Faculty collaboration improves undergraduate teaching

This collaborative professional development program encourages faculty to share their experiences in teaching and learning.

The quality of undergraduate education at the UW–Madison is being improved through a new faculty development program in WCER called Creating a Collaborative Learning Environment (CCLE). Initiated and supervised by faculty in the UW–Madison College of Engineering, the program has expanded to include more than 60 teachers from around campus, including the College of Agricultural and Life Sciences and the College of Letters and Science. The three-year project, supported by a grant from the Fund for the Improvement of Postsecondary Education (FIPSE), U.S. Department of Education, will benefit higher education nationwide as participants share their findings through a number of channels.

Participation in CCLE challenges university faculty—some for the first time—to think about the way students learn, and how teaching could be better directed toward student learning, says CCLE Program Director Katherine Sanders. Providing an opportu-

From the Director

A quality undergraduate education

WCER shares the UW–Madison's commitment to excellence in undergraduate education, and this issue of *Highlights* looks at two of WCER's pertinent efforts. UW–Madison Educational Psychology Professors Sharon Derry and Joel Levin have designed an innovative course to help undergraduate students considering a teaching career to engage in scientific data gathering and statistical problem solving. The course is based on the realization that literacy and informed decision-making require the ability to think statistically. In this multidisciplinary course preservice teachers engage in situated simulation activities, or "SitSims," where they form small groups that simulate productive communities of practice within larger society.

WCER's Creating a Collaborative Learning Environment (CCLE) project, initiated by faculty in the College of Engineering, is a voluntary professional development process where faculty collaborate to share their experiences in teaching and learning. Katherine Sanders and Michael Corradini help more than 60 faculty from the College of Agricultural and Life Sciences and the College of Letters and Science, as well as Engineering consider new ideas, perspectives, and techniques. Participants help each other plan, implement, and assess changes in the classroom, based on their new insights into learning. Most participants become motivated to change their teaching: They expand their definition of the teacher's role in the classroom and begin to see themselves from the learner's perspective.

Our National Institute for Science Education (NISE) is identifying and studying critical issues related to first-year college courses in science, mathematics, engineering, and technology (SMET). We recognize the first year of postsecondary SMET education as a curriculum "pressure point." Experiences in first-year courses greatly influence students' career paths and lifelong attitudes toward SMET-related fields. Our College Level One Team, directed by UW–Madison Chemistry Professor Arthur Ellis, is identifying effective, sustainable practices in courses and curricula and identifying cultural and structural characteristics of SMET courses that help lead to educational equity for women, students of color, and students from low socioeconomic status groups.

For information about these and other research projects at WCER, visit our Web site at http://www.wcer.wisc.edu.

Andy Porter

nity for in-depth study about how people learn, CCLE is a voluntary, collaborative professional development process. Faculty work together to share their experiences in teaching and learning and serve as a resource for each other. They help each other plan, implement, and assess changes in the classroom, based on their new insights into learning. Most participants become motivated to expand their definition of the teacher's role in the classroom, to begin to see themselves from the learner's perspective, and to change their teaching.

Reaching underrepresented groups

As CCLE faculty in the College of Engineering develop their teaching skills, they are developing innovative curricula to attract and retain more students from underrepresented groups—minorities and women—in engineering majors. In the past, only 15 to 20 percent of incoming freshmen in pre-engineering have been women. And attrition rates have been relatively high: 15 percent of the men and 35 percent of the women from that incoming freshman class typically drop their engineering majors by the end of the first semester, before they have ever had an engineering course. It is common in engineering for students to report difficulties in seeing connections between science and math and their own future as potential engineers.

To remedy the problem, a group of CCLE faculty piloted a team-taught "Introduction to Engineering" course in the 1994–95 school year with approximately 80 pre-engineering freshmen. Student retention rates have since improved. Of the students who took the course that first semester, 96 percent are still in engineering, compared with 75 percent retention for the students who signed up on a waiting list for the introductory course but didn't take it. The overall retention rate for the 1994–95 freshman class of pre-engineering students is 58 percent. The introductory course was taught to 220 students in fall 1995, and by 1997 it will be offered to the entire freshman class.

The program expands

Since the conclusion of the pilot CCLE program in Spring 1995, the FIPSE grant has allowed CCLE to expand its services beyond the College of Engineering to the physical sciences. CCLE Program Director Katherine Sanders says the inclusion of more diverse faculty into CCLE is strengthening and stimulating the program. CCLE has welcomed 21 new participants: 10 from engineering and 11 from physical sciences, including math, chemistry, physics, food science, soil science, computer science, statistics, and geology. Michael Corradini, principal investigator of the FIPSE grant and a Professor of Engineering, says the three new first-year faculty teams are examining the learning process, while the two more experienced groups are exploring special topics including assessment of student learning, classroom experimentation, and integrating design into the engineering mechanics curriculum.

