The Journal of the Coalition of Essential Schools

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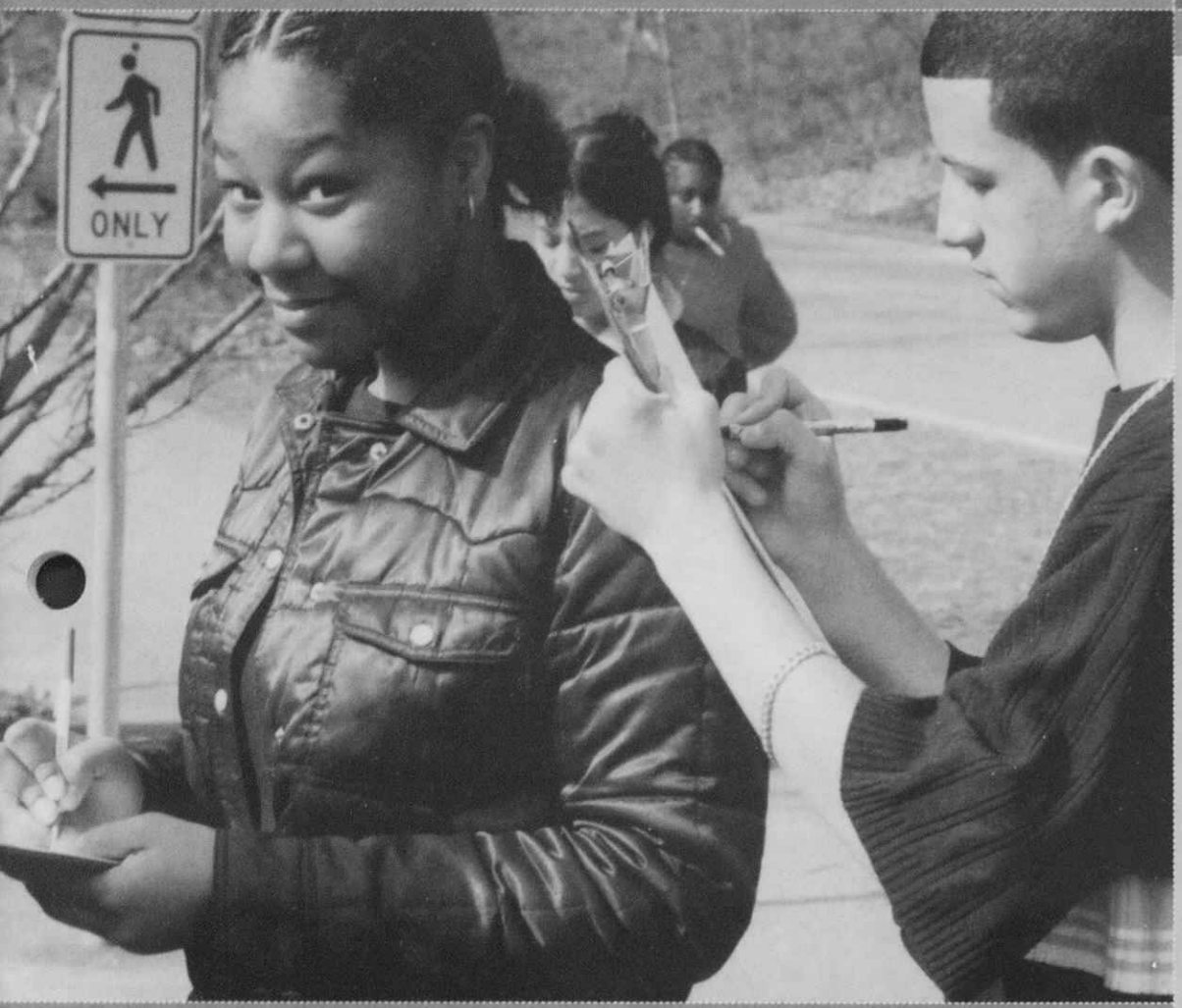
Innovation in Education



Making Math Personal

Working the Demand Side The Bay Area Coalition of Equitable Schools' Victor Cary interviews civil rights leader Robert Moses, founder of the Algebra Project.

What is Essential in a High School Mathematics Curriculum Framework? New Mission High School's Response to the Challenge of Designing and Supporting a Meaningful Mathematics Curriculum Roser Giné, New Mission High School Mathematics Curriculum Coordinator, discusses the process of bringing math learning to life at a recently founded, small, student-centered school.

ALSO IN THIS ISSUE

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ers who volunteered to prepare students for the MCAS during after school and Saturday sessions.

The Three Mathematical Elements

The three elements I presented to the staff as essential for our students to develop are mathematical modeling, mathematical proof, and problem-solving. I questioned extensively why some students who would not pursue a scientific or mathematical field in higher education, or who would only encounter statistics in college in connection to the social sciences, or who maybe would not attend college, might need to develop mathematical thinking skills and processes. Additionally, I really wondered whether mathematics would be interesting to someone if they were taught skills and topics leading to the development of calculus, but never actually took a calculus course to understand their secondary mathematics education in its entirety. These questions along with the evolution presented above led me to identify the three elements outlined (they overlap in many ways) and to support the integration of mathematics with other disciplines and within itself (distinct mathematical fields are naturally connected).

The most important quality of the mathematics curriculum at NMHS is that it provides opportunities for the development of the thought processes not only needed to understand more complex and pure mathematics concepts, but also useful in exploring and making discoveries about other disciplines or other human endeavors. Learning how to create and assess a mathematical model allows a student to test her/his ideas, to determine shortcomings or limitations that arise from simplification, and to extract useful results (by making predictions, extrapolating from the model) from that same simplification. Through mathematical manipulation of an original model, the student may find a unique solution to a problem; she/he learns that reorganization, a new perspective, or a small change in a variable could yield an unexpected outcome, or even a contradiction. The creation of a math model in fact reflects the habits of mind embraced by Coalition Schools; perspective, supposition, and connection, three habits outlined at New Mission, are practiced when students engage in this work.

New Mission High School Mathematics Curriculum Essential Questions

Foundations (9th grade): How do we obtain evidence to justify conclusions?

The focus in Foundations is to learn how to make a claim about a particular situation, collect data, and recognize patterns in the data to justify the claim made. For example, Foundations this year will investigate the health of our watershed. Students will make claims about certain aspects of the watershed and then collect data relevant to their claims.

Inquiry (10th grade): How do relationships provide evidence to justify conclusions?

There is a slight shift in focus from Foundations to Inquiry. In the Inquiry level, students learn how to recognize cause-and-effect relationships and use those to justify claims. A lot of work is done at this level to understand and represent the relationships between quantities that change.

Midlevel (11th grade): How is evidence used to justify conclusions?

Midlevel students spend more time exploring relationships among variables (i.e. is there a relationship between the hours of TV I watch and my grades in school?), representing those relationships, and making conclusions using data. At the Midlevel, students are using what they have learned during the previous years and adding to it by exploring more complex relationships.

Graduate (12th grade): How do we justify our solutions?

Graduate students are synthesizing and formalizing the work done through their math experience. The focus is around creating mathematical models (or using math to explain a problem situation), analyzing error associated with their models, applying their learning to real-world situations, proving their claims, and learning various problem-solving techniques connected to their explorations.

New Mission High School Mathematics Curriculum Structure

Essential Question of Course

↓

Skills and Habits of Mind (Learning Standards)

↓

Topics

↓

Vehicles (guided by the three Portfolio Strands: mathematical model, mathematical proof, and problem-solving)

↓

Classwork, Homework, Class Activities

New Mission High School ninth graders share data for an integrated math-science project

Rolanda Walker, Kadeisha Traore, Bianka Santana, Richard Phillips, Michelle Lee, and Rashad Lewis identify birds for an integrated biodiversity project

In addition to the mathematical modeling strand, we recognized the importance of deductive reasoning skills, again within the study of pure mathematics, and in connection to everyday life. A mathematical proof depends on deduction; an initial conjecture is made and tested, and a formal logical procedure developed and applied. When a student engages in this process, she/he makes a claim from observed patterns (or more typically, is given an idea to prove), and organizes information to determine the truth of the claim. He/she then 'digs up' stored units of mathematical knowledge, piecing them together to build a valid argument. Logical symbols may even be accessed in order to render communication of subtle relationships more effective. Once a claim is proved, it too becomes accessible mathematical knowledge. Much as it happens during the design of a mathematical model, a student's habits of mind develop through the construction of a proof; evidence is used at each juncture as one premise builds on the truth of the previous one.

The third element, problem-solving, complements the other two strands in providing opportunities for the development of essential habits of mind. When students solve problems, they look for patterns as they explore what already exists and imagine extensions or alternatives. Patterns are tested through particular cases, and generalizations are made; through this process, students learn to use pictures, representational diagrams, and mathematical language to describe a situation. Additionally, they make connections from one problem to another, and often extend their ideas to more complex problems that arise in new situations. Habits continue to develop while skills sharpen and ideas emerge.

We continue to work on balancing the breadth and depth of the mathematics program; the NMHS curriculum is a work in progress, realized in different ways within the four grade levels. In our attempt to decide what we believe is important for our students to learn, we have designed a framework that guides the work within our particular school setting. It remains imperative that we find ways to measure the work our students are producing against our intent. The analysis of student data, including a close examination of student portfolios, will continue to steer the refinement of the framework and to help us close the gap between what teachers envision for their students and what students are really learning and understanding. Thus, the framework serves as a guide to spearhead our work and to mindfully return to as we engage our students in the learning process. ■

In November 2003, the CES Small Schools Project selected New Mission High School as an Emerging Mentor School. For more information on the Small Schools Project, visit www.essentialschools.org.

Kadeisha Traore and Bianka Santana collect bird data

Roser M. Giné is a teacher, advisor, and mathematics curriculum coordinator at New Mission High School in Roxbury, MA. She is also a Leadership in Urban Schools doctoral student at the University of Massachusetts, Boston. She would like to acknowledge the support of Valerie Vasti, New Mission High School's Curriculum Coordinator. Giné can be reached at rgine@boston.k12.ma.us

All of the photos in this article were taken by Elizabeth Chartier.

