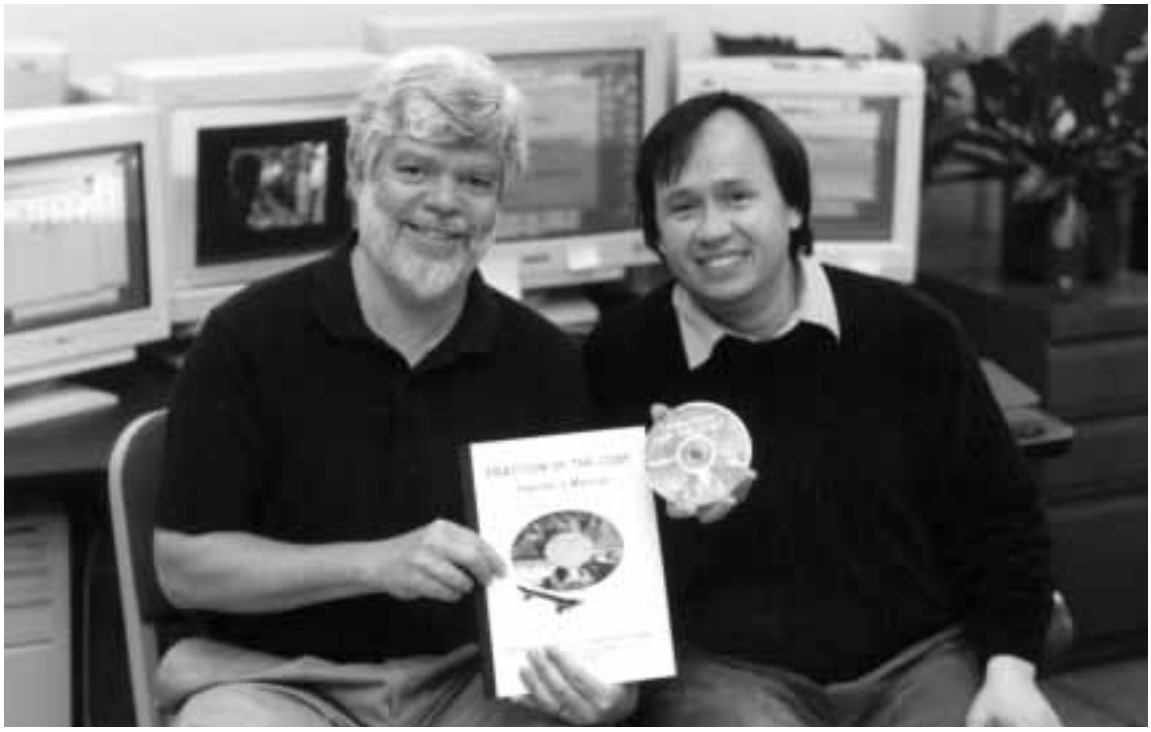
WCER Highlights

WISCONSIN CENTER FOR EDUCATION RESEARCH • SCHOOL OF EDUCATION • UNIVERSITY OF WISCONSIN–MADISON

New technology advances research and teaching



Researcher Brian Bottge (left) and multimedia artist Enrique Rueda teamed up to produce an instructional CD-ROM.

In the areas of mathematics, science, special education, and teacher education, investigators at the Wisconsin Center for Education Research (WCER) are using new digital media, hypertext, and computer networks to analyze and disseminate research data and to develop training tools. CD-ROMs disseminate data sets and curriculum resource materials. Online, interactive Web environments are used to share data among institutions.

Here is a brief look at how digital resources shape our research and development.

Improving student mathematics skills

UW–Madison education professor Brian Bottge and colleagues have worked with multimedia artist Enrique Rueda to develop a new CD-ROM–based multimedia tool that presents a problem in applied mathematics. Paired with applied tasks in classrooms, the video and animation tools on the CD-ROM aim to stimulate mathematics problem-solving skills of students with and without disabilities in inclusive classrooms. Called *Fraction of the Cost*, the unit was developed in WCER's multimedia studio.

