



WCER Highlights

Wisconsin Center for Education Research
School of Education / University of Wisconsin-Madison

Vol. 5, No. 1
Winter 1993

Project Prepares Task-Oriented Assessments

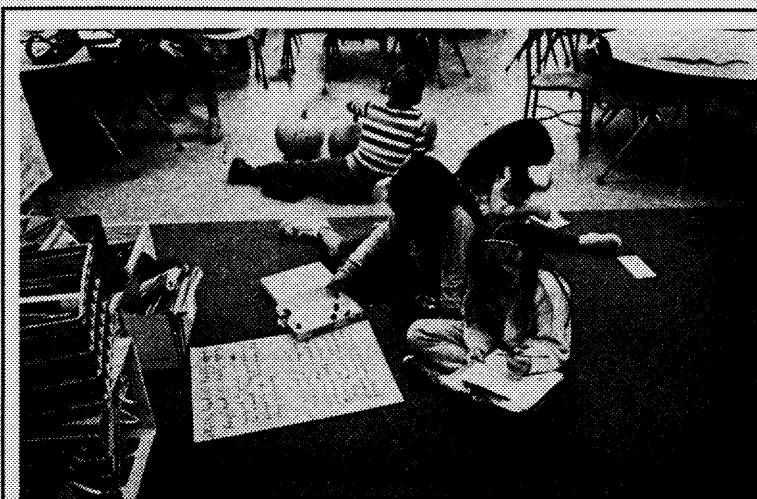
A new project at the WCER is helping Wisconsin tackle the tough issue of student assessment.

The Wisconsin Department of Public Instruction (DPI) has developed the Wisconsin Student Assessment System to systematically assess all of the state's elementary and secondary school students. WCER's Performance Assessment Development Project is working with DPI to develop performance assessment instruments.

The assessment system in general and the performance assessment instruments in particular will try to achieve several objectives: measure students' attainment of certain desired outcomes of schooling, like higher order thinking skills; provide longitudinal assessment of student performance; provide accountability information to policymakers, parents, teachers, students, and the public; provide information that students and parents can use in making decisions about students' academic futures; and provide staff development through teacher participation in assessment development and using rubrics to score task responses.

State Program Unique

According to Darwin Kaufman, director of DPI's Bureau for Student Assessment, the Wisconsin assessment program will be unique for



Performance assessments—to be developed in mathematics, science, language arts, and social studies—will let students demonstrate their attainment of outcomes, including higher order thinking skills.

several reasons: It is a comprehensive approach to assessment that anchors the evaluative effort in the desired curriculum; all students in grades 4, 8 and 10, not just a sample of students, will be assessed; and student attainment will be measured broadly, not just in a few narrow subjects, in four content areas—mathematics, science, language arts, and social studies. It will also be unique because the assessment instruments will require students to actually perform complex tasks.

"Hands-on performance assessment tasks are on the cutting edge of what is going on in schools as far as assessment," Kaufman said.

According to WCER director Andrew Porter, Wisconsin educators are in the midst of likely the most challenging and important curriculum reform effort this century, focusing on hard content for all students.

Assessments must aid curriculum reform with timely and valid information about school inputs, practices and outputs, said Porter. Achievement goals and objectives must be widely shared and widely seen as achievable.

Clear Goals

"Assessment makes education goals clear at a level that teachers, students, and the community can rally around," said Porter. "Currently, Wisconsin has virtually no informa-

tion on how well its education system is serving its students, only a test that is administered to children in third grade. The state has the responsibility to know how well schools are serving all students."

"We are very excited about the assessment program and the relationship with the scholars at WCER," said Kaufman. "The scholars at WCER have the expertise to create these unique forms of assessment instruments."

Norman Webb, a senior scientist at WCER, leads the WCER project that is creating the performance assessment instruments. A director and a team of two or three other scholars will guide the development of the assessment instruments for each of the four content areas.

A joint committee between DPI and WCER has been established to

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coordinate the effort. One purpose of the committee will be to ensure that the new performance assessment instruments meet the needs of the Wisconsin Student Assessment System, said Webb.