CALL FOR NOMINATIONS

CES National is currently launching a national search for the second cohort of CES Mentor Schools. We need your help in identifying schools that share our common set of beliefs about the purpose and practice of schooling. Based on decades of research and practice, the CES principles call for all schools to offer:

- → Personalized and intellectually vibrant instruction to address individual needs and interests
- → Small schools and classrooms, where teachers and students know each other well and work in an atmosphere of trust and high expectations
- → Multiple assessments based on performance of authentic tasks
- → Democratic and equitable school policies and practice
- → Close partnerships with the school's community
- → Equitable outcomes for all students

All nominees must also fit the following criteria:

- → The school population is 400 or less
- → *The school is eager to take on the responsibility of mentoring new or exist* ing CES schools
- → The school has the organizational capacity to withstand the additional stresses this work will inevitably bring
- → The school must have a commitment to continuous improvement and regu larly uses student achievement data to inform and drive change efforts
- → The school has a stable faculty and leadership in place
- → The school is formally or will become formally affiliated with a CES center or CES national at the time of their application (visit our website www.essentialschools.org for information on how to affiliate)

We look forward to receiving your nominations. For additional information about the project and how to send your nomination visit our website on www.essentialschools.org or email inquiries to mbenitez@essentialschools.org Co-Director, New and Mentor Schools.

Samples of the Three Mathematical Elements at New Mission High School: Mathematical Modeling, Mathematical Proof, and Problem-Solving

Mathematical Modeling

1. In Roser Giné's Midlevel and Graduate classes this year, students have used math models and mathematical reasoning to explain the impact of epidemics on the world's population (vehicle: "Investigating Epidemics Through Mathematics"). The goal of this project was to examine how different epidemics have spread in order to make predictions using identified patterns. Students applied their knowledge of exponential functions to epidemiology. After researching a particular disease and gathering statistics, students explored appropriate mathematical models and analyzed their 'goodness' against the reality of the problem.

2. In a different kind of math modeling project, "Studying Conic Sections", students in Roser Giné's Midlevel and Graduate classes created parabolic dishes, whispering galleries, and three-dimensional models of our galaxy. The projects were guided by the following questions:

> How can we use the equations of conic sections to create real-world objects that reflect true physical laws? What may this imply about our physical surroundings?
>
> How can we use evidence from our work to explain why mathematical models are useful?

Students who created a parabolic dish used the equations and graphs of parabolas and the location of their focus points to create the model, and showed how the Law of Reflection contributes its function. Students working on the 3-D models of our galaxy worked on creating appropriate scales to fit all planets in one model and used the eccentricities of the elliptical orbits of the planets to represent their paths. Students who built whispering galleries used the equation of an ellipse and algebraically located the focus points in order to show the reflective qualities of their model.

Mathematical Proof

1. At the Foundations level, students engage in an inductive process of proof focused on the verification of a conjecture by pattern discovery. In a vehicle designed by Stephen Cirasuolo, "Pythagorean Triplets," students were presented with four methods that may or may not generate triplets. Their task was to explore which methods always work by conjecturing and testing each method for its validity. This problem allowed different entry points for students; those who chose could write algebraic proofs while others could delineate their inductive approach by presenting cases tested.

2. In her Midlevel class, Roser Giné integrated a unit on Logic and the study of trigonometry in a land-surveying project. Students worked on a project that included writing a mathematical proof of the Law of Sines, and then applied the Law of Sines and the Law of Cosines in their mapping of the school's surroundings. They first verified the theorem through an enactive process, and followed that by constructing a valid symbolic proof.

Problem-Solving

1. At the inquiry level, Heather Cabrera and Abby Paske engaged students in problem solving when they investigated "Egg Safety." Students designed and created paper cars that would prove "crashworthy" as they carried eggs and protected them against crashes into a wall. Participation in this project helped students develop skills in measuring, scaling, estimating, solving equations, graphing, and using data to justify their results. The students also explored concepts in physics as they determined the force that a car would have to survive in order to protect an egg.

2. In their yearlong study of urban ecology, students at the Foundations level work on projects in their exploration of the essential questions, "How can we obtain evidence to justify conclusions? How can we find out if our watershed is healthy?" One of the projects scheduled for implementation this year by Elizabeth Chartier and Stephen Cirasuolo challenges students to determine the amount of water that has entered the Muddy River watershed through precipitation. Students create and design their own plan for investigation while they develop their understanding of mathematical and scientific processes. As they proceed with this real-world problem, students explore three questions: "What do I know? What do I want to find out? What can I introduce?" With the guidance from their science and math teachers, they develop a real understanding of measurement and dimension while gaining skills in data collection and learning to make informed decisions.

Resources for Conceptualizing the Curriculum and Teaching Particular Math Units

The Core-Plus Mathematics Project (CPMP), published by Everyday Learning in Chicago, Illinois. This is a National Science Foundation (NSF) funded integrated mathematics curriculum project that provides lots of ideas for student investigation. It has provided me with interesting class activities that complement the portfolio strands. -

Functions Modeling Change, a book by Connelly, Hughes-Hallett, Gleason et al; published by John Wiley & Sons, Inc. This text emerged from collaboration among professors at Harvard University and has been used by college professors interested in revising higher education in mathematics, and addressing current student needs. The authors also wrote **Calculus—Single Variable,** 2nd edition, a text that contains more applications than most calculus textbooks. It was a product of the Consortium at Harvard University, funded by the National Science Foundation, published by John Wiley & Sons, 1998. Both of these have provided ideas for my own courses, particularly around mathematical modeling and appropriate applications of functions.

The Workshop Mathematics Project, published by Key College Publishing. I have used their pre-calculus book, **Workshop Precalculus,** and their statistics book, **Workshop Statistics.** Both have given me some interesting examples and applications to modify for my own classes. These books diverge from traditional texts in that they provide more hands-on activities to engage students.

On the Shoulders of Giants: New Approaches to Numeracy, a book edited by Lynn Steen/National Research Council and published by the National Academy of Sciences in 1990. This book has been an invaluable resource in thinking about the strands - big picture ideas.

The Systemic Initiative for Montana Mathematics and Science (SIMMS), an NSF funded curricular project developed by the Montana Council of Teachers of Mathematics and published by (Simon & Schuster Custom Publishing, 1998). Interesting ideas spiraling through many mathematics fields. Not too much on skill development for students but provides nice experiments and activities.

The Interactive Mathematics Project (IMP), another NSF funded project, published by Key Curriculum Press. The books provide units that are revisited at different points throughout the students' experience over three years. Schools that use this and some of the other NSF funded projects typically are trained specifically for their implementation; our school uses these more as resources for ideas.

Mathematics: Modeling Our World, a project developed by The Consortium for Mathematics and Its Applications (COMAP); offers many ideas for teaching mathematical modeling/real-world applications.

Contemporary Precalculus through Applications, a publication of the North Carolina School of Science and Mathematics, published by Janson Publications, Inc., 1991. Inspiring collaboration between a high school and Duke University. Many interesting ideas and well-organized text. The last section in the book provides projects that integrate scientific, social, and ethical problems with mathematics. Very good resource.

National Council of Teachers of Mathematics publishes yearbooks that inform emerging ideas in math education. The journal, **Mathematics Teacher**, is also published by NCTM - very interesting and useful, giving specific problems to be used in classrooms.

Thinking Mathematically, by Mason, Stacey and Burton, published by Prentice Hall, 1961. This has been useful in scaffolding the Problem Solving portfolio strand over the four-year student experience. It outlines phases involved in solving problems.

Problem-Solving, by the School Mathematics Project and published by Cambridge University Press. Much like Thinking Mathematically, it outlines meta-cognitive phases used in solving math problems.

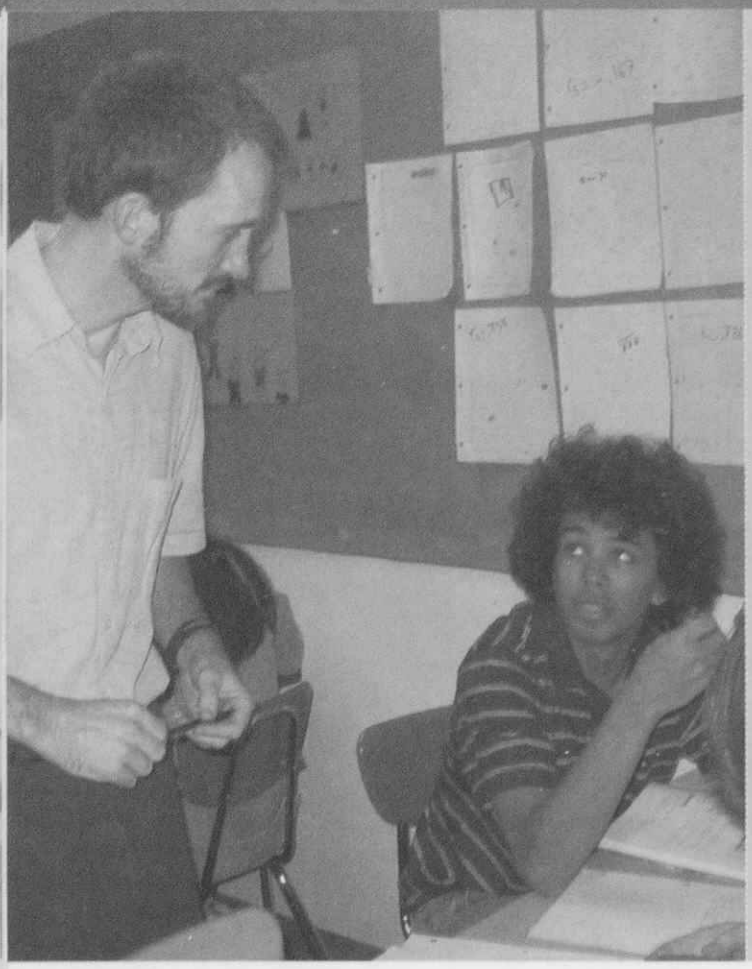
The Nuts and Bolts of Proofs, by Antonella Cupillari, published by the Academic Press 2001. Delineates methods of proof along with examples.

Knowing and Teaching Elementary Mathematics, by Liping Ma, LEA Publishers, 1999. Interesting connections among mathematics taught in China and mathematics taught in the US.

Why Math?, by R.D. Driver. Published in 1984 by Springer-Verlag. Very accessible publication; encourages deeper thinking about why math is important.

Understanding by Design, Grant Wiggins and Jay McTighe, published by ASCD, 1998. This source has helped the school in curriculum design by formulating essential questions and "planning backwards."

