



Reaching Students from Many Cultures

More and more students in U.S. classrooms come from families where little or no English is spoken. They represent demographic trends that are making the country more multicultural every year. Their presence creates real challenges for teachers and administrators, some of whom never planned to work with bilingual or limited-English-proficiency (LEP) students.

Fortunately, these teachers and administrators can turn for help to the Multifunctional Resource Center for Bilingual at the University of Wisconsin-Madison.

One of 16 MRCs nationwide, the MRC at UW-Madison serves Iowa, Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin. Teachers in these states are looking up from their desks to see the smiling faces of Native American, Southeast Asian, Arabic, and Central American children.

Working with these teachers are members of MRC's training staff, who practically live on the road—or, more accurately, in the air. Flying from state to state, MRC trainers advise teachers of bilingual and LEP students, and teachers of "mainstream" classes, which have only a few such students.

MRC director Minerva Coyne takes requests for workshops and matches the talents of her staff to the needs of each client school district. Each trainer has a unique mix of specialties to offer: Kristina Sargeant, for example, helps teachers adopt new ESL techniques such as cooperative



Art courtesy of Iowa Dept. of Education

learning and hands-on learning; field representative Cathy Reischl, who has worked in the Detroit/Dearborn area for the past six years, works primarily with "mainstream" teachers who have only a few bilingual students in their classrooms; and Minnesota field representative Mary Diaz specializes in second language acquisition, program development, and content area instruction.

All MRC trainers, in turn, receive ongoing professional training and education in semiannual workshops.

A growing need

Teachers want to know how to assess student progress, especially with more emphasis on outcome-based education. They also want to know how to work effectively with increasing numbers of minority students,

while facing budget cutbacks and a lack of sufficient materials.

Mainstream class teachers seek training in cultural sensitivity, second language acquisition, and non-traditional teaching methods. They want to know how to bring bilingual and LEP students into their mainstream classrooms.

The major concern Reischl hears from mainstream teachers is, "Nobody told me there would be this many bilingual and LEP students, and I didn't think they would stay around."

Sargeant says teachers of bilingual students want to know how to teach subject content along with language instruction, and they're hungry for new teaching materials.

MRC staff help teachers develop meaningful ways to discuss foreign cultures in class, an increasingly important activity. "Teachers are responsible for teaching students about many cultures," says MRC trainer Neysa Chaparro, "because children will be exposed to people from different cultures as they mature and go out into the world. The U.S. is becoming more multicultural all the time. A teacher's failure to expose students to other cultures is a disservice."

Chaparro encourages younger teachers to adopt new techniques without fearing that there may be a single, "correct" method of teaching. She assures teachers that a child's language limitation does not necessarily limit learning.

The biggest challenge Chaparro

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faces is convincing mainstream teachers to learn everything they can about LEP students' home cultures. "When teachers work within their students' ethnic sensibilities, they make them feel more comfortable and they facilitate learning," she says. "The most effective teachers learn about their students' home cultures, and they teach those students about the foreign classroom culture they find themselves in."

Field representative Mary Diaz points out the increasing need for such understanding. The population of one small Minnesota farm town is projected to soon be 25% Laotian, something the little town never expected. How will the schools work with those children?

"Large urban areas have been dealing with multicultural education for decades," Diaz says, "but small towns are just now facing the problem for the first time. They're just now joining the 20th century in terms of learning to deal with minority populations."

Professional workshops

Early this summer, teachers in the Dearborn (MI) School District prepared a summer academic enrichment program for LEP and bilingual students. MRC trainers Scott Jones and Kristina Sargeant were there to guide them. District resource teacher Maura Sedgeman says the teachers found Jones and Sargeant easy to work with because they modified their teaching approaches when necessary to reach their 17 K-12 teacher trainees most effectively.

Workshops such as this one are funded by the U.S. Department of Education through the Office of Bilingual Education and Minority Languages Affairs. They can include teachers from one school district or from an entire state region, and involve as few as six

participants or as many as 100. In each case, the MRC trainer and the client group determine the agenda together. "Sometimes the client can articulate the goal without knowing how to get there," says Sargeant. "That's where I can help."