Teachers Are Key

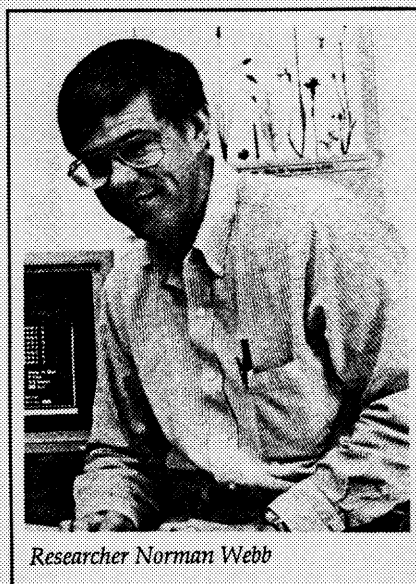
Teachers are participating in the writing of the assessment instruments and find the experience rewarding. One language arts teacher said it was "my best educational experience since I started teaching 21 years ago." A mathematics teacher added, "A wonderful step ahead. It's so good to see these tasks about which we have been so concerned come to fruition."

For each content area, a small group of teachers is writing performance tasks. They work under the guidance of the director and team of scholars for the respective content area. After the task writers complete their work, the assessment instruments will be field tested and scored by another group of teachers.

"By using the teachers as writers, we can take advantage of their expertise about their students and the content area being assessed," said Webb. "Teachers really know the students, their language, and how they think. The teachers can gather feedback on the pilot assessment instruments from students."

Ultimately, these teachers will be available to serve as leaders for assisting other teachers when the assessments are implemented statewide.

Webb explained that the three grades in which students will be assessed were chosen for very specific reasons. Grade 4 was chosen because it is a time when students become less dependent on teachers, he said. Grade 8 was chosen because students are making the transition to high school, and grade 10 is a time when students are making



Researcher Norman Webb

decisions about college, vocational school, or the work force.

Webb said that the development and pilot testing of the instruments for all four content areas and all three grades are expected to take approximately five years in total.

Other Projects

In addition to the Wisconsin Student Assessment System Project, Webb heads other WCER projects. One, Case Studies of United States Innovations in Mathematics Education, is a subcontract with the National Center for Improving Science Education (NCISE).

This project is part of a collaborative effort among the NCISE, the Na-

tional Center for Research in Mathematical Sciences Education (NCRMSE), and the Organization for Economic Cooperation and Development (OECD) to conduct in-depth case study research on major science, mathematics, and technology education innovations in the U.S. The case studies are in turn part of a larger international project working with a majority of the 24 industrialized nations of the OECD.

The detailed case studies will provide information on these innovations to people working to improve mathematics education in the OECD nations, as well as to the education community in general.

Webb is also guiding an evaluation of the Interactive Mathematics Project in California, a new curriculum that was prepared by San Francisco State University and EQUALS, Lawrence Hall of Science at the University of California. It is being used at several California high schools.

The project will attempt to evaluate the influence of the new curriculum on student outcomes and the type of resources and professional development teachers need to implement the new curriculum.

Another project near completion is Dissemination of Instructional Materials in Mathematics for the Pre-College Level: A Report to the Profession. Webb is gathering existing information and data on the impact of

nine current and past projects funded through the Division of Materials Development, Research, and Informal Science Education at the National Science Foundation.

The study will provide profiles on each of the projects that summarize the information provided by the studies and discusses methodology issues in a general report. Project outcomes to be examined include student outcomes, teacher classroom practice and knowledge, and professional acceptance.

For more information, contact Webb at WCER.

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WCER Highlights is published three times a year by the Wisconsin Center for Education Research, School of Education, University of Wisconsin-Madison. WCER is funded through a variety of federal, state and private sources, including the U.S. Department of Education and UW-Madison. The opinions expressed in this publication do not necessarily reflect the position, policy, or endorsement of the funding agencies. Printed at 30 N. Murray St., Madison, Wisconsin. Fourth-class, bulk-rate postage is paid at UW-Madison, Madison, WI. Send changes of address to WCER, UW-Madison School of Education, 1025 West Johnson Street, Madison, Wisconsin 53706 (608) 263-4200. Include the address label from this issue.

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Educator Sees School as Extension of Community

An ancient African proverb says that it takes the whole village to educate the child. We've tried to instill that philosophy here at Lincoln Elementary. We've extended the classroom beyond the school into the community and brought the community into the classroom.

We try to create a refuge at our school that replaces some of what is lacking in students' lives. Home and community are lacking for some of our students in many ways. Basic needs like food and clothing are neglected for some of our children. Others don't get all the medical attention they need, or their parents spend too little time with them.

