



## FROM THE PRESIDENT

*Mark D. Reckase, Michigan State University*

### HAVE MODEL, WILL TRAVEL

A few weeks ago I was on an airplane traveling to a meeting in Washington, DC and I was thinking about topics for the President's Column for the NCME Newsletter. All of a sudden a musical tune popped into my head. It was the title theme song for a very old television program (from the 1970s) called "Have Gun, Will Travel." This musical introduction was played over a picture of a business card with the picture of a knight chess piece on it with the words, "Have Gun, Will Travel, wire Paladin, San Francisco." There may be a few of you who are old enough to remember this program.



The basic premise of the program was that there was a person living in San Francisco that would travel to places in the Old West to solve problems, presumably for money. However, the person was basically good, but he carried a gun in a holster with a white knight on it. Amazingly, he always solved whatever problem there was in one segment of the show.

After these thoughts ran through my head, I wondered whether there was the psychometric/educational testing equivalent of Paladin. Where there white knights that traveled around the country doing good and solving problems? I also wondered whether there were members of NCME who would be interested in taking on that role, but who had not yet logged tens of thousands of miles on airlines. Over the years, I have noticed that the same persons keep reappearing at meetings. Where these folks the equivalent of white knights or hired guns?

At this point, I will make a distinction between those who travel to meetings to present the results of analyses and research projects. These people have are actual workers. They are the equivalent of the contractors who comes to your house to do a fairly high level job that you yourself are not capable of doing. It might be running analyses for a test equating or being a facilitator for a standard setting. These do not fit into the Paladin mold. Paladin did not have a real trade except for fixing problems. What I am describing here are folks who show up to attend a meeting to react to what is presented. They are not the presenters. I have been in both roles and they are both interesting positions. The reactor position is more like Paladin.

There are many meetings where the traveling psychometricians might appear. Most states have advisory committees, as do many federal programs. There are even some opportunities to be an advisor for foreign governments and other agencies outside the U.S. Other options on the psychometric travel circuit are testing companies, research organizations and professional organizations. A final option is functioning as an advisor to research projects housed at universities. What all of these have in common is that a psychometric professional, usually a university faculty member, is given a fee for reacting to whatever is presented at a meeting. This could be the results of an analysis or a proposed methodology. Sometimes the traveling psychometrician is brought in to recommend approaches for solving a problem, or to lend credibility to a project.

So, are those on this traveling circuit white knights or hired guns? From my observations, almost always the psychometric advisors try to do the right thing. They want things to be done in the right way according to their best understanding of what the right way is. That is where the title of this paper comes into play. The traveling psychometricians typically have a favorite model that they use – their gun. It might be true-score theory, the Rasch model, the three-parameter logistic model, or even a multidimensional model. Given that they have a favorite model, there is a tendency to see every problem in that context, but like the Paladin in the TV show, there is also the desire to solve the problem within the context that is given without being too dependent on the model.

The place where the positions of the psychometric advisors become somewhat ambiguous is when they are asked to find the best solution to a bad idea. A common example is equating tests that measure different constructs. There is also the possibility that psychometricians will give credibility to projects simply by being in attendance at a meeting. Such cases can lead to a reputation of being a hired gun. There are other prices to be paid for being on the traveling circuit – fatigue and not enough time to do solid research and publish the results.

Given the price of participation, why do people do it? One answer is that that working on the psychometric circuit can be lucrative. We never know what Paladin charges, but he seems to live a pretty good life. But there are also positive professional benefits. It is easy to keep up on the major issues in educational measurement and get ideas for solutions from bright colleagues. Participation in these meetings also gives high visibility among important groups and helps with networking for jobs and other positions.

For persons interested in this role, there is a need to balance the time and energy demands with other goals. A person also needs to develop the necessary skill set – technical knowledge and diplomatic skills. There is also the need to accept that there is no correct answer to many problems, but there are some answers are pretty good given the details of the problem and the constraints placed on the solution.

So, if you want to be a white knight, what should you do. You could post your business card on the web – “Have Model, Will Travel, e-mail Paladin, University of ... “. You may get a few hits. A better approach is to become a “squire” to a white knight to learn the ropes. This may take a few years, but the training is worth the effort. I will look forward to seeing you at the next meeting.

## NCME News

On a less fantastic note, the NCME Board Meeting is coming up soon and there are a couple of important issues on the agenda. One is the financial status of the organization. First, let me state that the financial status is good, but not as good as it was a few months ago. At the last Board meeting, we discussed how to use some funds that had accumulated. Now the issue is whether we can still implement some of those good ideas. You do not have to worry about changes to existing services and costs of membership, but it may be that we need to wait a little while before putting new ideas into place.

Another issue is a ‘good news, bad news’ problem. The good news is that we are getting a lot of good submissions to the NCME journals. The bad news is that we have a fixed page count and it is difficult to decide how to deal with abundance of good work. You should notice that the Journal of Educational Measurement will have a few more pages per issue, but the increase is not enough to cover the increase in submissions. We will be considering this issue in detail at the Board meeting and hope to come up with a solution that can take advantage of the increase in quality research.

## Reflections

A final nostalgic thought – it has been a great experience being the president of NCME. It is hard to believe that my time in office is nearing its end. I am looking forward to this year’s annual meeting in San Diego where I turn over the office to Terry Ackerman, but I will also be sad that the term of office is finished. I highly recommend running for this office if there is the opportunity, or any other NCME office. This is a great organization and it is great fun to work with all of the people who are involved in making the organization what it is.

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## 2008 ELECTION REVIEW

*Larry Snowwhite, Vice President, Public and Government Affairs, McGraw-Hill Education*

### Federal Election Results

#### President-Elect Obama

President-Elect Obama will take office on January 20<sup>th</sup>, 2009 having run with a detailed education agenda. On testing, it states:

**Reform No Child Left Behind:** Obama and Biden will reform NCLB, which starts by funding the law. Obama and Biden believe teachers should not be forced to spend the academic year preparing students to fill in bubbles on standardized tests. They will improve the assessments used to track student progress to measure readiness for college and the workplace and improve student learning in a timely, individualized manner. Obama and Biden will also improve NCLB's accountability system so that we are supporting schools that need improvement, rather than punishing them..