JEFF MILLER

Workshops and new initiatives

Over the past year, guest speakers have conducted workshops and shared their teaching techniques. Tim Riordan of Alverno College, for example, helped CCLE faculty devise developmental assessment strategies, and William Cerbin of UW–LaCrosse demonstrated how to use techniques such as writing assignments and collaborative classroom exercises to help students confront their own misconceptions about such fundamental topics as the change of seasons. In a workshop on constructing meaningful teaching evaluations, Cerbin showed CCLE participants how to mentor other faculty in course portfolio construction and evaluation strategies.

CCLE faculty are creating forums for learning outside of CCLE. A series of monthly brown-bag meetings called "Connecting Dialogues: Teaching and Learning Conversation" allows teachers and students from across disciplines to share teaching and learning experiences. About 20 graduate students and faculty participate now; in the fall semester undergraduates will be recruited to incorporate more student perspectives.

Besides providing workshops and guest speakers, CCLE supports faculty with a diverse set of readings and alternative perspectives on topics including learning styles, teaching techniques, and ways of assessing gender and cultural issues. "CCLE guides participants through the program and opens doors to new views that may otherwise remain unopened," Sanders says. As an example, in spring semester 1996, CCLE helped interested faculty design, advertise, implement, and assess the outcomes of a lab section devoted to "Women's Issues in Engineering," one of 14 laboratory sections in the Introduction to Engineering course. A group of six faculty meets weekly to discuss gender issues in teaching and learning and to transfer those insights to the Introduction course. This group will meet through the summer to plan laboratory activities and assessment approaches for the fall semester.

Where it's going from here

Sharing the results of this project is an important part of CCLE's mission. Over the past academic year, CCLE's structure and effects have been presented at the Lilly Conference on Excellence in College Teaching, meetings of the American Association for Higher Education, and via a PBS Adult Learning Network broadcast, "TQM in Higher

CCLE participants begin to see themselves from their students' perspective.

Education: Curriculum Development." Journal articles are being drafted for submission to *Innovative Higher Education, Change* magazine, and the *Journal on Excellence in College Teaching.*

Program Director Sanders says the project aims at three outcomes: to raise faculty awareness of the need for teaching improvement and development; to support and train faculty to experiment in their classrooms with different teaching styles to improve and assess student learning and to communicate these results to colleagues; and to work across colleges with faculty to develop new curricula that transcend traditional disciplinary lines and lead to more unified courses in the physical sciences.

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The program was initiated by faculty in the UW–Madison College of Engineering but now includes teachers from around campus.

3

Innovative course develops statistical reasoning skills

We live in a world of uncertainties. In a constantly changing world, we are expected to make decisions about our personal affairs and community concerns. Research indicates, however, that most adults in American society cannot think probabilistically or statistically about important societal issues.

Making effective decisions requires thinking in terms of probabilities and, often, referring to statistics we've heard or read. A recent referendum in Madison, Wisconsin, for example, called for a city-wide ban on handguns. In heated debates, proponents and opponents of the ban cited statistics on gun-related violence. And in a proposed ban on smoking in all city restaurants, citizens and business owners marshaled statistics on smoking-related illness and how the ban might hurt the restaurant business. Citizens had to sift through the statistics presented, evaluate the evidence, and reach conclusions based on the validity of the arguments.

Students measure the rate of growth of "Wisconsin Fast Plants," a specially engineered strain of plants that grow very quickly, allowing for easy study. Working in groups of five or six, students gather statistical data using many tools, including rulers, calipers, calculators, and a digital scale. Each group studies about a dozen plants; one student may count the number of flower buds, another may count the number of leaves. Some discuss ways to measure the plants' relative greenness and height; others discuss possible sources of bias in their measurements and observations.

Future teachers taking an innovative class at the University of Wisconsin–Madison are developing the statistical literacy needed for such decision-making, and they'll eventually help their students use statistics to become better citizens and thinkers. A new multidisciplinary undergraduate course in statistical reasoning, designed and taught by Educational Psychology Professors Sharon Derry and Joel Levin, engages students who are considering a teaching career in scientific data gathering and statistical problem solving and in using statistical concepts as tools for social reasoning. Among the students are participants in the School of Education's Education Fellows program, which recruits students of all backgrounds who are interested in teaching in underserved areas.

