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WCER RESEARCH highlights

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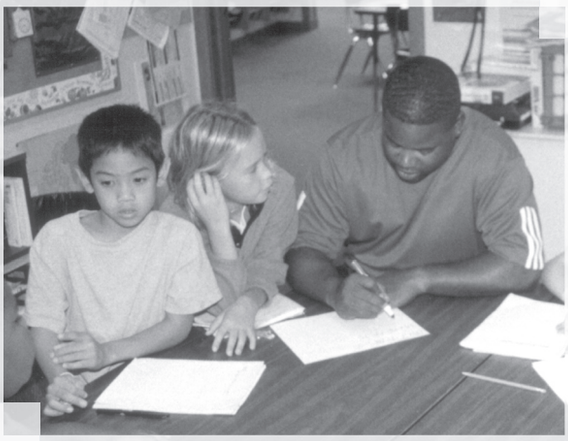

Toward Equity in Science Instruction

Instituting reform is particularly urgent in urban schools because of the array of obstacles these schools face. Teachers and students work under stressful conditions. Students have higher truancy rates, lower graduation rates, and lower achievement levels than their peers in nonurban settings. In addition, teachers in urban schools are less likely to be adequately prepared or to have access to needed resources. Urban school leaders say that higher academic achievement and teacher recruitment are their schools' most critical needs.

These needs are an important equity issue, says UW–Madison education professor Peter Hewson, because large urban districts educate 25% of all school-age students, 35% of all poor students, 30% of all English language learners, and nearly 50% of all minority children.

Hewson and colleague Jane Butler Kahle maintain that equitable reform of science education in urban schools involves:

- cohesiveness of school and community around clearly understood and accepted goals of reform;
- responsible and accessible leadership;
- teachers who feel effective, autonomous, and respected; and
- a community that is supportive and involved.

Equity is central to the current reform movement in science education. Although all students are capable of understanding and doing science, persistent and widespread differences continue to exist in students' access, retention, and achievement, depending on their culture, gender, race, and socioeconomic status.

Faced with large classes and little equipment, many urban science teachers use whole-class instructional techniques (lectures, class reading, worksheets), which put students in the role of passive learners. With this type of instruction, there are few opportunities for students to develop higher order thinking skills.

Although the movement toward standards-based education has led urban teachers to expect more from their students, instruction is increasingly affected by the accountability requirements of statewide tests. "Teaching to the test" often means drilling students on repetitive examples which may further alienate students from learning science.

Elements of inequity

Hewson and Kahle are identifying progress in, and obstacles to, equitable reform. They have used an analytical tool to assess the progress of two urban middle schools toward equity in the reform of science education. The tool, called an equity metric, was developed by Kahle of Miami University, Oxford, Ohio, while she was a fellow at UW-Madison's National Institute for

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FROM THE DIRECTOR

A New Beginning

This issue of WCER Research Highlights focuses on the issue of equity, one of the most important and challenging goals of education reform. Equity issues have always been at the top of WCER's agenda. Our recent work sheds new light.

When I joined WCER as director in 1988, it was already one of the oldest, largest, and most productive education research centers in the world. Coming to the center as its fifth director was an opportunity for me to join the best. Over the past 15 years, WCER's annual funding has grown by a factor of ten because of the quality of the work produced here.

This summer I'm leaving WCER and UW-Madison to accept a new challenge and opportunity. I am joining the faculty at Vanderbilt University to provide leadership to their new Learning Sciences Institute and to be a professor in the department of Leadership, Policy, and Organizations.

I'm leaving WCER in good hands. I know its success will continue because of its creative faculty, experienced academic staff, and dedicated administrative team. WCER's success also results from a supportive university environment. There is a strong tradition at UW-Madison, and at WCER, of scholars from across the disciplines joining together to work on significant applied problems. I know that WCER remains committed to research that holds promise for the improvement of practice.

My years at the University of Wisconsin-Madison and as director of WCER have been enormously rewarding, both professionally and personally. Working in this interdisciplinary environment has been productive and exciting. I will miss my colleagues, friends, and fellow alums here at UW-Madison.

– Andy Porter

Science Education (www.wcer.wisc.edu/nise/). The metric delineates the conditions within classrooms, schools, and districts that define equity in science education. It groups indicators of equity into three categories:

1. Student access to quality education
2. Student retention within the system and within mathematics and science
3. Student achievement, as a result of participation in the system

The metric also enumerates what can, and should, be measured to assess progress toward equity.