As of this writing, a Secretary of Education has not yet been nominated. Three transition task forces have been named. The Policy Transition team is headed by Linda Darling-Hammond of Stanford University. Other members include Ian Bassin; Jeanne Century; Robert Gordon; Kris Gutiérrez; John Jackson; David Kirp; Goodwin Liu; Ray Mabus; Geri Palast; Steve Robinson; Bob Shireman; and Jon Vaupel. The Review Team for the Department of Education is headed by Judith A. Winston, former General Counsel at the Department under President Clinton. A third team will handle jobs in the Department.

Melody Barnes, the former general counsel to Sen. Ted Kennedy and most recently the policy lead at the Center for American Progress, was named the director of the White House Domestic Policy Council (the post held by Margaret Spellings before she became Secretary of Education).

### Congress

The leadership of the House and Senate education committees was unchanged by the election. However, Senator Hillary Rodham Clinton (D-NY), a member of the Senate Health, Education, Labor and Pensions Committee, will give up her seat once confirmed as Secretary of State. In the House education committee, Ric Keller (R-FL), ranking Republican on the House Postsecondary Education subcommittee was defeated, along with Randy Kuhl (R-NY) and Tim Walberg (R-MI). Rep. Udall (D-NM) was elected to the Senate, so will leave the House Appropriations subcommittee on education. Mark Warner (D-VA) was elected to an open seat in the Senate; as Governor he chaired the National Governors Association and led its initiative for greater coordination between K-12 and postsecondary education systems.

The large number of new Democrats, particularly in the House, means further reduces the number of Members who were involved in the enactment of NCLB – and fewer still who worked on IASA or Goals 2000. Obama's victory also could lead to major personnel shifts in committee and congressional office staff, some going into the new administration and others leaving the Hill to new jobs with associations or lobby shops.

The consensus at this point is that Congress will not take up reauthorization of the Elementary and Secondary Education Act (ESEA), as amended by NCLB, until 2010 at the earliest. President-elect Obama, on December 6, proposed a massive public works program that includes school construction and technology infrastructure. The next Congress also will have to take up funding for the balance of this fiscal year; the fiscal year ends on Sept. 30, 2009 but Congress has funded existing programs only through March 2009. The new Congress could extend existing funding through the end of the fiscal year or could respond to Obama's priorities with new or redirected funding for education programs.

### **State Election Results**

State elections have resulted in changes among Governors, Legislatures, and Chief State School Officers, all of which could have significant effects on education.

### Governors

No incumbent Governors were defeated. In open races –

**Delaware** – Jack Markell (D), the incumbent state Treasurer, won; he supported computer-adaptive testing

**Missouri** – Jay Nixon (D), who ran on improving college affordability

**North Carolina**—Beverly Perdue (D), the Lieutenant Governor won

**Arizona** will have a new Republican Governor upon confirmation of Janet Napolitano, who has been nominated to head the Department of Homeland Security.

### Legislatures

The 2008 election resulted in only eight states having split legislative control – Alaska, Indiana, Kentucky, Ohio, Michigan, Montana, Pennsylvania, and Virginia. This is the fewest number of states with politically divided legislatures since 1982. Democrats took control of four legislatures – Delaware, Nevada, New York, and Wisconsin. Republicans took over control of the legislatures in Tennessee and Oklahoma.

### Chief State School Officers

There will be about a dozen new Chief State School Officers in 2009 between election results and retirements.

In the 2008 elections, **Washington** incumbent Terry Bergeson was defeated by Randy Dorn, who has raised questions about continuing the Washington Assessment of Student Learning (WASL). **Indiana** will have a new Superintendent, Randy Bennett (R), who won the race to succeed Suellen Reed, who is retiring. In **Montana**, Denise Juneau (D) prevailed.

# COMMENTS ON THE NACAC COMMISSION REPORT ON THE USE OF STANDARDIZED TESTS IN UNDERGRADUATE ADMISSIONS

*Steve Kappler & Doug Becker, ACT, Inc*

The report from The National Association for College Admission Counseling (NACAC) Commission on the Use of Standardized Tests in Undergraduate Admissions\* released in September 2008 offers some thought-provoking recommendations and opinions regarding the role of standardized tests in college admissions. In general, we at ACT agree with, and have long advocated for, most parts of the Commission's report, and we are working with NACAC to clear up a few misconceptions that were evident to us as we read the report.

We have always recommended that colleges use multiple indicators of college readiness along with ACT test scores for admissions, scholarships, and other high-stakes decisions. While research continues to show that the ACT coupled with high school grades continues to be the best predictor of college success, no single measure will ever be a perfect indicator of students' likely success in college. That's why having multiple pieces of information on any given student is so important. The art of admissions is blending objectivity with subjectivity, while balancing the sheer number of applicants who need to be individually reviewed.

The Commission clearly calls for a measure of high school courses and we couldn't agree more. The ACT is a standardized curriculum-based test of educational development designed to assess and measure the academic skills that students have learned in school and will need to succeed in first-year college coursework. The ACT does not measure aptitude or IQ. The content of the exam is designed to reflect the skills and knowledge that are taught in schools across the U.S., based on our exclusive National Curriculum Survey® which is conducted every three to four years. It includes a comprehensive review of state educational standards documents, surveys of secondary and postsecondary educators, and consultation with content area experts across the curriculum. Since the ACT is a curriculum-based exam, our research indicates that effective test preparation actually takes place within a rigorous school curriculum—in the classroom. ACT is committed to improving rigor in the classroom, especially related to the core courses needed for success after high school, whether in college or career.

