

The Way Ahead in Game-Based Learning

Jan Cannon-Bowers, Ph.D.



University
of Central Florida

iFest 2009
August '09

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE AUG 2009		2. REPORT TYPE		3. DATES COVERED 00-00-2009 to 00-00-2009	
4. TITLE AND SUBTITLE The Way Ahead in Game-Based Learning				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of Central Florida,4000 Central Florida Blvd,Orlando,FL,32816				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES ImplementationFest2009, 18-20 Aug 2009. U.S. Government or Federal Rights License					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 29	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Overview

- Background
- A Case for Game-Based Learning
 - Science of Learning
- Developing Game-Based Learning
- Challenges & Issues
- Example
- The Way Ahead



Background

■ Popularity of Video Games

- > \$10 Billion Industry yearly
- Top game budgets exceed \$50 Million
 - GTA IV is estimated at \$100 Million
- Maple Story has > 50 Million registered players!
- Second Life has > 3 million residents



■ Demographics

- “Digital Natives”



Background

BUT, serious games are:

- Mostly Hype...NOT science
- Lack of guidelines



World of Warcraft
Blizzard Games



Civilization 4
2K Games



Second Life
Linden Labs



SimCity 4
EA Maxis

Opportunity to exploit technology is tremendous!

Background

- Definitions:
 - Game
 - Serious game
- Simulation vs Virtual World vs Game



Elemental
Hidden Agenda Games



The Binary Game
Cisco

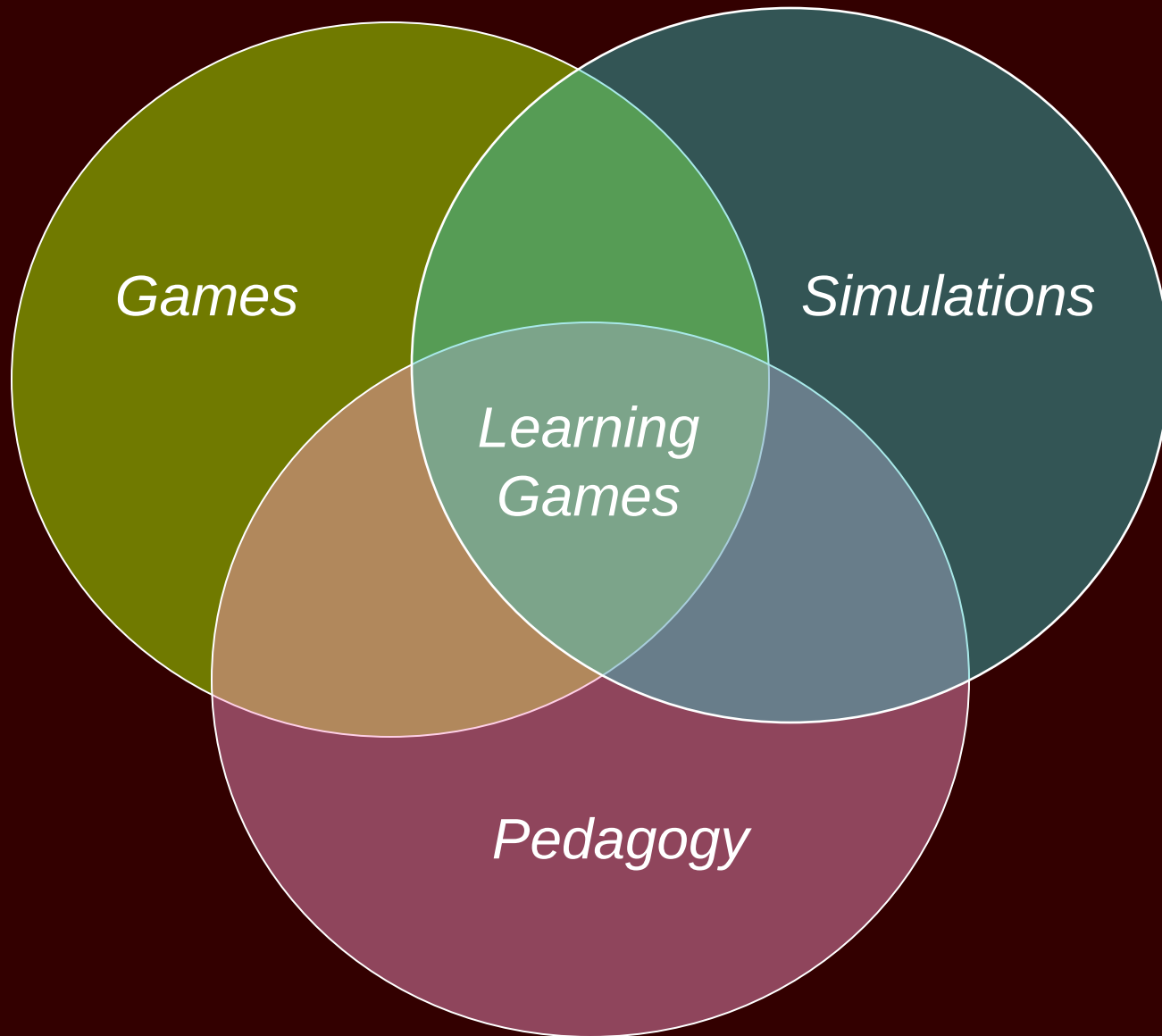


Darfur is Dying
MTV-U



Fatworld
Persuasive Games

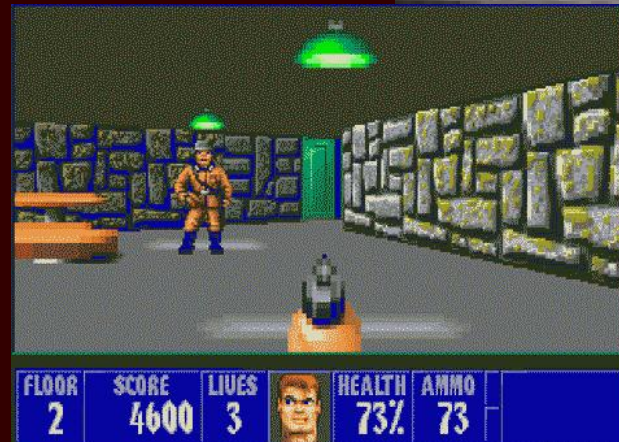
Background



A Case for Game-Based Learning

From the Science of Learning:

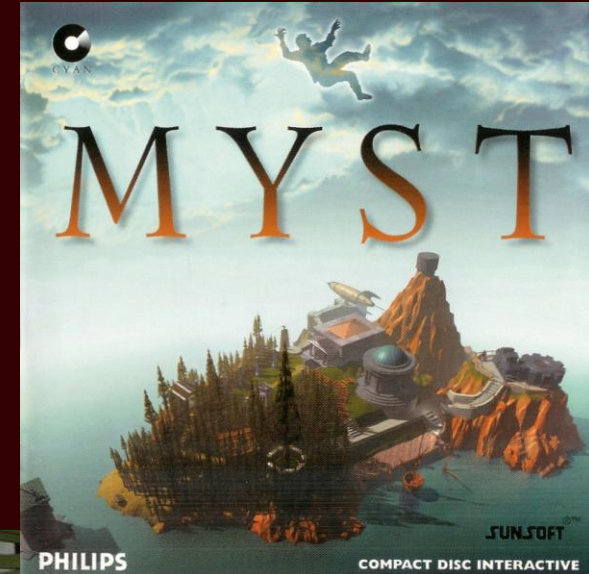
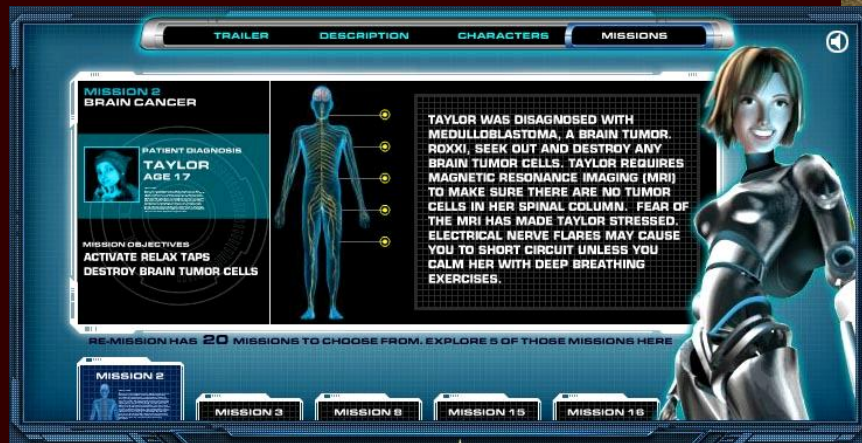
- Anchored Instruction/experiential learning
 - Situated learning
- Meaningfulness of material
- Authenticity/Fidelity



