



WCER Highlights

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New tools for educational data management



Transana software helps support researchers studying teacher-student interactions to build histories of student learning.

Video data is an increasingly important resource for education researchers. High-profile studies such as the Third International Mathematics and Science Study–Repeat (TIMSS-R) showcase digital video of classroom practices as a central element of their research.

Designers of new curricula and professional development materials are creating high-impact multimedia content that is based on rich studies of classroom practices.

Video data can be more fully utilized when archived in digital format, well catalogued, and readily accessible. WCER's Christopher Thorn and colleagues have developed tools to help educators and researchers more effectively use digitized video data and other forms of related evidence. Thorn's project, *Digital Insight*, supports researchers as they acquire, manage, analyze, and disseminate video-based historical accounts of learning and development.¹

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FROM THE DIRECTOR



Networking

Building networks is an important part of life and learning. In this issue of *Highlights* you'll read about a collaborative program in science and mathematics education in which South African doctoral students network with peers in U.S. universities. The doctoral students report their experiences have helped them complete important research tasks, to think about the implications of their research, and

to make breakthroughs in significant problems they had previously been unable to solve.

To become scientifically literate, students need a knowledge of scientific practice as well as science content. WCER researchers are working with ninth graders and their teachers to learn about science as it is actually practiced. This perspective marks a shift away from the view of science as a largely descriptive enterprise toward the view that *explanation* is a central goal of scientific work.

A program called Families and Schools Together (FAST) is enhancing children's academic and social performance by strengthening networks among parents, schools, and the community. Created in Madison, the program is now in practice in schools nationwide and in foreign countries. Students who have participated in the FAST program experience fewer behavioral problems and show improved academic performance.

And to consider the technological side of networking: Designers of new curricula and professional development materials are creating more high-impact multimedia presentations. These materials can be better used when they are archived in digital format and stored on servers, well catalogued and readily accessible. Our cover story explains tools that help educators and researchers more effectively acquire, manage, analyze, and disseminate video-based historical accounts of learning and development.

For more information about these stories and other research, visit our Web site at www.wcer.wisc.edu.

Andy Porter



Thorn

Analyzing and annotating analog video is time consuming. But new video management software being developed by the *Digital Insight* team supports participants throughout the research process. *Transana*, for example, allows researchers to study much more data in the same time it would take to analyze a handful of data sets of analog video. The *Digital Insight* research environment also allows for more sophisticated analysis and for sharing results with researchers at a distance.

The *Digital Insight* project is also designed to help researchers bring more forms of data to bear

on a problem and to make new arguments. It addresses the challenges researchers face in

- ▶ video management,
- ▶ human subject protection,
- ▶ data management, and
- ▶ use of archived multimedia data for secondary analysis and teaching.

Researchers can extract event-based data—such as an instance of teacher-student interaction—from video observations. These events can then be correlated with other kinds of data, such as field notes, images of student work, lesson plans, and assessment data. The goal is to build rich histories of student learning and development.

The first product of the *Digital Insight* team is a video transcription and analysis tool called *Transana*, now available at <http://www.transana.org/>. *Transana* was originally designed by Thorn's colleague Chris Fassnacht to support his own dissertation research.

Transana provides a way to view video, create a transcript, and link portions of the transcript to frames in the video. It facilitates identifying and organizing analytically interesting portions of videos and attaching keywords to those video clips. It also features database and file manipulation tools that help researchers organize and store large collections of digitized video.

More specifically, *Transana* allows users to

- ▶ import and view MPEG-1 videos;
- ▶ create transcripts of the videos;
- ▶ navigate through videos using several different mechanisms, including a graphic of audio soundtracks;
- ▶ link frames in the video to positions in a transcript by embedding video time codes in the transcript;
- ▶ automatically highlight the relevant portion of the transcript while the video plays;
- ▶ select analytically interesting portions of the video, which can be grouped;
- ▶ define keywords and apply them to portions of video;
- ▶ search for instances of keywords and see the video clips to which they have been applied; and
- ▶ transfer video files to and from a storage resource broker (SRB), a computer system with massive storage capacity.