Parents do value school, but some don't know how to communicate the importance of school to their children. They often send mixed signals and inconsistent messages to their children. For example, they tell their children they should study hard and do well in school, but they allow the children to stay up too late and not get needed rest.

We create a friendly place and give students consistent messages about the importance of learning, and we encourage them.

One way we have been carrying out our philosophy is through participation in the Partners in Improving Children's Achievement (PICA) project. One part of that effort is an after school program created by Zachary Cooper, a historian, lecturer at UW-Madison and former associate director of the PICA project.

The after school program offers fun and educational activities for children twice a week for eight weeks each semester. The activities are available to all of our students who wish to participate. About 50 children attended the first



Lincoln Principal Muriel Simms

after school programs four years ago. Today, about 115 participate.

The program has provided activities like African dance, gymnastics, bead making, biology in a bottle, and photography to the students.

This program has helped to reinforce the good messages about education not all of our students get at home. This reinforcement helps increase children's enthusiasm for school. The after school activities help some of the children's social behavior as well. We've seen some shy children who have attended an after school drama program become more outgoing during the school day.

For some students, parents don't have enough time to spend with them after school because of jobs or other commitments. The program gives them something productive to

do with their after school time.

In addition to reaching out into the community, the program has helped bring the community into the school. Cooper found people in the community who were willing to come into the school and teach many of the activities and share their expertise with our children.

Another project that Cooper launched was Project JAMAD. This project also helped stretch the educational experience beyond the walls of the school. Through it, students studied the connections between the African American culture in Madison and that in Jamaica. The children also had the opportunity to participate in fund raising efforts to try to earn enough money for a trip to Jamaica. Four students were able to raise enough and spent one week on the island, where they studied the culture and visited elementary schools there. This year they will have the chance to visit other schools in Madison and tell them about the Jamaican schools.

Through PICA, Cooper also initiated a lunch program for African-American boys. During the lunch program, Cooper brought in African American men from the community to have lunch with the children and serve as positive role models.

Through projects like these, and thanks to the work of Doretha Brown, our parent liaison, more parents feel comfortable coming into our school. We now have 80 to 90

percent attendance for parent conferences.

The PICA project has had a positive impact, but credit also must go to our teachers and staff. They share the philosophy that a school must be an extension of the community and must be a fun, challenging, friendly, and interesting place for children.

About the Author

Muriel Simms began her career more than 20 years ago as a teacher. This year is her fifth as the principal of Lincoln Elementary School in Madison, WI. Her school is one of the most ethnically and culturally diverse schools in the city. Lincoln Elementary School is paired with another school in the city. Approximately 50 percent of the students from the two schools combined are children of color. She and the teachers at Lincoln have been participating in the Partners in Improving Children's Achievement project at WCER. The project is part of a cooperative effort between the University of Wisconsin-Madison and the school district to increase academic achievement and improve educational opportunities for minority students.

Standard Setting in High School Math

School reformers who fear that increased state high school graduation requirements will result in watered-down course content can ease their worries. A study at WCER found no evidence of such results.

The project, Reform Up Close, set out three years ago to characterize the nature of mathematics and science instruction that high school students received as a result of states increasing standards. It was part of a subcontract with Rutgers University's Consortium for Policy Research in Education, with funding from the National Science Foundation.

The project's principal investigator was Andrew Porter, UW-Madison professor of education and WCER director. Two UW-Madison graduate students, Eric Osthoff and John Smithson, assisted Porter with the research conducted by the WCER team. Porter's team worked with a group from Stanford University led by Michael Kirst.

Porter explained that when states began increasing graduation requirements, some schools began pushing more students to take more advanced science and math courses. A Missouri school, for example, increased enrollments in algebra. A Pennsylvania school increased enrollments in algebra and eliminated basic science and math courses. This push toward increasing enrollment in college preparatory and other more advanced courses was more prevalent for mathematics than science, Porter said.

"Some education scholars wondered if course content would get watered down as more average and below average students enrolled in the more advanced courses,"

said Porter. "However, our data indicate that, in the schools in the states we studied, the content of math and sciences courses was as rigorous after standards were increased."

Data Collection

The team studied 18 schools from six states: Arizona, California, Florida, Missouri, Pennsylvania, and South Carolina. Each of these states had made relatively major increases

the school, and surveys were done of all mathematics and science teachers in each participating high school.

