



# WCER RESEARCH highlights

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## Assessing Learning in the 21st Century

In computer games, students can learn by solving problems that are realistic, complex, and meaningful. So games have great potential to teach the kind of thinking that young people need in the digital age, says UW-Madison education professor David Williamson Shaffer. But after years of designing and testing digital learning environments emphasizing learning in action, Shaffer has turned to the problem of assessment.

Games, simulations, and other digital tools have the power to revolutionize learning, letting students work in challenging, real-world situations. But standardized tests focus on basic facts and skills, which are only part of what it takes to solve real-world problems. So Shaffer and his research team at UW-Madison have been asking: How can we assess the digital learning that happens in educational games?

### Learning for the 21st Century

Shaffer and his team have spent more than a decade developing 'epistemic games' that use authentic professional training practices

to teach students complex problem-solving. Players learn physics and engineering by working as biomechanical engineers in the epistemic game Digital Zoo and designing characters like they see in computer-generated animation films such as *A Bug's Life*. In the epistemic game Science.net, players create an online science newsmagazine and learn about ecology, genetics, communications technologies, and other current issues.

Epistemic games are based on the idea that any profession, any community of practice, has a culture. That culture has a grammar or a structure, composed of

- Skills: the things people within the community do
- Knowledge: the community's shared understandings
- Identity: how members of the community see themselves
- Values: the beliefs held by members of the community
- Epistemology: how members of the community make decisions and justify their choices

*(continued on next page...)*

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Beth Graue

*FROM THE  
INTERIM DIRECTOR*

In this issue of Research Highlights you'll read about the relations between children's academic functioning and their socio-emotional health, what

African American boys say about who helps them be a "good student" and how these acquaintances provide this support, how we can assess the learning that happens in digital educational games, and a professional development project that aims to raise student achievement by increasing teachers' knowledge and understanding of U.S. history.

Recent developments in social and emotional learning (SEL) have pointed to the relations between children's academic functioning and their socio-emotional health. Tom Kratochwill says educators cannot afford to continue offering mental health services for K-12 students in isolation. These services need to be mainstreamed and folded into schools' broader academic mission.

The family structures of African American children are both variable and adaptive. Although some view African-American boys as lacking in resources, Jeffrey Lewis and colleague Amy Hilgendorf found that they have multiple levels of support.

Computer games have great potential to teach the kind of thinking that young people need in the digital age. After years of designing and testing digital learning environments emphasizing learning in action, David Williamson Shaffer has turned to the problem of assessment. How can we assess the learning that happens in these educational games, which have the power to revolutionize learning?

Researcher Shihmei Barger is assessing whether student achievement increases when their history teachers participate in a professional development project called BIC. Data is being collected this year and next; evaluation reports will include findings on changes in student knowledge, teacher knowledge, student work, teacher work products, and teacher self-reports.

Beth Graue  
Professor of Curriculum & Instruction  
Interim Director, WCER



Shaffer calls this structure an 'epistemic frame': a theory of learning that looks not at isolated skills and knowledge, but at how those skills and knowledge systematically link to one another—and to the values, identity, and ways of making decisions and justifying actions of some community of practice. In epistemic games, players learn to make those connections by taking action and then reflect on what they have done with peers and mentors.