With her expertise in computer-



Trainers Neysa Chaparro and Kristina Sargeant

related technology, Chaparro helps clients preview and use software and laser discs geared toward LEP and bilingual teaching. Chaparro includes lots of hands-on experiences. "I sit them down at computers and show them how to work comfortably with the software they have, and how to evaluate new software." She suggests ways for teachers to integrate software into their lesson plans, and encourages them to make the changes soon, while still enthusiastic. After the workshop is over, Chaparro peri-


odically calls to ask how the teachers are doing with their new material.

Diaz enjoys working with mainstream teachers because "it's like watching light bulbs turn on. They say, 'Yes, I've had that happen in my classroom.'" Diaz watches teachers become introspective as discussions bring out 'taboo' topics and express their private feelings about their bilingual students.

Single workshops can last from a couple of hours to a full day. A series of sessions may span several months. School districts in Iowa, for example, recently presented MRC a wish list of 30 workshops for the 1993-94 school year. Through such extended workshops, Jones watches teachers apply what they've learned. In return, they let him know what has worked for them and what has not.

Sargeant says measuring the results of her work can be difficult. Some changes are not directly observable, such as a change in a teacher's perspective. She says her job is to inspire teachers to question themselves about what they're doing, to get them into the habit of self-analysis. The evaluation forms Diaz sees are helpful, but she judges the effectiveness of her work best by observing teachers over time. Like Sargeant, she judges her success not only by the degree of enthusiasm she's able to generate, but by the changes in institutional practices that are made.

Diaz sees her work as nothing less than opening the students' futures. "The key to their success is their education," she says. Chaparro sums up the collaboration effort when she says, "Teachers succeed when they adopt the attitude that learning about the students' ethnic cultures can be enjoyable and useful."

For more information about bilingual, LEP, and ESL programs, write to MRC at 1025 W. Johnson St., Suite 770, Madison, WI 53706. 

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A Personal Narrative

I avoided mathematics courses in high school, choosing to take only the basic requirements: general and consumer math. Because of high science placement test scores, I was tracked into biology, chemistry, and physics. However, lacking the math skills needed for chemistry and physics, I barely maintained passing grades. I didn't struggle in these courses, I simply reconciled myself to the fact that I couldn't do math and didn't try. Some would say I was definitely an underachiever mathematically.

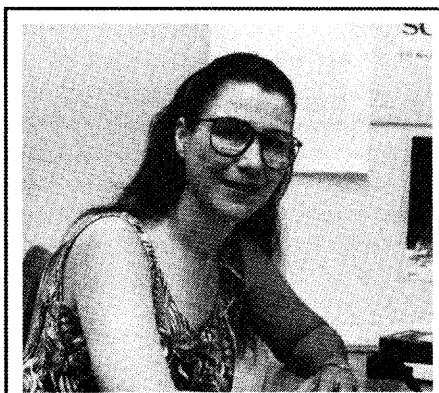
Why did I feel as I did about math? What was it about my childhood that led me first to devalue math, as I'm certain that I did, and later to think of myself as mathematically incompetent?

My family was very poor. Mamma and Papa homesteaded a small island 15 years before my birth. On this island, they reared five children, two girls and three boys. I was the youngest. In the summer Papa worked odd jobs, and during the winter he trapped. Mamma didn't work a paid job, but she worked—carrying drinking water, washing clothes by hand, and gardening.

Domestic violence and neglect had limited my father's education to finishing fourth grade. He had been born on the Chippewa St. Croix Reservation in Wisconsin. After his mother's death, he was taken to an orphanage in Chicago and was adopted by a cruel woman. When he was 10, Papa ran away and lived on the streets of Chicago until he moved, at age 19, to what was to become our island home. Mamma was Swedish and also an abused orphan. Mamma escaped her abuse by marrying Papa at 16 and moving to the island.

What does this have to do with my low math achievement? Everything. I remember watching Papa struggle to complete computations and then seeing him hand the paper to Mamma

saying, "Ruth, check it." From early on, I knew that Mamma was better at math than Papa—she knew her times tables and long division. But Mamma believed that she was mathematically incompetent. However, she and Papa both valued reading. Evenings were spent reading books aloud, and Mamma loved to write.



Judith Hankes felt the sting of racism.