Classroom data were collected by asking teachers to keep daily logs describing the content and pedagogy of instruction and to respond to weekly questionnaires about special instructional activities and professional activities in which they participated. A prelog survey was used to obtain basic demographic information. Teachers were observed at least once teaching the class being studied.

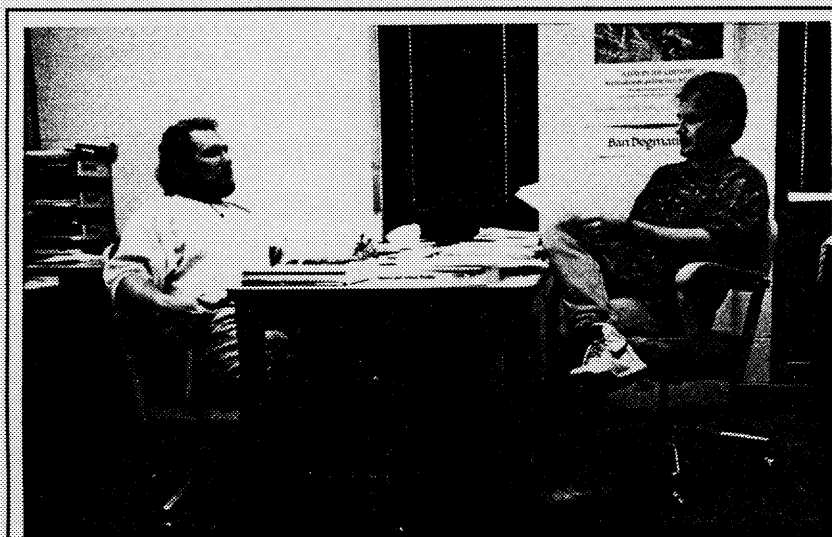
Porter and his colleagues reported that urban districts were more likely than small or rural districts to add their own curriculum control measures to those initiated by the state.

The researchers said that several explanations are possible. First, urban districts have a bigger bureaucracy to use in implementing state initiatives and to add to state initiatives in

ways that are unique to their district. Second, staff members in urban districts are more convinced that change is necessary. Third, there is a greater commitment to classroom level control in urban districts than in rural districts, which may, in turn, be explained by weaker connections between school and community in urban settings.

Mathematics Courses

The researchers found that there are still many basic arithmetic courses being offered in high schools. This is especially true in states where passing a mathematics test is required for graduation. When the researchers examined courses at the 18 schools, they found that course titles were fairly accurate representations of what was being taught.



Researchers John Smithson, left, and Eric Osthoff discuss findings from Reform Up Close.

in their standards for high school mathematics and science.

In each state the researchers studied two schools in a large urban district and one school in a smaller suburban or rural district. In each school, the researchers intensely studied two mathematics and two sciences courses as well as the teachers who taught them.

Data for the study were gathered at four levels. At the state level, interviews were made with key individuals at the state education agency.

At the district level, researchers interviewed assistant superintendents for curriculum, math and science specialists, and testing directors.

School level data came in two forms: Interviews were done with school administrators and teachers to learn of math and science practices in

Mathematics and Science Has Positive Effect

"On the positive side, we found that what was called an algebra class looked pretty much like algebra in both general and college preparation courses," said Porter.

"On the negative side," he continued, "there was little emphasis on the kind of instruction that the NCTM's *Standards* have been calling for." (The National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* have been proposed as a blueprint for reforming math education.)

Porter and his colleagues found that topics such as probability, statistics, and finite math didn't get any significant coverage in any of the courses studied. There was also little emphasis on collecting data, interpreting data, solving problems or doing proofs. The *Standards* recommend that mathematics courses include these types of activities.

According to Porter and his colleagues, if content was affected at all by increased requirements, low-level courses were more likely to be influenced in their coverage than high-level courses. For example, some schools created bridging courses for students to help them move from basic arithmetic courses into algebra. The courses included both basic arithmetic and algebra concepts. Some non-college preparatory courses had been created or revised to focus on the competencies needed by students to pass state-mandated competency tests.

Science Courses

The researchers found that classes were dominated by memorization and understanding of concepts. "Curiously," said Porter, "there is hardly any emphasis on collecting and interpreting data, even in advanced college preparation courses."