**Assessing epistemic frames**

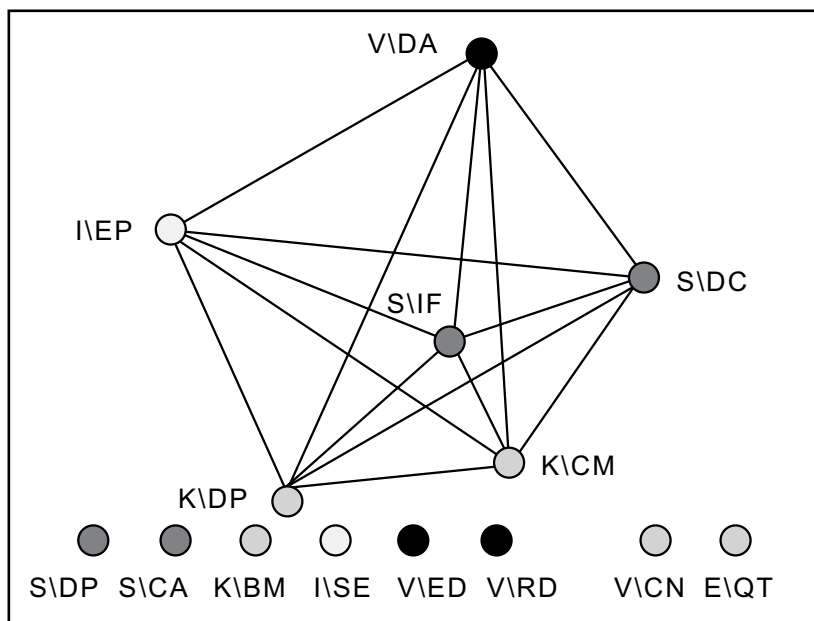
To assess the network of conceptual, practical, moral, and epistemological relationships that make up an epistemic frame, Shaffer suggests an analogy: "Think of a cocktail party," he says, "where one person talks with many others during the course of an evening." We could measure the social network of the party-goers by counting the number of times each pair of people talk in the same group during the party. This is the idea behind social network analysis, a set of tools for measuring social relationships.

But if we can measure the social network of people at a cocktail party, Shaffer thought, why not measure the epistemic network that players develop while playing a game?

From this basic insight, Shaffer and his team have developed a new measurement technique: epistemic network analysis, or ENA. ENA looks at how game players use elements of the epistemic frame, and how these elements are "in conversation" with one another over time. The epistemic network of a player is quantified by adding the number of times each pair of frame elements are recorded in the same strip of activity during a game.

Take for example the epistemic game Digital Zoo. Here's a look at data from approximately 80 hours of game play

Figure 1: 80 Hours of data from Digital Zoo





conducted over four weeks during a summer enrichment program (see illustration).

Notice that early in the game, the frame is relatively loose. It contains relatively few elements of the profession's epistemic frame, and The distribution of elements is relatively even.

In the middle of the game, the frame contains more elements. It begins to develop a central core that now includes knowledge and some values, as well as skills.

Later in the game, values and epistemology become more central in the player's frame. All the elements are incorporated and the core includes still more elements. The network as a whole becomes more dense over time.

Shaffer and his team have adapted measures from social network analysis to assess changes in players' epistemic frames over time, and to associate those changes with specific elements of game play. For example, in Digital Zoo, players who reported getting help from mentors showed a significantly greater change in the density of their epistemic frames during the game.

A player's progress in a game can be measured by assessing the extent to which players use elements of the frame the way a more experienced practitioner does. That is, we can measure *whether elements of the frame become linked* in the same way as they are in a valued social practice.

Shaffer and his team also use ENA to explore whether particular kinds of events in the game lead to significant changes in players' developing epistemic frames. So ENA lets researchers assess the development of complex thinking skills through game play.

Of course, ENA isn't just play. Shaffer points out that ENA can be used to assess learning in other contexts too. ENA is a way to measure learning any time—what counts is not just whether students have some collection of facts and skills, but how those facts and skills are connected to each other, and to some set of values and ways of thinking.”

As a result, epistemic network analysis is a “worked example” of assessment in the digital age. It shows how in a changing landscape of digital learning, new theories of digital learning need new methods of assessment design.

