

SPECIAL JOINT NEWSLETTER

NATIONAL CENTER FOR IMPROVING STUDENT LEARNING & ACHIEVEMENT IN MATHEMATICS & SCIENCE
AND CENTER FOR RESEARCH ON EDUCATION, DIVERSITY & EXCELLENCE

NCISLA
AND
CREDE



DIVERSE STUDENTS LEARNING MATHEMATICS AND SCIENCE:

ISSUES AND POSSIBILITIES

ABOUT THIS JOINT NEWSLETTER

This joint newsletter tackles an issue central to the missions of both the Center for Research on Education, Diversity & Excellence (CREDE) and the National Center for Improving Student Learning and Achievement in Mathematics and Science (NCISLA): culturally diverse students learning mathematics and science.

Ann Rosebery and Beth Warren, CREDE and NCISLA researchers at the Chèche Konnen Center at TERC, have studied the ways that children's languages and cultures can influence their learning of mathematics and science. In addition, they have studied and built an approach to teacher professional development that focuses on strengthening teachers' mathematical and scientific competence, as well as their understanding of diverse students' ideas.

Warren and Rosebery last year conducted an intense cross-disciplinary conference to tease out the issues central to diverse students' learning. Featured in this newsletter, the Children's Ways With Words conference broke through disciplinary barriers and drew researchers from across the United States into critical and challenging dialogue. Several points raised during the meeting are highlighted in this joint newsletter. We hope that it will make a positive contribution to future education research and public dialogue about educating culturally diverse students in U.S. schools.

Sincerely,

Roland Tharp, Director
CREDE

Thomas P. Carpenter, Director
NCISLA

THIS NEWSLETTER REPRESENTS

CREDE's *Talking Leaves*, Vol. 5 (1)

NCISLA's *Principled Practice*, Vol. 4 (1)

SPECIAL FOCUS

Children's Ways With Words Conference

ARTICLES

Education Researchers Accept Cross-Disciplinary Challenge 2

Case Studies Show Students Making Sense of Rigorous Content 4

A Haitian American's View of What Teachers and Researchers Can Learn About Diverse Students' Learning 5

An Agenda for Research and Public Discussion of "Diversity," Teaching, and Student Learning 7

CENTER UPDATES



CREDE News & Publications



NCISLA News & Publications

Education Researchers Accept Cross-Disciplinary Challenge

Bring together 40 experts from different disciplines to talk about a hot topic, and it is not surprising that serious and at times heated discussions take place. The hot topic? How do we do a better job of teaching culturally diverse, low-income, and minority children mathematics and science?

This issue is becoming increasingly critical in the United States, where the K-12 limited English proficiency (LEP) student population was estimated to increase by 104% between 1989 and 2000. Conservative estimates show that at least 3.4 million school-age children now come from homes in which English is not spoken.¹ In several states (e.g., Arizona, California, New York, Florida, Texas, New Mexico), children from linguistic and cultural minorities represent more than 25% of the school-age population, and in many large urban districts (e.g., New York City, San Francisco, Los Angeles) this figure is 50% or more.² Schools and parents are trying to discern how best to serve these kids: What kind of instruction best supports these children in learning mathematics and science and enables them to become competent and competitive members of a technology-driven society?

Researchers affiliated with the Center for Research on Education, Diversity & Excellence (CREDE) and the National Center for Improving Student Learning and Achievement in Mathematics and Science (NCISLA) have been working to address this question. In particular, TERC researchers Ann Rosebery and Beth Warren, who have conducted studies with both CREDE and NCISLA, have spearheaded an effort to create national cross-disciplinary dialogue about diverse students learning mathematics and science — to move the research field forward. Last year, they took the initiative to organize and host a cross-

disciplinary forum, the Children's Ways With Words conference, inviting 40 experts from around the country and from 11 disciplinary fields to discuss case studies of diverse students learning mathematics and science. The conference was cosponsored by the National Science Foundation, CREDE, and NCISLA.

This forum proved both challenging and fruitful because it compelled differently trained people to find a common language to discuss a complex topic, and it compelled the unveiling of researchers' often hidden theoretical and



(Left to right)
CREDE/NCISLA researchers Ann Rosebery and Beth Warren organized the Children's Ways With Words conference and released a report outlining recommendations.

methodological assumptions. Beneficially, it also yielded an agenda for cross-disciplinary research, essential for this era of school reform.

Conference organizer Ann Rosebery commented, "If we could begin to understand each other, rethink our assumptions, and examine our own and others' work with different lenses, our work would be that much stronger."

NCISLA researcher Paul Cobb, Professor at Peabody College at Vanderbilt University, concurred, "The most valued aspect of the conference for me was the opportunity to deepen my understanding of some alternative perspectives. I was familiar with most from reading the literature. However, it is a rare treat to be able to engage directly in an extended discussion about key ideas."

BREAKING DOWN DISCIPLINARY DIVISIONS

Beyond researchers and leaders reading the literature, "the education field tends to be divided along methodological and theoretical lines," observed Rosebery. To effectively address today's pressing issues and questions, Rosebery believes that it is important to draw people from various perspectives to the research table, to fill in the theoretical and methodological gaps — and to reconcile what on the surface appear to be conflicting findings. Moreover, Rosebery contends that it is important that the dialogue also include people not involved in research, but who have a deep concern for diverse students' learning — policymakers, parents, administrators, and teachers.

Cross-disciplinary dialogue is challenging, no matter who is participating. The experts attending the Children's Ways With Words conference come from a variety of cultural, professional, and theoretical backgrounds. As they worked with colleagues using different theoretical lenses, they found themselves grappling with different ways of "seeing" and talking about case studies of diverse students' learning.