—Roser Giné



Making Math Personal: Meaning in Mathematics for Teachers and Students

by Jill Davidson

Wildwood math teacher Michael Conway listens to a 10th grade student

When mathematics students and teachers are able to deepen their relationships with the curriculum and with each other, they are more likely to teach and learn in ways that promote sustained, connected, meaningful understanding. Stories of teachers' engagement with their own curriculum through mathematics discourse, students' connection with teachers through personalized pedagogy, and students' commitment to the curriculum through personally meaningful research and opportunities for revision illustrate some ways that Coalition and other like-minded schools are making math personal.

Teachers' Relationships with the Curriculum and with Each Other

Responding to unsatisfactory 2001 district-wide math scores, Shelley Schneider, Assistant Superintendent of Curriculum and Instruction for the Millville, New Jersey schools, turned to the Center for Effective School Practices (CESP), New Jersey's CES regional center. Schneider focused her attention on strategically improving teaching, knowing that ultimately improved test scores can be a side effect of instruction that is flexible, mathematically rich, and student-centered. "What we really want is to see our students thinking at a higher level," said superintendent Schneider. "We want our students to be productive in their world. Math is all around us. The best gift we can give our students is to feel comfortable and competent."

CESP mathematics coach Shelly Berman responded with an offer to observe teaching and design professional development that would create more meaningful learning. At Millville's Lakeside Middle School, Berman's coaching centered on improving classroom discourse about math. "Discourse is what you do as a teacher to help the kids make mathematical meaning out of tasks," explains Berman. "If kids are rolling a die 1,000 times, it doesn't mean much, but if you put in the right prompts and ask the right questions, they begin to find sense and significance." Discourse in math classrooms makes thinking and meaning public, allowing students to connect mathematical language with their own vernacular. Mathematics discourse also allows teachers opportunities for multiple informal assessments to check students' understanding. Rich mathematics discourse in classrooms depends on teachers' flexibility with the material; different students will learn at different rates and connect with the big ideas within the curriculum in various ways, and teachers need considerable aptitude and skills to create context in such constructivist environments.

Now in his second year of modeling mathematical discourse and focusing on supporting techniques, Berman says "I'm seeing Lakeside teachers asking more questions, resisting the habit of giving away answers for free. They're using prompts, practicing wait time, doing groupwork, and helping kids understand that though it feels fun, math time really is not social time. Most importantly, they are modeling thinking; they're making thinking visible." Lakeside's example demonstrates that CES pedagogy of teacher as coach-student as worker characterizes effective classroom discourse.

As teachers begin to engage with mathematics in deeper and more complex ways, they also may confront more directly their own attitudes about mathematics. Genuine ardor is contagious: in many classrooms, students benefit greatly from teachers' love of math. But sometimes, teachers struggling with their own anxieties may inadvertently transmit ingrained dislike or fear of math. John Belcher, a program associate and math coach at the Center for Collaborative Education's Systemic Initiative in Mathematics and Science Education, focuses his work with teachers on helping them identify where their own weaknesses limit students. "Your own familiarity with the content places a ceiling on where students can go," Belcher observes. "Your understanding of the content and what it connects to - horizontally within math and vertically across the disciplines - is an active, ongoing, dynamic process."

Math coaches like Belcher or CESP's Shelly Berman can help teachers increase their own mastery and comfort within the range of mathematics that they teach. Additionally, coaches can help teachers refine their teaching techniques as they adopt curriculum frameworks that move from projects and exploration to specific skills. The time-honored CES tradition of teacher collaboration also supports teachers as they transform and refine their practices.

Along with coaches, teachers supporting each other are their own best allies in adapting and refining their teaching to maximize discourse and create curriculum and conditions for project-based, constructivist math learning. In *The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom,* James W. Stigler and James Hiebert analyze data from the 1999 Trends in International Mathematics and Science Study and other research efforts, concluding that mathematics and science teaching benefits from methods that turn practitioner knowledge (what teachers know works

RELATED RESOURCE

For an in-depth analysis of discourse at work in mathematics classrooms, along with video illustrations, see "Encouraging Mathematical Thinking: Discourse around a Rich Problem" by The Math Forum's Bridging Research and Practice Group at

www.mathforum.org/brap/wrap/index.html

NCTM Standards for Teaching Mathematics: Discourse

In 1991, the National Council of Teachers of Mathematics released the Professional Standards for Teaching Mathematics, which pushed the profession to develop a more constructivist and student-centered approach. Two of the six Professional Standards center on discourse.

Standard 2: The Teachers' Role in Discourse

The teacher of mathematics should orchestrate discourse by-

→ posing questions and tasks that elicit, engage, and challenge each student's thinking;

→ listening carefully to students' ideas;

→ asking students to clarify and justify their ideas orally and in writing;

→ deciding what to pursue in depth from among the ideas that students bring up during a discussion;

→ deciding when and how to attach mathematical notation and language to students' ideas;

→ deciding when to provide information, when to clarify an issue, when to model, when to lead, and when to let a student struggle with a difficulty;

→ monitoring students' participation in discussions and deciding when and how to encourage each student to participate.

Standard 3: The Students' Role in Discourse

The teacher of mathematics should promote classroom discourse in which students-

→ listen to, respond to, and question the teacher and one another;

→ use a variety of tools to reason, make connections, solve problems, and communicate;

→ initiate problems and questions;

→ make conjectures and present solutions;

→ explore examples and counterexamples to investigate a conjecture;

→ try to convince themselves and one another of the validity of particular representations, solutions, conjectures, and answers;

→ rely on mathematical evidence and argument to determine validity.

See http://standards.nctm.org for links to these standards along with supporting material, examples, vignettes, and background information.

Examples of Hands-On Math Labs at Eastlake High School's Extended Core Program

Jane Hunter and her colleagues use labs, with focusing essential questions, to arrange experiences that create meaningful mathematics learning. Here, a series of labs designed to be run multiple times by teams of students in order to produce data sets:

Barbie Bungee Jumping Lab (Linear Model). Essential Question: How many rubber bands will it take for Barbie to have the best (and safest) jump of her life off the balcony? It's what you imagine: Barbie dolls diving and ascending.

Lid Tossing Lab (Quadratic Model). Essential Question: What size lid will not hit any edges of the one-foot-square tiles 40% of the time? Students toss several round lids of varied diameters onto a square-tiled classroom floor.

Volume Lab (Cubic Model). Essential Question: Is there a relationship between the height of a pyramid and the volume of water it can hold? Chemistry-lab beakers represent pyramids in this series of trials.

in their classrooms) into professional knowledge (the public sharing and documentation of collected experience and wisdom). Collaborative structures such as critical friends groups, teacher research focused on essential questions, and lesson study - a collaborative curriculum refinement process on which Stigler and Hiebert focus - all serve to create sustained professional knowledge for improved mathematics teaching and learning. (For more on the concept and practice of lesson study, see the Resources section, page 18.)

Students' Relationships with Teachers

Erin Levine still can't believe that she succeeded in calculus during her senior year at Sammamish, Washington's Eastlake High School. While her mathematics mastery is due to a number of factors, especially her own hard work, Levine attributes her accomplishment to her relationship with Jane Hunter, her math teacher for her three years at Eastlake. Levine was part of Eastlake's Extended Core Program (ECP), a school-within-a-school of 120 students in grades 10-12. Each grade level of forty attends classes in small groups, studying an integrated curriculum with a team of teachers. The teaching team often loops with the students for the three years of ECP, creating the conditions for teachers and learners to know each other exceptionally well. After her sophomore year, Hunter encouraged Levine to accelerate her mathematics studies. Levine, quick to say, "I'm not a math person," was reluctant but accepted the challenge, succeeding with more challenging math curriculum. "Ms. Hunter knew I could do it," Levine recalls.

Jane Hunter also believes that her students' persistence and skills result in great measure from personal bonds. "Being able to teach these kids for three years is the most incredible thing I've done in my life. Kids stick it out because they love me and love being with each other. And they learned a lot of math along the way. Many of them, like Erin, did math senior year though they didn't have to." Certainly, Hunter's warm personality and the small-scale design of Eastlake's ECP program created foundations for the kind of personalized approach that fostered students' desire to stick to it and do well, making it possible for them to leave high school with the math skills that predicate success in future academic and professional endeavors.

Hunter and other Eastlake ECP teachers are finding other benefits in their transformed curriculum, which features intensive cross-subject integration and an experiential, project-based approach. "I have felt for a long time that if there isn't a personal connection or buy in, teaching discrete skills doesn't mean much," says Hunter. "Kids have heard us say far too often, 'You'll see the application for this someday.' With us, all of the skills and concepts come from the labs; the students have more connection and more buy-in." Reflecting on her years of mathematics teaching, Hunter sees the project-based approach as a profound shift, noting that she - and most math teachers - based their curriculum around teaching explicit skills, hoping to pull in applications to boost relevance when possible. Now, Hunter says, she and other Eastlake ECP teachers teach from hands-on experience, meaningfully contextualizing the skills and concepts outlined by district, state, and National Council of Teachers of Mathematics (NCTM) standards.

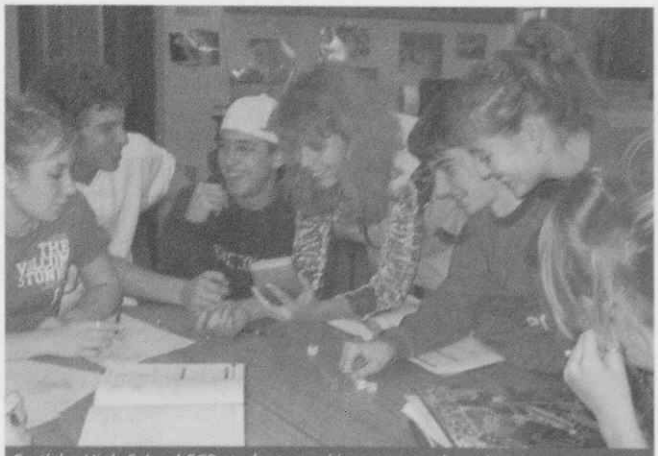
Students' Relationship with the Curriculum: Projects, Interdisciplinary Connections, Politics, and Revision

At Wildwood Secondary School, a 326-student independent middle and high school in Los Angeles, teacher Mike Conway is also feeling the effects of a forceful shift in his mathematics pedagogy as the Wildwood mathematics faculty creates a project-centered curriculum. Conway and his colleagues are in a new school - Wildwood's secondary campus opened in 2000 and will graduate its first senior class in 2004 - and have the opportunity to craft a new vision of mathematics teaching and learning. "The biggest shift from my prior teaching experience is that I have the chance to step away from the numbers and equations and look instead at understanding," reflects Conway. "Before, math was all about delivering content, and now it's about creating habits to enable students to understand concepts."