This multidisciplinary undergraduate course:
- ▶ invites students to solve problems set in "real world" community contexts that can be understood by applying statistical concepts and principles
- ▶ involves students in social, cross-cultural problem solving that requires evidential argument, debate, negotiation, and decision making
- ▶ engages students in investigating and examining their own thinking and decision-making process.

The course represents an important step in reforming teacher education: the systematic incorporation of statistics into teacher training. In the past, typical university statistics courses did not attempt to foster critical thinking about broad social issues. Statistics has traditionally been taught as a set of tools particular to an academic subject. Each professor teaches his or her own version, using textbooks written expressly for majors in the field. Derry says that model of instruction is not appropriate for future teachers, who need to understand statistical principles as useful tools that can be employed across disciplines as a common language for social discourse, problem solving, and decision making.

The statistical reasoning course, offered once a year, involves about 20 percent lecture/demonstration, 50 percent simulation activity, 20 percent group self-critique, and 10 percent evaluation. In situated simulation activities, or "SitSims," students form small communities that simulate productive, motivated communities of practice within larger society. Group activities are designed with help from professionals and researchers from a variety of disciplines: law, psychology, chemistry, pharmacology, and biology. In spring semester 1996 students studied the growth of "Wisconsin Fast Plants," engineered at the UW–Madison by Paul Williams, a professor of plant pathology. Students developed hypotheses about plant growth, then measured it and compared their observations with their hypotheses. Students presented their findings at a simulated conference where their classmates' critique and discussion helped them refine their ideas. This instructional approach is grounded in the theory that transmission of scientific thought to a broad, mainstream culture requires social interaction and cognitive apprenticeship. Derry and Levin believe that students can acquire skills

for cognitive and social negotiation, like other types of problem-solving skills, through training.

Students who complete the course are expected to:

- ▶ work cooperatively in decision-making groups
- ▶ use statistical ideas in writing and conversation to help construct and support good arguments
- ▶ acquire new criteria for judging the quality of evidence and argument observed in presentations and in interactions of social groups.
- ▶ define statistical ideas and concepts in their own words
- ▶ reason about, analyze, and judge the quality of arguments made by others, especially the popular press
- ▶ improve their ability to comprehend, develop, and critique evidential arguments in general and statistical arguments in particular
- ▶ improve their ability to read and critically analyze news reports of research
- ▶ make effective persuasive presentations that are enhanced by statistical evidence and graphical presentations of data
- ▶ distinguish between unexamined beliefs and those based on evidence.

Derry and Levin use various assessment methods to monitor and study their students' intellectual growth. In addition to standard examinations, they base evaluation in part on individual student portfolios, which contain a record of all individual and group work completed in the course, and clippings and critiques of newspaper and magazine articles read. Students also submit weekly reflection sheets that document their reactions to readings and class activities and try to relate class content to their everyday thinking and their futures as educators. Employing carefully designed problem-

solving tasks as a basis for discussion, students are interviewed in depth both before and after the course. Using all these sources of information, Derry and Levin analyze students' conceptual understanding and their thinking processes and describe how they appear to change over the semester.

Funded by the National Science Foundation's Division of Undergraduate Education, the experimental course will become a standard part of the curriculum in UW–Madison's Educational Psychology Department. The course will be advertised and offered to future teachers, including non-education majors who are considering teaching as a career. In addition, Derry and Levin are designing instructional materials intended for dissemination to faculty at other universities who wish to offer the course. The materials planned for inclusion are procedures, props, information resources, instructor training materials, computer tools, and databases necessary for carrying out instructional simulations varying in duration from one hour to several weeks. Levin and Derry will also complete and disseminate theory-based evaluative analyses of instructional outcomes resulting from several semesters' implementation.

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Areas of course emphasis are:

- ▶ thinking as argument, the history and nature of evidence, ways of knowing, scientific forms of thinking
- ▶ graphical presentation of data, covariation, correlation and causation, determinism and causal models
- ▶ how to lie with statistics, truth in advertising, media interpretations of medical research
- ▶ basic probability concepts, sampling distributions, hypothesis testing and estimation
- ▶ the perils of polling, medical research revisited, social experimentation
- ▶ eyewitness testimony, test bias, admissions policies, hiring practices.

Hispanic student dropout rate a national crisis

The school dropout rate for Hispanic students has remained a consistent problem over the past 40 years and, as recently as 1993, about 30 percent of the United States' Hispanic population ages 16 to 24 had dropped out of school. This compares with an overall dropout rate of 11 percent; an 8 percent rate for white non-Hispanics; and a 13 percent rate for African-American non-Hispanics. Hispanics remain among the most undereducated major segment of the U.S. population. While their educational attainment rates have improved somewhat during the past decade, Hispanics continue to enter school later, leave school earlier, and receive proportionally fewer high school diplomas and college degrees than other Americans.