NCISLA researcher and conference attendee Leona Schauble observed that many researchers

¹ These statistics are taken from the *Summary Report of the Survey of the States' Limited English Proficient Students and Available Educational Programs and Services, 1996-1997*. Washington, DC: National Clearinghouse for Bilingual Education (NCBE) (www.ncbe.gwu.edu/askncbe/faqs)

² See also Berman, P., Minicucci, C., McLaughlin, B., Nelson, B., & Woodworth, K. (1995); McLeod, B. (1994).

CONFERENCE ATTENDEES = DIVERSITY PERSONIFIED

Attendees of the Children's Ways With Words conference came from many walks of life, and socioeconomic and schooling backgrounds. The 40 attendees varied greatly in terms of —

DEMOGRAPHICS

- 35% men
- 65% women
- 55% white
- 45% persons of color
- 30% spoke a first language other than English

PROFESSIONS

- teacher-researchers
- administrators
- government personnel
- researchers and graduate students

DISCIPLINES

- Anthropology
- Biology
- Cognitive science
- Developmental psychology
- English
- Linguistics
- Literacy
- Mathematics education
- Physics
- Science education
- Sociology

found themselves confronting theoretical and methodological assumptions that had become “invisible” to them. She commented, “The meeting was very constructive in bringing to the surface the assumptions that many of us take for granted in our work. It also reinforced the value of working collaboratively, so that we better address our individual blind spots as researchers.”

CREATING A COMMON FOCUS

The meeting's innovative structure went a long way to enabling dialogue and assumption unveiling. By concentrating on case studies of diverse students' learning, including videotapes, transcripts, and student work, attendees had a common focus. (This format differed from the more common strategy of organizing topical meetings around individual paper presentations.)

Frederick Erickson, Professor of Educational Anthropology at the University of California–Los Angeles, pointed out the strength of the meeting's collaborative analysis strategy: “So often, in interdisciplinary conversations, people are talking past each other.” However, he stated, “I think there is something about having this third presence on the scene — myself, the others in the room, and the audiovisual documents — that changes the character of the conversation.” Productive conversation, he commented, emerged from having a common interpretive focus. This type of activity, he thought, could “make for progress over time.”

Michele Foster, Professor of Literacy Education at the Claremont Graduate School and a CREDE researcher, reflected on the difficulty of the first day of the meeting: “Coming together with people who study discourse... it never ceases to amaze me how the first day there's conflict, there's misunderstanding.” Fortunately, she noted, “it gets better. People learn to hear each other.”

PRODUCING HELPFUL RESULTS

The Children's Ways With Words conference was a productive meeting in at least two regards: First, it is a powerful example of a forum that helped draw very diverse and committed people into constructive conversation around case studies of diverse students' learning. Second, it produced a coherent (and agreed-on) cross-disciplinary research agenda that can provide a blue print for future education research.

Cross-disciplinary research syntheses are also being commissioned through a newly initiated CREDE–NCISLA collaboration. The two research centers are setting up multidisciplinary working groups of researchers, policymakers and teachers to synthesize what education research reveals about diverse students learning mathematics and science — and the implications of this research for improving instruction, learning environments, and teachers' professional development. This work will begin in spring 2001.

For more information about the conference, refer to page 7 of this newsletter, or read the on-line conference report available at the NCISLA and TERC web sites: www.wcer.wisc.edu/ncisla/publications and www.projects.terc.edu/cheche_konnen/English/activities.

CONFERENCE ATTENDEES SPEAK THEIR MINDS

Michele Foster,
CREDE Researcher and Professor of Literacy Education, Claremont Graduate School,
Claremont, California

Getting past conflict and misunderstanding:

Coming together with people who study discourse and understand discourse, it never ceases to amaze me how the first day there's conflict, there's misunderstanding — but it gets better. People learn to hear each other. If we as a group of researchers come together and have to go through that, then I think we shouldn't underestimate the work that goes into creating situations like that for teachers who are working together. Whenever I come to a meeting like this, it strikes me how difficult it is to create those spaces where people feel safe and where they can speak their minds and everything's not judged: It's very hard to do.

Apolinario Barros,
Mathematics Teacher, Burke High School,
Boston Public Schools, Boston, Massachusetts

Labeling students as college material:

I wasn't a good student until high school. To this day, I continue to hear people talking about college-bound students. I would like us to be a little bit more open-minded in terms of how we think of students, because there's a lot in a student that sometimes we can't measure with standardized tests or the MCAS [Massachusetts Comprehensive Achievement System, the state achievement test]. . . . We should always think of students, if they are in high school, as college-bound, and try to give them the opportunity to choose whether they want to do that or not.

Case Studies Show Students Making Sense of Rigorous Content

“How do you know when something is moving?” This question, directed at a combined first- and second-grade class of students from diverse ethnic, socioeconomic, and family backgrounds, led the students, their teacher, and observing education researchers into the world of Sir Isaac Newton. Captured in videotape and written transcripts, the students’ and their teacher’s learning became the focus of one of three case studies brought forward for expert analysis at the Children’s Ways With Words conference. Along with two other case studies of middle and high school students’ mathematics and science learning, the case studies challenged conference participants to explore —

- how diverse students made sense of mathematics and science,
- how diverse students used language to explain concepts, and
- how their teachers built from students’ language and cultures to leverage learning.