Wildwood's ninth grade math students focus on being organized and clearly showing work. These habits establish the basis for a mastery of mathematical language and make it possible to work effectively in groups. Wildwood's mathematics pedagogy is organized around groupwork, and this collaborative emphasis dissolves students' self-perceptions as "good" or "bad" at math. When a number of students work together on a project, they experience a wider range of opportunities for accomplishment. "As a teacher, I help them see their strengths," says Conway. "If you are a social and vocal person, then you will help other students get the wording just right. Maybe that verbal person won't be the first one to discover the concept, but the verbal

RELATED RESOURCE

Horace 8.3, "Math and Science in the Essential School" portrays the benefits and the obstacles inherent in integrating math and science; includes examples of several successfully integrated math and science programs. www.essentialschools.org/cs/resources/view/ces_res/165



Eastlake High School ECP students working on a math project

person is also learning the math. That's small school stuff; in order to do this, you have to know your students really well."

In addition to creating a project-based curriculum, Wildwood's mathematics faculty is also working on creating interdisciplinary connections. The World War I Probability Project asks students reading Erich Maria Remarque's *All Quiet on the Western Front* to design a simulation that, through 200 trials, explores the probability that an individual at the front would be killed, wounded, taken prisoner/go missing, or escape harm. Students work in pairs, designing the simulation, performing trials and recording results in a frequency table and a histogram, and presenting the results visually and orally. As Wildwood's project-based approach evolves, Conway hopes to build some additional "real world" community-based data collection and analysis projects at all levels of Wildwood's secondary curriculum.

For teachers like Conway seeking to move their project-based curricula beyond traditional, "safe" areas of study, Eric Gutstein, part-time middle school math teacher and Associate Professor of Math Education at the University of Illinois-Chicago, suggests that useful projects come from students' lives and experiences. At their primarily Latino, urban middle school, Gutstein and his students did a project entitled "Mortgage Loans - Is Racism a Factor?" in which they analyzed mortgage rejection rates for African American, Latino/a, and white applicants. Explaining the motivation for the project, Gutstein notes, "These kids had experiences of home desiring; the issue of housing and home ownership is central in people's lives." Gutstein affirms and embraces the overtly political nature of the project. "If we'd done it more blandly, if we'd studied other, less controversial statistics, it still would have been rich mathematics. But then students wouldn't realize that math is a tool that can analyze political realities, and they don't become prepared to use math to think about deeper questions."

RELATED RESOURCE

In "Home Buying While Black or Brown," (*Rethinking Schools*, Volume 18 No. 1 - Fall 2003) Eric Gutstein documents his students' mortgage rate-racism project,

www.rethinkingschools.org/archive/18_01/brow181.shtml

Eastlake High School's Jane Hunter suggests that allowing opportunities for revision is another way for students to connect more meaningfully to the curriculum. Eastlake has a policy of allowing students to retake math tests - a one-time option that requires teachers to create two versions of each test. Students must be completely current with class project work and homework, and they must accept the second test's result. Retesting and rescoring is a lot of work, acknowledges Hunter, especially with the essay-laden assessments that she uses. But the retake policy, she says, "allows students the ability to learn from mistakes. Kids come back from college and say that they really understand because they were able to more deeply engage with the content and skills. I can see that it really makes a difference cognitively."

RELATED RESOURCE

Horace 15.2, "Math Programs" reviews a range of math resources that support critical thinking and deep mathematical understanding.

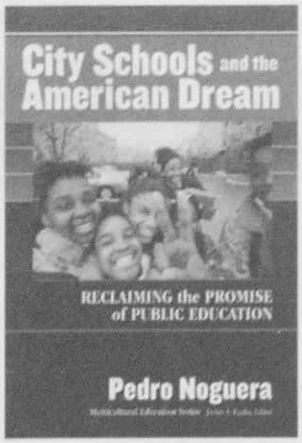
www.essentialschools.org/cs/resources/view/ces_res/91#2

Mike Conway agrees with the revision approach, especially in classrooms where students know themselves and their learning styles well. Wildwood's curriculum leaves room for re-entry and refocusing as projects evolve. "When there's no opportunity for revision, you either get it or you don't. You're not given an opportunity to build understanding." Conway continues, "Revising makes students stop saying, 'I'm no good; I can't do this' and helps them starting saying, 'How am I going to work on this? Try harder? Collaborate? Use diagrams because I am a visual person? Build a model because I am more kinesthetic?' Allowing revision gives opportunities for success. It turns things around in a math class right away."

Personalized Math Depends on Teacher Autonomy

Coalition schools trust teachers to create learning environments that encourage investigation, discovery, discourse, and revision while balancing the demands of standards-based curricula. Educators who deeply know both their students and the curriculum are able to capitalize on teachable moments, merging discovery with the progression of skills and concepts that they aim to cover.

Teacher autonomy also creates the conditions for the development of structured project-based curricula, which compel students to learn actively, increasing their chance to engage in meaningful and enduring ways. When teachers have the time, structures, and support to work collaboratively as professionals, refining the curriculum and their pedagogy, they are able to transform personal knowledge into their school's cache of professional expertise about how to teach for understanding.



City Schools and the American Dream: Reclaiming the Promise of Public Education, by Pedro Noguera (Teachers College Press, 224 pages, $19.95) Reviewed by Lisette López

Educators who seek to make a difference in the lives of students face tremendous challenges working in urban public schools that are under-resourced and over-burdened. In response, Pedro Noguera maps out his vision of hope and pragmatism in *City Schools and the American Dream.* Building on his experience as a former teacher, school board member, parent, activist, researcher, and Executive Assistant to a former mayor of Berkeley, CA, Noguera's *City Schools* provides a grounded analysis of how social forces undermine the quality of urban schools and the achievement of students of color. Noguera asserts that to meet the promise and end the perpetual crisis of public city schools, we must directly address the social context of urban education. However, unlike many others who have written on urban school reform, Noguera's call for schools to create partnerships that help provide social services and address urban conditions is only the surface of his argument.

On balance, *City Schools* is committed to showing how poverty, low social status, racial stereotypes, and other inequities not only affect children's needs and the resources available in their communities, but also translate into low political and social clout. Noguera illustrates how this means some parents have the ability to control the quality of their children's education and some don't. Whether due to stereotypes about which families care about education, to the ability to choose a private school when you are dissatisfied with your public school, to the privilege to hire a lawyer in a dispute regarding your child, or to the power to press the district to keep your school from getting shut down – more affluent families use what Noguera refers to as "social capital" to have greater control over their local schools. Noguera asserts the need to find ways to ensure that *all* families are able to hold schools accountable for responsive, quality, teaching. According to *City Schools,* addressing the social context involves remaking relationships of accountability to empower currently marginalized families and communities.

Through his analysis of the Bay Area, Noguera illustrates how cities and districts don't possess social power and wealth evenly. He views this is a central obstacle to reform and argues that all acts of reform, however big or small, "must be based on a willingness to engage in a process of change that aims at transforming relationships between those who have power and those who do not. Unless this transformation occurs, it is unlikely that even ambitious reforms will lead to lasting change." This analysis is one of the critical contributions *City Schools* makes to the dialogue on school reform.

Some might call Noguera's overall agenda a radical one. But he goes to great pains to define himself as a "pragmatic optimist." And *City Schools* forwards an argument clearly directed at progressives within the educational arena: our commitment to address the social context of schooling must be practical, not ideological, geared toward whatever ultimately will work for children. In his perspective "we must figure out how to work within the limits of what is possible at this historical moment...the challenge is to figure out how to be heard and taken seriously within debates over policy, rather than being content with the irrelevance that comes from being comfortably planted on the margins with other critics."

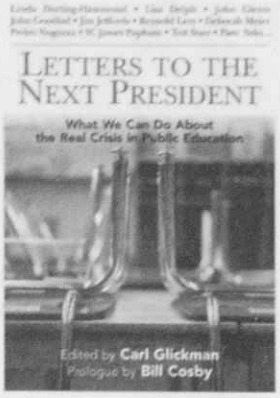
City Schools is an important read for those who want to expand on the successes of some urban CES schools. How do CES educators find ways to keep to what is "essential" - the central task of teaching and learning - while addressing what Noguera articulates is fundamental - the environment and social and political context of a community the affects how students learn and whether schools are consistently and appropriately responsive. To close the racial achievement gaps that persist even in CES schools, though they may be smaller than in comprehensive urban schools, it is imperative that we continue to ask ourselves how a community's race, class, and social context affects the implementation of personalization, democracy and equity.

City Schools might be dissatisfying to someone looking for specific answers and remedies. As Noguera himself states, the book is an "exploration" to "uncover lessons" on how some urban schools tried to deal with constraints. The power of *City Schools* lies in Noguera's humane, respectful, and impassioned perspective. We must meet the needs of communities and improve the conditions that impair the ability of schools to educate. But we also must respect the place public schools have in communities and find ways to make them accountable to the families that send their children there.

Most of those who have the calling to work in urban schools need to understand the context of their students' realities. They also need to have their passion and drive nurtured and rekindled. This book feeds the urban educator's need for insight and purpose. It will not leave practitioners with detailed strategies for use in their classrooms, or with a tried and proven list of reforms for administrators, it but will leave them more hopeful, better informed and better equipped for their daily mission.

Lisette López is a member of the CES National mentor and new schools project team. For the last six years she has integrated action research, policy advocacy, and capacity building to help schools, youth programs and neighborhood agencies respond positively and equitably to diverse students.

Letters to the Next President: What We Can Do About the Real Crisis in Public Education, edited by Carl Glickman, foreword by Bill Cosby (Teachers College Press, 288 pages $14.95), reviewed by Jill Davidson



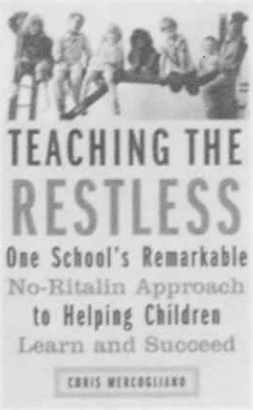
Letters to the Next President gathers fifty voices - parents, a superintendent, eighth grade Native American students, a first-grade teacher, a senior-class president, nationally known education reform leaders, a middle school assistant principal, university professors, United States senators and representatives, a prison inmate - that offer insight into the accomplishments and the tragedies of our public schools and call for specific leadership for change.

