WCER RESEARCH highlights

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Learning Communities Nurture Graduate Teacher–Researchers

Jen Schoepke is a graduate student in Industrial and Systems Engineering, focusing on human factors. She's recently worked at NASA's Jet Propulsion Laboratory on the Cassini-Huygens mission, which sent an unmanned craft to Saturn and one of its moons. Jen has already developed credibility as a researcher and knows that she will teach as part of her career. She wants her teaching to be as effective as her research.

In many cases, unfortunately, doctoral education and postdoctoral training programs fail to prepare future faculty to be effective teachers. The programs just have traditionally not been set up to do that.

But a good researcher can be a good teacher. Indeed, good teaching requires good research, for at the heart of excellent teaching is finding out what students have learned. This is a research problem, something that scientists and engineers have a natural inclination to do! And it will happen a lot more often because of

a learning community called the Delta Program in Research, Teaching, and Learning.

The name is no accident. As you may remember from high school chemistry, the Delta symbol Δ indicates a difference or a change. The graduate students participating in Delta undergo change in the way they think about research and teaching—in particular, that those activities are not separate.

For the past 5 years, the Delta Program at UW-Madison has brought together more than 1400 graduate students, post-docs, and faculty for teaching-related professional development. Three pillars anchor the program: Learning Communities, Teaching-as-Research, and Learning-through-Diversity (see text box, p2). Delta models the interactions that comprise a comprehensive and rewarding faculty life, says Associate Director Chris Carlson-Dakes.

Learning communities bring people together in intentional ways to accomplish shared learning objectives. Learning communities like Delta support the development of teaching ability that coexists with, builds upon, and integrates with research.

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WISCONSIN CENTER FOR EDUCATION RESEARCH

FROM THE DIRECTOR

Adam Gamoran

This issue presents the fourth and final installment in a series of articles summarizing 15 years of research findings from WCER's Consortium for Policy Research in Education. Among other accomplishments, CPRE has developed a procedure for identifying all of a district's and school's investments in professional development, and ways to redeploy those dollars to maximize their effect.

Graduate students training to be researchers master not only the content of their disciplines but also sophisticated statistical techniques. With the NCLB emphasis on being able to pinpoint "what works" in education, there's a need for researchers to be able to conduct rigorous quantitatively sound research. Researchers-in-training like Alyn Turner and Richard Prather are gaining those skills in WCER's Interdisciplinary Training Program.

Learning communities in higher education can support the development of teaching ability in a way that coexists, builds upon and integrates with research. UW-Madison's Delta project is part of the NSF-funded Center on the Integration of Research, Teaching, and Learning. The goal is develop a national faculty in the sciences, engineering, and mathematics who implement and advance effective teaching practices for diverse student audiences as part of their professional careers.

Adam Gamoran
WCER Director
Professor, Sociology and Educational Policy Studies

The Pillars of Delta

Three ideas underlie all Delta activities.

Learning Communities, the focus of this article, bring together groups of people for shared learning, discovery, and generation of knowledge.

Teaching as Research is the deliberate, systematic, and reflective use of research methods by STEM instructors to develop and implement teaching practices that advance the learning experiences and outcomes of both students and teachers.*

Learning through Diversity capitalizes on the rich array of experiences, backgrounds, and skills among undergraduates and graduates-through-faculty to enhance the learning of all. It recognizes that excellence and diversity are necessarily intertwined.*

Teaching as Research and Learning through Diversity will be explored in a subsequent issue of Research Highlights.

Delta is part of the National Science Foundation-funded Center for the Integration of Research, Teaching, and Learning (CIRTL; www.cirtl.net/). CIRTL aims to develop a national faculty in science, technology, engineering, and mathematics (STEM) who are committed to implementing and advancing effective teaching practices for diverse student audiences as part of their professional careers.

Why learning communities?