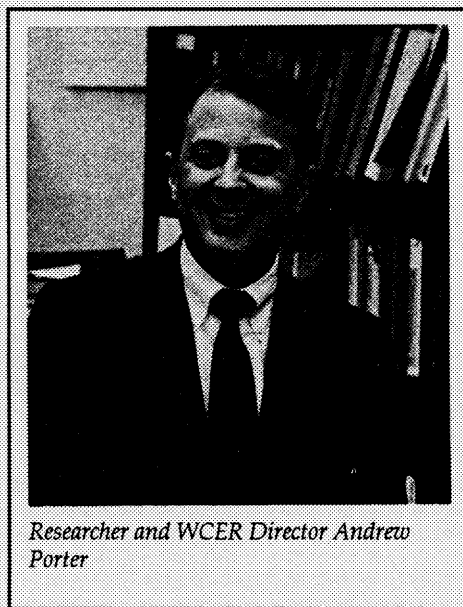
They also found very little laboratory work in biology and other science courses and virtually no field work anywhere.

Porter also commented that increases in high school graduation re-

quirements have been more dramatic and had more dramatic effects in science courses than in mathematics courses, not only in the number of added credits required but also in the amount of laboratory courses called for.

"Increases in the amount of laboratory courses put additional demands on science teachers," said Porter, "because laboratory courses require more preparatory time to set up experiments."

"Inadequate instructional resources are a particularly serious problem in urban areas," Porter said further, "although the problem at the rural Florida school we studied is equal to anything at any of the urban schools."



Researcher and WCER Director Andrew Porter

All of the schools report that they need more and better computers. The researchers said that at one site, even such basic instructional resources as textbooks are in short supply. Most schools need better science laboratory equipment and setup personnel as well, according to the project's report.

"Because of the requirements for more laboratory science courses in some locations, both for graduation and as entry requirements for college, science lab space is a serious problem," said Porter.

Teachers' Reactions

Teachers showed little resistance to the changes. "We saw surprisingly little evidence that teachers were unhappy about or resistant to state and district curriculum standards setting," the researchers' report stated. "To the contrary, there were several reports from teachers that these state and district controls were appropriate and having positive effects."

Complaints given by teachers tended to be of three types: new requirements were too hard for some students; the bureaucracy supporting state and district controls created too much paperwork; and state controls specify what is required, but the state fails to provide necessary resources to meet those requirements.

The researchers found that changes in requirements and standards had not resulted in negative sanctions against any teachers. "Not once did we see or did we hear of an instance when state or district standard setting and curriculum control had, through some accountability mechanism, a serious negative effect on a teacher in the form of dismissal, reassignment or salary," the report stated.

The most notable shortcoming the researchers found was in the area of staff development. "Not one state, not one district, and not one school in our study is doing anything like a good job at staff development . . .," the report states. "Where staff development does occur, it's provided by an 'expert' not at the school and with little knowledge of school need, who provides knowledge that is typically of superficial amount and questionable quality."

Staff development is desperately needed if curriculum reform is to have the intended effect. Porter suggested that teachers would need more release time to think about and discuss practice. Teachers who serve as leaders in the process would need extra release time to keep the development process moving, he added.

For more information, contact the researchers at WCER, 1025 West Johnson Street, Madison, WI 53706.

New Books by WCER Researchers

Assessments, standardized tests, higher order thinking, and authentic instructional discourse are among the topics being explored in two new books published by researchers from WCER.

Mathematics Assessment and Evaluation: Imperatives for Mathematics Educators was prepared by the National Center for Research in Mathematical Sciences Education (NCRMSE). The mission of the center is to create national networks of scholars to work collaboratively on important issues related to achieving reform goals. Thomas Romberg, UW-Madison professor of education and director of the center, edited the volume.

"The work presented in this volume represents important contributions to our growing knowledge about the impact of tests and testing on school mathematics," said Romberg.

In their book, he and his colleagues argue that American schools subject students to a variety of mathematics tests from kindergarten through college. Often these examinations are in the form of standardized tests. Such tests, they said, are widely believed to inhibit change and improvement in education, especially in mathematics education.

If mathematics education in the U.S. is to improve, said Romberg, then tests need to be changed to reflect the new curriculum that reform efforts demand.

This book came about, in part, as a response to the movement for a systematic reform of mathematics education. The first step that led to its publication came in 1986. The Mathematical Sciences Education Board organized a three-person Testing Design Task Force at UCLA to do research on how to improve mathematics tests.

