

WCER RESEARCH highlights

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Can Current Salaries Attract Prospective Teachers?

Can higher starting salaries attract undergraduate students with career goals related to math, science, or technology to a career in K-12 teaching? If so, what salary levels might be needed? To what extent do personality and work values influence the salary level that would attract these students to teaching? What other characteristics of the teaching profession reduce its attractiveness to these students?

In a recent study for the Consortium for Policy Research in Education (CPRE), Tony Milanowski conducted eight focus groups on career choice with freshman and sophomore students at a large Midwestern research university. Four focus groups involved students with math, science, applied science, or engineering majors; the other four involved students interested in a teaching career. Milanowski followed up the focus group study with a survey of sophomores and juniors with self-reported majors in mathematics, health occupations, engineering, and pure and applied sciences.

Milanowski found that (a) the math, science, and technology majors considered teaching a low-paid

field and (b) pay level was a significant factor making a career as a K-12 math or science teacher less attractive. However, many students said they would consider teaching if it paid substantially more than their current occupational choice. A salary level 45% above the local average would have attracted 48% of the sophomore survey respondents and 37% of the junior respondents to a career in K-12 teaching.

The math and science majors in the focus groups cited salary levels, perceived job demands, and their own abilities and interests as important reasons they were not attracted to a teaching career. Their concerns included doubts about their ability to be good teachers, discomfort with aspects of the job such as being responsible for others or standing in front of a class, and strong attachment to their current career choices. Although the math and science focus group participants identified difficulties in dealing with children, the necessity of taking work home, perceived intellectual monotony, and lack of up-to-date equipment as unattractive aspects of teaching, these were expressed less frequently than concerns about lack of ability or interest in teaching.

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FROM THE DIRECTOR

WCER Celebrates 40 Years

On August 6, 1964, the University of Wisconsin–Madison signed an agreement with the U.S. Office of Education establishing what is now called the Wisconsin Center for Education Research.

In his foreword to the 1990 book, *The Wisconsin Center for Education Research: Twenty-Five Years of Knowledge Generation and Educational Improvement*, UW-Madison President Emeritus Fred Harvey Harrington writes that he remembers the excitement of that day.

Here was recognition of the stature and accomplishments of the faculty and students of our School of Education. Here also was an avenue of opportunity for the future. And it was an adventure of opportunity that was in line with the University of Wisconsin's traditional commitment to innovation and experimentation in teaching, to the union of basic and applied research, to outreach tying the Madison campus to progress in the state and beyond. (p. ix)

As we now celebrate WCER's 40th anniversary, the School of Education faculty focusing on learning research and educational improvement are proud to be part of that continuing tradition. We look forward to many more years of ground breaking research across the education enterprise.

L. Allen Phelps

WCER Interim Director

Professor, Educational Leadership and Policy Analysis

On the other hand, prospective teachers in the focus group study said they were attracted to teaching because they enjoyed working with children, wanted to influence or help children, had been successful at tutoring or coaching, and preferred a schedule that would accommodate family demands and provide summers off. Many also cited their own teachers as models inspiring their career choice. Although prospective teachers generally recognized that their occupation was not highly paid, many cited good job security and benefits (e.g., health insurance, pension, and time off) as attractive features.

For a significant minority of the math and science majors, even very large increases in entry pay were unlikely to attract them to teaching. One focus group member, for example, claimed she would not be attracted to teaching even by a salary 50% higher than that she expected from her relatively low-paying field of astronomy.

Milanowski's survey results suggested that the entry salaries for math and science teachers would not have to be raised to the same levels as those in engineering, computer science, or the higher paid health occupations to attract some of these students. But the increases would have to be greater than 5–10% to attract a substantial proportion of them. The amount of increase did differ by student major, with higher increases needed to attract more engineering students than pure and applied science students.