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The practice of science

By the time they get to high school, students have had at least 9 years of learning to play the “game” of school. They know what it takes to win: Just give the right answer. In the field of science, this approach places undue emphasis on the end products of scientific inquiry, depriving students of the opportunity to learn about the *practices* through which scientific theories and explanations are constructed.

Fortunately, instruction can be reorganized to dramatically change the nature of the school game. In new instructional contexts, students participate in making and assessing knowledge claims. They learn to recognize these activities as necessary to achieving understanding in science.

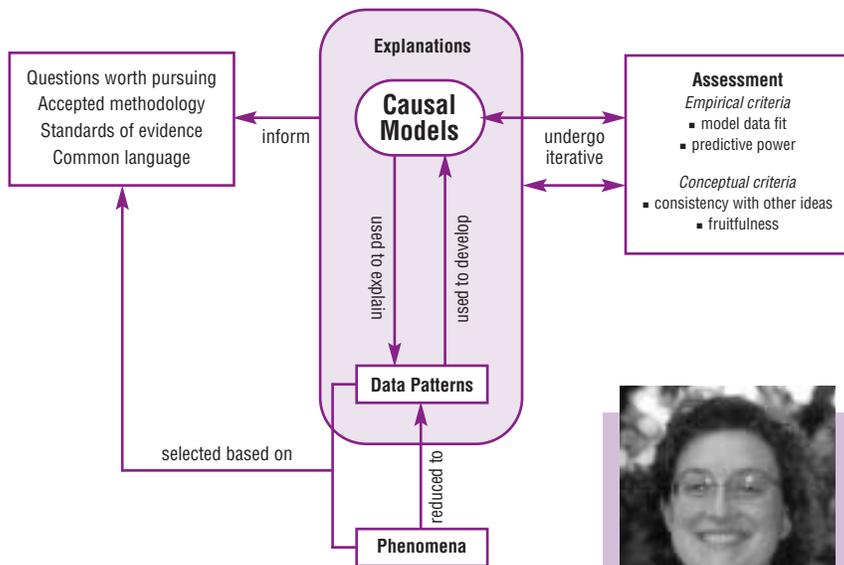
Jennifer Cartier, Cynthia Passmore, and James Stewart argue that a knowledge of scientific practice is an important part of becoming scientifically literate. Cartier, Passmore, and Stewart are part of a team of university researchers and local teachers known as MUSE (Modeling for Understanding in Science Education), headquartered at WCER’s National Center for Improving Student Learning and Achievement in Mathematics and Science (NCISLA).¹ They have articulated a view of classroom understanding that is consistent with science as it is actually practiced.

The *practice framework* designed by MUSE (see illustration) recognizes essential elements of inquiry, yet is general enough to be useful in classrooms. The framework shows the central role of *models* in asking questions, recognizing data patterns, constructing explanations, and providing the criteria for judging knowledge claims.

Cartier and colleagues say this framework reflects a recent shift away from the view of science as a largely descriptive enterprise. The current view holds that *explanation* is a central, if not *the* central, goal of scientific endeavor. “Scientific inquiry is fundamentally about reducing the world to order,” Passmore says. “Those reductions take the form of explanations.” Inquiry in science is of primary importance. In fact, the MUSE team has identified *the ability to participate in inquiry* as an essential component of understanding in science.

Models in scientific practice

Most often explanations involve the intersection of some *causal* model, or models, with data from the natural world. A scientific explanation is a careful mapping of a model to data. For example, an explanation for why we see phases of the moon



The MUSE Practice Framework

describes the movement of the Moon relative to the Earth and Sun (a model of celestial motion). This model results in the predictable data pattern of phase changes throughout the month.

In some cases, models themselves become the objects of inquiry. When a new question is asked—for example, does light always behave as a wave? does genetic drift account for evolutionary changes in some species?—scientists assess existing models to see if they can address the question. If they cannot, scientists revise the existing models or develop new ones.

