Talk about getting high school students engaged! Let’s give them the tools they need to build a big catapult to hurl the projectiles of their choice across a gym and land on, or near, a target.

Hurling accurate projectiles, or to put it more academically, the science of space and motion, has wide-ranging relevance for what children need to learn in school. Just think of the mathematics involved.

UW–Madison education professor Mitchell Nathan, psychology Martha Wagner Alibali, and colleagues have long sought to advance understanding of learning and teaching mathematics and engineering. Their theory of embodied mathematical cognition (see sidebar, p. 2) applies to a broad range of people, settings, and activities.

Nathan himself is a boundary crosser, holding degrees in psychology, mathematics, history, and electrical engineering. He says the most successful mathematics students are those who maintain conceptual cohesion across different kinds of modal engagements, from catapults or circuits to algebra. The key question is, what concepts will hold across all these varying modes?

Answers to this question should lead to useful perspectives on the nature of mathematical knowledge for curriculum designers, for teachers, and for the technical workplace.

Nathan and Alibali, along with colleagues at Vanderbilt University and San Diego State University, observe how students in high school electrical and mechanical engineering classrooms pursue mathematical symbols and science concepts through a variety of
In this issue of Research Highlights you’ll read about education partnerships. Leaders within partnerships are challenged to form and guide an especially complex organization. Partnerships operate in uncharted and unpredictable environments that do not offer established policies and structures. WCER researchers Matthew Hora and Susan Millar have published “A Guide to Building Education Partnerships: Navigating Diverse Cultural Contexts to Turn Challenge into Promise.” The book focuses on four interrelated aspects of organizational life: cultural models, structure and technology, relationships, and routines and procedures.

You’ll also read about the UW-Madison’s “Beyond the Game Initiative,” which confronts the challenge of Black male student athletes who face the end of their eligibility to play without identifying viable careers beside professional sports. The Initiative uses curricular, co-curricular, and on-the-field leadership training to develop and support student athlete’s post-graduation options. The Initiative results from a collaboration between WCER’s Wisconsin’s Equity and Inclusion Laboratory and the UW-Madison athletic department.

Meanwhile, Mitchell Nathan and colleagues are studying students in high school electrical engineering classrooms and how they pursue mathematical symbols and science concepts through a variety of tools, objects, and representations. Projects require students to work with physical models, electrical circuits, Boolean algebra, and computer-based geometry applications.

Opportunities for college attendance have expanded dramatically in the U.S. over the past several decades, but unmarried parents are still among those least likely to attend. And although completed degrees confer large economic benefits, they may be outweighed by the cost to these students’ families. Among all undergraduate students, the proportion of unmarried parents has nearly doubled over the past 20 years, from 7 percent to just over 13 percent. Sara Goldrick-Rab says more effective support could help unmarried parents to complete their college degree and certificate programs.

And, finally, Families and Schools Together (FAST) is a long time WCER project. It brings together the student, family, home, school and community for 8 weeks to increase children’s well-being. An after-school program for children and their families, FAST strengthens the relationships within and among families that protect against stress. The United Nations Office on Drugs and Crime (UNODC) has recognized FAST as one of 24 evidence-based family skills programs.

## The “Six Views of Embodied Cognition”

1. Cognition is situated.
2. Cognition is time-pressured.
3. We off-load cognitive work onto the environment.
4. The environment is part of the cognitive system.
5. Cognition is for action.
6. Off-line cognition is body-based.

*Wilson, M., Six Views of Embodied Cognition.*
Interpreting student gestures

One of the areas that specifically interests Nathan is how students and teachers use gestures to enhance their communication. In a recent afternoon presentation, Nathan projected videos of students working in three learning situations.

1. Students in a high school mechanical engineering class study the principles of ballistics and projectile motion. The multi-day project requires them to construct devices such as a catapult and to use physics, engineering design, machine shop techniques, algebra, and trigonometry to hurl their favorite projectile. Nathan singles out students’ gestures and motions as they discuss the task with their instructor and among themselves; and the teacher’s gestures as he tries to remind students how their design must instantiate the mathematical principles and physical laws from a previous lesson.

2. Students in a third-year digital electronics class design a security monitoring system for a voting booth, using logic, electronics, computer simulation and Boolean algebra. For one student gestures help reveal how the debugging process works when the circuit fails to light up properly under every possible condition.

3. Students in an honors geometry class use an interactive computer program to inscribe a quadrilateral inside a large circle. They know that sum of the quadrilateral’s opposing angles must equal 360 degrees. They use Geometer’s Sketchpad to alter parameters and record results. Again, Mitchell notes the importance of the gestures students and the teacher use as they discuss their ideas.