My childhood wasn't entirely devoid of math. My brothers and I were financial entrepreneurs. We speared carp and sold them to the old black men fishing across from our island. We caught worms, crabs, and helgramites and sold them for bait at a gas station. We planted seeds and sold the flowers, baked cookies and sold them door to door.

For young children, our arithmetic skills were incredible. We learned very early how to make an honest profit from an investment—Mamma and Papa taught us to be honest, never to steal, and never to accept charity. Poverty taught us to be self-sufficient problem solvers.

Our rich situated learning experiences should have prepared us to become successful mathematicians. However, something broke down—our formal education. Being labeled

"river rats" and "half-breed trash" prompted my older sister and two brothers to drop out of high school. My youngest brother and I graduated, but my graduation seemed to have happened *to* me, as though I had nothing to do with it. School was a place where I had to be tough, ready to fight when someone teased. I was never part of the system, and mathematics wasn't important to me because the system wasn't important.

Even now, deep down I feel the same. I feel that I understand how poverty impacts on math performance. More often than not, today's children of poverty have parents, like mine, who are alienated from the system, and their alienation influences the level of math assistance and support they are capable of giving. They are not inferior parents; poverty has marginalized them for so long that it has structured their thinking. Their children are not cognitively inferior; their experiences are drastically different from middle class children whose parents have internalized a belief in "manifest destiny."

Even today I feel incompetent with linear computation yet competent with spatial skills. My family culture simply involved me with one rather than the other: following Papa's map to find where traps had been set was expected; building tree huts with pulley systems to lower or raise oneself was play; hiking far into unfamiliar woods and finding the way back was challenging.

My unique family culture was incredibly rich with positive learning experiences. I fear that the majority of children in poverty today are not as fortunate. However, the unique lived experiences of these children must be valued. Instruction must be built on these experiences so children learn to appreciate and understand their respective cultures and, in turn, to appreciate and understand themselves. ■

About the author

Judith Hankes is a graduate student in mathematics education at UW-Madison and works for the Cognitively Guided Instruction project at WCER. Hankes wrote this narrative as part of a much longer paper titled *A Call for Collaborative Research to Investigate the "Indian Math Problem."*

Teachers Combine Practice with Research

Researchers at WCER work with classroom teachers at all phases of their professional careers. Some have many years of experience, others are teachers in training. But they're all developing better ways of educating children in U.S. classrooms.

To paint a complete portrait of all the teacher/researcher collaborative projects at WCER would require more canvas than is available here, so here's a representative sample.

New assessments

WCER researchers are borrowing the talents of experienced teachers in Wisconsin classrooms to design new methods of assessing student achievement. WCER's Performance Assessment Development Project, part of the Wisconsin Department of Public Instruction's Student Assessment System, is creating new ways to measure students' attainment of curricular goals over several years.

Participating are about a dozen teachers in each content area of language arts, science, and mathematics. Researcher Patricia Garber says that teachers are indispensable for the assessment project. "Teachers know their kids and what they're interested in," she says, "and they help us design the assessment so that the kids will really be motivated to perform."

The teachers also learn to develop and administer assessments that will be more valuable instructionally than paper-and-pencil short answer tests, says project director Norman Webb.

The assessment instruments challenge students with complex, open-ended tasks. They mirror normal classroom instruction and real-world experiences. For example, one language arts assessment task requires students to develop an advertising campaign. "What we do is, I believe, unique in the country," says Garber. "This assessment requires students to speak, argue, and debate, and create products and then critique them. The students are part of their assessment, and they reflect on their own learning."

Teachers met with researchers several times during the course of the 1992-93 school year to design assessments for students in grades 8 and 10. In the design process, they helped researchers consider what content should be included and how to compose an assessment. The teachers then piloted the assessments in their classrooms, which are home to many student populations, including the learning disabled and those living in inner cities and on reservations.

At the conclusion of a week-long assessment workshop in August, one teacher said, "This has been a super experience. I feel very fortunate to have been selected to participate." Another remarked, "It was exciting to work with so many *thinking* people. The institute really helped me grow." A third said, "I have learned so much about assessment at this institute. When I return to my classroom, I will look at all tasks and problems in a different light."

(For news about a related project, see page 6.)

Learning math with children

"Cognitively Guided Instruction is a philosophy versus a recipe," says elementary teacher Mazie Jenkins. "You as a teacher have to take the knowledge that CGI is about problem types, about solution strategies, and about how children develop cognitively, and you have to apply that to your own teaching style."