A Case for Game-Based Learning

From the Science of Learning:

- Compelling narrative
- Story



A Case for Game-Based Learning

From the Science of Learning:

- Active Participation
- Learner Control



A Case for Game-Based Learning

From the Science of Learning:

- Model-based Reasoning
- Metacognition
- Self-Regulation



A Case for Game-Based Learning

From the Science of Learning:

- Self-efficacy
- Goal Setting
- Intrinsic Motivation



A Case for Game-Based Learning

From the Science of Learning:

- Continuous Assessment
- Frequent Feedback
- Reward



A Case for Game-Based Learning

From the Science of Learning:

- Immersion/Engagement
- Emotional Context
- Embodiment
- Personalization



A Case for Game-Based Learning

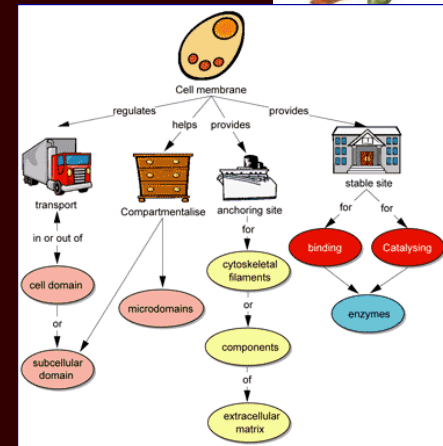
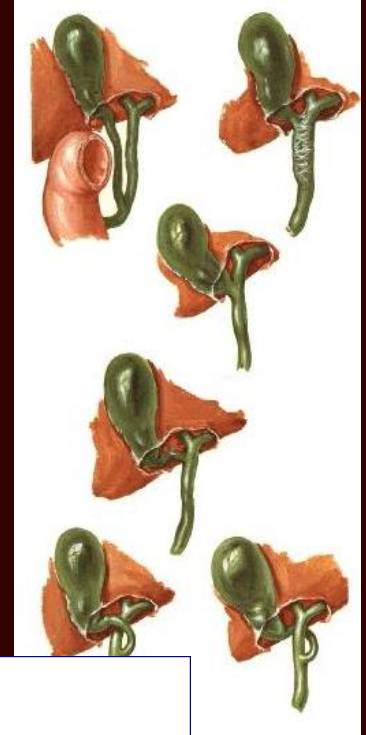
From the Science of Learning:

- Collaborative Learning
- Social Status
- Vicarious Learning
- Coaching/Mentoring



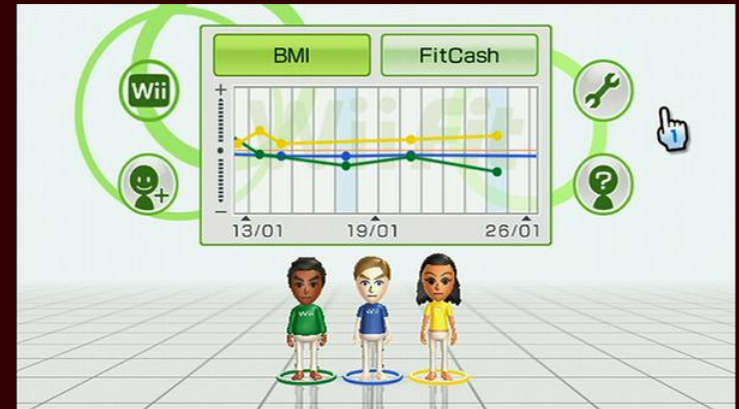
Why games *should* teach...

