Strong research mentorship has been linked to improved mentee self-efficacy, productivity, and ultimately career satisfaction. Unfortunately, mentors usually learn their craft by doing what their mentors did, or by trial and error. So it is not surprising that mentors’ capabilities and outcomes vary widely.

To test their conviction that a systematic, formal research mentor training intervention would result in more effective mentoring, WCER researcher Christine Pfund and a team at the UW–Madison Institute for Clinical and Translational Research (ICTR) adapted the published mentor training curriculum, Entering Mentoring, for the use of health sciences researchers. The curriculum focuses on six competencies:

- maintaining effective communication;
- establishing and aligning expectations;
- assessing mentees’ understanding of scientific research;
- addressing diversity within mentoring relationships;
- fostering mentees’ independence; and,
- promoting mentees’ professional career development.

The facilitators were trained together by UW staff in Madison, Wisconsin, for 1.5 days prior to implementing the curriculum at their individual sites. Across 16 universities facilitators led mentors in discussion of case studies and critical reflection of their mentoring philosophy. Participants considered an intellectual framework for mentoring, explored strategies to improve their mentoring relationships, solved mentoring dilemmas, and created mentoring action plans. The team assigned 283 mentors to two groups: one that received the training and one that did not. Their mentees were not told to which group their mentors were assigned.

Before implementing the intervention, the research team measured mentors’ skills quantitatively and described mentors’ practices qualitatively. Mentors self-reported their scores on a skills inventory—Mentoring Competency Assessment (MCA)—designed to align with the curriculum’s six competencies. Mentors, in both the control and intervention groups, and their mentees took the MCA before and after the training intervention. The two scores were then compared.

**Outcomes**

The change in MCA composite scores was larger in the intervention group than in the
control group of mentors. The team identified skill gains at each study site. Moreover, they observed skill gains in nearly every item in the MCA. The measured gains were supported by qualitative data. These skill gains were irrespective of mentor gender or career stage, suggesting that the intervention can have broad impact. Even mentors with more than 15 years of experience recognized areas for improvement in their skills and practice.

In addition to MCA skill gains, intervention group mentors themselves reported a significant increase in their awareness across the mentoring competencies and a need to implement behavioral changes. Nearly all (97%) of intervention group mentors reported an increased awareness, intent to change, or actual behavioral change, compared with 53% of the control group mentors. Most (87%) of the intervention group mentors reported they had implemented at least one behavioral change, compared with 42% in the control group.

Their mentees’ reports aligned with these quantitative and qualitative results. Of the mentees whose mentors were in the intervention group, 68% reported at least one positive change in their mentors’ behavior, compared with 57% in the control group. Further, 44% of mentees noted two or more positive changes, compared with 24% in the control group. These mentees retrospectively reported greater skill gains.

This study shows that a structured approach to training can improve the quality of research mentoring at academic institutions. Pfund says that, to her knowledge, this is the first multisite, randomized, controlled trial to provide evidence of perceived skill gains and behavioral changes, from research mentor training, based on reports from both mentors and their mentees. Given the national call to train clinical and translational researchers, this evidence is timely.

The curriculum used in the study, as well as newly adapted curricula, are accessible on the web at https://mentoringresources.ictr.wisc.edu. In addition, research mentor training for mentors across diverse disciplines and career stages is offered regularly on the UW–Madison campus in partnerships with the Institute for Clinical and Translational Research, the Delta Program in Research, Teaching and Learning and Wisconsin Institute for Science Education and Community Engagement (WISCIENCE) formerly Institute for Biology Education.

See www.delta.wisc.edu and https://mentoringresources.ictr.wisc.edu for upcoming offerings.
**Dual-Credit Courses Improve College Access and Success**

Dual-credit courses allow high school juniors and seniors to enroll in a college course and earn simultaneous credit in high school and college. Earning college credits before graduating from high school makes the transition to college smoother and can increase the likelihood of success there and in the workforce.

So it’s not surprising that dual-credit courses are popular. In 2011, 76% of U.S. high schools reported that some students took at least one dual enrollment course with an academic focus, while 46% of high schools reported students completing dual enrollment courses with a career-technical education focus.

Students who particularly benefit from those courses are those who live in or near manufacturing centers like Wisconsin’s Fox Cities region. Its three counties employ manufacturing workers at two to three times the national average. The area is home to APPVION, for example, which produces thermal papers and films for receipts and coupons, lottery tickets, and medical charts. Pierce Manufacturing and Oshkosh Defense manufacture tactical vehicles for the armed forces. Plexus Corporation produces missile systems, thermal imaging equipment, and sensors for sonar and radar.