The 7-minute lesson provides contextualized mathematics instruction. In the story, three middle school students plan to build a large skateboard ramp. The problem posed

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From the Director

Increasing capacity

JEFF MILLER

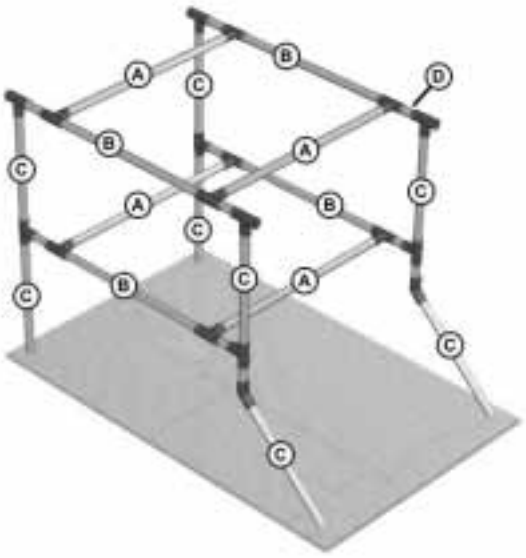
Gone are the days when the tools of education research were limited to pencil and paper, a typewriter, and a command of statistics. Researchers in education, as in so many areas of inquiry, are developing and mastering electronic forms of data acquisition, analysis, and management suitable for this digital age. This issue of *Highlights* illustrates how new electronic tools are shaping our work, and increasing our capacity, here at WCER and with our colleagues across the nation.

Increasing the capacity of local schools is an ongoing concern. In this issue, you'll read about recent work by Fred Newmann and colleagues that addresses the questions: How does improved school capacity influence student achievement? How does district policy influence school capacity? What is teacher inquiry, and how does it influence professional community and, in turn, school capacity? Where does improved professional development fit into this picture?

For more information, visit our (newly redesigned) Web site at *www.wcer.wisc.edu*.

Andy Porter

in the video asks how the students can build the ramp with the money and building materials available to them. To solve the problem, students have to use their math skills to convert feet to inches, calculate percentages, read schematic plans, and compute mixed fractions. The CD contains several



In one of Bottge's lessons, students build "rollover cages" for a student-sized hovercraft.

instructional models intended to help students strengthen and extend their computational and problem-solving skills.

After students solve the *Fraction of the Cost* problem in the math classroom, they apply what they have learned to building projects in the technology education classroom. For example, students at one school figured out the most economical ways to build three benches, which are now used at a new high school. At another school, students used plastic pipes to design and build "rollover cages" for model hovercrafts (see illustration). This project was especially motivating for the students because they raced the hovercrafts after they attached the cages to their base.

Bottge's research tests a theoretical model of learning mathematics for adolescents with learning disabilities in inclusive classrooms. The project intends to demonstrate how the theory can guide instruction to uncover mathematics skills that middle school students with disabilities already have, and to enhance those skills through contextualized problems. Another goal of the research is to document changes in how teachers and students perceive and act on their beliefs in these contexts.

This project is funded by the Office of Special Education and Rehabilitative Services, U.S. Department of Education. For more information, visit the project Web site at *www.wcer.wisc.edu/TEAM*.

Disseminating science assessment materials

WCER researchers John Smithson and Andrew Porter have produced a CD-ROM of science assessment materials developed over the past 8 years under the auspices of the Council of Chief State School Officers (CCSSO). Their work is part of the CCSSO State Collaborative on Assessment and Student Standards (SCASS) Science Education Assessment Project. The CD, which runs on both Macintosh and Windows platforms, contains a large pool of science assessment exercises, a portfolio implementation guide, surveys of the enacted curriculum, and reference materials. The user can point and click on a main menu to open the desired folders and documents. Hypertext links point to additional Web sites and sources of information on science education and assessment.