Though their passions and perspectives differ vastly - encompassing advocacy for the needs of African American students, rural schools, arts in the curriculum, afterschool programs, school funding reform, and more - the letter writers offer consistent wisdom about the best course for executive national leadership for systemic improvement. Fund schools equitably and properly. Employ and reward high quality, professional, experienced, culturally competent teachers. Give students books, meaningful curricula, and clean, well-maintained places to learn. Assess students, schools, and the larger system on multiple measures, honoring teachers' judgments. Support students' and families' health and safety outside of school. Build a system that guarantees two-way accountability.

Letters to the Next President is a powerful chorus for all civic and community and leaders, for anyone who wants to understand straightforward ways to beat back the dark undercurrents that prevent our children's tide from rising. In his introduction, Glickman describes "a strange combination of fear and optimism" that runs through the letters. Indeed, a thread that ties a number of powerful letters is the observation that fearmongering is among the most destructive things a leader can do, as it gives the wholesale impression that schools are truly dysfunctional and hopeless places. At the same time, *Letters* repeatedly reminds us of the powerful good for which schooling is responsible.

There's nothing universally true to be said about our at-extremes educational system. The contributors' examples of truly transformational positive change as a result of schools are the result of this particular teacher, that particular school. That's how it works: change happens when we can create lasting benefits at the individual, personal level. Leaders – and particularly our next president – should read these voices and carry away the mandate to act to support our schools financially, create systems that are designed to maximize the good we can do one another, and perhaps most of all, honor the difficult, life-changing work of teachers and students.

Teaching the Restless: One School's Remarkable No-Ritalin Approach to Helping Children Learn and Succeed, by Chris Mercogliano (Beacon Press, 256 pages, $25.00), reviewed by Jill Davidson



Chris Mercogliano has taught at the urban, independently funded Albany Free School for thirty years. The Free School, with fifty or so students ranging in age from two to fourteen, provides a physical and social environment that allows students, in close contact with teachers and other caring adults, to create their own paths to learning. Mercogliano sorts the Free School's students into two groups; half would likely thrive anywhere, and the other half would likely self-destruct anywhere else. *Teaching the Restless* tells the stories of several students in this latter group, students likely, in more confined and structured classrooms, to be described as attention-deficit disordered and compelled to take biopsychiatric drugs such as Ritalin.

Mercogliano describes the Free School as structured around the idea that "happy children are ready learners and are intrinsically sociable"; the Free School creates conditions for that happiness to evolve, bringing nurturing, validation, and accountability to the community to bear on each student's self-directed learning. Not without some anxiety, teachers, students, and parents abandon grades and schedules, trusting that some children learn to read at age three and others at age ten - and that no such "measurable" learning can happen before children feel accepted, engaged, and able to regulate their own responses.

As students enter the Free School, which requires them to be drug-free and which allows them to choose their own activities while holding them strictly accountable for their behavior toward teachers and peers, most children slowly, but steadily, find equilibrium and start learning. At various points, parents and kids themselves express concern about their literacy and numeracy progress; Mercogliano notes the particular worries of an African American boy's mother as she watches her six-year old son William's lack of reading progress even as he stabilizes emotionally. Some of those worries seeped into my consciousness even as I was rooting for William to find his emotional roots first so he could then start decoding and understanding.

The Free School made me consider anew what a good school can look like; most schools are unlikely to emulate its practices, but nearly all personalized and student-centered schools will reconsider their own policies and practices in light of Mercogliano's passionate description of the fusion of freedom and accountability required to set young minds free.

horace

Volume 20 no. 2
Winter 2004
Classroom Practice

Horace, the quarterly journal of the Coalition of Essential Schools (CES), is published by CES National. *Horace* combines educational research with "hands-on" resources and examples of innovative practices from CES schools around the country.

Visit the CES National website at www.essentialschools.org to read *Horace* issues from 1988 through the present. The staff of CES National invites your comments and contributions to *Horace* via the CES Interactive area of our website or at the contact information below.

Coalition of Essential Schools

The Coalition of Essential Schools, founded in 1984 by Theodore Sizer, is dedicated to creating and sustaining equitable, intellectually vibrant, personalized schools and to making such schools the norm of American public education. The CES national office is in Oakland, CA, with nineteen CES regional centers across the country.

CES schools share a common set of beliefs about the purpose and practice of schooling, known as the CES Common Principles. Based on decades of research and practice, the principles call for all schools to offer:

- → Personalized instruction to address individual needs and interests
- → Small schools and classrooms, where teachers and students know each other well and work in an atmosphere of trust and high expectations
- → Multiple assessments based on performance of authentic tasks
- → Equitable outcomes for students
- → Democratic governance practices
- → Close partnerships with the school's community

We aim to create a system that refuses to rank and sort students, and that, instead, treats each child as a precious being with great gifts to be nurtured and supported.

Our work supports the creation and sustenance of large numbers of individual schools that fully enact CES principles—schools that emphasize equity, personalization, and intellectual vibrancy. These schools can serve as models to other schools and demonstrations to the public that it is possible to re-imagine education.

In addition to individual schools, we also need to create the conditions under which whole systems of schools will become equitable, personalized, and intellectually vibrant. To affect these whole systems, CES National supports regional centers as they develop the capacity to aid schools and to influence school districts and states. We seek to influence wider public opinion and policy-makers to develop policy conditions conducive to the creation and sustenance of schools that enact CES principles.

Please visit our web site at www.essentialschools.org for more information on CES National, our affiliated regional centers, and affiliated schools. Interested schools, organizations, and individuals are invited to the website for more information about affiliating with CES National.

The Common Principles

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RESOURCES
Making Math Personal

The Math Forum
Drexel University's Math Forum is the best place to go for a deep, multi-perspective immersion in issues connected to mathematics teaching and learning. In addition to an astoundingly large sweep of interactive opportunities for teachers, researchers, parents, and students, the Math Forum features Problems of the Week (math challenges available to all, some with online mentoring assistance, and with extra support services for subscribing Math Forum members), Ask Dr. Math, vast inventories of tools, a "Teacher2Teacher" information exchange program, and a fantastically informative Internet Mathematics Library. Particularly relevant to the focus of this issue of *Horace* is the work of the Math Forum's Bridging Research and Practice Group's "Encouraging Mathematical Thinking: Discourse around a Rich Problem" videopaper, at http://mathforum.org/brap/.

www.mathforum.com

TERC
TERC's mission is to research and promote meaningful teaching and learning in mathematics, science, and technology. Most of TERC's research projects are school-based, and its curriculum, studies, professional development materials, semi-annual newsletter, and multifaceted web site are grounded in the realities of teaching and learning. CES affiliates may be particularly interested in the archived proceedings of the Third Annual Conference on Sustainability of Systemic Reform, an online conference produced as a culmination of a three-year project funded by the National Science Foundation to study "Supporting and Understanding Sustainability in Local Systemic Change." Rooted in math and science education but encompassing wider arenas of education change, the online record of the conference - particularly Deborah Loewenberg Ball's keynote address - presents a fascinating, school-based perspective.

www.terc.edu
Third Annual Conference on Sustainability of Systemic Reform: http://sustainability2003.terc.edu/

National Council for Teachers of Mathematics Principles and Standards for School Mathematics
The National Council for Teachers of Mathematics' Principles and Standards, now in their third iteration, has strongly influenced the use of standards in curriculum and assessment in math classrooms nationwide. Generally speaking, the NCTM standards have been welcomed and embraced by the "reform" mathematics teaching community and have functioned persuasively for more integrated, constructivist, equitable curriculum. NCTM offers a vast product line centered around the Standards; The Electronic Principles and Standards website offers their content and much more online. The Illuminations website offers lesson plans, learning tools, and other resources to help teachers align curriculum with the standards. While NCTM requires membership to view the published standards (most schools and/or districts are members, and many already have printed versions of the Principles and Standards), its website offers many other resources free of charge.

www.nctm.org
Electronic Principles and Standards: http://standards.nctm.org/
Illuminations: http://illuminations.nctm.org/

Eisenhower National Clearinghouse for Mathematics and Science Education
The Eisenhower National Clearinghouse for Mathematics and Science Education's website, ENC Online, comprehensively collects information about mathematics and science curriculum, professional development, internet-based resources, and articles about a range of topics including assessment, equity and diversity, real-world mathematics, implementing technology, and more. Notably well-organized, the site also provides a well-written weekly newsletter called "ENC Focus," a large set of curriculum ideas, some aligned with a daily calendar for lesson planning and inspiration, and "The Digital Dozen," a monthly review of stellar math and science web sites. The Standards section, http://www.enc.org/professional/standards/, is a bare-bones, comprehensive collection of national and state math and science standards and frameworks - an essential resource for planning a standards-aligned curriculum.

www.enc.org

Trends in Mathematics and Science Study Research
Approximately fifty countries worldwide participate in the Trends in International Mathematics and Science Study (TIMSS), designed to learn through classroom observation what works best in math and science teaching and learning. Conducted on a four-year cycle, TIMSS completed its third round of research and data collection in 2003. These websites offer a range of data-collection materials, descriptions, data, analyses, and conclusions related to the TIMSS effort.

The International Study Center at the Lynch School of Education, Boston College. The most comprehensive TIMSS site; includes links to the 1995, 1999 and 2003 TIMSS studies.
http://ustimss.msu.edu

National Center for Education Statistics
This site is an overview, offering TIMSS highlights and results.
http://nces.ed.gov/timss/

LessonLab, Inc.
LessonLab conducted the influential seven-country 1999 TIMSS Video Study that looked at teaching and learning in eighth-grade classrooms.
http://www.lessonlab.com/timss1999/

National Center for Improving Student Learning and Achievement in Mathematics and Science (NCISLA)
Based at the University of Wisconsin-Madison's Wisconsin Center for Education Research, the National Center for Improving Student Learning and Achievement in Mathematics and Science (NCISLA) conducts long-term, school-based studies of how K-12 students learn mathematics and science with understanding. NCISLA produces publications and professional development materials that support its findings, which generally point to the success of highly interactive and personalized content-rich classroom experiences. Its Teacher Resources section is a fast-track entry into its material and greatly helps educators focus on what works in the classroom to promote enduring mathematical and scientific learning.

www.wcer.wisc.edu/ncisla

Lesson Study Group and Lesson Study Research Group
These two websites provide overviews of and resources for implementing the practice of lesson study, an collaborative, Japanese-originated approach to teachers' professional development that grew out of the partnerships that sparked the ongoing TIMSS efforts; it calls for teachers to plan curriculum together, observe each others' teaching, and evaluate results for ongoing, systematic improvement. A close friend to teacher research and critical friends efforts, lesson study's structure and outcomes are well-suited to schools organized around the ten Common Principles.