CASE STUDIES REFLECT RIGOROUS MATHEMATICS AND SCIENCE IN DIVERSE CLASSROOMS

For the conference, some attendees were invited to prepare in-depth classroom case studies that showed elementary, middle school and high school students working through challenging mathematics and science content. These case studies were presented to all attendees, who split into three groups to study video

of classroom lessons, discussion transcripts, and class materials. The case studies included —

CASE STUDY 1: *A combined first- and second-grade class of students from diverse ethnic, socioeconomic, and family-education backgrounds considered the question, “How do you know when something is moving?” A teacher had modified her district’s required motion curriculum with the intention of helping students learn to see and analyze motion “through Newton’s eyes.” This case offered intriguing contrasts in the ways different children approached the question, in what they saw as significant in the motion of objects, and in their explanatory strategies.*

CASE STUDY 2: *Urban public middle school students from diverse ethnic, socioeconomic, and family backgrounds were presented with a fictive world in which they were asked to act as biological consultants and make recommendations about ways to care for guppies taken from a polluted stream environment in Venezuela. This case invited participants to explore what was “mathematical” in what students were doing and if students were becoming “more sophisticated” scientifically, how?*

CASE STUDY 3: *Students participating in a Cape Verdean Creole bilingual program at an urban high school explored the relation between the motion represented by a quadratic function and its graph (a parabola), specifically the motion of a car that proceeded along a linear path and then reversed direction. In this case, conference*

participants explored ways students used real-world objects, graphical representations, and symbolic expressions in the construction of mathematical meaning; what students learned by analyzing the car’s motion and one another’s graphical representations; and the kind of mathematical community these students and their teacher co-constructed.

The case study analyses proved challenging because the cases themselves were very complex, reflecting the daily reality of classrooms. Attendees’ varied analyses yielded a rich picture of students’ ideas and reasoning. The analyses as a whole supported the contention that when learning environments are structured to allow for students’ ways of talking about data and expressing ideas — and students’ language and cultures are leveraged in instruction that focuses on rigorous mathematics and science content — diverse students show great mathematical and scientific conceptual understanding. Implications for teacher professional development, and what is required to support teachers of diverse students, were outlined. The collaborative analyses also raised issues and questions that need to be addressed in future education research, public dialogue, and policy development.

CONFERENCE REPORT OUTLINES NEXT STEPS

The outcome of the meeting was a conference report that outlines steps that, if taken, might provide much-needed support for diverse students’ learning of mathematics and science, a fortified research base in mathematics and science education, and stronger, research-driven teacher professional development. For more information about these next steps, see page 7, “An Agenda for Research and Public Discussion of ‘Diversity,’ Teaching, and Student Learning.” The conference report: Children’s Ways With Words: A Conversation Across Disciplines is available at NCISLA (www.wcer.wisc.edu/ncisla/publications) and TERC (www.projects.terc.edu/cheche_konnen/English/activities) web sites.

Videoclips show students from Case Study 3 discussing motion and mathematics.



A Haitian American's View of What Teachers and Researchers Can Learn about Diverse Students' Learning

An Interview with Josiane Hudicourt-Barnes



Ann Gilbo

Teacher-researcher Josiane Hudicourt-Barnes offers her ideas to Rogers Hall (UC-Berkeley Associate Professor of Mathematics Education) and colleagues at the Children's Ways With Words Conference.

Josiane Hudicourt-Barnes was one of the 40 experts who attended the Children's Ways With Words conference. Her career has included teaching school in Haiti and studying Creole linguistics and children's cognitive development and language development. Following her graduate work at Indiana University, she taught in the Haitian Creole bilingual program of the Cambridge (MA) Public Schools and was a staff developer for the Boston Public Schools. In addition to working on CREDE and NCISLA research, Hudicourt-Barnes works as a teacher-researcher at TERC's Chèche Konnen Center³, where she examines the roles of language in the classroom, students' learning of mathematics and science, and teachers' professional development.

³ Chèche Konnen means "search for knowledge" in Haitian Creole. Information about the Chèche Konnen Center can be found at www.projects.terc.edu/cheche_konnen/

As a high school student in Haiti, Josiane Hudicourt-Barnes decided to become a teacher because "I wanted to do a better job than my teachers." Her scholastic career took her to the InterAmerican University of Puerto Rico where, through a research project, Hudicourt-Barnes found that language issues inspired intense reactions among her fellow college students: She says, "Their negative and emotional reactions to my simple questionnaire ignited my interest in Puerto Rico's language issues. I discovered that the language of education is a psychological, political, linguistic, and emotional issue that I had previously ignored in children's learning."

As an extension of her work as a teacher-researcher at TERC's Chèche Konnen Center, Hudicourt-Barnes has been working in Haiti, providing professional development to teachers. In the midst of her busy schedule, she took time to discuss her perspectives about the challenges researchers and teachers face in understanding and leveraging diverse students' learning. Hudicourt-Barnes points out that cultural and class barriers in the classroom constantly need to be identified and crossed, just as misunderstandings about diverse students' learning strategies need to be acknowledged. Researchers and teachers both, she comments, struggle to understand the ways diverse students' cultures and languages shape their learning and expression of ideas. Although these children "do not speak the language of academia," are not "white middle class," and do not speak English as their first language, these students show a great capacity for understanding difficult mathematics and science content when their teachers create learning environments that give them space to explore and express their ideas.

Researchers and teachers, Hudicourt-Barnes suggests, have a lot to learn — from each other

and the students — about the rich resources diverse students bring to their schools and classrooms.

INTERVIEWER: Why might some researchers and teachers underestimate the abilities of children from diverse cultural and linguistic backgrounds?

HUDICOURT-BARNES: Often, teachers and researchers will base their opinions or evaluation of a child's ability on the language the child produces in class. As a rule, children from a white middle-class background are more likely to produce the vocabulary and syntax of the white middle-class adult world. That world defines the proper and acceptable norms of language for academic purposes. As a result, children who speak more like their classroom teachers and researchers are often thought to be stronger students, more intelligent, more able to "do school."

Because often one of the teacher's goals is to teach all the children to speak the academic language, they may see children who come in with those [white middle-class] language skills as more advanced. Children who do not speak English as their first language may perceive they are thought of as less intelligent and recognize that their teachers do not know how to interpret their contributions to class discussions. As a result, they may speak less in the classroom. They may also stay on the fringes instead of taking leadership in various learning activities. Children are very astute at evaluating social situations and getting clues to what is liked and disliked in schools. They find out very fast whom the teacher likes to hear. Over time, they may try to emulate the "star" students, or stay silent until they feel ready to be part of [the academic] conversation, or sulk because they don't feel respected.