Cognitively Guided Instruction (CGI) research studies how elementary teachers, often very experienced, alter their knowledge, beliefs, and their instruction, when they have access to a structured, coherent body of knowledge about children's thinking in mathematics.

"Many of the teachers changed dramatically during the year we worked with them," says CGI co-director and education professor Elizabeth Fennema. At first, the teachers did not really assess children's understanding of mathematics, nor did they plan instruction to extend the children's knowledge. But gradually the teachers began to listen to all of

their children and they began to give students time to explain their solutions. They began to act on the basis of what they knew about their students.

In a typical CGI exercise, a teacher asked her students to add 15 to 85, then asked them to explain their methods. One student said, "85 is eight 10s and a five. Fifteen is one ten and a five. Add eight 10s and one 10, that's 90. Add the two fives, that's 10. So 90 plus 10 equals 100."

The CGI teacher praised the student's reasoning and asked for alternative methods. One student's suggestion was, "Break 15 into five and 10. Then add five to 85 to get 90. Then add 10 to 90 to get 100." The teacher agreed that this method worked as well and asked for yet another proposal. A third student's method was, "Start with 85, then count up 15."

One CGI teacher commented, "I am so much more aware of what the kids can really do. . . . Before, I would never have thought about first-graders trying multiplication and division." She and other CGI teachers begin to see that their students are capable of more than they had anticipated, and that they, the teachers, do not have to explain everything.

But teachers aren't the only ones who benefit. Researchers learn how teachers structure their classrooms so that children learn mathematics with understanding. And the children in CGI classrooms become more flexible in their choice of solution strategies and increase their fluency in reporting their mathematical thinking.

Researching their own teaching

A young middle school teacher who participated in a training program designed by WCER researchers Mary Louise Gomez and B. Robert Tabachnick shares an experience that occurred during her training.

"One second-grade boy was a behavior problem. I learned that the boy's father had died and his mother was in and out of jail. The boy had

to take care of three siblings. He often came to class upset and would act out his frustrations. It got progressively worse. One day he ran around and I couldn't stop him. So we sat down together and designed a behavior improvement contract, and we both signed it. I let him specify the behaviors he wanted to improve, and I let him choose a reward for succeeding. He lived up to the contract, so he got his wish. We went together to a Muppets movie and then we ate at McDonald's." Brenda had participated in the teacher education component of Partners in Improving Children's Achievement (PICA). PICA helps young teachers like Brenda research their own teaching and respond better to the unmet

educational needs of growing numbers of diverse student populations. "Through field experiences, course work, and seminars a pluralist perspective is emphasized, one that honors the power and possibilities of all people's backgrounds," says Gomez.

Brenda's cohort of eight student teachers kept daily logs of classroom experiences and they observed each other in action. They met weekly to critique and support each other. Brenda recalls her PICA training with appreciation. "The biggest benefit for me was learning strategies for dealing with behavior problems in class," Brenda says. "Some of the kids 'act out' in class, but I learned it's not necessarily because they're angry with the teacher."

Teachers in the PICA cohort share their personal narratives of classroom life as a way to understand their teaching practice, explains Gomez. Through story telling, they take more control of their own development as teachers. "The discipline of forming a story helps students to make their tacit theories of teaching more explicit and helps them examine their assumptions more closely," says Gomez. As they tell their stories the teachers perceive their experience first as an insider, and then as an outsider.

For more information about PICA, the student assessment project, or Cognitively Guided Instruction, write to the researchers at WCER. ☐

Awards and Accolades

A WCER researcher and a WCER communications director have won recognition for outstanding work.

The National Council of Teachers of Mathematics (NCTM) has named Thomas Romberg to chair its new assessment task force. Romberg is Sears Roebuck-Bascom Professor in Education at UW—Madison.

Assessment Standards for School Mathematics will join NCTM's publications *Professional Teaching Standards* and *Curriculum and Evaluation Standards*, the latter also developed by a task force chaired by Romberg.

Working groups on principles of assessment, classroom assessment, and external assessment (policy, program evaluation, placement of students) developed draft principles and standards this summer. The drafts will be reviewed before revision next summer.