We disagree with the Commission's findings that state testing with the ACT is inappropriate. The ACT exam is based on what is taught in the nation's high schools. We work with individual states to complete a curriculum match to specific state standards, and such measures for each state go through an independent, third-party review. There is usually a very close match between state standards and the ACT. The U.S. Department of Education has approved several states' use of the ACT for NCLB purposes. Greater access and opportunity for more students have been clearly demonstrated in the states that have used the ACT statewide.

The ACT has many uses beyond the admissions decision, including counseling, placement, advising, research, and retention. To view the ACT as just an admission test indeed limits the power of the available data. The days of tests being perceived simply as gatekeepers or barriers to admission need to end. ACT has embarked on a new generation of testing, one that has uses far beyond just admissions, and has gone beyond the "cutscore" mentality. The goal of this new generation of testing is to provide access and opportunity for all students, by removing barriers to higher education through our College Readiness System. Aligning longitudinal measures and providing information about students at a time when educators can impact their plans and development will certainly benefit students, educators, and states, while increasing the potential for students to be prepared for life after high school.

*\*([http://www.nacacnet.org/PublicationsResources/Research/Documents/TestingComission\\_FinalReport.pdf](http://www.nacacnet.org/PublicationsResources/Research/Documents/TestingComission_FinalReport.pdf))*

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## LEGAL CORNER: CONDITIONS QUALIFYING FOR EXTRA TIME “ACCOMMODATIONS”

*S.E. Phillips, Consultant*

Some test takers are using litigation to redefine the conditions that qualify as a disability. Two medical licensure testing cases provide examples of different results reached by state and federal courts in determining what conditions qualify for the “accommodation” of extra testing time.

## ***Currier v. NBME***

In a 2007 case in Massachusetts, a state court required a licensure test administrator to provide an extra hour of break time as an “accommodation” for a breastfeeding mother. In this case involving the Step 2 medical licensure exam, Harvard medical student and nursing mother, Sophie Currier, sought extra testing time for dyslexia and attention deficit hyperactivity disorder (ADHD) and extra break time so she could pump breast milk for her five-month-old daughter. She had taken and failed the Step 2 exam by a few points the previous spring and stated that she would be unable to begin her residency program in clinical pathology until she passed the exam. For her learning disabilities (diagnosed at age 16), the National Board of Medical Examiners (NBME) offered to replace the eight, one-hour segments of multiple-choice questions usually computer-administered in a single day with eight, two-hour segments administered over two days (double time) in a separate room. In response to her request for 60 extra minutes of break time each day to pump breast milk, the NBME offered the standard 45 minutes of single-day break time for each of the two test days, a separate room with a power outlet to pump milk and permission to bring food into the testing room. Currier accepted the two-day test administration for her learning disabilities but rejected the options for pumping breast milk as insufficient to avoid painful breast engorgement and possible infection from blocked milk ducts.

Currier filed suit in Massachusetts state court seeking a preliminary injunction requiring the NBME to provide an additional 60 minutes of break time each day for expressing her milk. She provided affidavits from experts stating that she needed to pump milk twice during each test administration day and that each pumping session would require 25 to 30 minutes. In support of its refusal to provide the extra break time, the NBME argued other breastfeeding mothers had successfully completed the exam with the allotted 45 minutes of break time, maintaining uniform break time limits was necessary to protect the integrity of the testing program and a computer-administered test form allowing both double time and extra break time was unavailable.

The trial court refused to grant the requested preliminary injunction and Currier appealed. The Appeals Court overruled the trial court and granted the requested injunction. The Appeals Court held that as a breastfeeding woman, Currier was *disparately impacted* relative to men and nonlactating women because denial of the requested *reasonable accommodation* would cause her significant physical pain and create an “unfair burden on the mental energies” necessary for the test. The Appeals Court described Currier’s situation as a “Hobbesian choice” between using the 45-minute break time to incompletely express her milk while ignoring her needs for food and restroom breaks or using the break time for her personal needs and enduring the pain caused by not expressing her milk. In addition, the Appeals Court found that extra break time would not provide an advantage because test takers are only permitted to use break time between testing segments. Moreover, the NBME’s alternative suggestion that Currier delay retesting until she was no longer breastfeeding was dismissed by the court as “unfairly imping[ing] on [Currier’s] opportunity to pursue her medical career in conjunction with the rearing of her child.”

In reaching its conclusions, the Appeals Court recognized a constitutionally protected right of a woman to breastfeed her child and a strong likelihood that the testing hardship imposed on Currier due to a post-pregnancy condition would constitute sex discrimination prohibited by the equal protection clause. According to the court, the remedy for this potential equal protection violation was the granting of the requested “accommodation” of extra break time. Thus, the court substituted a constitutional analysis for the usual Americans with Disabilities Act (ADA) requirement of a qualifying disability and awarded Currier an additional “accommodation” based on sex discrimination rather than on disability. This is an important distinction because it may signal a willingness of courts to require an “accommodation” in the absence of a qualifying disability when the condition at issue relates to a subgroup of persons based on gender or ethnicity.

## ***Baer v. NBME***

However, in another Massachusetts case decided in 2005 in federal (rather than state) court, a medical student with a reading impairment was denied extra time to take Step 1 of her medical licensure board exams because the court found that her impairment was not severe enough to qualify as a disability under the ADA. Heidi Baer attended medical school at Drexel University and had been granted extra time for the MCAT and on medical school exams. Drexel required passage of Step 1 of the medical licensure exam prior to beginning the third year of medical school. Despite a policy of dismissal after three failures, Drexel had granted Baer a fourth attempt to pass the exam. Similar to her first three requests, Baer’s request for an accommodation of time-and-one-half for her fourth attempt was denied by the NBME because its experts believed she had not provided adequate evidence to substantiate her claimed learning disability in reading and claimed attention deficit hyperactivity disorder (ADHD).