I'd like to give an example from when I was teaching a first- and second-grade class in which Haitian bilingual students were integrated with a monolingual [English-speaking] class in Cambridge. The children from the monolingual class came mostly from middle-class homes parented by college graduates. In the class I taught, when it was a child's birthday we used to have a meeting before the cake, and the other children were asked to give a "verbal birthday present." The monolingual, English-speaking students often said things like "I like your attitude," "I like your personality," or "I think you're a good artist." The bilingual children would say things like "I like to hold your hand when we are lined up," "I like to play tag with you at recess," or "You make nice pictures." At the end of the school year, the bilingual children started using the same sentences as the monolingual children. The monolingual children had access to higher level vocabulary from the beginning, but were they more expressive?

INTERVIEWER: What do you think researchers and teachers who work with children from diverse backgrounds can learn from one another?

HUDICOURT-BARNES: Teachers are certainly closer to the children on a day-to-day basis and see them functioning in their social and academic context. They can help researchers understand the context and the children's day-to-day school life.

Researchers can help teachers take a different view of the ways diverse students participate in class and learn. Because teachers have little time available to sit back and observe children with an open mind, they may miss seeing the ways diverse students reason and make observations about subject matter. Teachers go into a class, or a session, with a set of expectations and a task to accomplish. They are very focused on discipline and curriculum and think a lot about ways to achieve their goals with the children. They have a classroom agenda. Sometimes they cannot see or appreciate events in the classroom that fall outside their agenda. A "good student" is usually one who takes up the teacher's agenda and participates in the way that the teacher expects. Researchers can help the teacher find the value of unexpected behavior, or of classroom events that seem to fall outside the teachers' daily agenda.

For example, a teacher might ask the children to describe an object (say, for a science lesson). Some children might give a definition learned from a book, and the teacher might find that acceptable. Some other children might tell a story of a situation in which the object was used; the teacher might find that less acceptable. The researcher, though, might help the teacher to see that both contributions are equally valuable because the children are bringing prior experiences and perceptions into the classroom, each in ways that s/he has learned at home. At Chèche Konnen, this is what we do. Teachers and researchers together analyze diverse students' contributions and thinking and use that analysis to inform the way we structure lessons, so that all the students' participate more fully in explorations and discussion.

INTERVIEWER: What advice would you give teachers and researchers who want to help children from diverse cultural and linguistic backgrounds learn and achieve high standards?

HUDICOURT-BARNES: I think the connotation of the word "standard" is that every child of a specific age should display certain behaviors. Who defines those behaviors? Who declares some of them "high" and some of them "low"? Is adult behavior the high standard? If adult-like behavior is the high standard, we should think about the culture defining the academic expectations and the cultures of the rest of the society.

In many Haitian families, for example, it is believed that Catholic schools offer the highest standards because the students in Catholic schools wear uniforms, look clean, and are taught that misbehavior is morally wrong. In many academically oriented families, a lower premium is placed on outward appearance — on whether a child's clothes are ironed or her hair is combed. It is also acceptable for these children to question adult authority, and taken for granted that high standards imply that children perform above grade level on standardized tests.

I think that in a quality educational setting the teacher's goal must be to diversify the students' experiences so that children can learn and become competent in a variety of contexts. I think teachers and researchers in diverse settings should embrace a democratic outlook, not a meritocratic outlook. They should

assume that all children are trying to make sense of the world around them and have been influenced in doing so by their parents' world-views and educational experiences. If the skills a teacher is practicing with the students are commonly used in some families and rarely used in others, those children who have already seen and/or practiced the skills at home will look like higher achievers. Those children who have not seen or practiced the same skills will take longer to learn them and will look like lower achievers while they are learning. The question to ask is, What do the minority or linguistic-minority children learn at home, and how can their knowledge and ways of knowing be used as stepping stones for setting up and evaluating classroom instruction?

FOR MORE INFORMATION

Readers interested in literature and projects dealing with the topics Hudicourt-Barnes discussed here might look up:

Hudicourt-Barnes, J. (1999). "Our kids can't," *Hands On!* (1). Accessible at <http://www.terc.edu/handsonissues/s99/s99.pdf>.

Conant, F., Rosebery, A., Warren, B., & Hudicourt-Barnes, J. (2001). The sound of drums. In E. McIntyre, A. Rosebery, & N. Gonzalez (Eds.), *Classroom diversity: Connecting curriculum to students' lives* (pp. 51–60). Portsmouth, NH: Heinemann. (This chapter describes students' and their teacher's learning experiences, as captured in a CREDE/NCISLA-funded research study.)

The Chèche Konnen Center web site (http://projects.terc.edu/cheche_konnen/) Located at TERC, the Chèche Konnen Center is spearheading a five-year national reform initiative funded by the NSF to improve elementary and middle school science for language minority students. At the heart of the Center is a research-based approach to teacher professional development that integrates inquiry and reflection on three strands: science and mathematics, teaching and learning, and culture and language.

A new EDUCATOR RESOURCES LIST for teaching culturally and linguistically diverse students mathematics and science. The annotated list posted at www.wcer.wisc.edu/ncisla/publications highlights publications and web sites that teachers, professional development consultants, parents, and administrators should find useful.

An Agenda for Research and Public Discussion of “Diversity,” Teaching and Student Learning

“Photo not available for web release”

Fourth-graders participate in an all-class discussion.

At the Children’s Ways with Words conference, excellent progress was made in setting an agenda to guide future national dialogues that would include the many parties concerned about diverse students’ learning mathematics and science. CREDE and NCISLA researchers, along with researchers and educators from organizations nationwide, also agreed upon a research agenda that could inform future policies, classroom practices, and teacher professional development programs.