Nathan explains the importance of student gestures and teacher gestures in students’ learning. This project aligns with his continuing work to build an empirical basis for recommendations about how teachers can use gestures effectively. Moreover, the study responds to his long-term interest in teacher education and teacher professional development, as well as his desire to advance basic knowledge of the role of gesture in comprehension and learning.

Wei Lab and Athletics Form Partnership

College athletes often enjoy successful collegiate careers without identifying alternative careers outside of professional sports.

But no matter how talented, most student athletes do not go on to play professionally. And even those few who do make it to the pros ultimately will experience job termination.

The time to provide career exposure is early in a student’s undergraduate career.

In response to this need, the University of Wisconsin-Madison has developed an initiative to strengthen the post-graduation trajectories for Black male student athletes.

The University’s “Beyond the Game Initiative” confronts the challenge of Black male student athletes who face the end of their eligibility to play without identifying viable careers beside professional sports. The Initiative uses curricular, co-curricular, and on-the-field leadership training to develop and support student athlete’s post-graduation options. This program complements life skills programs and post-graduate counseling programs already in place.

The Initiative results from a collaboration between WCER’s Wisconsin’s Equity and Inclusion Laboratory (Wei Lab) and the UW-Madison athletic department. UW-Madison education professor Jerlando Jackson directs the Wei Lab (http://weilab.wceruw.org/). His colleague Mario Morris coordinates the project from within the Athletic department. They are developing curriculum for roll-out in fall semester. Student athletes will take a four-semester course that teaches leadership and professional development, and that is grounded in theory and practice.

The Wei Lab, established in May 2010, aims to help policymakers, practitioners, and citizens promote equitable and inclusive learning and work environments. The Lab also designs, conducts, and disseminates research to engage the most difficult and important equity and inclusion topics confronting the educational system.

The Wei Lab assisted with the curricular design of “Beyond the Game” and manages associated research and evaluation activities. The program is funded by the Lumina Foundation for Education and the University of Pennsylvania. The Office of the Vice Provost for Diversity and Climate at UW-Madison provided a planning grant to cover efforts during the past academic year.

More: http://weilab.wceruw.org/
When a Student is an Unmarried Parent

Unmarried parents who attend college face obstacles of money and time. Parenting young children while also attending college creates difficulties that are different from those faced by traditional students. Many public programs offer support to these students, but the support is neither well coordinated nor easily accessed.

UW-Madison professor Sara Goldrick-Rab says deficiencies in current higher education policy cause unexpected adverse consequences for families where an unmarried parent is also a student. Goldrick-Rab and graduate student Kia Sorensen say that more effective support could help these unmarried students complete their college degree and certificate programs.

Opportunities for college attendance have expanded dramatically in the U.S. over the past several decades, but unmarried parents are still among those least likely to attend. And although completed degrees confer large economic benefits, they may be outweighed by the cost to these students’ families.

Addressing this problem is important now. Among all undergraduate students, the proportion of unmarried parents has nearly doubled over the past 20 years, from 7 percent to just over 13 percent. And unmarried parents make up a substantial segment of undergraduates from racial and ethnic minority backgrounds: More than one-third (36 percent) of African American female undergraduates nationwide are unmarried mothers. Fifteen percent of African American male undergraduates are unmarried fathers.

Unmarried parents make up 21 percent of Native American undergraduates and 16 percent of all Latino undergraduates. This compares with 10 percent of white and 9 percent of Asian undergraduates. Overall, 8 percent of male undergraduates and 17 percent of female undergraduates are unmarried parents.

Families compete for time

Unmarried parents attending college find very little time to spend with their children. Because financial aid often doesn’t make ends meet, many unmarried parents work long hours while taking classes. In years past, financial aid enabled students to devote all their time to studying and parenting. But students now commonly study, parent, and work.

These students tend to take longer to complete four-year degrees. Among all students who started college in 1995-96, 29 percent attained a bachelor’s degree by 2001, compared with just under 5 percent of unmarried parents.

National data indicate a serious shortage of campus child care centers—with existing resources meeting only one-tenth of demand. The shortage is particularly severe when it comes to infant care—only about one-third of campus child care centers accept infants.

Benefits of degree completion

Women who pursue additional education following their child’s birth increase their odds of repartnering with a college-educated man by 62 percent. Attending college
helps unmarried mothers form networks of similarly well-educated friends. These friends help shape their decisions about parenting practices and their expectations for their children’s educational success. For example, middle-class mothers with more education are more committed to their children’s education. Families with more education create more structured activities for their children. They emphasize lessons and activities to fully develop children’s cognitive and social potential. These parents also talk to children as if they were adults and reason with them. Such parenting leads children to gain a sense of confidence that has implications for how they interact with other adults and institutions.