Engaging students in exploring phenomena (such as the phases of the Moon) and developing or invoking models to account for those phenomena is a powerful way to get students started in classroom inquiry. As students explore specific phenomena, they participate in practice by developing explanations and beginning to formulate their own questions. Students’ questions are often quite sophisticated. For example, one student participant in MUSE research learned about the phases of the Moon by exploring local data. Then the student asked whether the same pattern would be visible from the southern hemisphere. This prompted him to gather information, print and electronic, to answer the question. In this case, the student was probing the fruitfulness of his model.

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Cartier



Passmore



Stewart

FAST strengthens families



McDonald

Recent school violence has shattered the public's perception that their children are safe. The roots of violence can often be traced to the family and the neighborhood. Parents are often too busy to spend time with their children, and neighbors do not know one another. Stretched thin by the demands of work and family and struggling to survive economically, parents find less and less time to socialize with other parents. The recent book *Bowling Alone* by Robert D. Putnam (Simon & Schuster, 2000) documents the deterioration of friendships and other reciprocal relationships—*social capital*—in U.S. communities. People in schools and communities risk health and safety without the protection of networks of trusting relationships. Without social support, parents cannot provide enough support for their children as they face developmental stresses. Without caring parents, youth move toward dark futures of school failure, delinquency, drug and alcohol abuse, and even violence.

To prevent these root causes from taking hold, WCER Senior Scientist Lynn McDonald initiated a school and community program in 1988 called Families and Schools Together (FAST). McDonald

developed the FAST program to enhance children's academic and social performance. FAST programs build relationships among parents, schools, and the community. Multiple families from a school gather once a week for 8 weeks to share a meal and participate in a variety of structured social activities, including music, drawing, family games, children's sports, and opportunities for parents to interact in activities that apply theory and research. Students who have participated in the FAST program experience fewer behavioral problems and show improved academic performance.

To prevent violence and delinquency, McDonald says, it's important to work with younger children and their family networks. Early in children's lives, protective factors can make a big difference in development. Children in kindergarten and first grade are at an ideal age, and schools are an ideal location for intervention, with families having a central role. "All kindergarten children should have the chance to go to FAST," McDonald says.

This past winter saw the completion of four multiyear research studies that used randomized trials to assess the impact of FAST. The studies evaluated the multicultural FAST program in 9



A recent \$1.9 million grant has enabled the launch of FAST as a major national initiative.



New Orleans schools, 10 inner-city Milwaukee schools, 3 rural Wisconsin schools serving Native Americans, and 9 Madison schools. The results of these studies are consistent: More than one year after FAST, teachers and parents report FAST children show a statistically significant decrease in mental health indicators of risk for negative outcomes when compared with control group children. In some instances, the control group children showed significant increases in behavioral problems over time, compared with the FAST children.

If a family attends one FAST meeting, there is an 80% chance the family will graduate from the full 8-week program. This high retention rate is unusual, especially for stressed, low-income families. Two years after graduating, 86% of parent participants report that they are still seeing friends they made through FAST. Parents become friends and support one another over time. Some become community leaders. Using schools as community-based structures helps create outreach to families and becomes a viable approach for national replication.

The growth of FAST

At WCER, McDonald directs the national dissemination of FAST. The program has been disseminated to more than 600 communities in 38 states, 4 Indian nations, and 5 other countries. A recent \$1.9 million grant from the Bureau of Justice Assistance, U.S. Department of Justice, has enabled the launch of FAST as a major initiative, ensuring the quality of replicating this evidence-based model.

In June, FAST officially became a Model Program for the Center for Substance Abuse Prevention (CSAP) at a ceremony at the National Press Club in Washington, D.C. Wisconsin was just awarded a federal State Incentive Grant (\$3 million annually for 3 years) to disseminate CSAP Model Programs across Wisconsin. The Wisconsin Department of Health and Family Services has been designated to administer the grant.