Measuring progress toward equity

Using the equity metric to study Urban Middle School and Webster Middle School (both pseudonyms)—allowed Hewson and Kahle to map and compare schools' readiness for, and progress toward, reform. The two schools had many similarities, yet each had a unique set of factors that influenced equity in the reform of science education.

Each school combined a magnet program with a special program that met district-wide needs. Per-pupil expenditure was slightly more than $8,000 at both sites. Both enrolled predominantly minority students, although Urban's students represented multiple cultures.

Urban Middle School was going through difficult times. It had failing grades on the district's indicators for student achievement, school attendance, and school climate. Teacher morale was low, and turnover among teachers and administrative staff was high. The school's environment was in constant flux. The principal had proposed a vision of academic achievement that challenged low expectations for the school's diverse, mobile student body, but many teachers did not accept that vision. An influential group questioned equity and resisted reform. Thus, administrative effort was spent on reacting to events rather than on implementing the principal's vision.

Webster Middle School adhered to the Paideia philosophy, which favors a general liberal arts program. Paideia aims to create a school environment in which all children are given the same opportunities to learn. The principal at Webster involved teachers in making decisions that changed instruction. Staff turnover was low: Webster had had only three principals since 1985. Webster met many of the criteria for successful middle schools, and it had taken a number of steps to better meet the needs of its urban students.

Jane Butler Kahle

For example, it eliminated tracking, offered the same curriculum for all students, created stable learning communities (teams), and provided a safe environment for students and teachers.


Peter Hewson

An equity analysis

Hewson and Kahle analyzed the progress of Urban and Webster Middle Schools toward equity using the equity metric's three indicators: student access to quality education, student retention, and student achievement. Additional indicators are included in the equity metric's "overall" category.

Student access.
At Urban, the cultural differences between teachers and students produced challenges. For example, teachers did not believe that their students could meet the goals in the school's academic achievement plan. At Webster, in contrast to Urban, administrators, parents, teachers, and students had agreed on high academic and behavioral standards for students. The overall quality of mathematics and science courses at Webster provided students with opportunities to learn and resulted in enhanced achievement.

Student retention.
Indicators of student retention in school and in science classes are teacher expectations and behavior, teacher and student attitudes and beliefs, and instructional quality. Recent research has shown that other factors—such as teachers' qualifications, content knowledge, and pedagogical practices—also influence student retention and achievement. Science teachers at Webster were highly qualified, all holding secondary school science certifications and taking graduate courses in science. They had been involved in extensive professional development that emphasized standards-based teaching practices. They held high expectations for their students and believed that all students could reach high standards. They had good relations with their students and chose topics relevant to the students' lives.

At Urban Middle School, the principal held high expectations for the students, but those expectations were not shared schoolwide. Many teachers disagreed with the goal that 30% of its eighth graders should pass the state's ninth-grade state proficiency test. At Urban, as at many other urban schools, teachers had low expectations of students' abilities. Teaching at Urban did not reflect culturally relevant pedagogy characterized by high teacher expectations, inclusion of students in knowledge production, or engagement of students in a critique of society's social structure.

Student achievement.
The quality of the science courses at Webster Middle School and the school's overall positive climate resulted in student achievement in science that was higher than that found at other schools in its district or at Urban Middle School. Because of the scarcity of European American students in the science classes at both Webster and Urban, Hewson and colleagues were unable to assess any effect on the achievement gaps between European American and other students.

Overall indicators.
Webster and Urban differed with respect to their equity plans and implementation. At Urban, an academic achievement plan with strong equity components was approved. Yet its implementation was jeopardized because of the school's fragile administrative infrastructure. There was no community of learners, and teachers did not focus on student learning. Meanwhile, Webster students who belonged to groups traditionally underrepresented in science succeeded. Webster teachers had autonomy, felt a sense of community, and held high expectations for student learning. At the time of the study, however, Webster did not have a specific equity plan.

Webster also ranked well in parental involvement. Parents were members of the school's decision-making committees and served on selection committees for new teachers. Parents at Urban were involved in creating the school's academic achievement plan, but they were not involved in other decision-making committees.

Two stages of reform

The two schools studied by Hewson and Kahle illustrate the diversity of experiences for students, teachers, and administrators in urban schools. When mapped against the equity metric, those different experiences reveal two schools at different stages in reaching equity in the reform of science education. In addition, they illustrate that indicators of equity can be used to identify both progress in, and obstacles to, equitable reform.