Lesson Study Group at Mills College: http://www.lessonresearch.net/index.html
Lesson Study Research Group at Columbia University Teachers College: http://www.teacherscollege.edu/lessonstudy/

Balanced Assessment in Mathematics Project
The Balanced Assessment project ran at the Harvard Graduate School of Education from 1993 to 2003, developing and refining in classrooms over 300 innovative, performance based assessments for K-12 learners. The assessments can be evaluated by an accompanying scoring system that covers assessment for individual tasks and larger projects, thus providing a way to evaluate performance-based mathematics assessment across classroom, schools, and districts. The tasks are online and available in print and on cd-rom. The Balanced Assessment in Mathematics Project was conducted under the same National Science Foundation grant that funded similar research at Michigan State, U.C. Berkeley, and England's Shell Centre for Mathematical Education Publications at the University of Nottingham. See the Mathematics Assessment Resource Service web site for more information about other aspects of the Balanced Assessment work.

Balanced Assessment in Mathematics Project: http://balancedassessment.gse.harvard.edu/
Mathematics Assessment Resource Service: http://www.nottingham.ac.uk/education/MARS/

Mathematically Sane
Mathematically Sane collects studies, reports, articles, and other analyses of one point of view in the "math wars": the controversy about whether reform or back-to-basics approaches best help student's mathematical mastery. Mathematically Sane comes down emphatically in the reform camp, offering a voluminous show of evidence that supports constructivist, standards-based curriculum as the key to understanding and higher-order thinking. While there's no curricula per se here, Mathematically Sane is an ideal place to turn to find support for approaches to teaching that make sense in CES schools; it's deep, well-organized, and tremendously affirming.

http://mathematicallysane.com

Mathematics Education Collaborative
The Mathematics Education Collaborative (MEC) is an advocacy group that aims to promote the cause of "rational reform" in math education, aligning itself to the call for standards based, meaningful curriculum as delineated by the National Council for Teachers of Mathematics and other groups. MEC offers courses for teachers to realign their pedagogy, a library of curriculum and resources, and a long list of books and articles that support various aspects of reform math: the need for teachers to understand math deeply, the weaknesses of high-stakes tests as meaningful assessments, the meaning and significance of quantitative literacy, and the importance of math in the world of work.

www.mec-math.org

The Guide to Math and Science Reform
This online guide, compiled under the auspices of Annenberg/CPB, provides a wide-ranging, searchable database of reform-oriented math and science projects, research, and organizations. Each entry – and there are hundreds – is annotated extensively, including contact information, funding data, project duration, detailed descriptions, and more. Age somewhat limits The Guide to Math and Science Reform's utility; it appears not to have been updated since 2000. Nevertheless, it includes projects and research from far and wide, on a vast array of subjects and with all age groups. Clicking on the long list of projects is fascinating and addictive, and the list of organizations included in the Guide is a useful index. If you find yourself wondering if anyone has looked into a particular aspect of mathematics or science, a wise first step would be consulting this resource.

www.learner.org/theguide

GO TO THE SOURCE: More About the Schools Featured in this Issue

Schools

Eastlake High School
Public school serving grades 10-12
400 228th Ave. N.E.
Sammamish, Washington 98074
425/836-6600
http://wwwehs.lkwash.wednet.edu/

Lakeside Middle School
Public school serving grades 7-8
2 North Sharp Street
Millville, New Jersey 08332
856/293-7600
www.millville.org/lakeside/index.html

Lanier High School
Public school serving grades 9-12
833 Maple St.
Jackson, MS 39203
601/960-5369
www.jackson.k12.ms.us/schools/high/lanier.htm

New Mission High School
Public school serving grades 9-12
67 Alleghany Street
Roxbury, Massachusetts 02120
617/635-6437
http://boston.k12.ma.us/schools/RC664DEC2003.pdf

Wildwood School
Independent school serving grades k-12
Secondary Campus:
11811 West Olympic Boulevard
Los Angeles, CA 90064
310/478.7189
www.wildwood.org

Support Organizations

The Algebra Project, Inc.
99 Bishop Allen Drive
Cambridge, MA, 02139
617/491-0200
www.algebra.org

Bay Area Coalition for Equitable Schools
1720 Broadway, Fourth Floor
Oakland, California 94612-2106
510/208-0160
www.bayces.org

The Center for Collaborative Education
1 Renaissance Park
1135 Tremont Street, Suite 490
Boston, Massachusetts 02120
617/421-0134
www.ccebos.org

Center for Effective School Practices
Rutgers, The State University of New Jersey
One Possumtown Road
Piscataway, New Jersey 08854
732/564-9100
http://cesp.rutgers.edu

School Design

How do we design schools so that all students can learn to use their minds well? Topics include: structures for space and time, teacher collaboration, and data collection and analysis.

Classroom Practice

How do we bring Coalition ideas like less is more, teacher as coach, and demonstration of mastery to life in the classroom? Topics include: curriculum and instruction, assessment, and classroom culture.

Leadership

What kinds of leadership are necessary to transform schools into more humane and intellectually rigorous environments? How can the change process be sustained? Topics include: governance, distributed leadership, and managing the change process.

NEXT ISSUE

***Horace* 20.3 will examine the role of school and community leaders in creating the momentum for and doing the work of converting large high schools into small learning communities**

Community Connections

How can schools most powerfully engage the community as advocates and partners in the education of its students? Topics include: parental involvement, service learning and internships, and using community members as resources.

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Classroom Practice

Making Math Personal

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Charles Stewart Mott Foundation, Bank One
KnowledgeWorks, and Wells Fargo

Making Math Personal

Volume 20 no.2 | Winter 2004 | School Design

Cover: New Mission High School students Kinkeisha Baskin and Robert Baez observe weather conditions as they begin a year-long study of the Muddy River Watershed

Notes on this Issue

Years ago, I read about Dr. Robert Moses' Algebra Project, and was both intellectually thrilled and emotionally moved by the idea of mathematics education as a civil rights action. I am honored to be publishing Dr. Moses' words in *Horace*, thereby making the link between the Algebra Project and CES more explicit. Civil rights work of decades ago tells us about our nation's complexity, making evident elements of systematic inequity and the actions needed to overcome and create social justice. The Algebra Project's work shows us that teachers and students are in the midst of a crucial parallel struggle for the conditions and curriculum needed for mathematics proficiency, a fundamental factor for ongoing educational access and success. Decades from now, I hope, we will look back on the work of schools that fought for equity in mathematics achievement with pride.

Also in this issue, Roser Giné, mathematics teacher and curriculum coordinator at New Mission High School, describes how to create mathematics curriculum that both demands much of and conscientiously supports students. New Mission's story of creating a meaningfully mathematics framework serves as a crucially valuable roadmap for other new and restructuring schools.

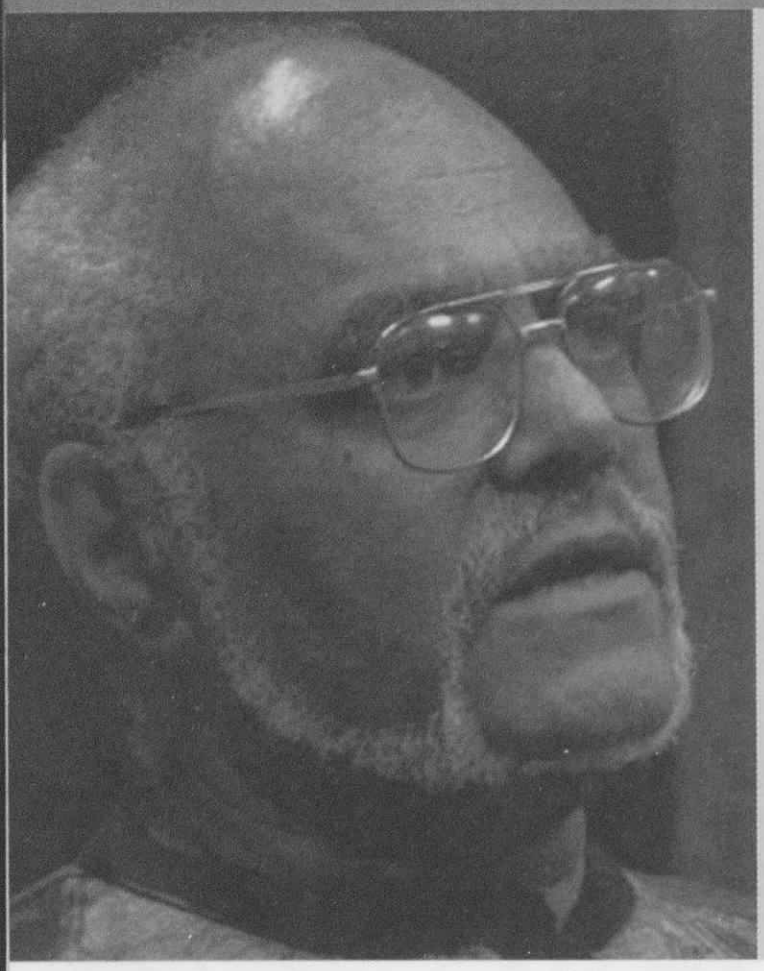
I'm happy to have the chance to convey my thanks to all of the schools, organizations, and individuals that provided information and inspiration to this issue of *Horace*. Fascinated by teachers and researchers who understand how to teach math in life-changing ways, I talked to far more people than I was able to include in these pages, and am grateful to so many people for enriching my understanding.

Horace's next issue will focus on the brand of leadership needed to create, preserve, and improve small, student-centered schools. If you have ideas and experience to contribute, I'm eager to hear from you at jdavidson@essentialschools.org.

A note about CES National's web resources: we have an online archive of fifteen years of Horace, accessible from the Horace graphic on www.essentialschools.org. As well, the CES National website provides information about CES National's Small Schools' Project, archives of past Fall Forums, and information about Fall Forum 2004 (we hope you can join us in San Francisco to celebrate CES at the twenty-year mark!). All of us at CES National appreciate the hard work of Jacqueline Gross and Abbey Kerins, who maintain and improve the web site.