Implications

For policymakers interested in implementing higher entry salaries to attract students with math, science, and technology majors to K-12 teaching, Milanowski suggests considering the following factors:

First, significant increases in entry salary (e.g., 25%) would be needed to attract a substantial proportion of these students, though entry salaries would not have to be as high as in many other careers.

A review of average salary offers to new college graduates reported by the National Association of Colleges and Employers in 2002 showed that median annual salary offers for majors in mathematics, accounting, science (except biological and life sciences), engineering, and computer science were between \$40,000 and \$52,100. By contrast, median annual offers to elementary and secondary education majors reported by the same source were in the \$29,000–\$30,000 range.

The 2001 American Federation of Teachers salary survey reported an average teacher beginning salary of \$27,989 for 1999–2000, and beginning salaries in math- and science-related occupations ranging from \$37,688 for accounting to \$47,112 for engineering. These numbers suggest that substantial increases in beginning salaries would be needed to make teaching a competitive career choice for graduates with math or science career goals.



Second, it would make sense to target students who are majoring in fields that are not at the top of the pay scale or students who are not expecting top entry salaries. In Milanowski's study, this subsample would have included the pure science and health-related majors.

Third, some students are not going to be attracted to K-12 teaching by the higher salary levels that realistically could be implemented. To consider teaching, some of these students would require a premium over what they expect to earn in their current career choice, due to their commitments to that career

Tony Milanowski



or their concerns about their ability to teach. These students are probably not worth trying to attract, both because of their salary expectations and because of their uncertainty about whether they would make good teachers.

Milanowski's results suggest that K-12 teaching could entice math, science and technology majors to become teachers, given a sufficient pay level or compensating differential. However, the fact that a substantial minority of the participating students said they would not consider a career change even to make substantially higher salaries—either because they did not have the needed skills or abilities or because they were committed to another career choice—suggests that the supply of labor to K-12 math and science teaching may not be expanded sufficiently to eliminate shortages by feasible increases in entry pay .

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Two Receive NSF CAREER Awards



Richard Halverson

The National Science Foundation (NSF) has awarded two Faculty Early Career Development (CAREER) grants to UW-Madison education professors doing research at WCER.

Richard Halverson has received \$792,590 to support his project "Data-Driven Instructional Systems—Assessing How School Leaders Develop Local Capacity to Influence Instruction." This 5-year study will determine how local school leaders create the capacity to systematically review student achievement data and integrate it into daily instruction in schools.

David Williamson Shaffer has received a \$585,000 CAREER award to support his 5-year project, "Alternate Routes to Technology and Science." Shaffer develops and analyzes learning environments in which students acquire science, technology, engineering, and mathematics (STEM) understanding by engaging in professional practices not traditionally seen as part of STEM education.



David W. Shaffer

NSF's CAREER program recognizes the early career development activities of those teacher-scholars deemed most likely to become the academic leaders of the 21st century. CAREER awardees are selected on the basis of creative career development plans that effectively integrate research and education and are designed to build a firm foundation for a lifetime of integrated contributions to research and education.



Scaling Up Innovative Practices in Math and Science *(part 2 in a 4-part series)*

For 8 years, researchers at WCER's National Center for Improving Student Learning and Achievement in Mathematics and Science (NCISLA; <http://www.wcer.wisc.edu/ncisla/>) worked with teachers and schools to create and study classrooms in which compelling new visions of mathematics and science are becoming the norm.

To support teacher change and enable these visions to “travel” to other classrooms, NCISLA researchers sought to understand how these classrooms function, what it takes to construct them, and how this knowledge can be used to create similar classrooms in new settings.

Part 1 of this four-part series, which appeared in the last issue of WCER Research Highlights, focused on NCISLA's findings about learning with understanding. This article delineates what teachers need to know to help students learn mathematics and science with understanding and how professional development can be designed to foster teaching for understanding.