- Players learn in **context** by interacting with objects in a complex world.
- Consistent with **anchored, experiential learning**, learners can make connections among concepts
 - Players build sound **mental models** of a domain.
- Games are excellent **model-based** environments to foster complex reasoning.
 - Students observe system behavior over time; draw and **test hypotheses**.
- Games provide the players with **constant challenge**--many parallel achievements feed into an overriding goal.
- **Goals** are concrete and immediate.



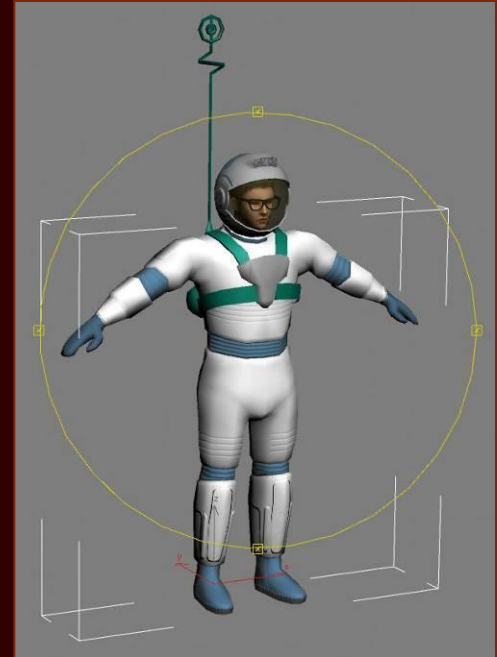
Why games *should* teach...

- Players negotiate successive, proximal goals—result is a feeling of **constant accomplishment**.
 - Likely to have a positive effect on **self-efficacy**.
- Games provide a **continuous source of assessment and feedback** so that players know where they stand with respect to their goal accomplishment.
- Game play is **self-regulating**.
- Players are **intrinsically motivated** to accomplish the next challenge and will readily acquire new knowledge as required to do it.
 - Moreover, mechanisms to track and plan **successive achievement** are often used (e.g., skill trees).

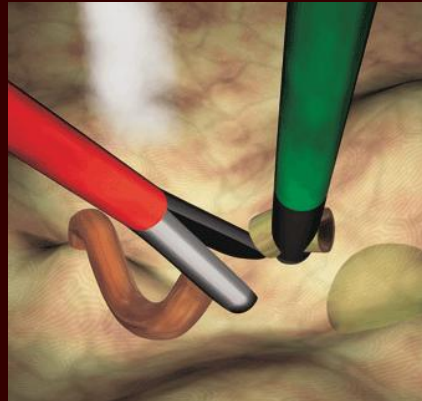


Why games *should* teach...

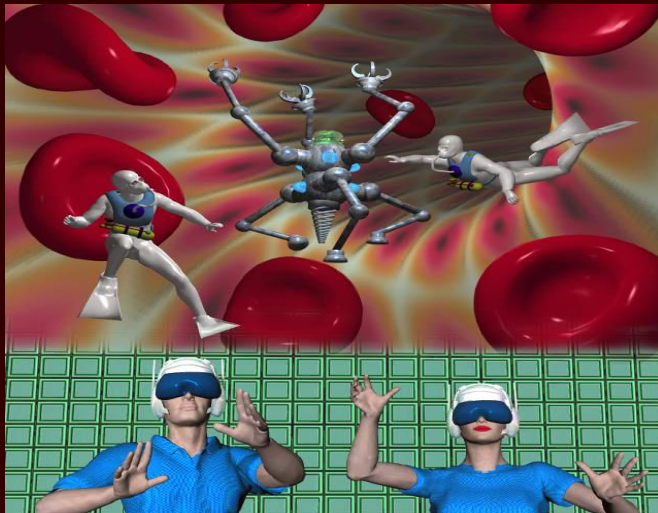
- Gaming is fundamentally a **social phenomenon**
 - It often results in distributed social groups that foster **collaborative learning** and resemble communities of practice.
- The **embodiment of the student** in the story enhances the players' sense of connection to the game
 - This enhances engagement.
 - **Personalization** of a player's avatar may do so as well.
- A player's accomplishments can easily be made public in a game format.
 - Such **public rewards** and recognition provide a **sense of competence, challenge and motivation** to achieve more.