Finally, thanks to all Horace subscribers - you're making it possible for us to continue to tell the stories of what's happening in Essential schools. If you don't already subscribe but find Horace useful, consider joining us. Subscription rates are $35.00 per four-issue year, with discounts for multi-year subscriptions. Use the attached subscription card, call us toll-free at 1.800.62HORACE, or go to www.essentialschools.org/horace. Another way to receive Horace is to affiliate with CES. The connection with CES is well worth it. See more information on affiliation on our website or call us at 510/433-1451.

Jill Davidson
Editor, *Horace*



Working the Demand Side: An Interview with the Algebra Project's Robert Moses

Robert Moses

In January 2004, Victor Cary, Program Director at the Bay Area Coalition of Equitable Schools, talked with Robert P. Moses, longtime civil rights activist. Known for his voter registration work in the Mississippi Delta in the 1960s and his subsequent math education efforts, Moses founded the Algebra Project in the 1980s as a grassroots efforts to improve math literacy among African-American middle and high school students. Along the way, Moses has earned a constellation of awards and recognitions for his multifaceted civil rights achievements. The co-author of *Radical Equations: Math Literacy and Civil Rights,* Moses is currently the President of the Algebra Project and a math teacher at Lanier High School in Jackson, Mississippi.

Victor Cary: When you look at the work you're doing and what you see happening in education today, where do you think we are now, especially in terms of the impact on African American kids, kids of color, and poor kids? I'm thinking about things like No Child Left Behind, high school exit exams, and all that we have to deal with as we try to work.

Robert Moses: Broadly speaking, the country is running what I call a legacy of sharecropper education in the public school system. When we were registering sharecroppers in the Mississippi Delta in the early 1960s, we went before the federal district judge in Greenville after we had taken hundreds of sharecroppers to register to vote. The judge asked me on the stand why we were taking illiterates. "Don't you know that Mississippi has illiteracy tests? So why bother?" The answer was that the country couldn't have its cake and eat it too. It couldn't, through its political decisions and institutions, deny people an education and then turn around and say they couldn't access politics because they weren't educated.

In the 1940s, the Hopson plantation, outside of Clarksdale, first demonstrated machines to pick cotton. Richard Hopson, the plantation manager, wrote a letter to all of the plantation owners in the Delta urging them to mechanize the picking of cotton as rapidly as possible to alleviate "the Negro situation," as he called it. That started a wave of migration that lasted almost twenty years. About five million sharecroppers were refugeed, in my way of thinking, into every urban area of the country. What nobody paid any attention to was that an urban version of sharecropper education went with them.

As for No Child Left Behind, this is a country not really willing to discuss what it would take to fix the schools, so it's setting a way of measuring what's actually being accomplished according to certain standards. But there's no stomach at the moment for discussion about the national policies that would have to be in place to put a floor under every child's education and opportunities. That's where I think we are nationally on the policy level. I think that the country just hasn't got what it takes to face the history. You know, I think of Strom Thurmond and that case as a metaphor. For large political reasons, Strom Thurmond and his family, while he was alive, weren't going to recognize Essie [Mae Washington-Williams], his child, publicly. From slavery through sharecropping down to today, this country does not recognize all of the children in its school system. This puts the onus on the individual child and says, "Well, you've got to measure up and these are some of the things you have to do." But no one is saying, "Look, these are children that we, in effect, gave birth to but that we ignored and really didn't treat as our children, and now we need to figure out what we're going to do to rectify that." So there's no drive to put in the additional resources that are needed to try to make a dent in the problem.

RELATED RESOURCE

For more on Robert Moses' 1960s voting rights work: *Radical Equations: Math Literacy and Civil Rights*, Robert P. Moses and Charles E. Cobb, Junior (Beacon, 2001). Also: "SNCC: 1960-1966" at www.ibiblio.org/sncc/index.html

Cary: That's a great transition to talk about the work and the practices within the Algebra Project itself.

Moses: One really successful outcome of the project has been the growth of a fairly vibrant group of young people who have grown up in the project. They have their own organization and call themselves the Young Peoples Project.

RELATED RESOURCE

For more on the Hopson letter: *The Promised Land: The Great Black Migration and How It Changed America*, Nicholas Lemann (Vintage, 1992)

Cary: How long has that been in existence?

Moses: It first came into being in 1996. They now have a network of math literacy workers that are in college and high school. They run math literacy workshops in school or after school. In terms of the strategy of the project, it fits with what we learned about trying to change these big, broad issues during the '60s with the right to vote. We had to get the sharecroppers themselves in the mix, making the demand for their rights before you could shake the power structure that was vested in the system that kept them as sharecroppers. I think there's a similar strategy here: the young people who are the target population have to get involved in working the demand side, making the demands. The Young Peoples Project has found a way to stimulate that idea. The young people make some demand on themselves to master mathematical material to the extent that they can present and discuss and run workshops. Embedded in that is looking at how to get these young people to think about the broader policy issues. But the most important thing is getting them functionally involved in spreading math literacy and making a cultural change as they do it.

Cary: Was this something that came out of students' own experience and energy?

Moses: They actually did this on their own. In their early twenties, they are role models, which is extremely effective and important with the middle school students. People in their early twenties who are really engaged in working with students and helping them to move into a public space - this is an entry-level introduction to knowledge work. What's missing for the kids is some way to be introduced to knowledge work, as opposed to the mechanical work at McDonald's or the other kinds of jobs that young people from the grassroots get pushed into.

The Southern Initiative of the Algebra Project has also had some real success with professional development activities with elementary school teachers that emphasize mathematical processes. They're having impact in some areas of Arkansas and elsewhere. The teachers are really looking at how to take ideas about experiential learning and ideas about regimenting language and discourse to produce mathematical representa-

tions into areas that trouble teachers in elementary school math. I think these teachers want to teach and feel they have to teach but have trouble figuring out how to teach.

Cary: Could I ask you more about the demographics of these teachers who you're working with?

Moses: They're primarily African American schools and teachers in the delta of Arkansas - it's on the western bank of the Mississippi River across from the Mississippi delta.

Cary: Have you had any experience bringing this work to urban settings where the school's faculties are mostly white?

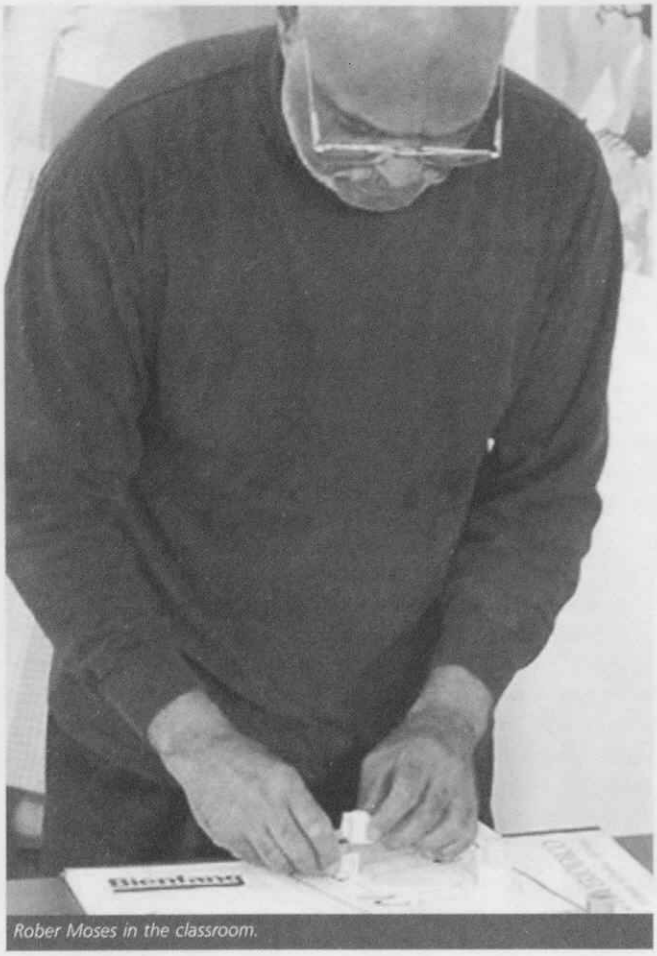
Moses: Not too much. The Southern Initiative has focused on the rural South. Efforts to do the project at the middle school level in the urban systems didn't take root. We weren't able to really solve the kinds of political and institutional problems in the major urban centers. So the only project that's trying to get off the ground again is in Chicago, where the Young Peoples Project is. It's returned to an area where the Algebra Project wasn't able to take root, and they are having some initial success in working with other players in the math reform movement in Chicago.

Cary: Could you characterize those obstacles that prevented the Algebra Project from taking root, given the success that you've had and a powerful curriculum that you've developed?

Moses: One obstacle in the urban areas in schools with the target populations that the Algebra Project is trying to reach is the teachers' level of real mathematical training, their level of cognitive flexibility which is needed to run a classroom in math using a more coaching, hands-on model. And then there's the overcrowding and the lack of real opportunity for daily professional development.

Cary: Boy, that's true.

Moses: One way of thinking about it is the model we have put in microcosm here at Lanier. There are three of us who are doing the teaching here at Lanier High School; this is my eighth year at Lanier. If we're really going to try to put a floor under the students, then the students have to agree to take math every day on a block schedule for their four years of high school. Now, that raises issues. One of the issues is that the classes have to be smaller. You have to have more teachers, so we try to raise [the funds for] our own salaries. We finally worked out with the school system that we are extra resources in the school so we can have fewer students; this also lightens the student load some for other teachers. We have a total of six classes between the three of us, and we have a common period off every day, the same period so we can sit and talk about what the issues are and do the professional development work among ourselves.



Rober Moses in the classroom.

Cary: That's why we're trying to create small schools here in Oakland. We're trying to create those conditions that you're describing.

Moses: The other question, of course, is getting the students to agree to take math every day for four years. We have roughly eighty sophomores that have agreed to stay on with us from a cohort of about a hundred freshmen. The question is, will we get a significant percent of them to agree to keep doing math every day? The goal is that they finish four years of college prep math - this enables them to be credible on either the ACT or SAT. Then they have the option to go to college, and once they get into college they won't have to remediate math. Then math shouldn't be an obstacle for any particular area that they want to study. The whole college curriculum should be open to them and math shouldn't be a barrier. The students we are trying to put the floor under really will have to agree to do math every day. This raises the question of what is taught and how do you teach it so

RELATED RESOURCE

For more on the Algebra Project and its related efforts, including the Young Peoples Project and the Southern Initiative of the Algebra Project: the Algebra Project web site at www.algebra.org

RELATED RESOURCE

Horace 18.2, book review of *Radical Equations: Math Literacy and Civil Rights,*

www.essentialschools.org/cs/resources/view/ces_res/276

RELATED RESOURCE

For more on the work of experiential learning theorists John Dewey, Jean Piaget, and Karl Lewin as analyzed by David Kolb: www.learningfromexperience.com

that they want to keep studying. Those are things that we are wrestling with.