Romberg and the WCER-based staff—Linda Wilson, Marvin Smith, and Kathleen Steele—organized the

three working groups and are overseeing the development of the principles and standards. WCER researcher Norman Webb is a consultant to the working groups.

Funds for the working groups and for meetings of participants are provided by NCTM, which will publish the *Assessment Standards* during

of the American Educational Research Association (AERA).

The award is given to individuals who relate research to practice by publishing in nonresearch publications.

The award was announced at the 1993 AREA convention in Atlanta. AERA established the award to stimulate and recognize

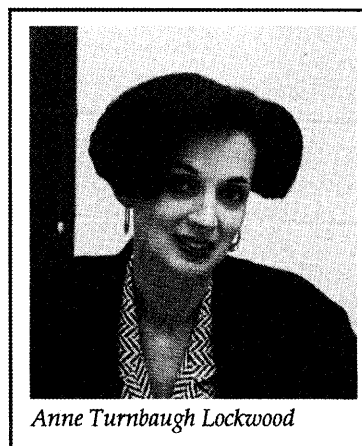
outstanding contributions by individuals to increasing practitioner and lay group understanding of the contributions of educational research to the improvement of educational practice.

Lockwood won for the educational writing that she does for publications she created at the NCES, which is housed

within WCER. The publications, a quarterly entitled *Focus in Change* and a biannual publication entitled *Research and the Classroom*, have a national circulation of about 16,000 school administrators, curriculum coordinators, teachers, and educational organizations. ☐



Thomas A. Romberg



Anne Turnbaugh Lockwood

the 1994-95 academic year. The award to WCER is \$111,550 for the period June 1, 1993 to Dec. 31, 1994.

Anne Turnbaugh Lockwood, Communications Director for the National Center for Effective Schools (NCES), has been awarded the Interpretive Scholarship Award

Assessing Students with Disabilities

Students with disabilities face more challenges in school than most kids do. When they're called on to participate in large-scale, on-demand performance assessment tasks, they may face yet more hurdles.

Unlike traditional tests that ask students to simply select from multiple choices, performance assessment tasks require them to create a complex answer or product that demonstrates their knowledge or skills. Students may be asked to conduct an experiment, write an extended essay, or do mathematical computations, tasks that resemble those commonly required for functioning in the world outside of school.

But nobody knows exactly how students with disabilities (whether language/speech, learning, physical, or emotional) will fare on assessment tasks. It's an important question for psychologists and educators. Intent on finding the answer are WCER researchers Stephen Elliott and Thomas Kratochwill. Elliott is Professor of Educational Psychology and a Vilas Associate at the University of Wisconsin-Madison. Kratochwill is Professor of Educational Psychology, Director of the department's School Psychology Program, and Affiliate Professor, Department of Psychiatry.

Their study dovetails with an assessment development project headed by WCER researcher Norman Webb (see p. 4), which in turn is part of the Wisconsin Department of Public Instruction's Wisconsin Student Assessment System (WSAS). The performance assessment instruments are developed by a group of master teachers from around Wisconsin working with WSAS project personnel. "By working within the WSAS, we're able to complete our study at about a tenth of the cost of

starting it from scratch," Elliott says. "And our study of students with disabilities adds value to the WSAS."

The results of the Kratochwill/Elliott study have the potential to influence both *policies* about inclusion of students with disabilities in statewide performance assessments and *practices*, that is to say, scoring standards, feedback methods, and the structure of assessment tasks.

Kratochwill says that there's a de-

velopment literature on performance assessments with minority students, some of whom may be considered to be at risk educationally, but there is no published research on the use and effects of performance assessment on students identified as disabled.

veloping literature on performance assessments with minority students, some of whom may be considered to be at risk educationally, but there is no published research on the use and effects of performance assessment on students identified as disabled.

While all students should be included in statewide and national programs of assessment, Kratochwill says, 40% to 50% of school-age students with disabilities are excluded, and for several reasons: schools waive them out, some students request not to be involved due to their disability, and parents and teachers want students to avoid another "failure experience."