Romberg, Jeremy Kilpatrick, from the University of Georgia's College of Education, and Tej Pandey, from the California Department of Education, served on the task force. They proposed several research studies that would lay the foundation for developing improved assessments.

Among other things, they recommended that several literature reviews be undertaken. The

ways secondary schools could improve the academic achievement of all students, with special attention to the needs of the disadvantaged and less successful students.

The NCESS scholars recently published the results of their research. NCESS director Fred Newmann is lead author for the publication.

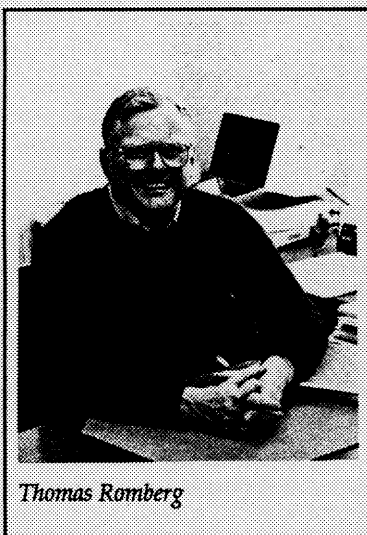
The book presents new findings on the importance of higher order thinking, authentic instructional discourse, special programs for at-risk students, the quality of teachers' worklife, and the influence of parents and peers on students.

The authors provide information about the negative effects of grouping, tracking, and standardized tests. They explore the possible influences of family, part-time employment, and extracurricular activities on student achievement.

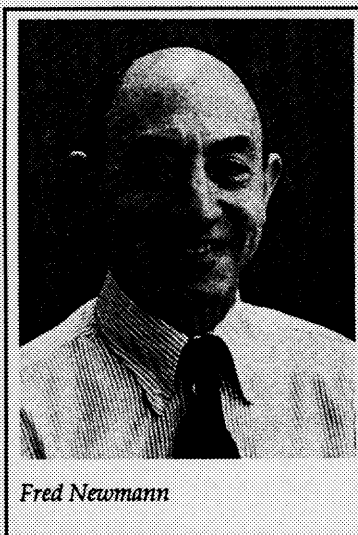
The book's conclusion, which summarizes the implications of the researchers' findings, offers practical recommendations for high school teachers and administrators.

The work of Newmann and his colleagues indicates that educators can enhance student engagement in academic work by attention to two general factors: first, building a sense of student membership in the school at large and, second, designing academic tasks to maximize the authenticity of school work. If they expect to accomplish these, the researchers said, educators must pay attention not only to new forms of curriculum and instruction, but also to school culture, organizational structure, and the process of institutional change.

Student Engagement and Achievement in American Secondary Schools is available from Teachers College Press, New York.



Thomas Romberg



Fred Newmann

NCRMSE took on the responsibility of preparing several of the recommended reviews and studies.

This resulting book includes a dozen papers covering many of the issues identified by the task force. The chapters are authored by the NCRMSE staff as well as other scholars who were invited to contribute.

The book is available from State University of New York Press, Albany, NY. It is part of the SUNY Series "Reform in Mathematics Education."

The other recent publication from WCER researchers is *Student Engagement and Achievement in American Secondary Schools*, from the staff of the former National Center on Effective Secondary Schools (NCESS).

Recently, the NCESS completed its five-year effort to study America's secondary schools. NCESS explored

CGI Research and Teacher Change

Teachers change their patterns of instruction when they are given access to knowledge about children's thinking. The change is gradual, and depends on the teachers' prior beliefs, knowledge, and classroom practice as well as the value individual teachers place on the new knowledge.

The Cognitively Guided Instruction Project (CGI), which was described in the Winter 1989 issue of *WCER Highlights*, gives teachers access to structured knowledge of children's thinking within well-defined mathematical domains. Teachers become aware that children come to their classes with informal mathematical knowledge and can use that knowledge to solve a variety of problems. Students do not need to be taught how to solve the problems by the teacher. Teachers are encouraged to pose problems to students, to ask the students to describe how they solved the problems, to listen to the students' descriptions, and to use that information in subsequent instructional decisions.

As a part of the CGI Project Megan Loeff Franke, Elizabeth Fennema, Thomas P. Carpenter, and Ellen Ansell studied the process of teacher change in nine teachers over a three-year period. Results of the first year of that study were presented in April 1992 at the annual meeting of the American Educational Research Association in San Francisco.