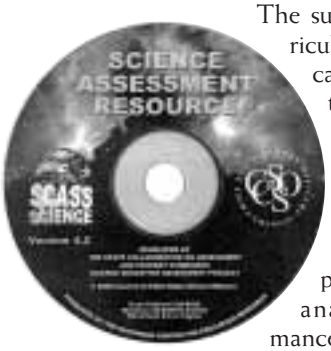
The science assessment pool includes all the assessment exercises developed by the SCASS science project, organized by elementary, middle, and high school levels. The more than 1,000 individual assessment items are organized into three groups:

- *Events:* hands-on group activities that take one class period to complete;

- *Modules:* multiple-choice, short-answer, and extended responses; and
- *Tasks:* individual projects expected to take more than a week to complete.

Other materials include scoring rubrics, teacher instructions, field test data, and "anchor papers" showing exemplars of student work.

The science portfolio materials include teacher and student guides for elementary, middle, and high school grade levels, and an implementation guide and appendices for trainers. The portfolio allows teachers to devise and refine instruction based on student development and individual need.



The Porter/Smithson CD offers science assessments and more.

The surveys of the enacted curriculum are survey-based indicators of classroom practice that schools, districts, and states can use to gather information about instructional content and practice. The surveys provide educators and policy makers with data for analyzing student performance on assessments, measuring classroom curriculum changes in relation to state or local content standards, and evaluating the specific programs' effectiveness.

Finally, the CD offers a collection of reference materials, including a glossary of terms found in the SCASS science resource materials, information on the history of the SCASS science project, reference tables and release dates for the assessment pool, and links to related Web sites. The CD includes full search and retrieval capacity for all science assessment items, student work, and professional development materials.

Smithson says the goal is to increase the use of high-quality, multimethod assessments in science education. This project is funded by CCSSO and participating states. For more information, contact Smithson at *johns@mail.wcer.wisc.edu*.

Analyzing digital video data

The success of the video classroom study of the Third International Mathematics and Science Study (TIMSS) is one example of the increasing importance of video as a form of data. Researchers now need robust video analysis tools and well-tested collection management procedures to support this work.

WCER researcher Christopher Thorn and colleagues at Carnegie Mellon University, the University of Pennsylvania, and the San Diego Supercomputer Center are integrating their data management systems through a project called Digital Insight. Digital Insight is a prototype for acquiring, managing, analyzing, and disseminating digital video data in education research. This project, funded by the National Science Foundation, addresses challenges in video management technology, research methodology, human subject protection, data management, mixed-methods analysis, and the use of archived multimedia data for secondary analysis and teaching.

Thorn says, "We're developing tools for education researchers for extracting event-based data from video and correlating these data with other kinds of data, such as field notes, images of student work, lesson plans, and assessment data." Researchers will be able to build histories of student learning and development. They will be able to separate video-based research into its constituent parts of acquisition, management, analysis, and dissemination. Then they can describe and encourage a set of best practices at each stage of the process. Applying these technologies will enable researchers to study many more cases in the same time it took to analyze a handful of cases with analog video. Digital Insight will

- allow users to engage in more sophisticated analysis;
- share the results of analysis with a wider audience;
- help partners make new arguments and bring more forms of data to bear on a problem; and
- make it easier for collaborators at other locations to participate.

Digital Insight's effect should be felt across a wide range of funded research, as well as in the classrooms and professional development activities of its partners. For more information, see *www.wcer.wisc.edu/digitalinsight*.

Improving assessment literacy and accommodations

Assessment and educational accountability are critical for students with disabilities. Federal legislation requires states to include students with disabilities in educational accountability assessments. Many states demand that students with disabilities meet state standards for promotion and graduation. Unfortunately, educators are generally not well prepared to include students with disabilities in educational accountability assessments. Special educators, in particular, lack the specialized knowl-

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Smithson


Thorn


Elliott


Braden

Professional Development That Addresses School Capacity

Lessons from Urban Elementary Schools


Newmann

Effective professional development can advance achievement of all students in a school, according to recent research by Fred Newmann and colleagues at UW–Madison. They found that improving student achievement is more likely to happen when professional development addresses not only the learning of individual teachers, but also other dimensions of the school's organizational capacity.