"A learning community supports its members as they collectively strive towards common learning goals and objectives," says Co-Faculty Director Bob Mathieu. "It encourages a diversity of viewpoints and opinions. When we say a learning community is an intentional environment we mean that each program, activity, and interaction within the community is intended to further the primary learning goals."

In learning communities, experts help novices succeed. Learning communities engender feelings of belonging, feelings that can be so strong that members report changes in identity as a result of membership.

In forming Delta, Mathieu says, "we specifically applied learning community principles to professional develop-ment in graduate education. We wanted a conceptually driven and intentionally designed community working together to develop their teaching skills."

That the Delta teaching and learning community was established at a research-intensive institution like UW-Madison shows that teaching and research can

indeed go hand in hand. The successful program has thrived beyond the term of the original National Science Foundation grant and is now supported almost entirely by the university.

Over the long term, the program should enhance the learning experiences of future undergraduates across the nation. Current and future faculty are learning how to change the landscape of higher education in the sciences, engineering, and math.

Four core elements of a learning community

Shared learning and discovery. Shared learning can take many forms, but common to all is the decentering of the teacher as the sole source of knowledge. The "teacher" becomes a facilitator who structures experiences that enable students to learn from and with one another. A graduate student who participated in several Delta offerings reflected on the role of shared learning and discovery: "The atmosphere in the classroom or wherever we are still comes out to be more of a community atmosphere with people working together for a common cause, rather than everyone being competitive and doing it on their own."

Functional relationships. Learning communities develop when the interactions among learners are meaningful, functional, and necessary to accomplish the work of the learning community. Interactions should lead to meaningful connections that extend throughout the learning community and not limit themselves to specific cohorts or role-related peers. Members continue to interact because their interactions produce something of value to them and to the learning community itself.

Inclusive learning environment. Research demonstrates that groups produce higher quality output when diverse perspectives are represented. Learning community leaders monitor activities to ensure a sufficient variety and quantity of opportunities to attract a diverse participant base. Delta's 54% participation rate for women exceeds that in UW-Madison STEM fields, in which 38% of doctoral students and 30% of postdoctoral researchers are women. Of the Delta participants whose race/ethnicity is known, more than 11% are from underrepresented groups, which is above the institutional average. (This figure does not include Asian Americans, who are not under-represented in STEM fields.) Across disciplines, 43% of Delta participants are from the biological sciences; 19%, from engineering; and 22%, from the physical sciences.

Connections to other learning experiences. Learning communities flourish when participants can make implicit and explicit connections to experiences and activities outside the course or program. These connections help situate and embed learning in a larger context. They reduce isolation, increase diversity in people and programming, and help create a campus-wide momentum for educational and curricular reform. Connectivity

is a vehicle for the sharing of resources, delegation of responsibilities, and reduced redundancy of opportunities across campus.

Learning community outcomes

Participants have observed that Delta gives them the vocabulary to talk about teaching and learning. For example, one participant said that the language she learned from Delta enables her to articulate what she knows about teaching in an intelligent way, a skill that proved immensely valuable at an interview for a position at a community college.

Members share responsibility for, and contribute to, the products of the community. They assume roles that are important to the running of programs and activities or take responsibility for the "care and feeding" of the community, including helping new members acclimate and accomplish their learning goals.

Members share responsibility for Delta's operations in many ways. Veteran student members have developed ways to "buddy up" with new members in classes and through monthly roundtable dinners, and faculty participants have become a second generation of course and program instructors. A Delta participant who graduated and found a teaching position at a local liberal arts college now serves on the Delta Internship Committee, offering internships at her institution to Delta participants.

Successful implementation of learning communities such as Delta ultimately results in cohorts of peers who benefit from a shared identity. They belong to a community for which they feel ownership and commitment. Feelings of membership manifest themselves as participants collectively contribute to, and take responsibility for, sustaining the community.

For more information, see the Delta site: http://www.Delta.wisc.edu/index.html and the CIRTL site: http://www.cirtl.net/

These programs are funded by the National Science Foundation and the University of Wisconsin-Madison.