The Elliott/Kratochwill study, funded by the U.S. Department of Education, will attempt to determine whether and why there are discrepancies between performance assessment results and traditional test results. "We hope our study will advance both empirical and practical knowledge about performance as-


sessments, particularly for students with disabilities," Kratochwill says. Elliott and Kratochwill expect the children participating in their assessment study to perform with different levels of success, depending on the kind of disability. Elliott says there may be some surprises, because the study sails on previously uncharted waters. But he's optimistic that the knowledge produced by the study will result in more inclusive assessment practices.

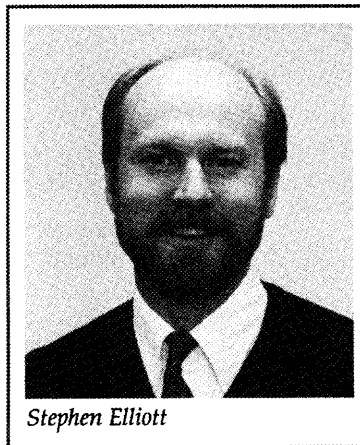
"The outcomes of the assessment will be greater than just some more numbers," Elliott says. "Students will benefit from participating in the project. They should learn something about their own math and language arts skills, and they can provide input into the development of assessments that may be more 'user-friendly' to others with disabilities. And there is no cost to the schools for participating, either in

funds or in status related to outcomes."

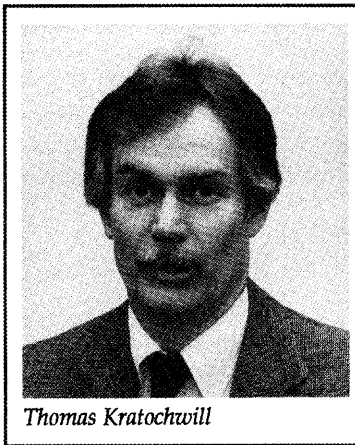
Elliott and Kratochwill intend for their research to enable more students with disabilities to participate in the statewide assessment program. This is important for three reasons: their participation provides for a more accurate measure of how *all* students are performing in the system; assessment programs are part of a "normalization" experience; and if they don't participate, adaptations to assessment methods will not be hastened.

The study should also help establish a set of performance assessment administration "guidelines" for students with disabilities. The information will help shape an agenda for future research on variables that students and teachers believe influence functioning on performance assessment tasks.

For more information, contact Elliott and Kratochwill in care of WCER. 



Stephen Elliott



Thomas Kratochwill

New Books by WCER Researchers

Concerns for equity in mathematics education, the dissemination of mathematics instructional materials, and opportunities for using technology in graphing mathematical functions are among the topics being explored in three new books by WCER researchers.

New Directions in Equity for Mathematics Education argues that opportunity is unequally distributed in our society, and education and mathematics play a role in that stratification. Mathematics reform should include the creation of a fairer social order as a legitimate goal, argue its editors, Walter G. Secada, Elizabeth Fennema, and Lisa Byrd.

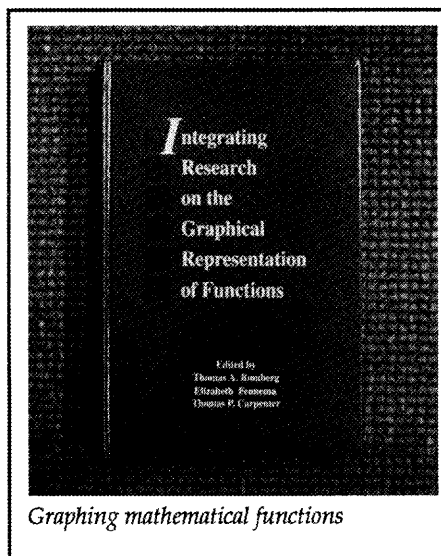
Prepared at the National Center for Research in Mathematical Sciences Education in WCER, the book address a wide range of cultural issues in its 14 chapters. Three chapters report on projects designed to enhance student experiences in mathematics. Three show how mathematics instruction can involve social and cultural analyses, and four chapters address issues of gender equity in mathematics education. Two chapters examine bilingual students and mathematics, while others look closely at teachers, teaching, and classroom dynamics.

Edward Silver and Barbara Scott Nelson describe the QUASAR Project, which aims to foster the development and implementation of mathematics instructional programs for students attending middle schools in economically disadvantaged communities. "The students targeted for this study are important," the authors say, "because demographic trends predict that we will see in coming decades an increasingly large proportion of our society made of persons who are the least well served by the current educational system: racial and ethnic minorities and the poor."