With sufficient institutional and financial support, researchers Rosebery and Warren envision expanding the dialogue initiated at the conference to involve more teachers, researchers, policymakers, administrators, and parents across the nation. Such a dialogue, they propose, could raise awareness of diverse students’ high capacity to learn mathematics and science in classrooms in which students’ languages and cultures are accounted for in instructional design — and also yield policies and practices that better support diverse students’ learning and teacher professional development.

Attendees agreed that at least five broad topic areas — including specific questions and recommendations — require more discussion and

research. These are outlined below for policymakers, researchers, teachers, administrators, and parents concerned about educating students in ways that are both “responsive to the student[s] and responsible to the discipline[s]” of mathematics and science (Ball, 1997). (The following recommendations were derived from the conference report available at www.wcer.wisc.edu/ncisla/publications and at www.projects.terc.edu/cheche_konnen/.)

STUDENTS LEARNING SCIENCE AND MATHEMATICS

Intense discussion centered on the question: “What counts as scientific and mathematical knowledge and practice?” As conference attendees evaluated the case studies (see page 4 of this newsletter), they discussed essential features of mathematics and science classrooms with a focus on teaching for understanding. Key features included students’ engagement in group practices that align with aspects of adult mathematical and scientific practice, inquiry, and argumentation — and with community norms of mathematical and scientific accountability. The case studies illuminated various relationships between what practicing scientists and mathematicians do, what students do in classrooms designed to teach for understanding, and the ways schooling typically represents and assesses scientific and mathematical knowledge and learning. At the same time, the case studies showed students using varied sense-making resources, including forms of reasoned argumentation, explanations, juxtaposition of models, and other strategies that enhanced their learning. Teachers’ instructional approaches proved strategic in leveraging learning. Following are some of the questions attendees proposed for further public discussion and research:

- How is disciplinary understanding formed, and how does it emerge in classroom interaction? How can researchers and teachers

better understand the nature of learning-in-interaction and ways to foster it?

- How do skilled teachers use students’ understanding, no matter how unusual, wrong, or imperfect, as a powerful lever for change?
- How close or distant are the uses of language in mathematics and science classrooms to the uses of language in professional mathematical and scientific practice? What implications do answers to this question have for discourse in science and mathematics classrooms?
- As we create “authentic contexts” for learning science and mathematics, do we need to rethink what counts as evidence of mathematical and scientific understanding? How is disciplinary rigor maintained in such contexts? Do we see changes in the participation, learning, and achievement of typically marginalized students in such contexts? How do typically successful students fare?

TEACHER PREPARATION AND TEACHING SCIENCE AND MATHEMATICS

Analyses of the cases gave rise to questions and concerns about the preparation and professional development of teachers, given the need to teach in ways that are responsive to children and responsible to the disciplines of mathematics and science (Ball 1997). Teaching in this dynamic way is a complex act, requiring knowledge of both the ideas and practices of the focal discipline and students’ diverse ways of using language and of knowing. Rosebery states that if this complexity is taken seriously, concerned decision makers and practitioners will need to “rigorously reevaluate and redefine the practice of teaching and rethink teacher preparation and professional development in longer-term, intensive, and sustainable terms.” Questions requiring consideration include the following:

- What forms of professional development in science and mathematics will help beginning and experienced teachers see the deep connections between disciplinary ideas and practices and children's understandings and sense-making?
- What do teachers need to know about children's sense-making in relation to (a) central ideas and practices of science and mathematics; (b) use of language and other semiotic systems (e.g., notational systems, tool use); and (c) cultural resources and the knowledge and ways of knowing children bring into the classroom from their homes and communities?
- How can teachers learn to see the intellectual strengths of "at risk" children? What forms of professional preparation and development are needed?
- Teachers need to be able to use both general theoretical knowledge (e.g., of teaching, learning, the discipline) and highly situated local knowledge (e.g., of particular classrooms, particular children) in creative and flexible ways. What tools and forms of a professional community can support teachers' ongoing learning?
- What do these questions imply for the preparation of teacher educators and others who teach teachers?

TEACHING AS A PROFESSION

What does it mean for teachers to participate in professional practice and professional communities? Two of the teachers who presented conference case studies engaged in professional practice that included participation in a science or mathematics learning community, documentation of classroom episodes that focused on students' sense-making, analytical discussion of these episodes with colleagues, and presentation of their research to other audiences. Alone and in concert with colleagues, these teachers formulated and puzzled through interpretations and questions of classroom life. They did this (a) to better understand their students' ideas and ways with words; (b) to strengthen their own understanding of the discipline; and (c) to refine and elaborate their own practice in an ongoing fashion. These teachers, it is important to note, had administrative support to engage in

these activities, including release time. Their practice changed as a result of their engagement with researchers and colleagues and their participation in analytical activities. (See Rosebery & Warren, 1998; Rosebery & Puttick, 1998.) Participants at the conference posed the following questions for consideration and study:

- What is needed for teachers to become recognized arbiters of what constitutes good teaching and robust learning – and garner the regard accorded to other professionals (such as doctors and engineers)?
- How can educational researchers, policy-makers, administrators, and parents learn to see and respect the intellectual strengths and pedagogical skills of teachers?
- How do critical self-reflection and disciplinary learning become an integral part of teaching?

THEORY AND METHOD IN EDUCATIONAL RESEARCH

Depending on the paradigm a person brings to the discussion – "diversity," research theory, methodology, assumptions, and values about the nature of learning and teaching, language, symbol use, classroom discourse, and mathematics and science – can all be regarded differently and become a point of confrontation. Productive differences and tensions that arose during the meeting prompted the following questions for future address:

- How can theory and method in the field(s) of educational research be informed by multidisciplinary groups working on common data?
- What does the concept of "diversity" encompass, and how can it be used productively in analyzing learning and teaching? For example, how does diversity play out in classrooms relative to (a) students' sense-making resources; (b) different types of semiotic and representational systems; and (c) different types of curricular environments? How is linguistic diversity identified and organized as a "problem" or a "resource," instructionally, theoretically, politically?
- What is needed to bring researchers closer to the experience of the students and teachers for whom they design problems, investigations, activities, and the like?



