What Are We Playing At?

What It Means to Integrate Games into the Curriculum, and Why We Should

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Increased Popular Interest in Games

✓ Interactive Digital Software Association:
  ✓ 47% of all Americans bought or will buy at least one computer game in 2005
  ✓ 248 million games were sold last year
  ✓ 35% of game players are under 18
  ✓ 43% are 18-49
  ✓ 55% are male, 43% are female
Games & Learning

✓ Many examples in education and industry (e.g., Aldrich, 2004; Gee, 2003; Prensky, 2000)
  ✓ Knowledge structures and transfer (Day, Arthur, & Gettman, 2001), Mental Rotation & Spatial Intelligence (De Lisi & Wolford, 2002; Greenfield, 1994 & 2000), Motor Skills (Fery & Ponserre, 2001), CAD training (“Fun in CAD Training,” 2001), Hypothesis Testing (Greenfield, 2000), Job Skills (King, 2003), Biohazard Response (King, 2003), Cognitive Skills (Ko, 2002), Symbol Use and Self-Regulation (Licona & Piccolotto, 2000), and Collaborative Learning and Text Processing (Ravenscroft & Matheson, 2002).

✓ Education Arcade: Environmental Detectives
  ✓ Virtual U

✓ But why and how do they work?
Cognitive Benefits of Games

✓ Flynn effect: Documented increase in IQ scores across all cultures that do standardized testing
  ✓ Cannot easily be attributed to education, nutrition, or other factors
  ✓ Cognitive complexity of mass entertainment like video games may be responsible (Johnson, 2005)

✓ Games require higher-order cognition*
  ✓ Cognitive disequilibrium
  ✓ Problem-solving, hypothesis formulation and testing, rule formulation, concept learning

* Not necessarily in a recognized content domain
Theoretical Support for Games

- Play is effective learning paradigm (Lepper & Chabay, 1985; Crawford, 1982; Reiber, 1996; Papert, 1998; Gee, 2004)
- Situated cognition & learning (Brown, Collins, & Duguid, 1989)
- Anchored instruction (Bransford et al., 1990)
So What IS Digital Game-Based Learning?

✓ Three approaches to DGBL

✓ Games are created by students
  ✓ Students take on role of game designers
  ✓ In building game, they learn the content, problem-solving, programming, etc.
  ✓ Time intensive and limited domains

✓ Educational games could be built from scratch*
  ✓ We design games to seamlessly integrate learning and game play
  ✓ Resource intensive, and lead to edutainment (Shavian Reversals--Papert, 1998)

✓ Commercial games* are integrated into the curriculum
  ✓ Support, deliver, and/or assess learning in the classroom
  ✓ Most cost effective
  ✓ Quality maximized by leaving game play up to game designers, and learning up to teachers

* As distinguished from edutainment titles
Integrating Commercial Games & Learning

✓ Requires careful analysis (Van Eck & Gikas, 2004)
✓ Matching is largest barrier (McClellan, 2005; McFarlane, 2002).
✓ Must recognize not all games are alike
  ✓ Card games
    ✓ Matching, numbers, patterns
  ✓ Jeopardy-style games
    ✓ Verbal information, facts, concrete concepts
  ✓ Arcade style (“twitch” games)
    ✓ Speed, visual processing, automaticity
  ✓ Adventure
    ✓ Hypothesis testing, problem solving
<table>
<thead>
<tr>
<th>Bates’ Taxonomy of Games</th>
<th>Explanation of Genre</th>
<th>Gagne’s Intellectual Skills</th>
<th>Bloom’s Taxonomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action</td>
<td>Keep the player moving and involved at all times. Primary skills are eye/hand coordination and quick reflexes. Deep thinking is generally not required. Examples: Dark Age of Camelot, Jedi Knight</td>
<td>Defined Concepts</td>
<td>Application</td>
</tr>
<tr>
<td>Role Playing</td>
<td>Revolves around characters, story and combat and takes place in large, expansive worlds and played out over hundreds of hours. Examples: Baldur’s Gate, Diablo, Icewind Dale</td>
<td>Concrete Concepts, Discriminations</td>
<td>Comprehension</td>
</tr>
<tr>
<td>Adventure</td>
<td>Story based on exploration and puzzle solving where the player is the hero. Examples: CSI, Law &amp; Order, Myst</td>
<td>All</td>
<td>Knowledge</td>
</tr>
<tr>
<td>Strategy</td>
<td>Effective strategy games are balanced. Just enough information is provided for motivation and interest. Too much information, the player doesn’t make effective decisions; too little information the player spends time worrying about what to exclude. Examples: Rise of Nations, Civilization</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Simulations</td>
<td>The purest form of wish fulfillment; fulfill the player’s fantasy of what he can’t do in real life. Examples: The Sims, Cruise Ship Tycoon, Flight Simulator</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Sports</td>
<td>Allows players to play their favorite sports activity to their heart’s content. Examples: Tiger Woods PGA Tour, NHL 2004</td>
<td>Defined Concepts</td>
<td>Application</td>
</tr>
<tr>
<td>Fighting Games</td>
<td>Allows players to taunt their rival who is playing beside them. Special moves and signature moves are a must. Examples: Quake II &amp; III, Star Wars</td>
<td>Concrete Concepts, Discriminations</td>
<td>Comprehension</td>
</tr>
<tr>
<td>Casual</td>
<td>Games for the “new gamers” – easy to learn and not difficult to master. Examples: Who Wants to be a Millionaire?, Monopoly</td>
<td>Defined Concepts, Concrete Concepts, Discriminations</td>
<td>Comprehension</td>
</tr>
</tbody>
</table>