In denying her request for an injunction requiring the NBME to grant the extra testing time, the federal district court held that although she had demonstrated a weakness in reading that affected her ability to “read, comprehend and process written material quickly,” her impairment was not severe enough to satisfy the ADA requirement that a qualifying disability “substantially limit a major life activity.” In addition, the court held that “the specific task of taking timed tests ... is not the kind of ‘major life activity’ protected under the ADA.” The court also discounted evidence of a discrepancy between her “very

high IQ scores and her actual performance on certain tasks” finding that poor exam performance could also be caused by many other factors “such as anxiety, stress, nervousness, cautiousness, poor organization, poor time management, lack of motivation, lack of appropriate preparation, or weakness in a particular subject matter,” some of which were the case for Baer. Further, even if taking timed tests were considered a “major life activity,” the court held that evidence that Baer scored at the national mean for female test takers on the SAT college admissions test without any accommodations but more poorly on timed math and science tests suggested that “any impairment she has substantially limits only her performance on timed math and science tests, not timed tests generally.” Based on these factors, the court upheld the NBME’s determination that Baer was not disabled within the meaning of the ADA and denied the requested extra time accommodation.

## **Implications**

Cases like the *Currier* and *Baer* cases described above raise difficult issues about what conditions qualify as disabilities and how much change in standard testing conditions is required. Test administrators in the *Currier* case provided extra testing time and a two-day administration in response to the recognized disabilities of dyslexia and ADHD but were reluctant to provide additional break time for health-related needs resulting from a personal decision to become pregnant and breastfeed. Alternatively, in the *Baer* case where the learning disability in reading and ADHD disability were diagnosed relatively late in the student’s educational career, the student’s performance was near average without the extra time accommodation and the request for judicial intervention was delayed, the court was sympathetic to the NBME’s determination that the test taker was not disabled as defined by the ADA.

One question raised by these cases is the perception of the court that extra break time confers no advantage on the test taker. The *Baer* court found that the test taker’s impairment in response speed for math and science tests was caused by factors other than a disability and was therefore not sufficient to justify the advantage of additional time to work on the test questions. Alternatively, the *Currier* court found that possible gender discrimination qualified the test taker for extra break time that the court assumed would provide no advantage because it could not be used to work on the test questions. However, some medical professionals might disagree with the *Currier* court’s assumption. Although extra break time does not directly impact working time on the test questions, it may provide indirect positive benefits if a test taker’s mental energies are recharged to a greater extent with longer break times. For example, it might be the case that some test takers could improve their scores with a longer break between the morning and afternoon exam segments, perhaps with a nap to counter fatigue or a walk to rest sore muscles or tired eyes. Thus, one might wonder whether conditions other than breastfeeding that do not qualify as a disability might also be deserving of extra break time, particularly if they are more often experienced by test takers of one gender or ethnicity. If so, the burden on test administrators may be substantially increased.

Another question raised by these cases is, “Should test administrators be required to provide alternate testing arrangements for the convenience of test takers with temporary conditions caused by personal choices that do not qualify as disabilities?” For example, what if a test taker chose to have elective laser eye surgery prior to a licensure exam and requested a reader due to unexpected complications involving swelling and blurred vision? Should the reader be provided or should the test taker be required to postpone the exam for a few weeks until fully recovered from the surgery? The answers to such questions obtained through litigation are likely to continue to redefine and change the boundaries of required “accommodations” in testing programs for the foreseeable future.

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## **GAMES WILL ENTER EDUCATIONAL ASSESSMENT AS DISRUPTIVE TECHNOLOGIES**

*C. Victor Bunderson<sup>1</sup>, EduMetrics Institute, Jonathan D. Ferguson<sup>2</sup>, Champlain College*

*“Games are entering educational assessment? What a foolish notion. Why would anything as well understood as test development and good psychometrics benefit from understanding or using games? Aren’t game developers psychometrically illiterate? Anyway, aren’t violent and sexually themed games morally offensive, fully justifying the Columbine parents’ lawsuit against the game companies?”* Thoughts like these have possibly entered the senior author’s mind at times while watching the unfolding saga of the multi-billion dollar industry in interactive games. Interactive electronic games were first imagined in the 50’s, launched in the 60’s, grew up in the 70’s and 80’s, and exploded in the 90’s and 2000’s (Horowitz et al, 2008, see also Ok, 2008).

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<sup>1</sup> Victor Bunderson is an emeritus Brigham Young University Professor who founded the non-profit EduMetrics Institute and other companies. He served as ETS vice president of research management in the late 1980s, and now serves as a member of the WGU Assessment council. Despite cutting his teeth on computers in the 60’s, and keeping up fairly well, Marc Prensky (2001) would classify him as a “digital immigrant” while his children and especially, grandchildren, are *Digital Natives*. He worked with Jonathan Ferguson at EduMetrics, who mentored him in gaming while he taught Jonathan something of educational measurement.

<sup>2</sup> Jonathan Ferguson is a digital native who teaches Game Design at Champlain College, Vermont. Champlain College has one of the country’s oldest electronic Game Design programs for undergraduates. The program is extremely selective, and the gamers who make the cut, are bright and highly motivated digital natives.

There is a great divide between the existing educational establishment on one side and emerging disruptive technologies on the other. Any measurement professional who has had thoughts like the above was thinking from the establishment side. This divide is now much better understood through “*disruptive innovation theory*”. This theory clarifies what has happened in other industries and what will likely happen in this one. It thus deserves the brief account found herein, and further investigation of the sources by interested readers. In addition, this report summarizes an example of a disruptive innovation in education, Western Governor’s University. This example motivates discussion of possible ways games might impact assessment.