(Left to right) Sarah Michaels (Clark University Professor of Education), Carol Lee (Northwestern University Associate Professor of English/Literacy), and Frederick Erickson (UCLA Professor of Educational Anthropology) in discussion at the Children's Ways With Words conference.

BUILDING A CROSS-DISCIPLINARY PROFESSIONAL COMMUNITY AND CREATING FORUMS FOR PUBLIC INVOLVEMENT

The conference attendees found that this unique forum – which focused on analysis of cases, rather than formal paper presentations – allowed them to interact productively about content and also to compare perspectives, assumptions, and methods. This experience was so valued that participants recommended not only expanding the initial forum to support the work of this emerging social science community, but also –

- Expanding this community to include more researchers and teachers, as well as administrators and policymakers. Rather than increasing the size of a conference, attendees suggested creating additional forums across the country to include this larger constituency.
- Creating forums to involve parents and children in exploring and discussing "what counts" as learning in science and mathematics, high quality curriculum and teaching, and meaningful assessment. There is as yet no publicly shared language for what is meant by high-quality teaching and learning in urban classrooms.
- Creating a journal devoted to promoting multidisciplinary research on learning and teaching in science and mathematics in urban settings.

For an expanded version of the questions and recommendations emerging from the conference, see the Special Report: “Children’s Ways With Words: A Conversation Across Disciplines” at www.wcer.wisc.edu/ncisla/publications and at www.projects.terc.edu/cheche_konnen/English/activities.

AERA'S NATIONAL MEETING FEATURES RESEARCH DEALING WITH DIVERSITY ISSUES IN EDUCATION

People interested in discussing cultural diversity and education issues should seek out CREDE and NCISLA researchers who will be presenting their work at the national meeting of the American Educational Research Association, April 10–14, 2001, in Seattle, Washington. Topics to be addressed include the following:

The AERA Commission on Research in Black Education Presents An “Educational Excellence Expo: Search for Knowledge in Our Cultural Practice”

(Interactive Symposium; Session 5.30; April 10, 2001) Beth Warren, Ann Rosebery, Josiane Hudicourt-Barnes, & Cynthia Ballenger, Chèche Konnen Center, TERC, presenting: Demonstration 2.

Documenting Learning Practice: Reports from the 1st Jackson Hole Datafest

(Symposium; Session 3.73; April 10, 2001) Beth Warren & Mark Ogonowski, TERC, presenting: *Making the Invisible Visible: Embodied Imagining as a Collective Resource in Understanding Gravity*.

Representations in Mathematics Learning

(Session 13.11; April 11, 2001) Roxana Moreno, University of New Mexico; & Richard Duran, University of California, Santa Barbara, presenting: *Interactive Visual Metaphors in Multimedia: Aids to Math Learning Among English Language Learners*.

Educational Research in Pasteurs Quadrant

(Invited Address; Session 21.06; April 12, 2001) Ann S. Rosebery & Beth Warren, TERC, presenting: *Chèche Konnen: Connecting Theory and Practice*. Susan R. Goldman, Vanderbilt University; Hugh Mehan, Lea Hubbard, University of California San Diego; & Mary Kay Stein, presenting: *Learning Research & Development Center: Reform as Learning in San Diego City Schools*. Discussant: Roland Tharp, University of California Santa Cruz

Culture, Diversity and International Research on Education Studies from the Center for Research on Education, Diversity and Excellence

(Symposium; Session 37.45; April 13, 2001) [See AERA directory for full presentation details.]

Information about the AERA meeting is available at www.aera.net or can be requested by E-mailing webmaster@aera.net.

CONFERENCE ATTENDEES SPEAK THEIR MINDS

Michele Foster,
Professor of Literacy Education and CREDE researcher, Claremont Graduate School,
Claremont, CA,

Creating “safe” spaces for teacher professional development:

Like students, teachers get boxed into being right or wrong. And in the same way we want kids to experiment and try, I think that is what needs to happen in schools and classrooms with teachers. As long as teachers are being held to this standard of either performing or not, either being great or not, being right or wrong, then they are probably not going to be any more open to risk-taking than anybody else. So I think that teachers need a safe place where they can feel comfortable with each other, where they're really trying to understand and learn, where they can offer each other suggestions without one person seeming to have the answer.

Aida Walqui,
Director of Teacher Development, WestED, San Francisco, CA

Teacher professional development as progressive and multilayered, implications for policy:

I think, in terms of policy, we've looked at teacher professional development very unidimensionally. We really need to review all of our premises and start looking at the many purposes that teachers need to satisfy along the continuum of their development as teachers. What are some formats that work best for certain purposes? [Preservice teachers and third-year teachers have different needs.] Both Suzanne and Apolinario [teachers presenting at this meeting] have been studying practice, have been helped by TERC people, provided with help to videotape their classes, provided with transcripts, and provided with a community that focuses on the multiple dilemmas that these case studies show. It would be marvelous to provide that for all our third-year teachers...It points to the vision of what is ideal for teachers who are beyond their first year of teaching and ready to more deeply investigate their practice, student thinking, and mathematics and science content.

Carol Lee,
Associate Professor of English/Literacy, Northwestern University, Evanston, Illinois

Expanding the conversation to include policymakers, parents, students, community activists, and others:

Unlike some countries that have national systems of education, the fact that we have a decentralized system of education means that we are constantly engaged in dialogue and compromise to come to terms with what schools should look like and what they should do and what counts as evidence that students are learning and what it is they ought to learn. To some degree, I think that as a community of educational reformers, we have largely talked to ourselves. We need to go outside our normal sets of associations and engage actively with policymakers, with parents, with community activists, with students themselves — to understand the various perspectives they bring, to understand the complexity of all the different vested political interests in this thing that we call education. And we need to better learn how to develop a common, straightforward language for talking about what we mean and what we think and what we value.