These companies and others draw many workers from Fox Valley Technical College in Appleton, Wisconsin. Students there learn industrial maintenance, metal machining, fabrication and welding, energy and environmental technologies, and mechanical design, among other subjects. And many of those students took dual-credit courses while still in high school.

Although dual-credit academic course completion has been studied in some states, little is known about how it helps students get into college and succeed there.

In 2013–2014 UW–Madison Professor Emeritus and WCER researcher Allen Phelps and colleagues looked closely at demographic factors and school factors associated with students’ success in dual-credit courses at Fox Valley Technical College and 20 large public high schools. Theirs was part of a larger study examining the factors affecting postsecondary student success at four Wisconsin technical college campuses.

The 2,295 students studied had graduated from high school between 2008 and 2010 and had enrolled at Fox Valley between 2009 and 2011. Student characteristics of interest included the number of accumulated dual credits, the rate of postsecondary course completion, whether students continued from the first to second year of college, whether they graduated from Fox Valley within 3 years, and their annual wages when employed.

School-related variables included 10th-grade standardized test scores or the 2008 average ACT scores; the percentage of students with disabilities or from diverse cultural backgrounds, school enrollment Grades 9 through 12, and the schools’ college-going emphasis, or seniors’ post-graduation plans.

**Course completion rates**

The study found that female students completed more dual credits than males; on average, 1.4 more credits of any kind of dual credit. Transcripted credit and advanced standing was positively related to college course completion rates. Students completing seven or more dual credits had a course completion rate of 14% to 17.5% higher than their peers.

**Likelihood of continuing to the second year**

Transcripted credit course completion was associated with a higher likelihood of continuing to the second year of study at Fox Valley. Students in engineering- or health-related programs were significantly more likely to continue to the second year, but transfer students were less likely to persist than their peers in Associate of Applied Science programs.

**Likelihood of graduation**

Transcripted credit and advanced standing students were significantly more likely to graduate in three years (11.6% to 12.6%), compared with their peers. Students with disabilities were less likely than their peers to graduate in three years. Students in the shorter technical diploma and certificate programs were more likely to graduate.

**Likelihood of employment**

Transcripted credit was positively related to the probability of being employed after college, although female students, English language learners, and students with disabilities were less likely to be employed than their counterparts. Students enrolled in engineering and manufacturing programs were more likely than students in other programs to be employed at or above the minimum wage. Students enrolled in one-year technical diploma programs were more likely to be employed than those in Associate of Applied Science degree programs.

*(continued on page 7...)*
WCER Celebrates 50 years of Informing, Teaching, Learning

In August 1964, UW–Madison signed an agreement with the U.S. Office of Education establishing what is now the Wisconsin Center for Education Research (WCER). The center’s mission was “to improve the efficiency of learning, both formal and informal, by children, youth and adults.”

From those origins, WCER has gone on to establish itself as one of the largest and most productive university-based education research centers in the world. Today, WCER features annual expenditures of more than $55 million and employs nearly 500 people.

Over the decades, this center within the School of Education has worked to improve teaching and learning by supporting faculty and academic staff researchers with facilities, project administration, technical services and grant writing support. Add it up, and much of WCER’s success is due to a remarkably high success rate with grant funding. In 2013, 52 proposals were submitted, with a success rate of over 35 percent.

Brian Bottge, now at the University of Kentucky, recalls his first year as an assistant professor at UW–Madison in 1997.

“Our department chair ordered me to make an appointment with WCER Director Andy Porter to discuss submitting a grant through WCER,” says Bottge, who spent 10 successful years with the Department of Rehabilitation Psychology and Special Education. “That was the best advice I have ever been given.”

As WCER celebrates its 50th year, we take a glance back at where WCER came from, and check out where it’s going.

The early years

From the beginning, WCER research focused on the nature of the human mind and human motivation.

In this regard, most WCER researchers took a cognitive, rather than behavioral, approach in their studies of learning and development. Their work drew from the emerging field of cognitive psychology and, in turn, has contributed significantly to its growth and refinement across the years.

Researchers in the 1960s documented how students learn and develop concepts, within and across subject areas. Staff published papers on the nature of complex, higher-order thinking, and research teams developed programs and instructional materials in mathematics, pre-reading, reading and motivation.

Cutting-edge studies of student learning in mathematics and science have also formed a core WCER activity for five decades.

“WCER didn’t simply respond to the expressed needs of investigators, its staff were knowledgeable enough and smart enough to be looking out on the frontiers to recommend solutions that we didn’t necessarily even know existed,” says former researcher Leona Schauble, who was among those developing innovative mathematics instruction at WCER during the 1990s.

One early WCER product was an instructional TV program called “Patterns in Arithmetic.” This program of videotapes, student lessons and teacher notes was used by children across the nation.

