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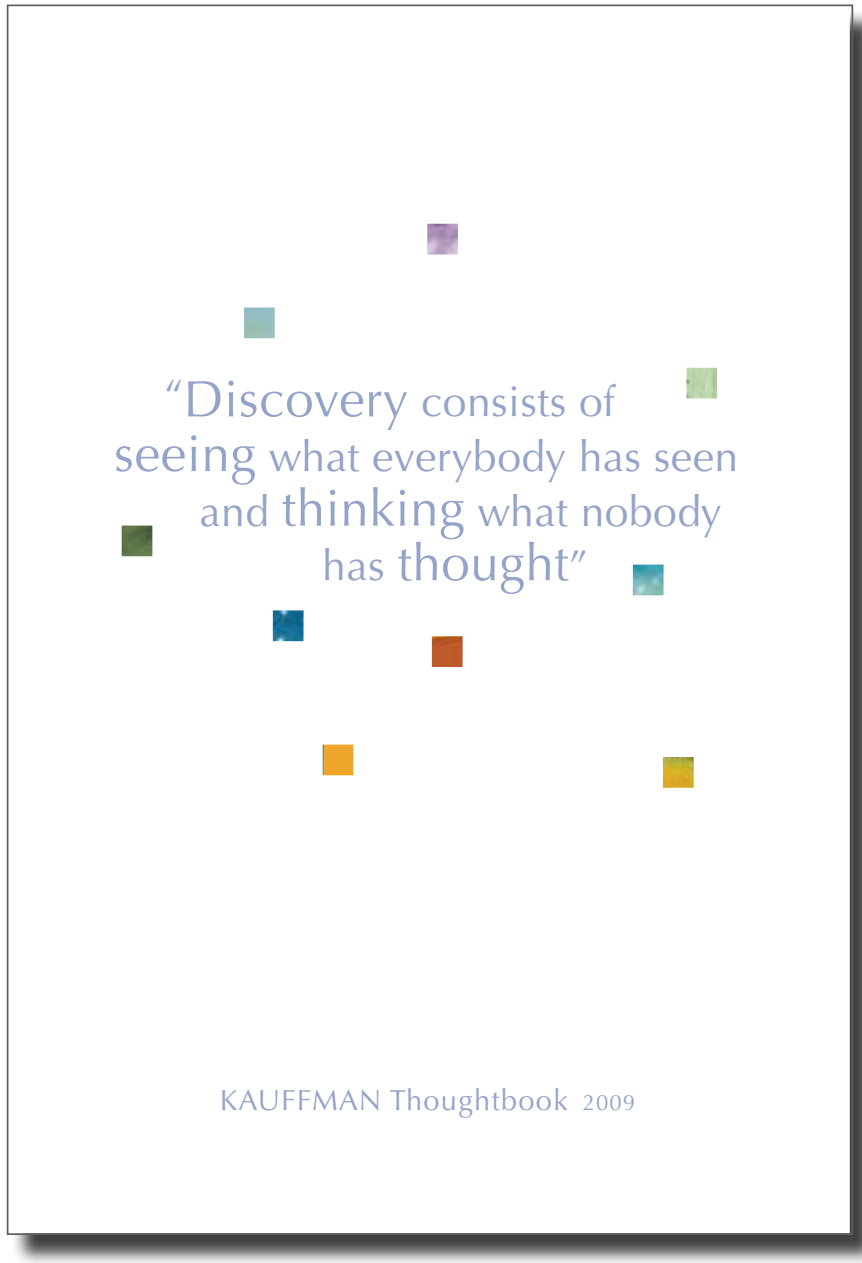

Fourth in an ongoing series, the *Kauffman Thoughtbook 2009* captures what we are thinking, learning, and discovering about education, entrepreneurship, and advancing innovation. This collection of more than forty essays is written by the talented Kauffman Foundation associates, partners, and experts who are pursuing the principles and vision set by our founder, Ewing Kauffman.

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Want to Truly Scale a Learning Program? Try Gaming.

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Think big, really big.

Every year, the higher education system in the United States produces about 350,000 bachelor of science students. Every year, ten million people, or twenty-eight times as many, are playing World of Warcraft. Even small games you've never heard of, like Dofus, attract 450,000 players (see *mmogchart.com*).

But, when we speak of education interventions in this country, we think of one or ten classrooms at a time: a summer camp for students, teacher training experiences that serve fifteen teachers a year, innovative curricular materials that make it into five or ten or maybe forty classrooms. Nothing we do has the scale to make a difference on the national scorecard.

Video games might.

But—Don't Video Games Rot Your Brain?

Maybe not. There is a burgeoning field that goes by various names—immersive learning, 3D Internet-based learning, Serious Games, to name a few—that has embraced the vision of games and virtual worlds as authentic and powerful learning experiences. Certainly, from a theoretical point of view, games have many features that cry out for application to learning. To wit:

- Goals: Research has shown that students persist longer in a task if working toward a goal. Games, almost by definition, have goals.
- Self-Efficacy: Another key to learner persistence is the learner's own perception of how well he or she is doing. Games foster self-efficacy by rewarding the player immediately for even the tiniest successes, through progressive accumulation of points and level.
- Feedback: In a typical classroom, a student gets to ask 0.11 questions an hour (J.D. Fletcher, 2001). He is given feedback on performance at a rate as slow as two exams a semester. Game feedback is continuous, immediate, and on the scale of seconds.
- Collaboration: Collaborative learning yields, on average, a 50 percent improvement over solo learning (D. Johnson, 1981). Many of the massive multiplayer online games have collaborative problem solving hardwired into their architecture.
- Inquiry: Games, particularly those set in virtual worlds, are designed explicitly for user-directed exploration.
- Brain Chemistry: the encoding of memory is enabled by dopamine production in the brain; the work of M. Koepp et al (1998) showed video games generate almost double the levels of dopamine experienced by humans at rest. Performance doubled as well.