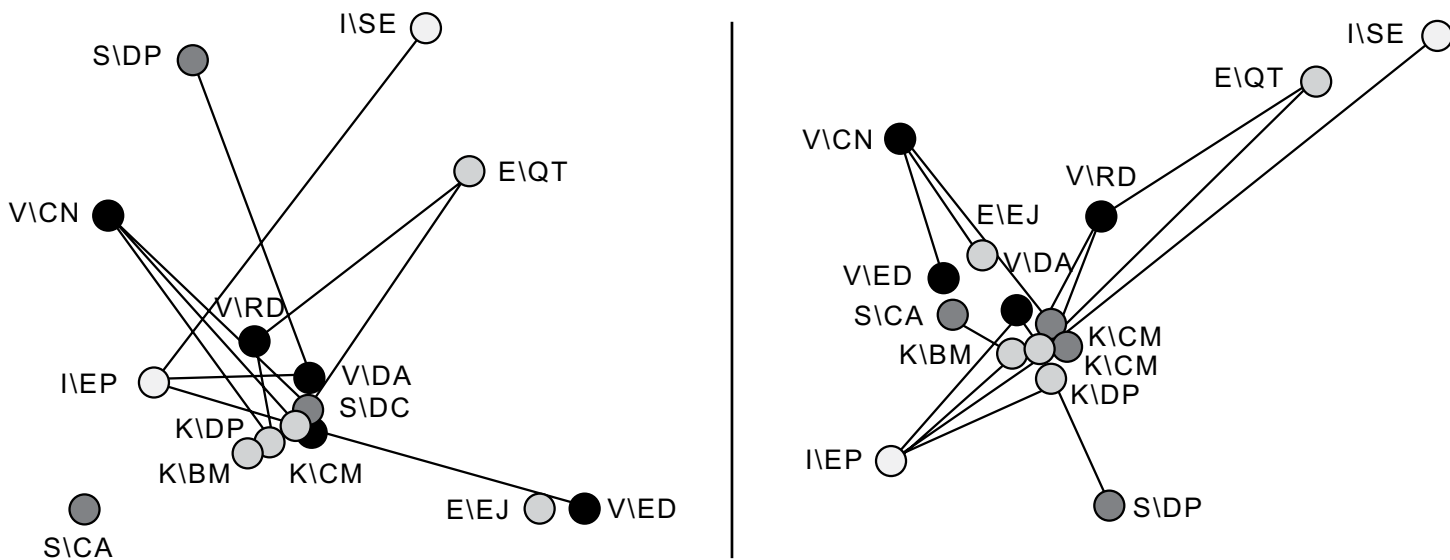


For more about epistemic games and epistemic network analysis, see

<http://epistemicgames.org/eg/?cat=89>



David W. Shaffer





## Hand in Hand: Academic Success & Emotional Success

Recent developments in social and emotional learning (SEL) have pointed to the reciprocal relations between children's academic functioning and their socio-emotional health. Professional literature in this field points to the need for including students' academic skills and competencies as part of mental health intervention research.

University of Wisconsin-Madison psychologist and professor Thomas R. Kratochwill says educators cannot afford to continue offering mental health services for K-12 students in isolation. These services need to be reframed, mainstreamed, and folded into schools' broader academic mission.

The good news is that schools already have resources, supports, and opportunities that may provide entry points for delivery of expanded mental health services. Virtually all elementary and secondary schools in the U.S. have school psychologists and provide mental health services, Kratochwill says. The bad news is that the proportion of students needing services continues to outpace supply, and mental health services often remain separate from academic programs. Knowledge about mental health programs and educational achievement have developed in isolation from each other.

Many children receive mental health services in school settings. Although studies of social and emotional learning have linked social and academic competence, the impacts of mental health interventions on academics, and of academic interventions on mental health, are understudied.

Kratochwill argues for a multi-tiered intervention approach in schools. Varying levels of service intensity are available over time and in different grades for students, especially during transitional periods.

Because schools and districts have tight budgets, it's important to know which students might benefit most from different types of intervention. And to streamline or adapt effective interventions for dissemination on a larger scale, it's important to understand how various interventions produce positive outcomes.




Kratochwill says the relatively few studies that did target both academics and mental health focused mainly on younger children and on those with externalizing behavior problems. Few of the published studies examined children

in middle or high school settings, nor did they include children with internalizing behavior problems including anxiety and depression.