Listen first to a voice from the gaming side of this great divide, answering the dismissive comments above; challenging testing to face its problems and become more relevant:

*“Come on, dude. Video and computer games are serious business today. The game industry posts sales of more than \$9.5 Billion in the United States, and by some estimates, more than \$30 Billion worldwide (ESA, 2008; Prensky, 2003). The testing industry could learn a lot from game developers, and vice versa.*

*High stakes TESTing is in crisis. Teachers are required to teach TEST-taking skills, as well as teach “to the test.” Online TEST systems further reinforce a limited item-type vocabulary, and therefore, the types of assessment available to all test developers. The future is Games. According to some game design theorists, the fun in games is Mastery (Koster, 2005). The point of a TEST is to demonstrate mastery, but it does it in un-fun, un-cool ways. Well, games have been demonstrating mastery for millennia now. It’s just that academics have not taken games seriously until recently. This bias has led test developers to focus on various forms of item based assessment. Items use lots of words, with no context to show what the domain looks like— no story, few pictures, no ways to see what progress you are making in a timely fashion. High-stakes TESTs give few chances to try again and improve, by design. High-stakes TESTs are used to measure the effectiveness of institutions— unfortunately, that’s not how high-stakes TESTs come across to learners. Learners want to learn. As any educator knows, the learning cycle depends on good feedback, and high-stakes TESTs will never fill that role. Instead, they offer a score at some artificial milestone, but this score conflates different pieces of mastery into a conglomerate— the worst sort of feedback available.*

*The crisis doesn’t end there, however. TESTs have a specific vocabulary, one that is anchored in the tools of the past. Items reference text passages in school-books and give snippets of text back in tricky ways. This tends to favor those who have high verbal skills. As important as words are, the world is not just about words. Printed pages do not invite actual performance of serious, integrated tasks with problem solving. If you were to situate a learner in the role of a player in a game, that player would volunteer to play your “assessment.” A game doesn’t have to be a fancy interactive virtual world; it doesn’t even need to be computerized. Wordy tests only really test wordy skills. They don’t provide a context for rapid, highly motivated and collaborative learning. Games do, however. The current Holy Grail in measurement is a system that provides real-time assessment of task-based activity while simultaneously teaching that learner. Games teach mastery. Games neatly combine learning and assessment, in profoundly transformative ways. Games are the future of assessment. No TEST even comes close to matching the persuasive engaging immersiveness of games.*

*There’s an entire branch of the Game Development universe called Serious Games, which aims to bring games forward as major training and simulation options for measurement. Today’s sophisticated Massively-Multiplayer Online Role Playing Games and Virtual Worlds have the ability to track, record, and quantify learner actions, interactions, and state. How will you take advantage of these disruptive technologies?”*

## **What is a “Disruptive Technology?”**

Harvard Business School professor Clayton M. Christensen introduced *The Theory of Disruptive Innovation* in a series of books and articles Christensen et al (1997, 2003, 2008). To understand and use such a technology to its full potential is so disruptive of conventional practices as to generally prevent its adoption – except outside of the currently dominant conventional organizations. The term *Disruptive Innovation*, rather than *disruptive technology* is used in his later work because the same technology can be used either in a *sustaining innovation* – like making a minicomputer faster and giving it larger capacity and better software – or in a *disruptive innovation*. We use the earlier term *Disruptive Technology* in the title because we want to draw attention to the significance of the technologies developed to grow this huge gaming industry. These technologies now have great potential in the quest for realistic and situated assessment. Games have accelerated the development of screamingly fast graphics and audio chips and multi-core processors. The game industry has also been a driver for the development of incredible software for rendering 3-D graphics in real time, creating virtual worlds, and enabling



multiple players to interact with one another within an intriguing 3-D virtual domain. Creative scoring systems for showing gamers how they are progressing up through many levels to high attainment are worthy of investigation in assessment.

Christensen's recent book *Disrupting Class* (Christensen, Horn, & Johnson, 2008) is directed at Education. In this book the authors apply the theory to the entrance of two waves of disruptive innovation into education using computer-administered learning systems. In the first wave, the monolithic learning systems of the current educational establishment will increasingly give place for computer-based learning. Built to fit within the system, this innovation does not disrupt educational practice very much. The second wave, *student-centric learning* is individualized to the way different "brains are wired" to learn best. It requires the disruption of the entire monolithic model of schooling. The first wave has already penetrated and is at the unobtrusive bottom of a cumulative normal or logistic-like S-curve. *Student-centric* learning systems are still in the wings. Assuming continuity between these two waves, Christensen's model and data-based projections up the S-curve are compelling, predicting a much more rapid penetration than is commonly believed.

The section below on Western Governors University gives an example of disrupting the roles, rules, and technologies of college education around a competency-based model. This example does not yet illustrate the ideal of student-centric on-line learning, but it shows that an institution using disruptive innovation must make many convention-shattering changes in order to succeed.

As developed in some detail in *Disrupting Class* and the earlier books, the theory of disruptive innovation explains why the executives of companies or organizations with profitable or dominant positions have acted as they do. Partly because of their dominance in their marketplace they ignored small and seemingly unthreatening products, only to find to their horror that these innovations eventually "grew up" and took over their markets. Christensen shows that these executives actually made wise decisions at the time. Their biggest and best customers could not use the disruptive innovations. The new products did not offer enough capacity, sounded too tinny, were too slow, or too small. To use them required too much change in conventional ways of doing business -- too hard to reorganize a company. Because of its limitations early on, the new product could not compete with consumption—where people were buying and using the best the current market could offer. Also, the new products did not offer large enough profit margins. Two examples from *Disrupting Class*: why sell a microcomputer for \$2000 and make \$800 net profit when you could sell a DEC Minicomputer for \$250,000 and make \$125,500? Why sell transistor radios when the existing retailers made their real money replacing vacuum tubes, not selling the radios and stereos initially? In the minicomputer industry, the leading companies were geared up to make computers bigger, faster, and give them more functions. Meanwhile, those promoting the disruptive innovations of microcomputers were trying to make them smaller and cheaper; but over time, faster and with more functions. They could not win away the customers of the dominant companies, so they found new customers who were not being served at all – children and other non-consumers of the dominant offerings. Over time, the minicomputer companies became history, while those offering the disruptive innovations took over the old customers and retained the new ones.

