *Discovery* Institutes

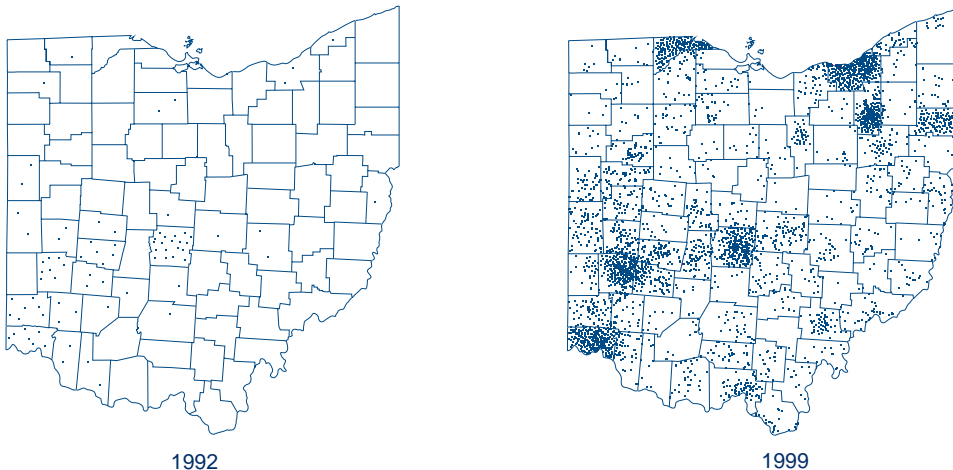


Note: *Indicates teaching practices associated with improved student learning in mathematics and science.

What is Discovery's Impact in Ohio?

Beginning in 1992 with two *Discovery* Institutes at Miami and Ohio State Universities, *Discovery's* Institutes have been offered at all public and many private colleges and universities in Ohio. Local districts join with *Discovery* to provide professional development for their teachers. By 1999, *Discovery* teachers have impacted school districts across Ohio.

Figure 10: *Discovery* Teachers Across Ohio from 1992 to 1999



Note: Locations are approximated based on professional development activities attended. *Discovery* teachers are underestimated in 1999, because many districts now independently provide *Discovery* Institutes for their teachers.

Who Has Guided *Discovery's* Progress, 1995–1999?

Representatives from the following institutions and agencies meet as *OSI-Discovery's* Coordinating Council to guide and shape the reform:

Cincinnati Federation of Teachers
Cleveland Urban Systemic Initiative
Columbus Urban Systemic Initiative
Miami University
Ohio Board of Regents
Ohio Department of Education
Ohio Education Association
Ohio Mathematics & Science Coalition
Ohio School Board Association
The Ohio State University
Sinclair Community College
State University Education Deans
University of Toledo, Community &
Technical College
Wright State University

For more information about Ohio's systemic reform of science and mathematics education:

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