During the 1980s and 1990s, WCER’s National Center for Research in Mathematical Sciences Education integrated research on learning, teaching, curricular reform and assessment to produce Mathematics in Context. This middle-grades curriculum used realistic contexts to engage and motivate students and has been adopted by schools in Atlanta, Philadelphia, Chicago and elsewhere.

Mathematics researchers also produced Cognitively Guided Instruction (CGI), a professional development program for teachers of math in early grades.
Measuring outcomes to improve student learning
WCER researchers over the decades have also studied and designed better ways to evaluate student outcomes. Educators still use WCER’s Depth of Knowledge scales to compare the consistency of alignment among state-level content objectives and assessment items, and to measure how well expectations and assessments work together to improve student learning.

Educators from around the country use WCER’s “Surveys of the Enacted Curriculum” to produce reliable, comparable data on teacher preparation, teaching practices, curriculum and professional development.

And WCER’s Value-Added Research Center works with some of the nation’s largest school districts to turn mountains of student achievement data into actionable information. Sophisticated analytical tools are produced to develop and implement student growth measures and to help districts set achievement goals.

Graduate student training
Preparing graduate students for careers as education researchers has always been part of WCER’s mission. During the 1990s former researcher Stephen Elliott managed 13 grants through WCER (many with colleague Tom Kratochwill) that funded more than 90 graduate students.

And for over a decade now, the Center on the Integration of Research, Teaching and Learning has been developing a national faculty committed to implementing and advancing effective college-level teaching practices for diverse learners in the fields of science, technology, engineering and mathematics. Its national network now includes 25 colleges and universities.

“Fundamentally, the future faculty of the nation lies in today’s graduate students,” says Robert Mathieu, the director of WCER who is CIRTL’s principal investigator. “If we can enhance their graduate preparation in teaching, we can advance undergraduate learning across the nation.”

Examining the challenges of today
Among WCER’s many current focuses are its efforts to improve equity and inclusion in education.

The center is home to a national coalition of multiracial school districts called the Minority Student Achievement Network. It conducts research and examines practices to change policies that keep racial achievement gaps in place.

Art Rainwater, who was superintendent of the Madison Metropolitan School District from 1998 to 2008, presided over MSAN during its early days. “With the support of WCER,” he says, “the Network has continued to provide valuable work in the area of reducing student achievement gaps.”

Similarly, teachers today are working with more linguistically diverse learners than they have in decades past. The World-Class Instructional Design and Assessment (WIDA) consortium within WCER provides standards, assessments, and professional development for educators of English language learners in 33 states, plus the District of Columbia and Northern Mariana Islands.

And at the higher education level, the Wisconsin Equity and Inclusion Laboratory (Wei LAB) promotes equitable and inclusive learning and work environments, with one focus on broadening participation of African Americans in computing sciences.

Those within WCER also are examining cutting-edge ways to use the latest technologies as state-of-the-art learning tools. WCER’s Epistemic Games Group has developed a virtual internship called Nephrotex that places students in the role of virtual interns working for a fictitious biomedical engineering design firm. Nephrotex has been adapted into the UW–Madison’s Interdisciplinary Engineering 111 course.

As far back as 1964, researchers were thinking about how to use computers as instructional tools. But the technology researchers and educators use today would have been inconceivable then.

What has not changed is WCER’s continuing mission to make teaching and learning as effective as possible, no matter the range of challenges facing students, schools and society.

* STAY IN TOUCH! Research Highlights to Go All Digital! *

WCER Research Highlights will soon convert from a print publication to digital only.

Besides streamlining news delivery to readers, this change will conserve paper and save the costs associated with printing and distributing nearly 9,000 pieces of mail.

To continue receiving WCER research news in digital format, enter an email address in the space provided for WCER Today on this page: http://www.wcer.wisc.edu/publications/index.php

Or send an email to the editor at pbaker@wisc.edu
Program Prepares Mathematics Education Researchers for Careers

A mathematics training program at WCER is helping answer the nation’s need for a continuing supply of experts who can provide an empirical basis for curriculum design, assessment, instruction, and learning environments, and who can determine the effectiveness of educational programs and policies.

Future mathematics education researchers develop these skills in WCER’s Postdoctoral Training Program in Mathematical Thinking, Learning, and Instruction (website http://iespostdoc.wceruw.org/). Funded by the U.S. Department of Education’s Institute of Education Sciences (IES), the program at UW serves postdoctoral fellows by supplementing their graduate training experiences. For example, postdocs who specialized in curriculum and instruction may seek to learn more about quantitative research methods such as multilevel modeling. Students in psychology and other social scientists can come and learn how to conduct studies in natural settings and collect, analyze, and interpret process-level, qualitative data. The UW–Madison School of Education is rich with experts from a range of research methods and theoretical perspectives that these young scholars can learn and apply in ongoing research projects.