To learn how some schools used professional development to address school capacity, Newmann, Bruce King, and Peter Youngs studied nine urban elementary schools. These schools were selected through a national search for schools that served large proportions of low-income students and that (a) had histories of low achievement, (b) had shown progress in student achievement over the previous 3 to 5 years, (c) attributed their progress to schoolwide and sustained professional development, (d) participated in site-based management, and (e) had received significant professional development assistance from one or more external agencies.

Varying approaches

All of the schools appeared to have high potential for addressing all aspects of capacity. But after 2 years of data collection, it became clear that the schools varied considerably both in their approaches to professional development and in the extent to which they addressed aspects of capacity.

Two schools used professional development to comprehensively address school capacity. These schools illustrate contrasting approaches to professional development and the roles of external agencies. Lewis Elementary, in an urban district in Texas, focused on schoolwide implementation of Success for All (SFA), a comprehensive program developed by a national organization that provided ongoing technical assistance. At Renfrew Elementary, in an urban district in California, teachers crafted an approach to improving instruction and achievement unique to their school by developing learning standards at each grade level, measuring student performance with special attention to achievement gaps between students of different racial and ethnic backgrounds, and discussing implications of the results for curriculum and teaching. Schools that used professional development less comprehensively were more likely to use traditional short-term approaches such as one-time workshops or college courses chosen at teachers' discretion without collaboration and systematic infusion into the school program.

Lewis and Renfrew schools demonstrated that it is possible for urban elementary schools serving low-income students to organize professional development to comprehensively address school capacity and that this can be accomplished through diverse approaches. Newmann and colleagues also found that comprehensive use of professional development over time was strongly related to schools' initial capacity and to principal leadership that channeled professional development, and positively related to funding, but not consistently related to the level of external technical assistance or extent of policy support from district and state.

The researchers synthesized literature from different perspectives to elaborate a conception of school capacity and its findings on how schools use professional development to address different aspects of capacity. Their synthesis presents a perspective on school reform that could benefit schools, districts, states, and other providers of professional development.

Newmann says the failure to craft professional development to address school capacity comprehensively may well be a major reason for the disappointing results of so many school improvement initiatives. If so, it seems that those who fund, regulate, and design programs and policies that affect professional development should try to advance all dimensions of school capacity and to minimize ways in which professional development and other policies undermine dimensions of capacity.

In a related study, researcher Peter Youngs examined the ways school district policy can enhance or undermine professional development.

Coherency and consistency are important

Youngs examined connections between district policy related to professional development and school capacity in one school in each of four school districts. For two of the schools, Kintyre and Renfrew Elementary Schools, Youngs found

that district policy for professional development addressed shared commitment, collaboration, and reflective inquiry. For example, Kintyre's district required consolidated plans in which schools focused improvement efforts in one content area over several years and provided assistance through district resource teachers. Kintyre elected to focus on reading and built a strong, shared commitment to particular strategies for teaching reading. The district resource teacher who worked with the school helped plan and carry out schoolwide professional development related to guided reading and other instructional strategies. In addition, several district-sponsored activities, including a weeklong summer literacy institute, enhanced teacher collaboration. In contrast, teachers from Pitlochry Elementary, an SFA school, participated in district professional development largely on an individual basis, and the district had few strategies for promoting collaboration or inquiry among teachers from the same school. Professional community remained low at Pitlochry throughout the study.

School districts' professional development strategies should balance promoting coherence within the district and providing autonomy to individual schools.

Youngs also found that districts were more likely to help schools strengthen or maintain high levels of professional community and program coherence when their policies were internally coherent and remained consistent over time. For example, Renfrew's district provided support for inquiry groups for many years, as well as autonomy for schools to make decisions about professional development. On the other hand, Pitlochry's district implemented policies that sent conflicting signals to schools related to curriculum, assessment, and professional development over the course of the study. For example, the district required a standardized reading assessment, which many staff at Pitlochry felt was inconsistent with SFA reading. Further, the district required teachers to participate in math workshops that were unrelated to SFA math.