News & Publications

Center for Research on Education, Diversity & Excellence (CREDE)



CREDE ADDS CODIRECTOR

Dr. Yolanda Padrón has been appointed codirector at the Center for Research on Education, Diversity & Excellence (CREDE). A professor of curriculum and instruction at the University of Houston and a CREDE researcher, Padrón's work explores resiliency among English language learners. As codirector, she will guide the creations of CREDE's innovative "synthesis teams" – working groups of researchers, policy-makers and teachers. "There are new challenges for CREDE in the months ahead, but we'll continue addressing them so that we can improve the education of all our children and help them achieve academic excellence," said Padrón. "CREDE's work is crucial in bringing the needs of culturally and linguistically diverse students into the forefront of education." For more information on Yolanda Padrón's work, see her project page on CREDE's web site: www.crede.ucsc.edu/Programs/Program5/Project5_4.html, or call 713.743.9816.

NEW PUBLICATION SERIES: PRACTITIONER BRIEFS

Designed for teachers and other educators, Practitioner Briefs introduce classroom practices drawn from CREDE's research. First in the series:

Family Visits Benefit Teachers and Families – and Students Most of All. D. Kyle & E. McIntyre, October 2000. Available at www.cal.org/crede/pubs/PracBrief1.htm.

NEW RESEARCH BRIEFS

RESEARCH BRIEF #7: Improving Classroom Instruction and Student Learning for Resilient and Non-resilient English Language Learners. Y. Padrón, H. Waxman, A. Brown, & R. Powers, November 2000. Available at www.cal.org/crede/pubs/ResBrief7.pdf.

RESEARCH BRIEF #8: Linking Home and School Through Children's Questions That Followed Family Science Workshops. M. Callanan,

C. Alba-Speyer, & H. Tenenbaum, December 2000. Available at www.cal.org/crede/pubs/ResBrief8.pdf.

NEW CREDE-ERIC/CLL DIGESTS

Brain Research: Implications for Second Language Learning. F. Genesee, December 2000. Available at www.cal.org/ericcll/digest/0012brain.html.

Examining Latino Paraeducators' Interactions With Latino Students. CREDE, December 2000. Available at www.cal.org/ericcll/digest/0015examining.html.

NEW REPORT ON ASSESSMENT

The Role of Classroom Assessment in Teaching and Learning. L. Shepard, 2000. This occasional report develops a framework for understanding a reformed view of assessment, in which assessment plays an integral role in teaching and learning. The author explains how classroom assessment practices must be transformed to help students learn. (48 pp., \$8.00)

NEW RESEARCH REPORT

RESEARCH REPORT 9: Sociocultural Factors in Social Relationships: Examining Latino Teachers' and Paraeducators' Interactions with Latino Students. L. Monzó & R. Rueda, 2000. This report explores the impact of sociocultural factors on the relationships and interactions between Latino students and 32 Latino teachers and paraeducators. Findings suggest that teachers' and paraeducators' knowledge of students' cultures, communities, primary languages, and familiar interactional styles can facilitate meeting students' academic and social needs. (\$5.00)

NEWCOMER DIRECTORY REVISED

Directory of Secondary Newcomer Programs in the United States: Revised 2000. Compiled by D. Short & B. Boyson. This revised and updated directory contains profiles of 115 middle and high school newcomer programs serving

recent immigrant, secondary students with little or no English proficiency and often limited formal schooling across 196 sites in 29 states and the District of Columbia. (542 pp., \$35.00)

TWO-WAY IMMERSION DIRECTORY UPDATED AND ONLINE

The Directory of Two-Way Bilingual Immersion Programs in the United States. Compiled by J. Sugarman & E. Howard. Revised and online, this directory contains detailed information on 253 programs in 23 states and the District of Columbia and includes a search function to look for programs according to different criteria. Continuously updated, it is located at www.cal.org/twi/directory/.

NEW BOOK BY CREDE RESEARCHERS

Classroom Diversity: Connecting Curriculum to Students' Lives. Edited by E. McIntyre, A. Rosebery, & N. González, 2001. *Classroom Diversity* takes a sociocultural approach to curriculum design, which puts students' funds of knowledge and experiences at the heart of their learning. Drawing from nine different CREDE research projects, it presents both the theoretical framework for linking students' lives with curriculum and specific strategies from teachers who have done so successfully. This book (ISBN: 0-325-00332-7) is available from Heinemann at www.heinemann.com or tel. 800.793.2154.

Books by CREDE researchers are also available through CREDE's virtual bookstore in conjunction with Amazon Books at www.crede.ucsc.edu/Portfolio/Books/Books.html.

To order those publications available from CREDE, send a check, money order, signed purchase order, or credit card (MasterCard or Visa) information to CAL/CREDE, 4646 40th Street NW, Washington, DC 20016. Please include 10% shipping and handling (20% international orders). For questions on ordering, contact credepubs@cal.org or call 202.362.0700.



News & Publications

National Center for Improving Student Learning & Achievement in Mathematics & Science (NCISLA)

COGNITIVELY GUIDED INSTRUCTION (CGI) RECOGNIZED AT DC DECADE OF BEHAVIOR LAUNCH

Cognitively Guided Instruction (CGI) – an elementary mathematics instruction and teacher professional development program based on 15-plus years of research – was selected by a coalition of social science research organizations to be featured at the Washington, DC, launch of the Decade of Behavior. CGI was selected because it has yielded consistently positive results in young students' mathematics learning. NCISLA director and researcher Thomas Carpenter and teacher-colleague Mazie Jenkins explained CGI research and its implications for teacher professional development to national policy-makers and agency leaders. For more information about CGI, see the Teacher Resources and Publications pages at www.wcer.wisc.edu/ncisla.