The study's conclusions are not framed exclusively in terms of science education. The reason for this may be seen in the Urban case study. A combination of factors, perhaps unique in urban schools, consumed the attention of science teachers and left them with little time or energy to teach science. In successful schools, teachers assume they have the conditions needed to support quality teaching. But try as they might, Urban's science teachers could not focus on science teaching. Webster's science teachers, in contrast, worked in a cooperative, stable environment that provided the time and space to focus their energies on teaching science.

For more information, contact Hewson at pwhewson@wisc.edu
This research was funded in part by a grant from the National Science Foundation (REC 9602137; J. B. Kahle, Principal Investigator). Some material was originally published in the Journal of Research in Science Teaching, vol. 38, no. 10 (December 2001), pp. 1130–1144.

See also NISE Research Monograph No. 9, Reaching Equity in Systemic Reform: How Do We Assess Progress and Problems? Published by the National Institute for Science Education (NISE), available online at www.wcer.wisc.edu/nise/Publications/Research_Monographs/KAHLE/KahleALL.pdf

A new principal manages school resources to better meet the needs of low-income students and students of color.

Allocating resources for equity

When a new principal arrives at a school she brings fresh insight into ways to improve student achievement. Successful principals work with staff to implement those changes and eventually show evidence that their initiatives are working.

UW–Madison education professor Colleen Capper's current WCER research documents successful school leadership practices that help students who struggle. Capper recently conducted case studies of principals who have raised academic achievement in their schools.

One of Capper's four case studies follows the successful initiatives of Deb Manson (a pseudonym), principal of a K-2 school serving about 400 students from both high-income and low-income families. When Manson assumed her first principalship at Frederick Elementary School (a pseudonym) she learned that the school's pull-out programs were hindering students as well as helping them progress. Many students of color were leaving the regular education classroom to attend remedial reading instruction; many students for whom English was a second language left their classrooms to receive ESL tutoring; still other students left the classroom to receive Reading Recovery tutoring or to participate in gifted and talented activities. These pull-out programs left mostly middle- to upper-class European American students in the general education classroom, and these students then further benefited from the small class size.

A student who attended all the pull-out programs for which he or she qualified would spend very little time in the general education classroom. Thus, school staff had agreed that students would be pulled out from classes only once a day. For example, an ESL student qualifying for Title I services would not attend Title 1 tutoring because doing so would mean the student would be pulled out of the general education classroom twice each day. Despite this policy, Manson and the teachers at Frederick identified six problems with Frederick's pull-out programs:

1. Students in the pull-out programs became fringe members of their classrooms. Thus, the students who most needed to feel part of the school community were exactly the students who were being pulled out.
2. The students who needed the most routine, structure, and consistency in their day had the most disruptions.
3. Students in pull-out programs missed out on classroom instruction and were sometimes unable to complete assigned tasks.
4. General education teachers did not have time to communicate with all the specialist teachers about the students in pull-out programs.
5. No adult felt fully accountable to the students in pull-out programs.
6. Pull-out programs segregated students of color and lower income students, undermining the school's commitment to desegregation.

Manson wanted to change the de facto segregation that resulted from Frederick's pull-out programs. Her goal for reform at Frederick was to increase achievement in reading, language arts, and mathematics for every student, especially students with limited English proficiency and Title 1 students. Manson and the Frederick teachers sought to accomplish this goal by focusing highly effective teaching strategies on fewer students and building the capacity of classroom teachers to meet the unique needs of all students.

(Schools with more than 50 percent of their population receiving free and reduced price lunches could use their Title I funds to support whole school reform, yet Franklin's population was below that 50 %. In that case, under federal law, schools were required to hire a Title I teacher to deliver reading and math instruction outside of their regular classroom. Hence Manson applied for a Title I waiver, becoming one of the first schools in the country to do so. This waiver freed her to use her Title I money to support whole-school efforts, rather than funding a reading teacher to pull students out for reading.)

Colleen Capper

Other factors pushed the educators at Frederick School to change their practices. First, of the 29 elementary schools in the district, Frederick consistently scored in the lowest quartile, raising concern among district administrators. Second, shortly before Manson arrived at the school, the district required all schools to complete a needs assessment; Frederick's assessment pointed to areas for change.

Restructuring support staff

When Manson first assumed the Frederick principalship, she was completing coursework for her principal's license at the local university, where she researched school reform efforts. Manson had learned in her university program that one way to reduce class size was to restructure support staff. These teachers could be moved from pull-out programs to general education teaching positions, or they could assist general education teachers by supporting students in the general education classroom; either approach would reduce the student/teacher ratio.