Games grew up competing against non-consumption at the first. No one was offering them. They were free to innovate wildly. Now they compete against a great entertainment industry and have displaced other players in that industry. As new forms of games, and a spin-off, Virtual Worlds have emerged and seized huge markets, it has become apparent that entertainment is not the only industry being transformed by games.

## How Does a Disruptive Innovation Become Mainstream?

They rarely succeed by being adopted by an organization already competing well in the dominant market with the dominant technology and service model. Christensen et al (2008) give many examples of visionary leaders and creative engineers who proposed, even demonstrated stunning innovations, only to find that their companies could not or would not use them. If they were used at all, they were used in very limited ways that fit the business model and organizational habits and culture of the organization. Thus; in Education, the first wave has been computer-based education in schools and colleges, and the next will require more profound disruption of the roles of students, teachers and administrators; the rules by which schools are governed; the tools and technologies used in fulfilling the roles, and the titles (form and content of the educational media).

In the many cases documented in Christensen's books and other sources, the innovation is first taken to the leaders of the organizations already dominant in a market. They ask their marketing department and best customers, and are told that the fledgling innovation is not good enough to fulfill the needs of these customers. Following Christensen's advice in *Innovator's Solution*, a wise company would set up a wholly or partially owned separate company, and not place it under the current business model. Usually this has not happened, so the innovators quit and go set it up themselves. They cannot compete well for the customers served by the market leaders, so they go to non-consumers who have never owned the a --- radio, tv, small disk drive, computer, game machine, etc. Establishing a viable market, they have the revenues to keep improving their product through *sustaining innovations*, but within the same disruptive model they have put forth to attract the new customers. Through these sustaining innovations, they kept improving their smaller, cheaper products until they were so good they began to take away the customers in this order: First, those in the original market who had the fewest and least demanding requirements.



Second, the mid-range customers. By then the old market leaders are either dying off, or have hired people who can implement the disruptive approach – and let them do it. In the mini-computer market, it took 10 years before the microcomputers offered an unmistakable threat, but by then it was too late. The microcomputer companies took over their middle and top levels of customers as well.

In chapter 4 of *Disrupting Class*, p99, Christensen and his co-authors present a table tracking the penetration of computer-based instruction offerings into education. The penetration is competing with non-consumption, not against the main-stream course offerings of schools. Many rural schools cannot offer advanced placement classes, or less common foreign language or math/science classes. These and other schools are increasingly offering on-line courses, generally provided by outside organizations, to meet the needs of their learners. Otherwise, these learners would be non-consumers. These on-line courses are on a substitution curve, because these courses would be taught in classrooms with teachers if it were feasible for the schools to do so. The substitution curve contains a first data point in the fall of 2000 -- 45,000 enrollments in fully online or blended (teacher using computers) courses. By the fall of 2007, this number had grown to one million, nearly 22 times. Still, this is only 1% of all courses that year. Five data points between 2000 and 2007 show that this growth curve is exponential, since the logarithmic plot of the points fall along a straight line. Analysts should not assume a linear growth curve from this data, which would project insignificant change over the next 10 years. If the function is indeed exponential, then penetration of on-line learning into these markets will be nearly 50% by 2019. These data come from a largely high school market (70% ), and of the rural schools, 43% of them so far. Despite how little impact computers have had so far in schools, these growth curves show a profound and surprisingly rapid substitution taking place in schooling already. As explained by the disruptive innovation model, the low impact computers have had on schools so far is due to forcing the technology into the current “business” model of the schools. Many studies have shown that when this is done, even when it is done with larger innovations like the early TICCIT or PLATO computers (Bunderson, 2008)<sup>3</sup> the typical finding is “no significant difference”.

## **Western Governor’s University as a Disruptive Innovation**

The non-consumers of campus-based alternatives served by Western Governors University average 40 years of age. They are generally working adults. They require flexible hours and a very different delivery structure than campuses can provide to accommodate their lives, locations, and schedules. By the time of this writing WGU has grown from a handful of students working toward a few degrees in 1999 to over 13,000 in 2008. WGU now serves students in all 50 states and several foreign countries and employs faculty mentors in over 30 states.

Western Governors University has a regional accreditation from the Northwest Commission on Colleges and Universities. The Distance Education and Training Council (DETC) also accredits WGU nationally. In addition, NCATE has accredited WGU’s Teacher’s College. From NCATE it received accolades for the tight alignment between domain descriptions with objectives, including student dispositions, and assessments. Conventional Education schools struggle with alignment and assessment.

Validity of assessments is the keystone of the WGU model. WGU was built from the ground up based upon two essential goals. “The first is a commitment to producing highly competent graduates. The second is to use flexible distance education techniques to expand access.” (WGU web site 1, 2008). In quest of these goals, WGU evaluates the extensive assessment data it collects on each student on each competency in each degree program. Other external data is collected as well, so WGU is able to judge what is working well and what needs to be improved. WGU has rapid data-based improvement cycles, with a goal to continually self-assess and improve its offerings and services. It keeps track of how well its graduates perform on other national exams, and gauge the satisfaction of employers of WGU graduates (WGU Website 2, 2008).

It would not be feasible in general to transform a campus-based University to match the WGU form of organization. Disruptive innovation theory predicts that the best approach is to form an entirely new organization. Role differentiation of the Teachers role at WGU has been extensive. Of interest to this article, the first role differentiation is to remove two functions from the teacher that are currently dear to their hearts: Delivering instruction, and (less dear to the hearts of many) making and giving exams. Instead, the faculty mentors are advisors who stick with the students from their admission all the way (hopefully) to their graduation. They do some key teaching with individuals—and increasingly, with members of learning community cohorts who are on the same degree track. But individuals do most of their learning on their own initiative. They commonly take some on-line courses from external providers, but otherwise study alone and in cohort learning communities using their own and WGU-provided library and learning materials. Their studies are guided by information about the competencies they will be demonstrating in their next scheduled assessments. Their mentor and their cohorts may also help them understand the competencies.