What teachers need to know

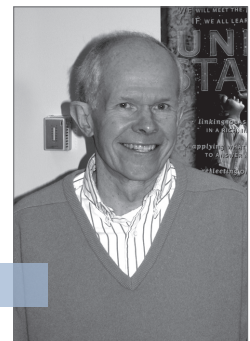
UW-Madison education professor Thomas Carpenter and colleagues* found that to foster learning with understanding, math and science teachers need to know how to help students:

1. connect new knowledge to what they already know;
2. construct a coherent structure for the new knowledge;
3. engage in inquiry and problem solving; and
4. take responsibility for validating their ideas and procedures.

This kind of teaching requires that teachers have a coherent vision of:

1. the structure of the mathematical or scientific ideas and practices they are teaching;
2. the conceptions, misconceptions, and problem-solving strategies students are likely to bring to the classroom and the areas in which students are likely to have difficulty;
3. the learning trajectories students are likely to follow;
4. the tasks and tools that can provide windows into students' thinking and support their learning and problem solving;
5. the kinds of scaffolding that can support students' efforts to engage in sense making and problem solving; and
6. the class norms and activity structures that support learning.

The NCISLA researchers found that this kind of knowledge cannot be embedded in curriculum materials or scripted into instructional routines. Teachers need flexible knowledge that they can adapt to their students and the demands of situations that arise in their classes. Acquiring this kind of knowledge requires new conceptions of professional development.



Thomas Carpenter

Designing professional development

Instruction that supports learning with understanding requires teachers to make ambitious and complex changes. Teachers must engage in experimentation, take on the role of the teacher as intellectual, and reinvent their practice in such a way as to reflect the interdependence of teaching and learning.

Achieving this vision requires educators to grapple with what it means for teachers to engage in ongoing, generative learning and to determine how professional development can contribute to that end. Building a basis for ongoing learning is one of the defining features of learning with understanding. NCISLA's work provides a needed framework for teacher professional development, addressing both student learning and teachers' growth as learners and professionals.

In a 7-year longitudinal study of a teacher professional development program, Franke, Carpenter, Linda Levi and Elizabeth Fennema found that teachers whose learning became generative perceived themselves as creators and elaborators of their own knowledge about children's mathematical thinking. They perceived knowledge acquired through professional development as something on which they could build, and they recognized that they also learned from classroom engagement with their students. Teachers whose knowledge did not become generative, on the other hand, tended to see what they gained from the professional development program as a fixed body of knowledge acquired from experts.

Generative learning imposed structure on teachers' knowledge, allowing them to attend to and remember details of their students' mathematical thinking and thereby refine their general understanding of children's mathematical thinking. All of the teachers demonstrating generative learning reflected on their own understanding of mathematics and on changes in their instructional practices that might help their students better learn mathematics. These teachers were articulate in expressing their ideas about their conceptions and practices and the relations between them.



Professional development can sow the seeds for ongoing inquiry, helping teachers strengthen their own mathematical and scientific understanding, deepen their understanding of how students' mathematical and scientific understanding develops, and devise instructional practices to foster that development.

* Carpenter's colleagues include Maria Blanton (University of Massachusetts-Dartmouth), Paul Cobb (Vanderbilt University, Peabody College), Megan Loef Franke (University of California-Los Angeles), James Kaput (University of Massachusetts-Dartmouth), and Kay McLain (Vanderbilt University, Peabody College).

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For more information:

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Organizational Context Colors Teacher Expectancy

"Rewards motivate performance improvement."

This belief is common among education policymakers.

But little was known until recently about the processes that underlie successful programs linking teacher rewards to improvement in student performance.

Recent research has identified teacher expectancy as the key motivational factor distinguishing schools with improved student performance from schools in which student performance failed to improve. Generally speaking, expectancy is the belief that individual effort will result in the achievement of specified goals.