School mental health research would be significantly strengthened by more carefully designed studies of the effects of specific intervention components and by the optimal timing for their delivery, Kratochwill says. They also would enable findings from this work to have more policy and practice relevance.



**Thomas Kratochwill**

-  To identify research directions for future studies of school-based mental health services, Tom Kratochwill and colleagues reviewed scholarly literature to identify evidence-based interventions that target a combination of students' academic-educational functioning and their mental health functioning.
-  They studied 2000 articles published between 1990 and 2006; only 64 studies met the methodological criteria for inclusion in this review. Of those 64 studies, 24 tested the effects of a program on both academic and mental health outcomes, while 40 examined mental health outcomes only.
-  Schools are increasingly held accountable for achieving academic outcomes. Given that, Kratochwill says he was surprised that most of the mental health studies did not include academically relevant outcomes. That means that the impact of school-based mental health interventions on educationally relevant behaviors is under-researched and may be poorly understood.



## Supporting African American Boys in School

Low educational achievement contributes to and perpetuates socioeconomic, health, and other inequalities for African Americans. And for males in particular, educational and employment outcomes have declined, even over the past two decades.

Research into low academic achievement for African American children shows that the culture of children and their teachers affects student engagement and learning, and that parental involvement and social networks are important.

Many African American children do not live in nuclear families; they live in a variety of adaptive family structures. This is especially true for low-income and working class Black families. Researchers and teachers know relatively little about how these adaptive family systems support African American children, beyond the fact that they have historically helped African American families survive and meet their psychosocial, cultural, and material needs.

To gain insight from children's lived experiences, and to map networks of social support, UW-Madison professor of Human Ecology Jeffrey Lewis and colleague Amy Hilgendorf interviewed 28 African American boys in grades 4-6 from 2 elementary schools and a middle school in Beloit, Wisconsin.

Lewis and Hilgendorf asked the boys who helped them be a "good student" and how these acquaintances provide this support. The support the boys discussed was often complex and multidimensional and worked in at least four layers (see sidebar).

Friends and siblings made up 26% of the supportive individuals the boys identified. Adding cousins, children accounted for slightly more than one-third of the boys' identified support networks.

As anticipated, the boys viewed women as providing substantial school-related support. Mothers, grandmothers, and aunts accounted for slightly over 30% of all responses. Adult males also played a significant role for nearly all the boys. Fathers, grandfathers, uncles, mothers' boyfriends, and others accounted for nearly one quarter of those

identified as providing homework support. When one considers the number of times the boys named their peers as providing support, males made up about 38 percent of the supportive individuals reported.

Many adult males mentioned were "non-residential" fathers who were nevertheless involved in the boys' lives. Some of the men were surrogate fathers—their mothers' boyfriends and unmarried partners. Brothers, cousins, and friends also played significant roles in support networks. They were particularly important when the boys were in trouble.

Two boys said the majority of their support came from households in other communities. This agrees with reports from many that their families made regular trips to visit relatives in other cities up to 3 hours away, and that they had regular phone conversations with supportive adults in other cities, including calls to discuss school. Thirteen of the twenty boys reported receiving most of their support from one location. However, six reported support networks that were spread over two locations.

Mentoring programs represent a common approach to securing support for African American boys. Yet regardless of their effect, formal mentoring programs have reached a relatively small percentage of these children. Many boys who want mentors must wait a year or more and many cannot meet the criteria necessary for success. Moreover, Lewis says, these approaches often fail to identify or tap into support already available within the boys' social networks.

Most boys identified supportive adults in addition to their primary caregivers, most often members of their extended and social families. Their support parallels many functions of mentors, including encouragement and reinforcement. These adults told the boys "to do the right thing" in school, voiced clear expectations for academic achievement, and celebrated the boys' successes.

Some boys also mentioned ways these adults modeled positive school-related behavior. Some recalled personal stories that conveyed lessons relevant to school and their education. Many adults provided instrumental help with schoolwork, paralleling the tutoring function of some mentoring programs.