Manson used her knowledge about whole-school reform to address student achievement. She applied for and received a federal grant to support her efforts. Her three reform strategies, all supported by research, were

1. reallocating staff to reduce class size,
2. eliminating pull-outs, and
3. implementing a developmentally appropriate, child-centered curriculum that emphasized high expectations for every student in all academic areas.

Manson insisted that students spend as much time as possible in the general education classroom with teachers who were prepared to teach a diverse range of learners. Manson's data revealed that pull-out programs had reduced student instructional time by one-half year over 3 years. The data also showed that one 5-minute classroom transition per day equals 15 hours of instruction in one school year. Because Manson emphasized the importance of reducing pull-outs and gained back time lost from transitions to and from classrooms, students received an additional year of reading instruction over a 3-year period. Manson was able to increase the number of classes from 20 to 25, and reduce the student/teacher ratio from 23.5:1 to 16:1.

The school's instructional design team solicited input from teachers at the end of each year as part of their evaluation. The design team's goal for spring 1999 was that "100% of students will experience more continuity in their curriculum and school day as measured by teacher perceptions on a school-based climate survey." Evaluations showed that Frederick had met its goal of reducing class size and had reduced the number of pull-out programs (a 91% decrease). Students experienced more continuity in their curriculum and school day, and student reading and math scores increased. (Initially, the African American students from her school did worse, on average, than other African American students in the district. But when these students left Frederick, their scores were not lower than the other African American students in the district, based on the tests given at her school).

Prior to the reform, Frederick School had no baseline achievement data for the most needy students or for students with disabilities because these students were not assessed. With the whole-school reform, these students are no longer routinely or categorically excused from assessments, regardless of the severity of their disabilities. Teachers adjust their assessments based on students' disability needs. Teachers also consider language needs so that students are not penalized on assessments just because English is not their first language.

As a principal who wanted to make a difference for all students —regardless of social class, race or ethnicity, or disability— Manson reiterated that it was important for the school restructuring to be comprehensive. Short-term, Band-Aid programs rarely address the root of student academic failure, Manson pointed out. The principal must be able to maintain a vision for school change and must be able to manage many complex elements and details of change at one time.

In sum, Manson took on the challenge of reallocating resources to efficiently and effectively meet the needs of low-income students and students of color at her school. Many forces and factors had to come into play for Manson to be able to support her staff in accomplishing these goals, and she had to be able to stand up to the public pressures and resistance that were mounted against her. As circumstances continue to change at Frederick Elementary, Manson does not waver from her goal of heterogeneous classrooms where all students learn with each other and are challenged to their highest academic potential. She and the district continue to monitor the longitudinal outcomes of her efforts.

Capper is now creating multimedia case studies of Manson and other principals and is integrating them into a leadership preparation program at the University of Wisconsin-Madison.

For more information contact Capper at capper@education.wisc.edu

Funding for Capper's study is provided by the Wallace Reader's Digest Foundation Ventures in Leadership Program. Some material in this story is taken from a chapter in the forthcoming book, Educational Leaders for Social Justice, Teachers College Press.

What Will Decrease Educational Inequality?

Despite good intentions and good work on the part of many educators, educational inequality has persisted in America. Will equity improve for students in the 21st century? On the basis of past trends, and on the assumption that the American educational system will remain largely stable, WCER researcher Adam Gamoran offers predictions about educational inequality over the next hundred years.

A UW–Madison professor of sociology and education, Gamoran foresees good news and bad news. He predicts a decline in the gap between black and white educational outcomes over the next century, but he sees signs that educational inequality by socioeconomic background will persist at current levels.

Racial inequality

The past century witnessed a dramatic reduction in overt racial discrimination in the educational system. Gamoran discusses several reasons these inequalities exist and the conditions that led them to diminish somewhat during the 20th century. Here are just a few:

Effects of school and schooling. Black and white students make similar progress during the school year, but during the summer the achievement scores of whites continue to improve while those of blacks remain flat or decline slightly. This pattern indicates that, on the whole, schooling helps limit the expansion of gaps in racial achievement as children age, at least during the elementary years. Trends toward reduced class sizes will probably continue in this century as well. On the basis of past evidence, Gamoran expects declining class size in the early grades will further reduce black-white inequality in achievement.

Cultural mismatch. Discontinuities between the cultural conditions of African American families and the culture of the schools their children attend, such as differences in language use, make it hard for blacks to close the educational gap. The history of racism and discrimination encourages distrust of institutions, such as schools, and makes it more difficult for even middle-class black parents to manage their children's academic careers in the way that white parents can. As blacks experience more educational success, however, discontinuities between schools and homes will diminish, so that the educational accomplishments experienced by blacks in the 20th century will provide a foundation for further progress in the 21st.