A recent study by UW-Madison education professor Carolyn Kelley and colleague Kara Finnigan (University of Rochester) examined the factors associated with teacher expectancy to illuminate the specific factors in the organizational context that might predict higher levels of teacher expectancy and, therefore, greater improvement in student performance under school-based performance award programs. Their findings offer help for policymakers and administrators who seek ways to motivate teachers to achieve accountability goals for schools.

Drawing from a broad array of studies on effective schools, Kelley and Finnigan identified potentially important predictors of teacher expectancy and school success. They then undertook a study of school-based performance award programs in Kentucky and in North Carolina's Charlotte-Mecklenburg school district (CM), at that time among the best established school-based performance award programs in the country.

Both programs were designed to raise student achievement, but with some differences. The CM program aimed to eliminate persistent historical differences in achievement outcomes between Black and White students. Kentucky's program, meanwhile, was designed to raise overall achievement in the state to a common standard that was significantly higher than most schools had previously achieved.

Kelley and Finnigan looked at the variables of teacher attitudes, organizational context, and school demographics as they related to teacher expectancy in both Kentucky and CM.

Among teacher attitudes, perceptions of program fairness stood out as the strongest predictor of individual teacher expectancy. Fairness was construed as reflecting the perception that the program was administered fairly and that teachers within each particular school context had a fair chance of achieving the goals.

Organizational context variables found to influence expectancy included the amount and quality of feedback on student performance, principal support, professional community, and amount of conflict between school goals and accountability program goals. This finding led Kelley and Finnigan to conclude that teacher expectancy can be enhanced by (a) providing student assessment data that can help teachers meet their school goals, (b) fostering principal support of accountability goals, and (c) developing a professional community within the school.

Variables related to school demographics included school level, school size, and student socioeconomic status (SES). School reward history was found to be a significant predictor of teacher expectancy in both study sites, as was school grade level. Teachers in high schools had lower expectancies than teachers in elementary or middle schools. This finding may be attributable to the fact that (a) the departmentalized organizational structure of high schools makes school-wide efforts at reform more difficult and (b) teachers in schools with school-based performance award programs find middle and high school students more difficult to reach than elementary students.

Attributes found not to be significant predictors of teacher expectancy were teacher knowledge and skills, goal clarity, site-based management, resource alignment, and student SES.

Recommendations

Kelley and Finnigan offer the following recommendations for policymakers and administrators seeking to increase teacher expectancy and thereby the effectiveness of accountability programs:

- Give weight to teacher perceptions of fairness by designing accountability programs that take school and student demographics into account, clearly communicate program goals, and encourage teacher involvement. Communication and teacher involvement may enhance perceived fairness by clarifying program rules and giving teachers a voice in accountability program design and implementation.
- Give teachers prompt, meaningful feedback about prior student performance and make sure they have the knowledge, skills, and time to make use of data. Teacher expectancy and program effectiveness are enhanced when programs give teachers prompt feedback on assessment results, opportunities for training in interpreting assessment results, and sufficient time to analyze these data and revise curriculum and instruction approaches accordingly.
- Foster principal support for accountability goals. Accountability programs should recognize the important role of the principal in creating an environment conducive to the high levels of teacher expectancy that enhance the likelihood of goal achievement.
- Strive to develop school and accountability goals that are complementary if not completely consistent. The pervasiveness of high-stakes accountability is pushing accountability goals to the forefront. School and district administrators should work to reduce conflict between accountability goals and school goals—and acknowledge conflict when it exists.
- Set challenging but achievable goals. A history of successful goal attainment enhances teacher expectancy and motivates teachers to work toward attaining future goals. It's important to set goals at levels that will enable schools to obtain early success so that teachers are motivated to work toward continued success.
- Assist high schools in overcoming organizational features that reduce teacher expectancy.



Kelley and Finnigan examined two distinct accountability environments. Despite important design and contextual differences in the two programs, similar findings were obtained at both sites about the factors that predict higher teacher expectancy and related improvements in student performance. These findings can guide policymakers and administrators in designing more effective accountability programs.

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Carolyn Kelley

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