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<sup>3</sup> This article also suggests that recent on-line communities, including gaming, introduce democratic ideals within meritocracies, which are indeed more motivating for mastery than typical schooling offers to today’s “digital natives”.

Assessments are developed by an internal assessment development team and by outside contractors. To assure validity of assessment WGU employs professional assessment development methods, guided by an Assessment Council of outside experts in Educational Measurement. A comprehensive view of each student's progress is assessed, using a combination of objective exams, performance exams with and without human judges, and portfolio projects. Methods of internal and external validation are used in a process that employs continuing scrutiny for flaws in validity and in utility of the exams. The mentor's goal of helping the students advance by passing their assessments is balanced by the WGU's strong commitment to assuring competence. Assessments are delivered using national test delivery providers, and physical centers set up in cooperation with WGU for performance exams.

In addition to differentiating the roles of Mentor from Teacher (presentation) and Teacher (test development, scoring, and delivery), a large body of graders are required for performance exams that need a human reader with expertise in the subject. These people may live anywhere in the country. Tutors are also employed, and for the Teachers College, Student Teaching Supervisors.

Because of its competency-based model, WGU has to rely on performance assessments and portfolio items extensively. Objective exams are insufficient to tap the cognitive and integrated performance competencies that will enable graduates to perform well and satisfy employers in jobs after graduation. The logistics of this assessment enterprise are staggering. At the time of this writing, WGU must administer and grade over 30 thousand performance tasks per month, scored by hundreds of graders located all over the country. These graders have stringent goals for rapid turn-around time for each performance task. The ideal is to provide useful feedback as close to the submission of the performance task as possible.

This difficult management task could be greatly facilitated by creating virtual environments, on-line performance tasks, and on-line forms of grading which provide feedback at key milestones within the performance tasks. Virtual environments with game-like continuous scoring/feedback systems are thus of enormous potential to WGU and other on-line learning organizations. How to gain these benefits? By repurposing technologies already developed in the gaming industry.

WGU's assessment practices partly agree with, but go beyond the model of assessment presented by Christensen et al, p107ff on "*The Future of Assessment*". These authors contrast the procedures for assuring mastery of tasks in an assembly line between the Chrysler approach and the Toyota approach. The former has a fixed time – 28 seconds per car to install and tighten the front passenger seat. The model of fixed time with variable mastery leads to an assessment at the end. This assessment functions as an "inspection" to detect flaws introduced when the 28 seconds wasn't enough for some installers. Schools adopted an analogous model of fixed time but variable learning and use it to this day. Tests are inspections since the learning procedure does not assure mastery. The Toyota model, by contrast, fits the mastery learning model. For the passenger seat task, it was broken into 5 steps, with variable time to achieve mastery, but a fixed target that combined mastery with assured quality. The learner cannot go on to the next step until the mastery and quality of the previous step has been established. At the end, a final inspection is really not needed. The job has been completed with mastery and quality assured along the way, so who needs a final inspection?

While the automotive comparison in *Disrupting Class* works well to highlight the superiority of variable time, assured learning, it does not go far enough. College graduates need more than the assurance that a single task has been mastered. Fragmentation wars against integration and transfer. WGU students, especially at the Master's level, must complete a capstone project as a final integrated assessment. A capstone performance project is more a celebration of expertise than a final inspection. In Education, assessments are needed at higher levels of integration, and these go well beyond inspections to discover defects. Capstone and domain level assessments must subsume earlier component masteries and integrate them at higher levels. The WGU competency model replaces inspections with built-in assessments providing feedback during learning. This does not do away with the need for good measurement – quite the contrary – it expands it from its narrow focus on "mastery level cut score" all the way down to early and intermediate milestones, and up to higher levels of attainment. It requires a much greater understanding of the domain model, the nature of underlying competencies, and the pathways from easier to harder to get there. In short, good hierarchies of competency assessment need a theory of progressive attainments in a domain, or "domain theory" as Messick called it (Messick, 1995, Bunderson et al, in press. See also Knowledge Space Theory developed by Doignon and Falmagne (1985; 1998) and Falmagne (1989; 1990) with support from the NSF).

## **Games in Assessment: The Opportunity and some Challenges**

Games are much older than our currently recognized, refined, and well regarded media (Koster, 2005). Humans are not the only ones who play games; other animals play games too. The earliest games date to the earliest ancient civilizations. Yet, academics are only now taking games seriously.

As articulated by Kutner, & Olson (2008), the reporting media has traditionally exaggerated the effects of any new media, from dime novels, to comic books, to nickelodeons, to rock music, to video games. Of course, these Moral Panics always occur well

before significantly unbiased research has been conducted. Kutner, & Olson undertook the most extensive study on video game violence to date, and, in the process, discovered that the current Moral Panic over video game violence is largely unjustified (2008). Moreover, what a game *teaches* and what a game displays on screen are quite different.

Games teach mastery of processes. Raph Koster defined fun in his seminal work *A theory of fun for game design* as the act of accomplishing mastery over a challenge or skill (2005). Tests represent this kind of fun to only a select few students. Frequently, games teach algorithms to accomplish given tasks as well (Consider this fictional process to level up: Go to the Armory, buy the Purple Sword of Justice, travel through the dungeons, slaying only the Purple monsters, and then open the Portal of Azimuth with the Purple Sword of Justice.) Game designers are able to craft dynamic, and engaging structures of learning that exist to establish mastery over a challenge, or skill. Game Designers are very sensitive to the tropes of mastery, and understand a wide variety of ways to attach meaning to the game play itself--- in addition to any existing game narrative and world. Further, Game developers must carefully test their games and levels so that they tie into an overall difficulty curve so that the player (learner) is never overwhelmed.

