

New Learning Technologies

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June 14, 2006

What would it be worth to:

- **Increase learning outcomes an average of one letter grade**
- **Allow any person to learn any subject 30% faster or at 30% less cost**

- ***We know how to help people learn faster, better***
- ***The methods are too expensive using current technology***

What Are Employers Asking For?

- Interpersonal skills
- Adaptation to rapid change
- Team building
- Decision-making
- Learning on the fly
- Strategic thinking
- Rapid information acquisition
- Information synthesis
- Determining what needs to be done

- Analytical thinking
- Problem definition
- Solution development
- Plan development/Execution
- Multiple-task prioritization
- Creativity
- Negotiating and Influencing
- Focus on customer
- Ability to assess time, cost, and resources required

Source: Commerce, U.S. Department of Commerce, June 2003; Monster.com job ads.

Members of Expert Teams

- Build shared mental models of a situation
- Know how and when to give and solicit suggestions and criticism
- Demonstrate strong explicit and implicit communication
- Constantly monitor information and communicate relevant changes to others
- Each member of a crew has a unique vantage on situation

The Essential Challenges

- Sharp increase in what must be learned
- Learners with highly diverse backgrounds
- Education budgets highly constrained

What's Really New?

➤ *It's Personal*

- Personal attention using artificial and real intelligence (questions answered)
- Continuous, embedded, unobtrusive evaluation and assessment

➤ *It's Active*

- Accurate, compelling simulations of real environments
- Continuous expectation of response

➤ *It's Available Any time Anywhere*

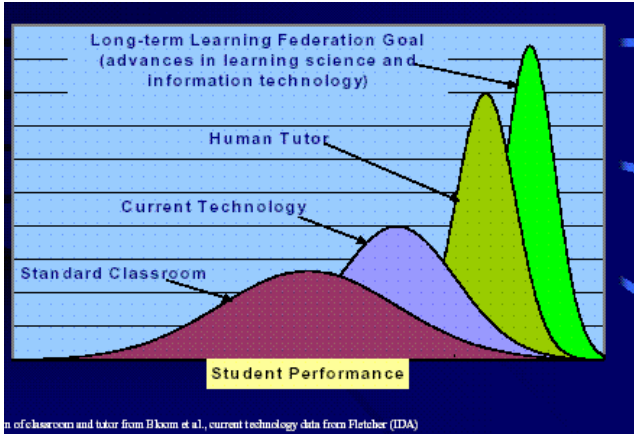
- Ubiquitous connectivity, PDAs, portables...
- Meets expectations of people who were born digital

We know that productivity gains in services are possible

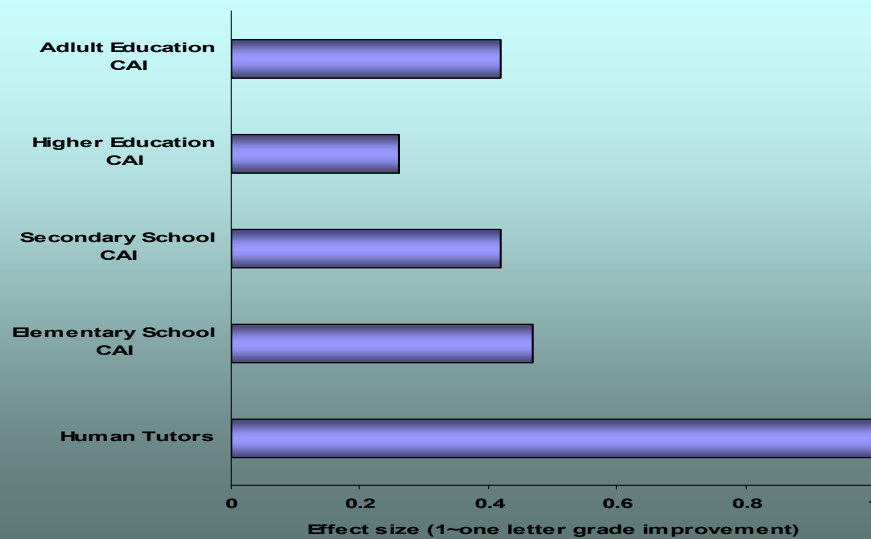
- Huge productivity gains in banking, insurance, retailing
- Dramatic new tools in entertainment (games, animations)
- Tools providing individualized answers to questions (help desks, website FAQs)
- Continuous user modeling and recommender systems on websites

Technology can make learning:

- ✓ More productive (quicker mastery, better retention)
- ✓ More compelling
- ✓ More personal
- ✓ More adaptable to local needs
- ✓ More accessible



Improved Learning Outcomes



Why aren't commercial developers investing in education?