Socioeconomic reasons for racial inequality in education. Improvement in the socioeconomic backgrounds of blacks compared to whites during the 20th century accounted for some reduction in test score gaps between black and white students. Such improvements probably contributed to the achievement of near-parity in high school completion as well. Gamoran points to an ongoing "virtuous cycle": Blacks who attended high school in the 1980s and 1990s benefited from the educational accomplishments of their parents. Their children will likewise benefit from the further narrowing of educational inequalities.

Socioeconomic inequality

American education offers different opportunities for students from different socioeconomic origins. A 1992 U.S. Department of Education study found that only 2% of the students from the top socioeconomic quartile failed to complete high school, compared to 7% of the students in the bottom quartile. Although the differences in high school completion are small in percentile terms, the economic consequences of failing to complete high school have grown increasingly severe. Meanwhile, socioeconomic differences in college completion are vast: Only 7.2% of the 1980 high school sophomores from the lowest socioeconomic quartile received college degrees by 1992, compared to 51.3% of those from the highest quartile.

Gamoran sees several sources of socioeconomic inequality in education; here are three:

Economic sources. Children whose families have greater income and wealth tend to have more educational resources, which contribute to educational success. In addition, high-income parents can choose elite schools that charge tuition. While some states are taking steps to reduce inequalities in school financing across districts, this trend will do little to reduce the major advantages enjoyed by families with more economic resources over those with less.

Cultural/social sources. Schools' emphasis on middle-class values makes it easier for children who enter school with these

values to respond to the requirements of schooling. Students whose families own more books, subscribe to newspapers and magazines, visit libraries, and have similar enrichment opportunities perform better on cognitive tests, receive higher grades, and stay in school longer than do students whose families lack these resources.

Persisting inequality. Despite enormous expansion of educational opportunities in the past century, relative advantages continue for those of higher-status origins. As long as societies are stratified, privileged parents will seek ways to pass on their advantages to their children. Because schooling is the major sorting mechanism, persons in positions of power and advantage will use schooling to preserve their positions and those of their children.

Comparing racial and socioeconomic inequality

How is it that racial inequality has declined in the U.S. while socioeconomic inequality has maintained? Gamoran explains:

1. The pressure to reduce racial inequality is much greater than the pressure to reduce socioeconomic differences. Racial equality is constitutionally protected and guaranteed by law, while socioeconomic equality is not. In the politics of representation, members of minority groups count, but those who simply grew up poor do not.

2. Racial inequality in educational outcomes declined during the 20th century, but inequality by social class origins did not. Much of the decline in racial inequality reflects the improving socioeconomic circumstances of blacks compared to whites. Meanwhile, those who are disadvantaged socioeconomically show no signs of a "virtuous cycle."

Adam Gamoran

3. Racial disadvantages have responded to social programs, but apparently socioeconomic disadvantages have not. Also, there is no evidence that educational programs that are designed to aid the general poor, as opposed to members of minority groups, have reduced educational inequality in the U.S.

Because of the strong role of educational background in reproducing educational inequality, most of the racial gap in education can diminish, even as occupational and income differences remain. But the remaining link between race and economic circumstances limits the predicted decline in racial inequality in education.

Under conditions of stability, the future of educational inequality in America can be projected from past trends: less inequality by race, but not by social class. By 2010, it should be possible to tell whether the "virtual cycle" mentioned above is operating as predicted. At the same time, available evidence will indicate whether socioeconomic inequality continues to persist at its current levels.

For more information see *Sociology of Education*, Extra Issue, 2001, p. 135-153. Gamoran can be reached at gamoran@ssc.wisc.edu

Material in this article was originally published in different form in Sociology of Education, Extra Issue (2001), pp. 135–153.

WCER *working paper series online*

WCER has launched an online Working Paper Series to achieve broader, more rapid dissemination of research by WCER-affiliated projects. The Working Paper Series includes a variety of publications, from manuscripts-in-progress ultimately destined for publication in professional journals to technical documents such as instruments, surveys, questionnaires, and handbooks. All working papers are available in PDF format.

The working paper series can be found at: http://www.wcer.wisc.edu/publications/workingpaper.

The working paper site also links to the independent publication sites maintained by some WCER projects, offering quick access to the full range of WCER publications.

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By Robert H. Meyer

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