Gloria Ladson-Billings writes that educators have too long assumed that success in mathematics is limited to certain select students. If education maintains its social reproductive function, she says, we will

continue to experience huge differences between the haves and the have nots.

Gender differences in mathematics learning often reflect prevailing circumstances rather than indicate absolute differences between females and males, argues Gilah C. Leder. Success in attracting females to mathematics courses is achieved not by making special allowances or provisions for females, nor by dwelling on gender issues, she says, but by creating classrooms supportive for all students.



Graphing mathematical functions

Materials developed for nine mathematics projects funded by the Instructional Materials Development Program of the National Science Foundation (NSF) from 1981 to 1991 are being used by teachers, influencing the content of textbooks, and serving as models of good practice long after the funds that underwrote their development have been expended.

This is the conclusion drawn from a recent study conducted by Norman L. Webb, Harold Schoen, and Sharon D. Whitehurst. Their report, *Dissemination of Nine Precollege Mathematics Instructional Materials Projects Funded by the National Science Foundation, 1981-91*, shows that thousands of teachers have been trained to use the materials that were pro-

duced by the NSF-funded mathematics projects.

All the projects produced units or modules that could be used to supplement existing materials, and rising sales figures for some of the materials suggest that the number of teachers who are using the materials will continue to grow.

"Most of the projects attempt to narrow the achievement gaps that exist between demographic and socioeconomic groups," Webb says. "These gaps traditionally separate male and female students and minority and nonminority students."

The mathematics projects embrace a range of targeted age groups, content areas, and approaches. Three of the projects prepared materials for the elementary grades, four prepared materials for the middle and beginning high school grades, and two prepared materials for students in senior high school.

Some of the innovative approaches and materials the projects developed have been emulated in new textbooks and curricula. For example, materials developed for the Middle Grades Mathematics Project were being used by as many as 11,400 teachers and 1,140,000 students in 1991, and at least three million students have used the materials since 1988.

With one exception, the materials developed have generally been distributed and used throughout the country, and several of the products have been sold in all 50 states.

These projects have created an increasingly large community of curriculum experts who are available for future research and development projects.

The increasing use of graphing calculators and computers in classrooms has changed forever the way mathematical functions can be represented and manipulated. That change is forcing scholars to reconsider the way functions are used and taught, argues *Integrating Research on the Graphical Representation*

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of *Functions*, edited by Thomas A. Romberg, Elizabeth Fennema, and Thomas P. Carpenter.

Their new book calls the graphical representation of functions an increasingly important mathematical subject. (The function, you'll remember, is one variable related to another so that, for each value assumed by one, a value is determined for the other.)

At the moment, scholars have no common approach to the study of functions and their graphs. They lack an extensive research base about graphing functions because current interest is concerned with modes of representation that were not readily available a few years ago. But technological developments can make important and useful mathematical ideas accessible and interesting to a much broader range of students, the book argues.

Computers and their new representational capacity can bridge the

gap between the rich experience of living and the sterile formalisms that have dominated our approaches to mathematical learning and knowing. With computers and the graphing calculator, the editors say, graphical representations are not only easy to create, but they can be transformed in a variety of ways.

Ongoing WCER publications


WCER research centers offer a rich variety of publications programs. Centers funded by the Office of Educational Research and Improvement have formal dissemination programs.

The National Center for Research in Mathematical Sciences Education (NCRMSE) publishes three issues of its *Research Review* newsletter annually and updates its annotated bibliography twice annually. The bibliography includes publications from other WCER math projects as well as NCRMSE books, journal articles,

and papers. NCRMSE also sells pre-publication reports through WCER's document service and maintains a free-on-request brochure.

The Center on Organization and Restructuring of Schools distributes an *Issue Report* newsletter in the fall and spring, publishes three issues annually of a *Brief*, develops an annual annotated bibliography of publications on the topic of restructuring, maintains an information packet that is available on request, and sells research reports and synthesis documents through the WCER Document Service.

The National Center for Effective Schools (which is not OERI-funded) publishes four issues annually of *Focus in Change* and *Research and the Classroom*. These are mailed to subscribers, both singly and in quantity.

For more information about any of these publications, write to the individual centers in care of WCER. 

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