Finally, Youngs' study indicates that districts can help schools build capacity through either centralized or decentralized approaches to professional development and school improvement. Kintyre's district had a more centralized approach, which featured the use of consolidated plan requirements and district resource teachers. Their approach helped the school maintain a high level of capacity. At the same time, the two schools with the highest levels of capacity throughout the study, Lewis and Renfrew, were in districts that had decentralized approaches. Renfrew's district, for example, offered 8 days of professional development, which were controlled by individual schools. In Lewis's district, schools had 4 days for professional development, 2 of which were controlled by schools and 2 of which were up to the discretion of individual teachers.

Reforms have uneven effects

Based on a review of empirical research, Youngs also examined the extent to which recent reforms related to professional development addressed different aspects of school capacity. The reforms included the California Subject Matter Projects (CSMPs), the use of consultants and intervisitation of schools in New York City's District 2, student

King

Youngs

assessments in Kentucky and Maryland, and school improvement plans in South Carolina. Youngs found that these reforms generally strengthened teachers' knowledge, skills, and dispositions but had uneven effects on other aspects of school capacity.

Ideally, professional development activities promote collaboration among teachers from the same schools in order to strengthen school capacity. In New York's District 2, for example, grade-team meetings provided regular opportunities for consultants to introduce new disciplinary material or content and instructional strategies in subject areas, and for teachers to modify their practices and discuss their experiences with peers. In contrast, California's CSMP summer institutes brought together teachers from different schools and introduced them to new ideas about curriculum and pedagogy. These activities provided teachers with important opportunities to share their expertise and assume leadership roles, but they also led many to identify more closely with fellow institute participants than with colleagues at their own schools. For schools where collaboration was weak, the CSMPs seem to have little positive effect on schoolwide professional community.

Youngs found that high-stakes assessment systems, such as those in Kentucky and Maryland, can cause professional development activities to be narrowly focused on introducing teachers to new assessments. It was unclear whether professional development related to the assessment systems enhanced teachers' knowledge, skills, and dispositions or merely helped them prepare students for the assessments. If professional development focuses on helping teachers prepare students for tests without increasing teachers' knowledge and skills or their expectations for student performance, it may not lead to instructional practices that help students engage in critical thinking, problem solving, and indepth understanding of subject matter. Youngs found little evidence that professional development related to the assessments contributed to a school's professional community, such as establishing shared goals for student learning or improving teacher collaboration to achieve them.

District professional development strategies must achieve a balance, Youngs says, between promoting coherence within the district and providing autonomy to individual schools. Districts can promote internal school coherence by requiring schools to focus professional development on one content area or one schoolwide reform model for an extended period. At the same time, districts must provide opportunities for school faculties to participate in making meaningful collective decisions. Although it is important for districts to promote coherence within schools, school capacity may be weakened if teachers have little role in developing improvement plans or providing input into other decisions concerning the operation of their schools.

Professional development to promote schoolwide inquiry

In a related study, WCER researcher Bruce King explored teacher professional development programs and the extent to which they promote schoolwide teacher inquiry—the degree to which educators critically examine their own and others' beliefs and practices. Studying seven urban elementary schools over two years, King found that typical professional development activities represented the antithesis of careful inquiry. These activities tended to be imposed by external authorities without seeking significant input from teachers, and they were rarely sustained.

Often, King says, professional development is divorced from teachers' work contexts and presents material that teachers see as irrelevant to student learning in their specific school setting. Professional development activities offered throughout a year or a period of years tend to lack consistent focus, either for individual teachers or for the school. And perhaps most important, traditional professional development mirrors traditional forms of instruction in that the learners (in this case, teachers) are passive.

In contrast, in professional development that promotes inquiry, teachers

- have considerable control over process and content;
- critically discuss issues of school mission, curriculum, instruction, or student learning;
- address areas of disagreement and entertain diverse viewpoints;
- draw upon relevant data and research to inform deliberations; and
- sustain a focus on a topic or problem and reach a collective decision.