Jen Schoepke   **Chris Carlson-Dakes**   **Bob Mathieu**

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CPRE's School Finance Research: 15 Years of Findings

PART IV: Synthesis with Policy and Practice Implications

With the ever-increasing emphasis on rigorous performance standards in education, schools face more demands for accountability. In the world of school finance, this emphasis has induced a shift from equity to adequacy in policy and litigation.

For 15 years, the Consortium for Policy Research in Education (CPRE) has worked to better align allocation and use of resources to school-based strategies to boost student learning.

The previous installment in this series discussed uses of dollars after a school finance reform. This installment concludes the series by offering a synthesis of findings and implications for policy and practice.

Over the past 100 years, per-pupil spending in the U.S., after adjusting for inflation, has increased about 3.5% annually, says UW-Madison education professor and CPRE director Allan Odden. The percentage of the dollar spent on instruction has remained the same, about 60%-61%. Policy makers and researchers still need to know more about the way resources are currently being used within the instructional category, Odden says. Gaining that knowledge would represent a first step toward knowing how better to use these resources to produce higher levels of student achievement.

Reallocating professional development resources. CPRE has developed a procedure for identifying all of a district's and school's investments in professional development and devising ways to redeploy those dollars to more effective strategies. This framework is used to conduct periodic fiscal audits of professional development to identify the level of investment and the foci of those investments. With this information, most districts, particularly larger districts, can reallocate substantial professional development resources to more intensive programs that focus on improving teachers' instructional practice in core academic subjects like mathematics, science, reading, writing, communication, and history.

Gaining insight into "what works" in education. The CPRE fiscal reporting structure shows expenditures by key educational strategies at the school and district levels, including details of all investments in professional development. By collecting these school-level data, as well as teacher- and classroom-level data, states can gain insight into "what works" in education. This kind of data enables policy makers and practitioners to engage in evidence-based policy making and practice and to reallocate resources to more effective uses.

Identifying an adequate level of resources. CPRE also has developed an evidence-based method of identifying an "adequate" level of resources (see gray box p.5) for districts and typical elementary, middle, and high schools.

This method yields data on the level and types of resources that should enable most schools to dramatically increase student academic achievement.

Doubling student performance and closing the achievement gap. Odden suggests that states sponsor studies of schools that have doubled performance and incorporate these findings into training programs to help share that knowledge among all districts and schools. States then should recalibrate their school finance structures to provide the resources they need.

Identifying an adequate teacher salary level. CPRE recommends that states analyze federal data to identify the salaries of workers whose knowledge, skills, and job responsibilities are similar to those of teachers, and then set the average teacher salary at about the same level. Odden also encourages states to provide salary premiums for teachers in subject area shortages—for example, mathematics and science—and in urban schools and low-performing schools. Salary premiums would help ensure that states can compete in the labor market for quality teachers in those subjects and in those communities.

Implementing new forms of teacher compensation. Teacher compensation structures can more closely link the level of pay to the level of effectiveness in producing student learning. Although there are multiple ways to design such structures, CPRE research suggests that states and districts base increases in compensation not on education degrees and units, or years of experience (except for the first 3 years), but rather on factors linked to student learning gains, such as scores on a performance-based evaluation system. New compensation strategies encourage teachers to learn and use more effective instructional strategies.

Devising a more strategic human resource (HR) system. A district audit of HR alignment would determine how well the elements of the HR system—recruiting, selecting, socializing, deploying, training, evaluating, and paying teachers—adhere to the district's instructional improvement strategies and to its vision of good instruction. The various pieces of the HR system should send consistent and reinforcing messages, all geared to improving student academic performance.