Recognizing the program's success, U.S. Health and Human Services Secretary Tommy G. Thompson said:

"Communities across the country should insist upon and work toward excellence in helping children to succeed at school and at home, reduce drug and alcohol abuse, and reduce stress and social isolation. Families and Schools Together (FAST) and other programs supported by the federal government have shown that prevention is possible and models of excellence are available."

The state of Wisconsin allocated FAST \$1 million annually from 1990 to 2000, and in 1994 then



Governor Tommy Thompson was recognized by Harvard University and the Ford Foundation's Innovations in American Government awards competition for that statewide FAST initiative. Now four other states have statewide FAST initiatives. With the support of Senator Herb Kohl (D-Wis.), FAST has received national recognition and federal research and development support since 1991.

Bipartisan political support and funding from the United Way, foundations, local and state governments, and the federal government have helped FAST grow over time. In September 2000, McDonald was awarded a grant for work in Moscow by the National Institute on Drug Abuse, U.S. National Institutes of Health, through the U.S.-Russia Competitive Program. Eleven FAST families graduated in Moscow in December 2001, and McDonald visited there to conduct FAST training this spring. She also received a grant for adapting FAST to work with Hmong immigrant students and their families in Madison, Wisconsin, in conjunction with the United Refugee Services; this grant was awarded by the Center for Mental Health Services, U.S. Department of Health and Human Services.

In addition to her duties as WCER Senior Scientist, McDonald is a part-time faculty member at Madison's Edgewood College in the Graduate Program in Family Therapy, and is president of the board of directors of the nonprofit FAST International, which maintains quality assurance for the dissemination of FAST with certified trainers.

For more information, contact McDonald at mrmcdona@facstaff.wisc.edu or visit the FAST Web site at www.wcer.wisc.edu/FAST.

Family games and family meals at the school help build networks of parents.

South African students meet U.S. peers



Students from South Africa attended a seminar with peers from Howard University in Washington, D.C.

South African science and mathematics education doctoral students studying at U.S. universities in 2001 report that their U.S. work has helped them make progress in their research.

A collaborative program was begun in 1997 to develop links between South African and U.S. science and mathematics education researchers on topics of mutual interest. One aspect of the program was the support of doctoral student education. UW–Madison Education Professor Peter Hewson oversees the U.S. part of the program, which is jointly funded by the U.S. National Science Foundation and the South African National Research Foundation.

Last year, 10 doctoral students who were registered at South African universities spent 2 to 4 months at selected universities in the U.S. They report that their experiences helped them progress in their graduate work in three ways: time for intensive study, access to more resources, and opportunities to share their work and receive feedback from their peers.

More time for thought

The doctoral student program in science and mathematics education was conceived to serve several purposes. First, since South African students typically do their doctoral work part-time, the visit to the U.S. aimed to give them an opportunity to focus exclusively on their doctoral research. The idea was that intensive study of this nature would permit them to make significant progress in both conceptualizing and analyzing data for their dissertations. Second, the research capacity of their host institutions in the U.S. provided them with access to significant resources, both human and material, for furthering their research. The program matched students with faculty mentors who shared their research interests and also gave them access to other faculty members, graduate students, courses, library holdings, and the like. Third, the South African students presented their work to audiences with interests and perspectives different from their own, which helped them clarify their



own research and provided them with confidence that their work represented a contribution to the field. Additionally, their participation in the academic life of their host institutions and departments helped to enrich and broaden the dialogue and perspectives of their peers.

The South African students took advantage of their host institutions' material resources, such as the journals, books, and online materials available through these institutions' libraries. Students reported that these resources helped them broaden their literature review, learn new methods of data analysis, and clarify issues in their research.

Students also appreciated the opportunity to attend lectures, courses, seminars, workshops, and conferences. Students attended courses on a variety of topics, such as science and mathematics education, discourse analysis, research methods in education, teaching for understanding, professional development, and the history of mathematics.