Cary: What are some of the practices that you're employing to motivate students to want to keep learning mathematics and feel comfortable and supported so they hang in there?

Moses: I think that what we are working on is a synthesis of two research traditions that have come down in this country. One is well known: experiential learning, coming through Piaget, Dewey, and Lewin. The other is a question I ran into as a graduate student: what is evidence for math? We ask students to accept a lot of things. So what kind of evidence do we offer? What are they pursuing to accept various statements? The person from whom I really picked up these issues and questions and framing of the discussion was [Willard Van Orman] Quine, the head of the philosophy department at Harvard when I was there in the '50s and again in the late '70s. Quine synthesizes one path in this research tradition that says that initial forays into elementary math come through a progressive sharpening of ordinary language. We've embedded that concept in the experiential learning model, welding these two research traditions together. In experiential learning, when there's reflection about some event or activity, there's a conceptualization of it. That's where our real work is, to look at how to substantiate those two traditions in classrooms. There are a lot of activities that the students do and then ways in which they're asked to reflect on them and think about them.

Cary: When I think about that, I think of how there's a lot of research on the notion of cultural competency that teachers need to have in order to meet their students where they are. I wonder about this in relationship to the work that you do. You are largely African American instructors working with African American kids; there's a certain cultural competence that you're bringing into the discourse, I'm assuming.

Moses: Another cultural issue is, and this is apart from content and pedagogy, the willingness to be relational with the students. How that's done and how it's not exploited by the students to just have everything disintegrate into talk and mere frittering away is one of the key issues in classroom management. For many African American students from grassroots or poor neighborhoods, their schools feel like everything has to be disciplined and rigid. Otherwise it will break down into chaos. And so there's a lot of "drill and kill" going on. How do students who have been exposed to that take to loosening up the classroom and figuring out how to work? That is the issue for which you want to gain real competence and understanding and respect.

RELATED RESOURCE

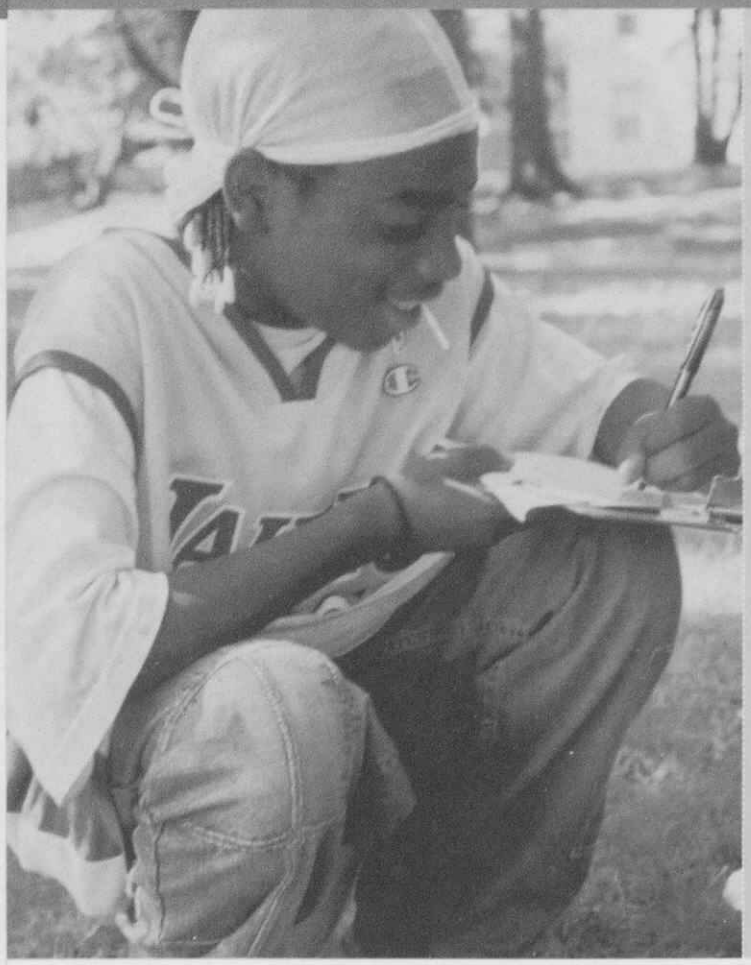
For more on the work of Willard Van Orman Quine: the Willard Van Orman Quine home page at www.wvquine.org

Victor Cary of the Bay Area Coalition of Equitable Schools

We have a group of over-age ninth graders that we agreed to take this year. As middle school students, the system didn't know what to do with them, and it piled up a whole bunch of them. And then after they reached a certain age, it just pushed them on into high school. We at the Algebra Project agreed to take the group that was coming to Lanier this year. It's been really instructive watching them begin to figure out how to work together as a class to commit more and more to their learning, to gain confidence that they really can learn this stuff as they work through levels of various issues - anger, pregnancy, whatever. It's something we're trying to learn about. I think that the country needs to put real resources into this combination: students making a commitment to doing this every day for a longer period of time and the system making a commitment to providing more teachers with less dense class ratios, to having the teachers really professionalize their work and take more responsibility for the creation and the deployment of materials. We need to be able to say that if we do this and this, then these are the kinds of results we can get, and this is what it costs.

Cary: It's a hard argument to make.

Moses: You can't make it in the abstract. It'll only work if there are places where it's actually happening and you can demonstrate some of the results. And one result is that it begins to work the demand side of the problem and you begin to create demand. h



New Mission High School's Response to the Challenge of Designing and Supporting a Meaningful Mathematics Curriculum

by Roser Giné

New Mission High School student Jarred Valeck collects data for an urban ecology project

Roser Giné and her New Mission High School colleagues have experienced the challenges and rewards of designing the mathematics curriculum for their recently founded, small, student-centered school. Based on a 2003 Fall Forum workshop led by Giné and New Mission teacher Stephen Cirasuolo, this article documents New Mission's process of creating a challenging, meaningful, standards-based mathematics curriculum, offering compelling advice, curriculum examples and resources to educators and other new or redesigning schools. As well, Giné details the essential questions, mathematical elements, and habits of mind that form the foundation for New Mission's evolving mathematics curriculum framework.

The Evolution of the Mathematics Curriculum

One of the major tasks teachers take on at New Mission High School (NMHS) is creating the curriculum. When I first arrived at the school in 1998, the mathematics curriculum did not yet exist, and the four math teachers had complete freedom to establish what we thought was important for our students to learn. We wrote an essential question, and taught integrated mathematics through classroom projects and activities that would help students develop tools they needed to respond to that question.

Established in 1997, New Mission High School is a small, urban public high school in Boston, Massachusetts that serves approximately 220 students. The school is culturally diverse, mainly serving African-American, Latin-American, Cape Verdean, and Hatian-American students, along with a smaller number of Asian-American and Caucasian students. More than 80% qualify for the federally funded Free and Reduced Lunch Programs.

The school's mission is to empower students to become self-directed, life-long learners by providing them with a creative and challenging high school education in a small, personalized learning community. To provide a supportive setting for our students, the students are divided into four clusters in which four teachers from different disciplines and one student support staff member work. Each cluster is further divided into four "advisories" of fifteen students and one teacher who provides academic and personal support.

New Mission High School Mathematics/Science Faculty

Foundations Integrated Math/Science: Stephen Cirasuolo and Elizabeth Chartier

Inquiry Integrated Math/Science: Heather Cabrera and Abby Paske

Midlevel Math: Gina Higgins, Javier Bastos, and Roser Giné

Graduate Math: Roser Giné

At the time, we only had two different grades, so we made the material accessible at two levels. But several problems were evident. First, we had not created a four-year plan, and when our school changed to accommodate four levels, the mathematics curriculum needed adjustment. Second, we had not established the graduation requirements for our students; this was crucial, as we wanted to build the curriculum by planning backwards, with clear goals and expectations. Third, in order for a curriculum to stand on its own, it must address what students need to learn; teachers needed to be informed of the national and state standards, as well as what other established mathematics curricula and educational research considered important. Additionally, we had to address problems specific to NMHS. These included very fast teacher turnover (especially in our mathematics staff), our students' varying levels of preparation, our interest in integrating different disciplines, and the challenge of balancing the depth of the mathematics curriculum with the breadth of the state mandated test.

Along with other teachers, I took on the challenge of creating a mathematics curriculum framework for our school. The framework was organized around the following questions: "What do we want our students to know and understand when they graduate from New Mission High School? Why?" After consulting other teachers and mathematics professors, as well as reviewing existing mathematics initiatives, we wrote four essential questions (they continue to evolve) that would guide the mathematics teaching and would be addressed through the four-year student experience at the school.

At each grade level, students would work towards answering these questions through the development of outlined quantitative skills and habits of mind, and through exposure to relevant topics. In order to support this hierarchy, projects (which we call vehicles) and activities were designed for use in the classrooms. As student portfolios evolved into living documents exhibiting students' progress and learning, I wrote portfolio strands that would reflect what I believed were the essential elements of our curriculum: a mathematical model, a mathematical proof, and a problem-solving strand. At this point, the framework was in progress, but still needed feedback and input from the teachers that would bring it to life.

Challenges still remained, including making a non-text based mathematics framework accessible to new teachers, getting feedback from other teachers, and making appropriate revisions, ensuring compatibility with national standards, providing academic support and test preparation for the MCAS (the Massachusetts Comprehensive Assessment System, our state test), integrating with other curricula, and putting the framework to use. The NMHS Science Coordinator and I were assigned as leaders in a new initiative supported by the Center for Collaborative Education in Boston, the Systemic Initiative for Math and Science Education (SIMSE), that would provide us with time and resources to realize our integration goals and to support our new teachers in working with the established framework; a mathematics coach was assigned to our school for the SIMSE work. As the Mathematics Curriculum Coordinator, I worked with the other three math teachers to make necessary changes, review national standards, and facilitate implementation. The school also gathered several teach-

New Mission High School Habits of Mind

Perspective: considering multiple perspectives/viewpoints

Evidence: citing and weighing evidence

Relevance: finding value both personally and socially

Reflection: rethinking, self-assessing, and self-adjusting for improvement

Connection: seeking relationships among ideas

Supposition: imagining possibilities