UW–Madison Education Professor Mitchell Nathan directs the program. He says it was designed to reflect the interdisciplinary nature of mathematics education research. That means two-year fellowships are available to students with an earned doctorate in mathematics education, psychology, learning sciences, or a related area. Student research interests have included basic processes in learning and instruction, curriculum development and innovation, efficacy and replication, and measurement.

The program helps fellows identify graduate research methods classes and theory classes to supplement their prior doctoral program training. Fellows produce peer-reviewed journal publications, contribute to annual conference proceedings and programs, and present at professional meetings.

One recent program fellow is Dr. Elise Lockwood, who has since secured a tenure-track position as assistant professor at Oregon State University (see testimonial). She participated in three federally funded projects directed by mentors while advancing her own research on undergraduates’ ways of thinking about combinatorial counting programs.

Another fellow, Dr. Candace Walkington, is now employed at Southern Methodist University. She says the IES postdoctoral program coupled excellent one-on-one mentoring from faculty with thorough training in the most recent statistical and experimental methods. She writes, “We had the opportunity to develop our own personal research programs and to continually improve our writing skills through publishing articles and writing grants. When going onto the job market, I felt confident in my competitiveness as a job candidate and in my ability to secure tenure once in an academic position.”

Nathan says research sponsored by the training program has already led to the design of new instructional practices that emphasize how teachers can more explicitly communicate the connections among mathematical ideas. To date, four postdoctoral fellows have progressed into more advanced research positions throughout the country. With the award of a new postdoctoral fellowship grant funded through August 2016, Nathan and colleagues will mentor up to four more fellows in cutting-edge research and teaching in mathematics education.

Testimonial

My experience in WCER’s postdoctoral program was probably the best thing that ever happened to me professionally. Perhaps the biggest way I benefited is through the practical effect it had on my research agenda and my progress toward tenure. By being involved with new projects, forming new collaborations, and also having the time to write up my own research, I now have a huge leg up with my publications and grants as I look ahead to tenure. Thanks to the postdoc, I started my job at Oregon State with a lot of momentum in my research. Being at UW raised the bar in what I wanted to strive for in terms of my research, and that is something that I am sure will continue to pay dividends as my career progresses. I tell everyone who will listen about how great the postdoc was for me.

Elise Lockwood Oregon State University
This study used data from the Wisconsin Technical College System office, the Wisconsin Department of Workforce Development, and the Fox Valley Technical College in Appleton, Wisconsin. Data included students’ demographic background, transcript records, and subsequent wage records. Researchers analyzed the relationship between student backgrounds, educational experiences, and career success. The research design controlled for differences in student demographic backgrounds and abilities, as well as when they came to FVTC (immediately out of high school or later), and the program they selected.

Dual-Credit Courses Improve College Access and Success (...continued from page 3)

Employment income

Male students, those in manufacturing programs, and those in 2-year technical diploma programs tended to have higher incomes than females, students in other majors, and in Associate of Applied Science degree programs, respectively. Transcripted credit was positively related to FY13 annual income in general, but dual credit course work was not related to FY13 annual income above federal minimum wage. (Earnings data are only for the oldest of the three cohort years (high school grads of 2008), and earnings data were only reported for one year, 2012–13.)

It’s a good option

It appears that accumulating more dual credits—specifically transcripted credit—is associated with better academic outcomes at Fox Valley.

The positive results for selected dual-credit courses taught by high school teachers (transcripted credit and advanced standing credit) contrasts directly with findings of prior studies. One, for example, found positive student outcomes from dual-enrollment programs only when the courses were completed on a college campus.

Phelps says that students still considering technical careers in manufacturing in Fox Cities aren’t the only ones to benefit from this information. This regional information will contribute to the national dialog about college completion and stands to inform secondary education policy. In short, dual-credit coursework is a good option for high school students, and its proven success should encourage more schools to offer this pathway.

An enormous number of personal and academic factors could influence students’ academic efforts and their success in college, including family background, academic ability, high school curriculum, and so on. From various studies we know that some factors are more important than others. Prior studies have also indicated that some factors are more related to other factors, whereas some are relatively distinct and by themselves have a major influence on what happens to students’ college success. To find these factors and to understand their relationships in a statistical way, education researchers often rely on multiple linear regression techniques. This technique allows us to consider a number of factors simultaneously (that’s why it is called “multiple”), control for the influence of other factors, and pay more attention to the unique contribution of certain factors to the outcome we are interested in.