NOW AVAILABLE ON-LINE

ALL the following publications from NCISLA researchers are available at www.wcer.wisc.edu/ncisla/publications

NEW REPORTS

Children's Ways With Words in Science and Mathematics: A Conversation Across Disciplines. Ann Rosebery and Beth Warren, February 2000.

Cognitively Guided Instruction: A Research-Based Teacher Professional Development Program for Elementary School Mathematics. Thomas P. Carpenter, Elizabeth Fennema, Megan Loef Franke, Linda Levi, and Susan B. Empson, September 2000.

Developing Conceptions of Algebraic Reasoning in the Primary Grades. Thomas P. Carpenter and Linda Levi, October 2000.

EDUCATOR RESOURCES LIST for Teaching Culturally and Linguistically Diverse Students Mathematics and Science

If you are a teacher, professional development consultant, parent, or school administrator, this extensive resource list might be useful to you. Researchers at the Chèche Konnen group at TERC have spent several years studying diverse students' learning and teachers' professional development. Together with their teacher-colleagues, the researchers have put together an annotated list that includes publications and web sites the Chèche Konnen team have successfully used to hone their understanding of student learning and mathematics and science content, and their teaching practices.

NEW ARTICLES AND CHAPTERS

The following articles and chapters are available both as PDF documents at the NCISLA web site and in print form at the noted National Council of Teachers of Mathematics (NCTM) teacher journals.

Gender Equity in Mathematics Education. Linda Levi. *Teaching Children Mathematics*, 7 (2), October 2000, 101–105.

Improving Data Analysis Through Discourse. Kay McClain, Maggie McGatha, and Lynn Hodge. *Mathematics Teaching in the Middle School*, 5 (8), April 2000, 548–553.

Why Are Some Solids Perfect? Conjectures and Experiments by Third Graders. Richard Lehrer and Carmen L. Curtis. *Teaching Children Mathematics*, 6 (5), January 2000, 324–329.

Children's Understanding of Equality: A Foundation for Algebra. Karen Falkner, Linda Levi, and Thomas Carpenter. *Teaching Children Mathematics*, 6 (4), December 1999, 232–236.

NEW WEB SITE

Reports and publications from ALL National Research and Development Centers are now accessible through ONE web site. <http://research.cse.ucla.edu/>

Federally funded research and development centers study critical issues:

- Assessment
 - At-risk students' learning
 - Adult learning and literacy
 - Diversity
 - Early childhood learning
 - English learning and achievement
- ...and more...

This web site is a useful resource and shortcut to current research conducted by centers funded through the U.S. Department of Education, Office of Educational Research and Improvement.

ABOUT THIS NEWSLETTER

This newsletter represents CREDE's *Talking Leaves*, Vol. 5, No. 1, Winter 2001

NCISLA's *Principled Practice*, Vol. 4, Number 1, Winter 2001

Writers: Susan Smetzer-Anderson, NCISLA Ann Rosebery, Chèche Konnen Center/TERC

Production: LUX Creative Services

This publication and the research reported here are supported under the Educational Research and Development Centers Program (PR/Award Numbers R305A60007 [NCISLA] and Cooperative Agreement No. R306A60001-96 [CREDE]), administered by the Office of Educational Research and Improvement (OERI), U.S. Department of Education. The findings and opinions expressed here are those of the authors and do not necessarily reflect the views of the supporting agencies.

Permission to copy is not necessary. This publication is free on request.

References

- Ball, D. L. (1997). What do students know? Facing challenges of distance, context, and desire in trying to hear children. In T. Biddle, T. Good, & I. Goodson (Eds.), *International handbook on teachers and teaching* (Vol. 2, pp. 769–817). Dordrecht, The Netherlands: Kluwer.
- Berman, P., Minicucci, C., McLaughlin, B., Nelson, B., & Woodworth, K. (1995). *School reform and student diversity: Case studies of exemplary practices for LEP students*. Washington, DC: National Clearinghouse for Bilingual Education.
- McLeod, B. (1994). *School reform and student diversity: Exemplary schooling for language minority students*. Washington, DC: National Clearinghouse for Bilingual Education.
- Rosebery, A. S., & Puttick, G. M., (1998). Teacher professional development as situated sense-making: A case study in science education. *Science Education*, 82, 649–677.
- Rosebery, A. S., & Warren, B. (Eds.). (1998). *Boats, balloons, and classroom video: Science teaching as inquiry*. Portsmouth: Heinemann.

Center Information



Center for Research on Education, Diversity & Excellence (CREDE)

University of California
1156 High Street
Santa Cruz, CA 95064

P: 831.459.3500

F: 831.459.3502

crede@cats.ucsc.edu
www.crede.ucsc.edu
www.cal.org/crede

Director: Roland Tharp

Codirector: Yolanda Padrón

Associate Director: Barry Rutherford

Communications: Stephanie Casher



National Center for Improving Student Learning & Achievement in Mathematics & Science (NCISLA)

Wisconsin Center for Education Research
University of Wisconsin–Madison
1025 W. Johnson Street
Madison, WI 53706

P: 608.263.3605

F: 608.263.3406

ncisla@education.wisc.edu
www.wcer.wisc.edu/ncisla

Director: Thomas P. Carpenter

Associate Directors: Paul Cobb, James Stewart

Communication Director: Susan Smetzer-Anderson



WINTER 2001

NATIONAL CENTER FOR IMPROVING STUDENT LEARNING & ACHIEVEMENT IN MATHEMATICS & SCIENCE

Wisconsin Center for Education Research
School of Education, University of Wisconsin–Madison
1025 West Johnson Street, Madison, WI 53706