> *As mentioned in previous installments of this report, the term* **adequacy** *may seem to narrowly focus on the amount of money needed to produce a desired level of student achievement.*
>
> *But the more general intent underlying the focus on adequacy is to redesign the education finance system to link resource levels, and resource use, more directly to student learning.*

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Measuring student learning at three levels. CPRE research aims to determine "what works" in education, using a variety of methodological approaches. CPRE researchers are identifying effective programs and strategies through sophisticated statistical techniques. One is a three-tiered educational framework that measures student learning factors at the student level, the classroom/teacher level, and the school level. CPRE researchers use this framework to verify whether, and to what extent, specific variables at these three levels, in specific contexts, actually link to student learning gains. Over time, the goal is to verify the positive impacts of various efforts to improve curriculum and instruction as well as the various cost elements in school-level adequacy models.

States and districts can restructure their financial reporting systems in ways that incorporate CPRE's expenditure framework and its broader recommendations for use of classroom and teacher data. Investigating these issues inside schools provides a key to understanding—from both programmatic and fiscal perspectives—how to improve student achievement dramatically.

The complete CPRE report is available online as a 33-page PDF: http://www.wcer.wisc.edu/cpre/

Allan Odden

Training Tomorrow's Researchers

The No Child Left Behind Act provides strong incentives to choose education policies and programs that work. Yet traditional educational research has rarely been designed with the goal of providing scientific evidence of "what works," and relatively few educational researchers have been trained in how to do that kind of rigorous quantitatively sound research.

WCER's Interdisciplinary Training Program (ITP) in the Education Sciences is preparing a new generation of scholars who can provide solid evidence of "what works" in education.

Supported by the U.S. Department of Education's Institute of Education Sciences (IES), the ITP focuses on two related themes: designing and implementing field-based randomized studies in schools and other complex, real-world settings; and statistical analysis of quantitative data (from surveys, observations, and assessments) on education, with special attention to questions of causal inference.

ITP Fellows come from several disciplines, including sociology, economics, psychology, political science, and social welfare. Working with more than 25 scholars from across campus, they receive specialized academic, professional, and financial supports and field research opportunities.

ITP Fellow Richard Prather brings training in Brain and Cognitive Sciences to his current studies of the mechanisms of learning in human cognition. He focuses on arithmetic learning, including arithmetic principles, concepts, and problem-solving strategies. With UW-Madison education professor Martha Alibali, Prather published a study of adults' knowledge of principles of arithmetic with negative numbers. They investigated the links between knowledge of principles and problem representation. In their recent study, participants who displayed greater knowledge of principles of arithmetic with a negative number were more likely to set up equations that involved negative numbers.

The study found that participants' knowledge or arithmetic principles was related to their problem representation. "The ITP program has very much enhanced my ability to conduct education related research," Prather says. "They have very generously provided funding for attending several research conferences. This allows me to present my research to education researchers and to form collaborations for future work. Given the very broad nature of education research, these sorts of collaborations are very beneficial to producing innovative education research."

ITP students fulfill the requirements of their disciplinary departments and are firmly grounded in the theoretical and methodological tools of their respective disciplines, including advanced statistics. Within this framework, the ITP program allows students and their mentors to craft individualized experiences that meet the students' interests and their disciplinary requirements.

Fellows' doctoral dissertations emphasize questions that are theoretically informed and stimulated by practical concerns, says ITC Director and WCER Director Adam Gamoran. Their work attends to issues of causal inference, through randomized field trials, quasi-experimental studies, and/or rigorous statistical adjustments to non-experimental data.

Entry-level students are in their first or second year of graduate study and receive up to five years of funding. Advanced students, like Prather, entered ITP as dissertators and will complete their dissertations within two years after entry. They receive up to two years of funding.

Internships

All entry-level students serve an internship on a large-scale randomized controlled trial in education (see sidebar). Typically occurring in the students' 3rd year in the program, the internship supports their development as independent researchers.

Richard Prather

Two kinds of internships are available. One involves spending a semester at a research institute like Mathematica Policy Research. The student participates in a variety of randomized trials, selecting from projects that best align with their personal research interests. Students see many projects in many different phases: some are at the design phase, some are in the coding phase, some in the analysis phase. They get a sense of the cycles projects go through. Exposure to the corporate culture at a place like Mathematica provides an insight into a non academic working environment.