The teachers in the study participated in workshops designed to give them access to knowledge about how children think within the content domains of addition/subtraction, multiplication/division, place value, and fractions. The workshops also provided the teachers with an opportunity to discuss the implications of this knowledge for their teaching. The teachers were interviewed at the

beginning and end of the year and were observed teaching mathematics in their classrooms six times. The study is investigating the relationship between the teachers' knowledge, beliefs, and classroom practice and the process of change.



CGI teacher Mazie Jenkins listens as a student explains his strategy for solving a problem.

Changes in Knowledge, Beliefs, and Practice

Knowledge. The change in knowledge that occurred over the year was not simply a matter of whether a teacher did or did not acquire knowledge. Each of the teachers made some use of the knowledge that was shared about children's thinking. What varied was the degree of change and the integration of the knowledge acquired. Some teachers acquired somewhat isolated, non-integrated knowledge. Some teachers acquired knowledge about the content in relation to children's thinking and began to integrate that knowledge within domains. A few of the teachers not only integrated knowledge within the domains, but also across domains, and began to expand CGI in terms of children's thinking into areas that had not been discussed.

Beliefs. Similarly, while changes in beliefs were noted in all teachers, the changes differed in degree and specificity. Teachers who believed

prior to the study that children cannot solve problems without direct instruction in procedures or strategies were beginning, by the end of the year, to differentiate between when children did or did not need intervention from the teacher. Yet these teachers continued to struggle with the idea that children could learn without instruction from the teacher.

Some teachers began the study with CGI beliefs. They believed that children can solve problems without direct instruction from the teacher and that knowledge of children's thinking can be used in making instructional decisions. By the end of the year these teachers were much more specific in their talk about students but differed in the degree to which they were able to use the knowledge they gained from their students.

A third group of teachers expressed contradictory statements of beliefs at the beginning of the study. While these teachers reported allowing children to solve problems without direct instruction, they also talked about the need to tell the children a solution. By the end of the year these teachers were changing in their beliefs and their awareness of those beliefs, but the inconsistencies continued.

Classroom Practice. Three dimensions of teachers' use of children's thinking in the classroom were studied: providing opportunities for children to engage in mathematical thinking, listening to children describe their thinking and understanding the children's thinking, and using what they heard to make instructional decisions. These dimensions are mutually dependent and tend to develop together. While all teachers changed in these dimensions and used children's thinking more in their classrooms, a range of change was noticed in each dimension.

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Although each teacher provided more opportunity for problem solving and discussion of strategies, the degree to which problem solving was the focus of the curriculum varied. The emphasis teachers placed on children's thinking versus the correct answer also varied.

Initially teachers tended to respond similarly to all children, did not differentiate strategies reported by children, and often accepted the same strategies as different. By the end of the year they responded differentially to individual children's responses.

Some teachers did not move beyond using content to determine the lesson. They involved the children in a variety of story problems, but seemed unable to determine whether the problem types were appropriate for the children. Eventually, however, some teachers began to use the children's thinking to drive the lesson decisions.

The Incremental, Integrated Nature of Change

While it took time for teachers to fully incorporate research-based information into their classroom practice, and while this change occurred differentially, it did occur. It appears that for change to occur information must build on teachers' existing knowledge, beliefs, and practice, and the teachers must see the value of the information. Domain-specific knowledge relevant to their particular grade level seemed to be valued by teachers. Depending on their prior knowledge, beliefs, and classroom practice, it was not until teachers worked with their own students that the information became valuable enough for them to use in making decisions about their classroom practice.

Some researchers have proposed that beliefs change before knowledge and classroom practice change.

Others suggest that first classroom practice changes and then beliefs change. This study indicates that teacher change is more integrative and these three areas are interdependent. Teachers often change in one area, and that change prompts changes in other areas. Beliefs, knowledge and practice tend to develop gradually in relationship with one another.

All teachers in this study changed. At times certain beliefs may be necessary in order for change to occur while at other times knowledge may become the driving force. Without consideration of each of these areas the picture of the teacher change process would be incomplete.

This research was supported in part by a grant from the National Science Foundation (MDR-8954679). For further information contact Megan Loef Franke, (608) 263-4267, or Elizabeth Fennema, (608) 263-4265, or write to CGI c/o WCER.

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