Students' oppositional behavior is a form of resistance to an institution that cannot deliver on its promise: Secada

In response to a request by New Mexico Senator Jeff Bingaman, Chair of the U.S. Senate Task Force on Hispanic Issues and member of the National Education Goals Panel, U.S. Secretary of Education Richard Riley appointed a seven-member Hispanic Dropout Project (HDP) panel in September 1995; Riley named UW–Madison Education Professor Walter Secada project director.

It will be a disaster if a large percentage of the U.S. labor force does not have a high school education, Secada says, and the high Hispanic dropout rate is increasingly a problem as the Hispanic population grows dramatically. "An undereducated and underskilled Hispanic workforce is harmful not only to Hispanics who drop out, but to the American economy and larger non-Hispanic population as well," Secada says.

The HDP's *Data Book* illustrates the dimensions of the problem of Hispanic dropout, its antecedents, and its consequences. According to the *Data Book,* social and economic costs are escalating for many reasons:

1. Both in absolute numbers and as a proportion of our nation's students, the Hispanic population is rapidly growing.

2. In tomorrow's workplace fewer and fewer dropouts will find employment.

3. Upgraded workforce skills are vital for an individual's and the nation's success in the evolving world economy.

4. To participate meaningfully in a democratic society, to vote intelligently, and to make intelligent consumer choices, people need to possess increasingly more sophisticated knowledge and skills.

5. As the number of America's senior citizens grows, labor force productivity and income must expand to help meet the needs of senior citizens.

6. Tomorrow's children will be powerfully affected by their parents' income and education levels.

The HDP is funded by the U.S. Department of Education's Office of the Under Secretary and Office of Bilingual Education and Minority Languages Affairs (OBEMLA) and staffed from those two offices. Secada says the project's three-fold mission is to call attention to the nature and scope of Hispanic dropout, to produce concrete analyses of the issues and syntheses of the extant research on interventions, and to recommend actions that can be taken at federal, state, and local levels to reduce the dropout rate of Hispanic youth. To achieve these goals, the project has commissioned a series of four technical literature reviews and five nontechnical papers for general audiences. In an effort to involve key stakeholder groups and interested members of the public, and to gather widespread input on matters involving Hispanic dropout, the HDP is conducting local meetings to gather information and to test the validity of its findings. Through a series of site visits, project members are studying dropout reduction programs that are working. They're identifying practical strategies that meet the needs of Hispanic students and that increase achievement and school completion.

Why is the rate so high?

In a paper written for the HDP, UC-San Diego Sociology and Education Professor Hugh Mehan argues that many Hispanic students drop out because they realize that, no matter how hard they work, they will still be relegated to low-paying jobs or, worse, no jobs at all. These beliefs are translated into actions: Disaffected Hispanic students withdraw from academic pursuits, act up in class, ignore assignments and homework, cut

Percentage of young adults with high school credential, 1992
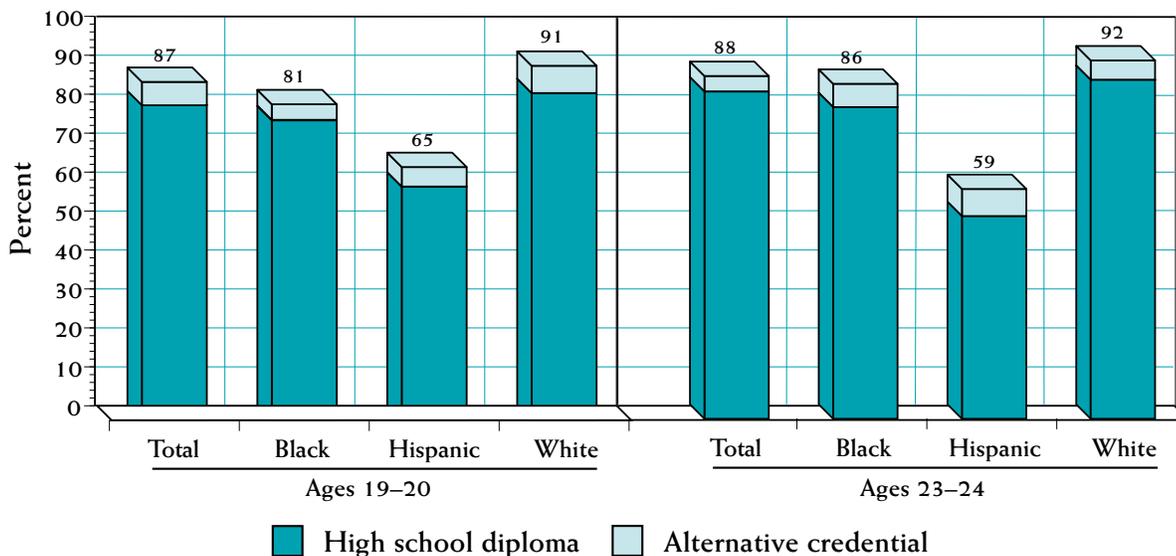
Sources: National Center for Education Statistics and Management Planning Research Associates, Inc., 1993.

classes, and eventually drop out.