Driving Question



So, how should we build games that teach?



Incorporating the Science of Learning

- Include Domain/Subject Matter Experts on the team
- Include Learning experts on the team
- Make a **deliberate** attempt to incorporate sound learning principles:
 - Provide compelling narrative to enhance motivation
 - Provide compelling visuals to increase immersion
 - Embed learning into a meaningful context
 - Provide continuous feedback
 - Make goal accomplishment salient to foster metacognition, self regulation
 - Include public recognition and reward to enhance motivation
 - Incorporate collaborative learning

Exploit game features so that they teach!!

Challenges & Issues

- User Acceptance
- “Coolness”
- Cost
- Ease of Modification & Reuse



Challenges & Issues

User Acceptance:

- Sometimes using the term “game” is off-putting
- Collect empirical evidence of effectiveness
- Attempt to estimate ROI
- Work closely with targeted users
- Iterate based on user feedback
- Create adjuncts to traditional methods



Challenges & Issues

Ensuring “Coolness”:

- Hire designers/developers who understand what makes games compelling
 - Hire “cool” people
- Involve users in all phases of design



IS IT FUN!?

Challenges & Issues

Containing Costs:

- Use low cost game engines
- Employ students for programming & graphics
 - Internships
- Consider “modding” an existing game
 - Best done at asset level



Challenges & Issues

Enhancing Ease of Modification:

- Develop scenario generation tools
- Use game engines that allow easy mods
- Develop/adhere to standards (SCORM-like)
- Embed content into “mini games”
 - Lunar Quest Example



Example: Lunar Quest

- Funded by NSF
- Targeted at college-freshmen level Physics
- Adjunct to classroom
- Alternate Timeline: Retro 50s



Addressing the Challenges

Modification:

- Hybrid Approach
 - 3-D Massively Multiplayer On-line Game
 - 2D Flash-based Mini Games
- Learning content in “light weight” mini games
 - Cheap to create
 - Easy to modify
 - Enhances reuse of assets, scalability
- Modular Content
 - Scalable to multiple domains (e.g., chemistry, geology, social sciences) inside the same virtual world



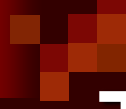
Peter Smith (Producer) and Tim Holt (Designer) Present Lunar Quest at The Austin Game Developers Conference

Addressing the Challenges

Cost:

- Selection of Multiverse Engine (www.multiverse.net)
 - Profit share model (e.g., we don't pay)
- Hybrid MMO/minigame approach
 - Learning content embedded in light weight minigames
 - Minimizes degree of advanced coding in favor of Flash-based content
 - Can be done (well) by undergrads
- Use of off-the-shelf and student-created art assets





The Way Ahead

Research Issues:

- Enhanced assessment routines
 - Automated tracking
 - Dynamic assessment of performance
- Intelligent Tutoring
 - Draw inferences about mastery
 - Automatic feedback/remediation
- Establish a Science of Game-Based Learning
 - Which features are most important?
 - What provides the biggest bang for the buck?

The Way Ahead

- Game-based technologies hold great promise as teaching tools
- More empirical research is needed
- Mechanisms to share results are needed
- Better business models are sorely needed
 - Need to make compelling business case
 - May help encourage funding
- Ultimately, scientific studies must be translated into useful design guidance

Let the (Serious) Games Begin...