Lewis argues for the importance of finding ways to connect African American boys' natural mentors to their school lives. While the important individuals the boys identified already serve many mentor functions, these adults may not be well equipped to provide other functions, for example, providing "bridging" social capital. Natural mentors have few opportunities to connect boys with more advantaged individuals or with employers or institutions of higher education institutions, Lewis says. But school staff are likely to have access to bridging capital. When made aware of the boys' support networks, school staff could provide this service to the boys and to their mentors. The entire social network as well would be strengthened.

*(continued on page 7...)*



## Professional Development for American History Teachers

In 2007 the Madison Metropolitan School District (MMSD) undertook a three-year teacher professional development project called “Building Informed Citizens.”

A Teaching American History grant from the U.S. Department of Education enabled the district to offer this professional development project that aims to raise student achievement by increasing teachers’ knowledge and understanding of U.S. history.

This joint effort involves the MMSD, the University of Wisconsin–Whitewater, the Wisconsin Historical Society, and the Wisconsin Veterans Museum. WCER researcher Shihmei Barger is evaluating this project and aims to provide scientifically rigorous evidence on the extent to which project outcomes meet the project goals and objectives.

Each year, the BIC Project focuses on a core topic in traditional U.S. history. The three annual themes are (a) roots and ideas of American democracy, (b) becoming an American—immigration and migration, and (c) America in the world. BIC professional development activities include full-day workshops during the school year and annual, week-long summer institutes.

To assess whether intervention teachers’ knowledge and quality of instruction has improved, Barger measures (a) content analysis of lesson plans using a 12-point rubric on standards such as teachers’ historical content knowledge, analytic thinking skills, instructional scaffolding skills, and lesson structure; (b) classroom observation and evaluation based on Authentic Instruction and Assessment, which includes higher-order thinking, deep knowledge, substantive conversation, and connections to the world beyond the classroom; (c) the American History Teacher Test, a 100-item, multiple-choice test constructed from the item bank of the Comprehensive Social Studies Assessment Project of the State Collaborative on Assessment and Student Standards; and (d) a teacher survey based on “Learning about the Teaching American History Program: A Questionnaire for Participants” from Evaluation of the Teaching American History Program.

Barger’s initial analysis of teacher lesson plans identified two areas for improvement: historical content knowledge and analytic thinking. When Barger collects and analyzes the next wave of sample lesson plans from BIC teachers she expects to see a 15% increase on all four of the lesson plan standards.

Barger’s analysis of classroom observations showed variations in the quality of classroom instruction. Individual teacher scores ranged from 6 to 15 points, with a mean score of 10.3 out of 20 points. Areas in need of improvement included ‘substantive conversation’ and ‘connections to the world beyond the classroom.’ Barger will observe the same twenty participant teachers and 20 comparison group teachers during Fall 2009 and Spring 2010. She expects to see a 15% increase in their average scores.

Prior to the BIC project, teachers in the intervention and comparison groups scored equivalently on an American history test (the U.S. Department of Education’s Comprehensive Social Studies Assessment Project). The two groups of teachers demonstrated the same level of knowledge of American history. When they take the test again in June 2010, Barger expects to see a statistically significant difference in scores between the BIC group and the comparison group.

A pre-BIC survey showed that the participating teachers had less confidence in teaching American history and in their general teaching ability than the comparison teachers. That’s even though the BIC teachers report a higher preference for teaching American history. When Barger surveys both groups of teachers again in June 2010 she expects to see the intervention teachers demonstrate a 20% increase in confidence in teaching American history and a 20% increase in confidence in general teaching ability.

To assess whether teacher participation in BIC has a positive impact on student achievement, Barger measures (a) student performance on the Wisconsin Knowledge Concepts Examinations—Criterion-Referenced Test, and (b) content analysis of student work (intervention group only).