The rebellious behavior, the low academic achievement, and the high dropout rate of Latino students have been attributed to students' lack of self-discipline, dullness, laziness, or an inability to project themselves into the future. But studies of students' belief systems show the actual causes of their academic difficulties are quite different. Their unwillingness to participate comes from their assessment of the costs and benefits of "playing the game." They believe that the chances are too slim that schooling will propel them up the ladder of success to warrant the effort required. "Given this logic," Secada says, "their oppositional behavior is a form of resistance to an institution that cannot deliver on its promise of upward mobility for all students."

Secada has heard from Hispanic parents complaining about the aging and inadequate facilities where their children go to school. One parent noted, for instance, that the noise in her daughter's high school is unbearable because the school is old and overcrowded and there is nothing to dampen the noise. "Kids can't help but jostle and bump into each other while changing classes; the noise levels put everyone on edge; and of course, fights are going to break out," Secada says. "Kids who fight get suspended and, from there, it's not too far to dropping out." Another Latino parent called Secada in desperation because his 13-year-old daughter, who had a baby, was being pushed out of school by teachers who were disciplining her for minor infractions that they would let other kids get away with.

Although many studies have tried to identify the causes of student dropout, they tend to focus attention on the individual student. Personal traits (self-esteem, language proficiency, pregnancy), sociodemographic status (race, ethnicity, social class, gender), and other individual-level factors (need to get a job, personal dissatisfaction with school) have been associated with a student's decision to leave school. But Mehan argues that concern about dropouts should focus on contextual factors such as classroom processes, tracking, and neighborhood-level forces that affect children and how those factors influence their decisions to leave or to stay in school.

One significant contextual problem is the social organization of schooling with its unequal distribution of resources, including teachers, curriculum, and instruction. Furthermore, public schools are caught in the middle of competing agendas. On the one hand, Mehan points out, educators are expected to teach every student to the best of his or her abilities. On the other hand, educators are asked to provide an equitable education for all students. These are competing agendas that pit the norms of "individualism" and "the common good" against each other.

Ability tracking takes on a caste-like character that limits students' educational options and affects their futures, Mehan says. Once students are placed into low-ability groups, they seldom are promoted to higher groups. And they're more likely to be placed in general and vocational tracks in high school, which can trap students, despite their good achievement.

Models of success

The Hispanic Dropout Project is finding some signs of success, however, in the form of dropout prevention programs. Most retention efforts for junior high and high school students use out-of-school efforts such as tutoring, mentoring, career advising, and arranging for older students (who might otherwise drop out) to work with younger ones. Other retention efforts include "schools within a school," school restructuring, and doing away with ability tracking. Elementary school efforts tend to focus on increased academic achievement for Hispanics.

Hispanic student dropout rate

High academic standards and strong social support for students to achieve those standards are common characteristics of many successful sites, Secada says. The principal at a Los Angeles high school that enrolls 79 percent Hispanics, for instance, got rid of the nonacademic track in which Latinas were studying cosmetology. According to her, "We [Latinos and Latinas] can do better than that." The issue was not whether her students were going to college, but where. Students whose friends have dropped out were very clear that what distinguishes them from their friends is that someone—parent, family member, teacher, coach, counselor—has taken an individual interest in their finishing school.

These initial findings will be supplemented as the Hispanic Dropout Project delivers its final report to Secretary Riley in Autumn 1996, after team members visit schools and prevention projects and meet with stakeholder groups and the press. Sites include San Antonio, Houston, San Diego, Los Angeles, Calexico, Miami, New York City, Albuquerque, Las Cruces, Chicago, and Toledo. In addition to

Secada, HDP members include UCLA Education Professor Jeannie Oakes, Johns Hopkins Sociology Professor Robert Slavin, New Mexico State University Education Professor Rudolfo Chavez-Chavez, Eugenio Maria de Hostos Community College President Isaura Santiago-Santiago, UC-Berkeley Education Dean Eugene Garcia, and William Howard Taft High School Science Department Chair Cipriano Munoz.

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