**Limits of current policies**

Financial aid policies intended to make college affordable include rules that make it difficult for parenting students to access the money they need. Current financial aid rules reward students who attend college full time without working, while penalizing those who take fewer classes and integrate work for pay into their schedules. Policies that make students with drug convictions ineligible for financial aid make it much more difficult for unmarried fathers to participate in post-secondary education.

**Solutions**

Policy changes could enhance college participation and completion among unmarried parents. For example, simplifying the aid application process substantially increases a prospective student’s likelihood of attending college and receiving need-based grant aid.

Dual enrollment programs help move students more seamlessly from high school to college by allowing them to earn college credit while still in high school. That potentially reduces the time and associated costs spent in college. College students in New York and Florida who had participated in dual enrollment in high school remained enrolled in college longer, had higher grade point averages, and earned more credits than comparable students who had not participated in dual enrollment programs.

As intermediate goals, Goldrick-Rab says policymakers could focus on increasing rates of full-time attendance among unmarried parents and reducing the time they spend working while parenting and in school.

Structures and technologies establish the parameters of what behaviors are possible, permissible, and rewarded.

Relationships are the key aspect of cultural life that tie individuals to other people, groups, and organizations.

Routines and procedures give meaning and identity to people's roles within an organization. An organization's structure creates opportunities and constraints for certain routines and practices, which in turn contribute to the development of a group's cultural models.

Each of these elements characterize cultural life in particular organizations, and they are brought into the “third space” where partnerships form. It is in the third space where leaders must essentially create an entirely new organization in uncharted and unpredictable environments that do not offer established policies and structures. Thus, participants will face new situations and problems, and leaders need “adaptive expertise,” or the ability to apply skills and knowledge to the novel problems that arise in partnership work.

Five principles form the basic message of the book that practitioners can use to design and implement education partnerships.

Visualize organizations and partnerships in multifaceted terms. The organizations within partnerships, and partnerships themselves, are not monolithic wholes, but are composed of subgroups that differ in important ways.

Plan and get acquainted. In a careful planning stage, all potential partners meet and get acquainted with one another and discuss the proposed work. It's easy to assume that the way business is done in other groups is the same as in your own, but this is rarely the case.

Engage in a careful design process. Because newly initiated partnerships lack structure and procedures, starting one is like creating an entirely new organization.

Find boundary crossers. Partnership personnel will contend with unpredictable challenges, differences of opinion, and the likely need to adapt to changing circumstances.

Foster new cultural dynamics. Partners will need to create task environments and foster new structures, relationships, and practices to generate new ways of thinking.

FAST Program Receives UN Recognition

Families and Schools Together (FAST) is a long time WCER project. It brings together the family, home, school and community for 8 weeks to increase children’s well-being. An after-school program for children and their families, FAST strengthens the relationships within and among families that protect against stress.

Now FAST has become a global phenomenon. The United Nations Office on Drugs and Crime (UNODC) has recognized FAST as one of 24 evidence-based family skills programs. The UNODC list ranks its evidence-based programs in order of scientific rigor, including the number of randomized controlled trials conducted on each program. Of 150 programs reviewed, FAST is listed as number 12 in the world.

In the FAST program, families come to the school building after hours to take part in activities including games, songs, and a family meal. Family groups are led by trained teams of local parents, school staff, and professionals specializing in mental health or treatment for drug abuse. These meetings introduce families whose children are new to the school to the families of their children’s classmates. The program aims to: (a) strengthen the family and the parent-child bond; (b) increase the child’s success at school; (c) reduce drug and alcohol abuse in the family; and (d) reduce family stress and social isolation.

The UNODC informs policymakers, program managers, non-governmental organizations and others about family skills training programs that are evidence-based. To help users select the program best suited to their needs, UNODC’s program guide details each program’s content, the groups targeted, the materials used, and the training implemented.

FAST originator Lynn McDonald has been helping the UNODC develop a new training strategy for use in developing countries. UNODC recently sent McDonald to Kazakhstan, Tajikistan and Kyrgyzstan, where she found enthusiasm about pilot programs. In each of six schools more than 20 families attended the first session, in two separate hubs per school. The child focus age for this global project is age 7.

WCER continues to pursue research on FAST in the U.S. The Children, Families, and School project examines the role of FAST in building social capital within and between families, and between families and schools, in San Antonio and Phoenix. Social capital for Latino families is a special focus of the study, which aims to test the relation between social capital and child development for young children.


More: http://cfsproject.wceruw.org/fastProgram.html

Lynn McDonald
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