In most of the schools King studied, professional development activities that involved inquiry were isolated instances rather than ingrained into the fabric of the school's culture. Only at two schools (Lewis and Renfrew) did teachers engage in schoolwide inquiry in an ongoing and systematic way. King says these two schools offer at least an existence proof that innovative forms of professional development can promote schoolwide inquiry. Critical supports for inquiry at the two schools included organizational structures and

Good professional development encourages teachers to critically discuss issues of school mission and to address areas of disagreement.

school leadership. That is, principal and teacher leadership played an important role in facilitating the sustained practice of inquiry, and these two schools used important organizational structures to further this work.

Although teachers can engage in careful individual inquiry about their practice, inquiry as a *collaborative activity* among teachers at a school is what contributes to a school's professional community. Teacher reflection becomes a joint responsibility that encourages teachers to work collectively toward shared understandings and commitments. Inquiry that is pursued individually by teachers in a school, even if a significant number of them are doing it, could lead to organizational fragmentation that weakens student and staff learning.

This study does not suggest that schoolwide inquiry is necessary to enhance student achievement, King says. Certain forms of instruction may be less dependent on collective inquiry. Some schools may not be ready at a particular point in time; for other schools, attention to other matters (e.g., teacher instructional knowledge and skill in a particular subject area) may appropriately take precedence in the short term.

Yet King found that sustained schoolwide inquiry at two schools strengthened other aspects of their professional communities—shared commitment to learning goals, collaboration, and teacher influence. Collective inquiry also seemed to encourage organizational growth by keeping the school focused, yet dynamic. Coupled with the research on professional community in schools and on organizational learning, the study suggests that in order to build capacity or to keep it at a high level, professional development should promote collective schoolwide inquiry.

This research was supported by the U.S. Department of Education, Office of Educational Research and Improvement; the John D. and Catherine T. MacArthur Foundation; the Spencer Foundation; and the Wisconsin Center for Education Research. The summary report for the project, "Professional Development That Addresses School Capacity: Lessons from Urban Elementary Schools," is available at *www.wcer.wisc.edu/pdbo/grandaje411.htm*. King's paper, "Professional Development to Promote Schoolwide Inquiry," is available at *www.wcer.wisc.edu/pdbo/INQ6.htm*. See Youngs' "District and State Influences on Professional Development and School Capacity" at *www.wcer.wisc.edu/pdbo/pol1py-oeri.htm*. Youngs' paper, "Connections Between District Policy Related to Professional Development and School Capacity in Urban Elementary Schools," is available online at *www.wcer.wisc.edu/pdbo/pol2py-oeri.htm*.

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Technology

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edge of assessment they need to meet inclusion and disability demands.

WCER researchers Jeff Braden and Stephen Elliott are evaluating a hypermedia distance education initiative designed to enhance educators' decisions regarding the participation of children with disabilities in assessments and to help educators apply their enhanced decision making to children's individualized education plans (IEPs). Developed in partnership with the Council for Exceptional Children (CEC), the initiative promotes situated, social, and distributed knowledge via Web-based hypermedia modules, virtual and physical discourse communities, case-based learning, and traditional media. This online professional development project provides links to current research, policy and practice, and other sources to enhance general and specialized assessment literacy. The project is funded by the Office of Special Education and Rehabilitative Services, U.S. Department of Education.

Learning content is grouped into three modules:

1. principles, polices, and practices of educational assessment,
2. large scale assessment, and
3. accommodations and alternate assessment.

The initiative will proceed in three phases: validation of module content and process, pilot dissemination to three intact educational communities, and national dissemination to more than 500 educators, parents, and administrators across the U.S.

Elliott and Braden will evaluate the project's impact via pre- and post-evaluation of participants' knowledge, analysis of concurrent and post-participation surveys, and evaluation of permanent products demonstrating knowledge application (e.g., IEPs).

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Address correction requested