Students received critiques of their work, both individually from faculty members and collectively from other graduate students. This feedback helped them clarify their thinking and sharpen their research focus, while also providing support, motivation, and encouragement to move forward with their doctoral work. Students reported that the feedback they received was especially affirming when it indicated that the work they were doing was of interest, importance, and relevance to others in their fields of study.

The program also offered the South African students the opportunity to participate in a day-long seminar with graduate students from Howard University, a historically black university in Washington, D.C. The purpose of this facet of the pro-

gram was to enable the students to explore the common ground between Howard's unique history in the U.S. and its research focus on oppression, on the one hand, and the South African students' research topics, on the other. Students affirmed the value of meeting students at Howard University and presenting their dissertation work in the day-long seminar. In particular, they appreciated the opportunity to discover the commonality of educational issues addressed and the diversity of the approaches adopted in studying them.

The next step

So what happens to the students in this program when they return to South Africa? What factors will influence their ability to capitalize on their experience? According to Hewson, the hope is that the students have returned with an enhanced understanding of their research projects, a broadened set of professional contacts, and the personal motivation and initiative to complete their doctorates and move on in the development of their research expertise.

At the same time, it must be recognized that, for the most part, the students will have returned to work environments where research capacity remains limited. Ongoing responsibilities in students' home institutions could limit their future research contributions. Thus, an important factor in their future development as researchers will be the availability of support, whether provided by their own institutions or by public or private granting agencies.

For more information, contact Peter Hewson at pwhewson@wisc.edu.



Hewson

Data management

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One way in which *Digital Insight* overlaps with the interests of related scholarly communities is Thorn's work with the TalkBank Project.² Funded by NSF, TalkBank aims to create a distributed, Web-based data archiving system for transcribed video and audio data on communicative interactions. Thorn and his technical development team are working to develop model video annotation tools that support collection building and cross-disciplinary analysis.

TalkBank's goal is to foster fundamental research in the study of human and animal communication. Thorn's colleagues are developing standards and electronic tools for creating, searching,

and publishing video data via networked computers. Six disciplinary groups make up the project's initial focus: Animal Communication, Classroom Discourse, Linguistic Exploration, Gesture and Sign, Text and Discourse, and Technical Development. Other disciplines will participate as the project grows. *Digital Insight* team members are active participants in several of these areas.

For more information, contact Thorn at cthorn@wcer.wisc.edu or visit the project Web site www.talkbank.org.

1. *Digital Insight* is funded by the National Science Foundation through both the National Partnership for Advanced Computational Infrastructure at the University of California-San Diego and the TalkBank project at Carnegie Mellon University.

2. TalkBank is funded by the National Science Foundation and Carnegie Mellon University.



Fasnacht



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Practice of science

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The MUSE team designed and implemented an introductory unit for ninth graders at a local, suburban Midwestern high school. The teachers used the unit to set the stage for the whole school's science sequence. One of the more complicated phenomena the students attempted to explain was that of the seasons. They identified several seasonal data patterns including the mid-day angular height of the Sun, average temperature, maximum shadow length, and average day length. The students found that all these patterns depended on both time of year and global location. The students were able to make sense of this complicated set of data with their teachers' help. The MUSE practice framework helped teachers redirect the students when necessary and focus their attention on creating *explanations* for patterns in nature, rather than simply attempting to offer the "right answer."

The MUSE view of scientific practice as it occurs in classrooms may have important implications for the reform efforts under way in the U.S. If the goal of "understanding for all" is to be achieved, science educators must recognize that understanding in science develops through practice. Educators must design classrooms where realistic practice can happen. As a community, educators can go beyond a simple call for inquiry in science classrooms to a clear vision that can guide curriculum and professional development.

For more information, contact Cartier at jcartier@facstaff.wisc.edu or Passmore at cmpassmo@students.wisc.edu, or visit the MUSE Web site at www.wcer.wisc.edu/ncisla/muse.

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