WKCE scores for the 8th grade students of both intervention and comparison group teachers were collected for assessing the three-year cumulative effects of the BIC Project. Students in the intervention group scored an average of 416.57 on the Social Studies Scale Score, which corresponds to the advanced performance level. Students in the comparison group scored an average of 393.34, which corresponds to the proficient performance level. On the Standards Performance Index History metric, the intervention students averaged 75.59 out of 100 whereas the comparison students averaged 65.36 out of 100, which is 15% lower than the intervention students. Similarly, on the Standards Performance Index Political Science and Citizenship metric, the intervention students averaged 76.0 out of 100 while the comparison students averaged 64.4 out of 100, which is 18% lower than the intervention students.

Students of intervention teachers are expected to score higher on the Social Studies proficiency category of the WKCE in 2009 than students of comparison group teachers; specifically, students of intervention teachers are expected to attain at least a 10% increase in 2009 in mean score on Social Studies Scale Score, Standards Performance Index (SPI) History, and SPI Political Science and Citizenship.

Barger's initial analysis of student work showed that students of BIC teachers performed just above the progressing level on American history achievement (a mean of 5 out of 10 points). This year Barger will again collect and analyze sample student work from the BIC teachers. She and the MMSD project director estimate a 15% increase in the quality of student work.



**Shihmei Barger**



(... continued from page 5)

#### **Supporting African American Boys in School**

Boys expressed some ambivalence about school—they did not always view it as “safe and familiar.” However, the sixth graders named at least one teacher with whom they felt comfortable. Most of the sixth-grade teachers had at least one African American boy that experienced their classroom as a good place to be. Lewis says he views this as a hopeful sign that productive and caring relationships can be established between the boys and their teachers.

Lewis is still gathering data on the boys' experiences of not having support, and he cautions that his analysis is preliminary and suggestive. However, the data revealed two issues to consider:

1. When the boys described situations in which they did not have support or help they needed, most often they described situations when the individual commonly available for support was simply not around (e.g., a parent is not at home or a teacher has left the classroom). These were generally short-term situations and preliminary data suggest these are not chronic or serious problems.
2. Boys described situations in which they needed assistance with homework, and an adult was available who could help, but the boys did not seek help from that person because the supportive adult had previously responded with anger or frustration with a request for help from the child. When this individual is the only person available, the boys report dealing with the need for help on their own, sometime with frustration and anger.

### **BOYS' 4 LAYERS OF SUPPORT**

1. **Instrumental support** for African American boys' academic achievement includes help with homework, enrichment and extra skill practice.
2. **Accountability, informational, and moral support.** Boys mentioned being held accountable for their behaviors and help with managing their emotions, and their parents' meeting with school staff.
3. Developing **school-oriented attitudes, behaviors, and habits.** Boys mentioned encouragement and expectations to “do good” and some extended conversations about the importance of “getting your education” to have a happy life.
4. **Support for basic needs.** Boys appreciated people's efforts to keep them fed, clothed, and supplied for school. Many said they valued emotional closeness and security as an important form of school-related support. Parents and grandparents often fulfilled these emotional needs.

### **Recommendations**

Lewis recommends a number of ways to improve school-related support for African American boys.

1. Educators should view African American boys and their families more consistently as resource-rich and full partners in support of their education. Start by creating opportunities for boys to share this information and by showing interest in the boys' lives.
2. Educators should develop a broader concept of family support for school that goes beyond what is typically called “parent involvement.” Find ways to partner with these support systems: (a) Look beyond “parents” and identify any adults who provide school-related instrumental and emotional support, and (b) Expand our understanding of what constitutes support. Identify how parents actually support their child's education, as well as what the boys experience as supportive.
3. Men matter to these boys. Educators should find ways to partner with them and connect them with boys' schools. Men regularly appear in support networks, even when they live in separate households and separate cities.
4. Peers play an important role in boys' support networks and can provide positive influence. Educators should identify and engage boys' peer relations that provide school-related support.



**Jeffrey Lewis**



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