Depending on the title, games are already gathering information on players. Basic mastery of “golden path” skills is required in order to successfully complete the game. This is the basest level of assessment offered in games. If the players beat the game, they’ve demonstrated this ability. The traditional uni-dimensional high-score systems of the arcades of the 70’s and 80’s have given way to multi-dimensional scoring systems with real-time reporting to the player. Collection of state information also leads to a natural evaluation of that information--- which help games such as Massively MultiPlayer Online Role Playing Games (MMORPGs) to study the behavior of players and to validate the design, and rules of the game system. While the specific implementation of these feedback systems differ, they are usually instantaneous, and provide enough information for players to modify their action, *right then*. Compare this with TESTs as conceived by today’s hegemonic educational infrastructure. TESTs tend to offer extremely narrow feedback, at significant distances from the point when the feedback is most needed. Traditional education, and qualitative feedback mechanisms have always suffered from poor feedback. Games offer the opportunity to give feedback to learners in near-real-time if not real-time. This marks a dramatic *value* shift, which Christensen (1997) has articulated as the key differentiator between a disruptive innovation and an incremental one. The values of a normative educational program (reading, writing, arithmetic) and the current pedagogy in place to deliver those values are at odds with today’s gaming youth. Today’s learners expect to be able to learn in more creative, immersive, and engaging ways. They also expect to be able to achieve mastery through practice involving immediate feedback.

Games offer a profound potential to the Psychometric community, yet there are a number of risks associated with game development:

1. High-appeal AAA computer and video games are expensive to develop and market. Typical development budgets for such games run in the 10-30 Million ranges. Most of that cost is due to art, not the design, and not the engineering. Game publishers generally spend as much promoting the game as was spent developing it. This is not to say that Game developers are locked into huge cost structures. Indeed, there is an indie game movement which seeks to take advantage of the now greatly lowered barriers to entry, and distribute small games online. Many indie-game developers capitalize on indirect funding models, shunning the traditional process of pitching a game concept to a publisher for funding (much like the movie industry).
2. Games face a barrier of social acceptance and understanding, which is only beginning to change.
3. Game designers are generally not well versed in Psychometric and Pedagogical theory and practice. They are very smart people, however. As a result, Psychometricians approaching a game studio should expect to teach the game development studio up in these areas.
4. Game design is a nascent discipline. Game designers are working on establishing a formal design language, and development methods that work reliably. Academic interest in this area is improving matters in a variety of areas, however there is still a long way to go to achieve discipline parity with other design disciplines.
5. The design of a game frequently depends on the goals articulated during the requirement-gathering phase of development. That is to say, the gameplay mechanics (what you do) are directly tied to the learning goals. In game design, it is what you DO that matters, not what the story says you’re doing. The best games deeply integrate the gameplay with the game narratives and environment. This is notoriously difficult to achieve, but it is achievable.
6. You must already have mapped out your domain before you attempt to build a game out of it. There are several strategies to do this, including Domain Theory and Knowledge Space Theory. These are, however, not trivial tasks, and require real task analysis to identify what is relevant and what is not.

The game industry is still maturing as an industry. The Serious Games movement is the most natural fit for Psychometricians seeking to employ a game as a measurement tool. Serious Games, as a term, however is somewhat contested, and other terms are emerging, including Advanced Learning Technologies (stolen from the NSF program of the same name), Games that Teach, and others.

## Concluding Thoughts

Measurement is a technology which enables and, at its best, includes good science (Gibbons et al, 2005). Measurement instruments have always been driven by innovative technologies. The technology of games has been refined in a fierce competitive fire with incredible creativity. It offers remarkable tools for creating either high fidelity simulations or interesting virtual worlds -- fantasy environments that can be aligned to cognitive, conative, and personal being or becoming goals (Thomas and Brown, 2009). Compellingly useful hyper- maps of these domains have been developed, and clever navigation graphics to show where you are and where you have been.

Instead of asking how games can become more like tests, consider the reverse. On-line tests are like the most primitive of early single-user games. They are largely text-based. One person plays against the computer. Better players get higher scores, but do not know it unless the teacher provides a distribution at some later time. Unlike tests, a gamer can play even a single-user game over and over and master it to high levels of proficiency, because it provides progress feedback. But even a text-based single user game provides a map of the domain – e.g., the dungeon layout. Tests do not disclose the map of the domain, nor a user-friendly blueprint for what part of the domain this test covers. Electronic game structures have evolved dramatically beyond single user games over the last 25 years, both by tapping a much deeper gaming history and exploiting IT inventions. 3D graphics and audio create virtual worlds of great appeal and interest. Multi-User games introduce competition with other players, and teamwork. Massively multi-player on-line role playing games (MMORPG's) have opened up possibilities for assessing organizational and management skills, team building, attaining resources, planning campaigns, and fulfilling missions (Brown & Thomas, 2006,).

Meanwhile, the learners are changing (Prensky, 2001). Games, virtual worlds, texting, and cell phones with multimedia are a part of the native language of today's learners— digital natives, while most test developers are digital immigrants. Disruptive innovation comes quietly at first, competing with non-consumption in an under-served market. It stays away from the heart of the old market for years, nibbling away at the edges, then becomes more bold, until the digital natives once limited to the old market find better ways to attain what they need from the disruptive innovation, and increasingly regard the old offerings as irrelevant.

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## EDITOR'S NOTE

Scott Bishop

Thanos Patelis's tenure as *NCME Newsletter* Editor will begin with the next issue (Volume 17, Number 1). We wish him well. I would like to thank NCME for giving me the opportunity to serve as Newsletter Editor. Special thanks go to all of our contributors over the last three years (especially our last three NCME presidents—Mark, Anne, and Dan—who wrote the "From the President" article for the last 12 issues). The Advisory Board members had many new ideas and deserve credit for their wonderful creativity. I've really enjoyed working with them. Finally, I would like to thank Julie Korts for helping me with many administrative tasks.

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