- High risk, benefits spread broadly
 - Unique and difficult market
 - Over-promising and many failures
 - Small, poorly focused government research efforts: still a cottage industry
- Classic market failure leading to private under investment in basic research (remember educational TV in the 1950s)

Federal Research Partnerships

- Morse telegraph in 1842
- A&M research successes (hybrid grain, pest management)
- health care/ pharmaceuticals
- modern jet engines and aircraft
- communications satellites/Global Positioning Satellites
- VLSI, parallel computing, computer graphics
- the internet and world-wide-web

We know that Games are engaging

- 55% of all Americans play video games
- Average game player age: 31% under 18 years; 44% 18-49 years; 25% 50+ years
- The average adult woman plays games 7.4 hours per week; average adult man 7.6 hours
- 60% of college students are regular game players
- Game sales \$7B in 2005
- US Army's America's Army (as of April 2005):
 - more than 16 million Internet downloads of the game and upgrades
 - 60 million hours spent "completing" >600 million virtual "missions"

Federally-funded Learning Games

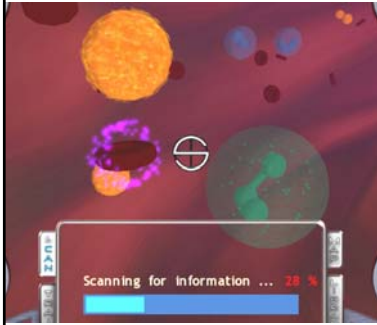
1. **Immune Attack:** basic immunology education for high school and college undergrads (NSF)
2. **Discover Babylon:** humanities for 8-14 year-olds in classrooms and museums (IMLS)
3. **Mass Casualty Incident Responder** decision-making and communications training for fire chiefs (DoC)

FAS Prototypes are Rooted in Learning Science

- ✓ Tools to scaffold learning
- ✓ Successively more difficult challenges
- ✓ Encourage questions & provide tailored, timely answers
- ✓ Immediate feedback to the learner
- ✓ Authentic problems and challenges get time on task
- ✓ Continuous evaluation and feedback

Prototype Demonstrations

Immune Attack Objectives



Goals:

- Teach basic immunology concepts
- Create a more positive attitude towards biology
- Help teach young adults to choose better life-style behaviors to protect themselves from infection
- Expose young adults to the exciting fields of healthcare and biosciences


Features:

- Navigate realistic, biologically accurate settings
- Explore human body environments, including blood vessels and connective tissue
- Explore cell structures and teach behaviors using game-based controls
- Defeat invading bacteria to prevent infection

Immune Attack Collaborators & Sponsors

- **Sponsor:** National Science Foundation
- **Project Team:** Federation of American Scientists, Brown University, University of Southern California
- **Advisory Panel:** Prof. Christine Byron, Brown University; Prof David Scott, Dr. Li Zhang, University of Maryland; Dr. Jeremy Ahouse; Jon Getbehead, Meghan Kuhn, Troy High School; Angelique Bosse, Montgomery Blair High School; Joe Issac, McKinley Technology HS; Rod Wong, Bellarmine College Preparatory HS; Steve Prewitt, La Center HS
- 1st evaluation at 5 high schools; 10 classes, ~225 students; 2nd evaluation will include community college
- **Distribution:** high schools and colleges for educational use; CD distribution planned; also web-downloadable
- **Game Specs:** OGRE game engine (open source with unlimited distribution); PC Windows O/S

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Discover Babylon

Goals:

- Engage learners, ages 8 – 14, in challenges and mysteries that can only be solved by understanding
 - the origins of writing and the path from pictures to phonetics
 - Mesopotamian society, business practices, and trade
- Demonstrate new ways to reassemble artifacts and knowledge about them now spread across many different museum and library collections

Features:

- Accurate historical and scientific information
- 3D photorealistic simulations of cities & temple complexes that allow open-ended exploration and discovery
- Contextualization of museum artifacts used by characters in virtual environments
- Question & answer management tools to stimulate learning
- Compelling, age-appropriate challenges and assignments

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Discover Babylon

Collaborators & Sponsors

Sponsor: Institute for Museum and Library Services

Project team: UCLA, Federation of American Scientists, Walters Art Museum, Escape Hatch Entertainment

Advisory Panel: Near Eastern scholars, historians, learning scientists, middle school teachers, museum educators, & students

Collaborators: Library of Congress, Berlin Max Planck Society, University of Central Florida, School of Film and Digital Media, Carnegie Mellon University Entertainment Technology Center

Distribution: Walters Art Museum and web; CD distribution planned; also web-downloadable

Game Specs: Viscous Cycle game engine (licensed, unlimited distribution rights for educational use); PC Windows O/S

MCI Responder Objectives

- Shorten time to decision competence through the use of simulation and learning science
- Set appropriate incident *goals and strategy* matching *risk assessment* of the fire
- Recognize significant *cues*, usually *audio* (radio) cues
- Maintain a real-time 'big picture' *situational awareness* of the fire incident
- Manage *resources and information*
- Demonstrate the ability to generate an effective customizable simulation-based training solution at a practical cost using common technologies
- Make available to almost any fire house in the USA



MCI Responder Collaborators & Sponsors

- **Sponsors:** Departments of Education & Commerce
- **Project Team:** Federation of American Scientists; Fire Department, New York City (FDNY); Wisconsin Technical College System; Academic Advanced Distributed Learning Co-lab; Univ of Wisconsin; inXsol LLC
- **Distribution:** Firehouses throughout the US; web-downloadable
- **Game Specs:** Visual Basic (unlimited distribution); PC Windows O/S

What We Don't Know Can Hurt Us

- **Clear potential for using technology to make learning more productive for people of all backgrounds**
- **Experience with prototypes raises many fundamental questions about what works and what is needed**
- **Commercial developers can't make the investment needed to explore many of these questions**
- **Productivity and innovation in the service sector is an essential part of any Competitiveness initiative**
- **Education is no exception -- and it's difficult to think of a service more important than education**

For more information:
www.fas.org/learningfederation