As an alternative, Fellows may choose to intern with UW-Madison faculty researcher on a WCER project. One student, for example, is doing data analysis for a Los Angeles-based elementary science research project that's being evaluated by faculty members Adam Gamoran and Geoffrey Borman. Another student will work on a randomized trial in Milwaukee with WCER's value-added research project. Another is studying the political participation of parents whose children attend an after school program called Families and Schools Together, which builds social capacity among parents. Research suggests that parents who are more engaged in the community are also more politically active.

Coursework

ITP students take courses and advising in education and other social science disciplines. They pursue a distributed minor in Education Sciences, consisting of four courses outside their home departments related to their scholarship on education.

For most students, the minor includes at least one course in experimental design, such as design of educational experiments; at least one course in measurement, such as test theory; and two courses in education in context, such as policy issues in educational assessment, professional development and organizational learning, seminar in the politics of education, and introduction to the learning sciences.

Through the minor courses and an inter-disciplinary seminar, students work with a variety of faculty from outside their home departments. At least two members of the training program faculty sit on each student's dissertation committee.

For more information see the ITP web site: http://www.wcer.wisc.edu/itp/

ITP Fellow Profile

Alyn Turner is a fourth-year sociology student at UW-Madison and a third year ITP fellow. Her research is supported in part by funds from the National Science Foundation.

Alyn recently interned at Mathematica Policy Research Institute. At a recent noontime brown bag meeting she discussed her internship, which so far has involved three research projects.

Alyn Turner

To date Alyn has worked on three projects. The first explored 2005 DHHS Dietary Guidelines to identify and analyze the scientific basis for dietary recommendations for children. For this project, Alyn systematically reviewed scientific statements made by organizations such as the American Heart Association and the American Pediatrics Association and made assessments both about the process that each organization went through to gather evidence to support dietary recommendations for children and about the extent to which the recommendations were based on evidence on children or on adults.

The second project was an evaluation of Head Start Region III's implementation of "I am Moving, I am Learning," a Choosy Kids, LLC initiative that aims to prevent childhood obesity and promote active learning. Alyn analyzed qualitative interviews with Head Start program directors, teachers, and parents of Head Start children to develop logic models to describe variations among program implementation of IM/IL within classrooms.

The third project Alyn was involved with was an impact study a community center program designed to target orphaned and vulnerable children in Zambia. This intervention aims to improve the well-being of orphans and other vulnerable children ages 8-19 and to increase the percentage of children attending school. Alyn's role on the project was to develop a detailed codebook for researchers analyzing quantitative data from two surveys previously administered in the community.

Alyn's internship experience included in-depth discussions about program evaluation in a randomized trial setting. Specifically, in her work with the IM/IL implementation study, she analyzed data on how programs were using the IM/IL initiative. This information will be used to design a randomized trail of the impact of IM/IL participation on reducing obesity rates among Head Start participants.

Alyn says her experience at Mathematica was eye-opening. "I was able to see how research is done in a non-academic setting. The main differences included the focus on pleasing the client with rigorous and well-designed studies that address the client's concern and the quick turn-around of projects that have strict deadlines and budget constraints. There was also a focus on working with teams of researchers who bring distinct expertise to the project. These teams change with each project, giving each researcher the opportunity to work with many people from different disciplines over the course of a year."

Alyn says she also benefited by gaining a better understanding of the different settings in which research can be done. "That clarified for me that students may want to expand their career considerations to include policy research firms in addition to the option of working in the academy," she says. "Research done in non-academic settings is equally exciting and rigorous, albeit done with less autonomy."

Alyn's internship experience gave her exposure to the option of working for a company like Mathematica in the future and experience with the potential trade-offs that are made choosing one type of career over another.

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www.wcer.wisc.edu/publications

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