Sports Bytes: Engaging Students In the Science of Sports Via Mobile Phones

In 2008, the Kauffman Foundation teamed up with Hot Lava Software to test a proof of concept among United States youth: Would they use their mobile phones to take quick math and science quizzes connected to sports at sporting venues?

Through July, August, and September, this concept was tested at all home games held in a half dozen independent and minor league baseball parks and at three major league soccer games. During the games, a stadium announcer dressed as a quirky professor encouraged fans to take out their cell phones to register and interact with the Sports Bytes module. The goal was to have 100,000 registered users take at least one quiz in the module. That goal was met during the three-month testing period, and a total of 300,000 people registered on the site.

Why test this concept? Well, as Kauffman continues to explore new avenues of learning, we understand that many other countries are ahead of the United States in how mobile phones are used for supplemental education. Because students in Asia, Europe, and South Africa are much more likely to have a mobile phone rather than a computer, students in those countries are more adept at using the phones for learning modules, accessing the Internet, and advanced text messaging. In the United States, mobile phones are still primarily used for voice calls and limited text messaging.

At Kauffman, we understand that young people can learn anywhere, not just in a classroom, so we wanted to find out if American students would use their mobile phones to do so, as many of their European, Asian, and South African peers already do.

So, the Foundation teamed up with Hot Lava Software, the company with the most experience in developing learning modules for mobile phones and hand-held devices. Most of Hot Lava Software's business is overseas. As an example, Hot Lava Software works with Vodacom, the South African mobile phone company, which added a library of learning modules that help phone users become educated in basic skills and in health issues. In the United States, Hot Lava Software works with kajeet, a pay-as-you-go cell phone service that markets their phones and services primarily for young people, and has added a number of learning modules for free on their phones. kajeet also donated a number of phones for the Sports Bytes test in the summer of 2008.

Hot Lava Software has a history of developing mobile phone learning modules for public schools, as teachers use mobile phone quizzes to prepare students for standardized tests. Hot Lava Software quickly got on board with the Sports Bytes project, and assembled a content development team to develop questions that meet academic standards for middle school students.

Ultimately, Kauffman is exploring various ways to get more students engaged in METS subjects. Linking science concepts to sports activities is one way to reach them, especially as they use their mobile phones to take the quizzes. Sports Bytes may be an example of how more and more students will learn in the future.

Can We Prove It?

What proof do we have that any or all of this is true, that games can produce superior learning outcomes? Well, the proof is precious little because the field is so new, but at least it is positive. Witness these games:

- Supercharged! [electrostatics]—a 28 percent increase in learning outcomes over lecture (K. Squire et al, 2004).
- Geography Explorer [geology]—a 15 to 40 percent increase in learning outcomes over lecture (P. McClean et al, 2001).
- Virtual Cell [cell biology]—a 30 to 63 percent improvement in learning outcomes over lecture (ibid).
- Dimenxian [algebra]—an average increase of one test grade (e.g., from B to A) for most kids, up to three grades for underachieving kids (N. Etuk, 2006).
- River City [ecology, scientific inquiry]—a 370 percent increase in test scores over lecture for D students; a 14 percent increase in test scores over lecture for B students (D. Ketelhut, 2007).
- NIU Torcs [numerical methods]—twice as much time spent by game-playing kids on their homework, much more highly detailed concept maps (B. Coller, 2006).

A key distinction between the games above and the so-called edu-tainment games of yore is the player's direct engagement in the content, rather than a game-like "test" of content learned elsewhere.

Why Aren't We There Yet?

Every parent's dream would be to have their kid as addictively engaged in their own education as they are in their video games. If the technology is here, and the content is here, and the audience is here, why aren't these products available?

Lack of a for-profit model. Large game companies (Sony, Nintendo, Microsoft) swore off education-related games with the edu-tainment bust. And, let's face it, even in the pencil-and-paper world, education is not a big moneymaker.

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Lack of sustainability in the not-for-profit model. Government agencies (NSF, NIH, DOD, NASA, NOAA) and several foundations, including ours, MacArthur, and Hewlett, are stepping up to the plate. But, in the grant-based model, there is no financial allowance for product marketing, distribution, or product existence after the life of the grant. "Dissemination" usually amounts to putting the game on the developer's obscure Web site, trafficked only by graduate students and/or professional colleagues. Meanwhile, all the kids who could benefit from it are over at *Disney.com*. That's OK. (I should note that we collaborate with *Disney.com* on the Hot Shot Business online youth entrepreneurship game at *hotshotbusiness.com*) Yet, in most grant-based models, the software will be rendered obsolete by the new Windows release, anyway. There's no provision for compatibility upgrades after the grant is over.

Technical barriers that dramatically limit usability. Imagine an Internet without search (no Google), without copy and paste, that only ran on some computers and not others. How would you do anything? Not easily. The technical prowess to solve these deficiencies in 3D worlds exists; the leadership to coordinate the effort does not.

Uncertainty about quality and relevance. How can I tell if this game really teaches? That it will be fun? Are the games designed to adhere to state standards? Can they be taken apart into modules of less than forty minutes? Is there a teacher guide? Consumer acceptance issues have not been worked through, for the most part.

We have a ways to go. However, the combined scale and effectiveness of game-based learning far exceeds many other educational innovations. For this reason, the Kauffman Foundation is committed to solving the above-identified infrastructure issues of dissemination, sustainability, usability, and adoption through targeted projects. Within the next five to ten years, games should be available that allow you to learn what "you" want to learn.