Gagne’s Taxonomy of Instruction

- All:
  - Defined Concepts
  - Concrete Concepts
  - Discriminations
- Application: Evaluation
- Comprehension: Synthesis
- Knowledge: Analysis

Bloom’s Taxonomy

- All:
  - Defined Concepts
  - Concrete Concepts
  - Discriminations
- Application: Evaluation
- Comprehension: Synthesis
- Knowledge: Analysis
Challenges to Integrating Games

✓ Commercial games are not designed to teach
  ✓ Topics will be limited
    ✓ But there are ways around this
  ✓ Content will be inaccurate or incomplete
    ✓ But this is actually a good thing
✓ Commercial games are expensive to purchase
  ✓ But not as expensive as building from scratch
  ✓ And not as expensive as implementing ineffective games
The Biggest Challenge Is…

✓ Doing it right
✓ Lots of examples in history of how NOT to implement technology-based learning
✓ “Moore’s Law” has led to a “build it and they (better learners) will come” philosophy
✓ History tells us what this approach leads to
Media Use in the Schools

✓ 1960s & 1970s
  ✓ Audio and video in the schools
  ✓ Televisions in the schools
  ✓ Hundreds of “horse race” studies of media impact on learning
  ✓ Experimental and anecdotal evidence of efficacy reach popular press

✓ 1980s
  ✓ Meta-analyses show “no significant difference” (NSD)

✓ Why?
  ✓ Never accounted for the strengths and weaknesses of the media
  ✓ Never analyzed media in relation to learning outcomes, strategies, and pedagogy
  ✓ Mistook use for integration
Technology Integration

✓ 1970s
  ✓ Birth of the PC

✓ 1980s
  ✓ Purchase of the PC for schools
  ✓ Anecdotal and experimental evidence reach the popular press

✓ 1990s
  ✓ Studies of the impact and use of PCs continue

✓ 00s
  ✓ No significant difference

✓ Why?
  ✓ Never examined how technology aligned with pedagogy and what we wanted students to DO
  ✓ Mistook use for integration
Games in Learning Environments

✓ 1970s
  ✓ Birth of the video game industry

✓ 1980s
  ✓ Games meet the PC

✓ 1990s
  ✓ Games outstrip movies in sales
  ✓ Technology allows for interactive worlds and environments
  ✓ Experimental & anecdotal evidence on efficacy reaches popular media

✓ 00s?
  ✓ Must learn from our past
  ✓ Games can be:
    ✓ Exceptionally powerful learning tools
    ✓ Or a waste of time and resources
  ✓ Cannot mistake use for integration
For Example: Choosing a Suitable Game

Sometimes topic matches content of course

<table>
<thead>
<tr>
<th>Game</th>
<th>Game Content</th>
<th>Course Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of Empires, Civilization</td>
<td>History</td>
<td>History</td>
</tr>
<tr>
<td>Sim City</td>
<td>Geography, Civil Engineering</td>
<td>Geography, Civil Engineering</td>
</tr>
<tr>
<td>Law &amp; Order, C.S.I.</td>
<td>Criminal Justice, Forensic Sciences</td>
<td>Criminal Justice, Forensic Sciences</td>
</tr>
</tbody>
</table>
For Example: Choosing a Suitable Game

Other times, gameplay matches content of course

<table>
<thead>
<tr>
<th>Game</th>
<th>Gameplay</th>
<th>Course Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraption, Roller Coaster Tycoon</td>
<td>Build Machines To Specification &amp; Tolerances</td>
<td>Physics, Mathematics, Engineering</td>
</tr>
<tr>
<td>Cruise Ship Tycoon</td>
<td>Manage Budgets, Purchase Supplies, Ensure Financial Success</td>
<td>Business, Economics, Resort Management</td>
</tr>
</tbody>
</table>
How Is Game Aligned With Curriculum?

✓ Top-down or bottom-up
  ✓ Game as frame for new learning (top-down)
  ✓ Game as chance to synthesize and apply prior knowledge (bottom-up)
✓ Hybrid of both
  ✓ Will see an example with *Physicus*, later
How Is Game Aligned With Content?

✓ What IS covered?
  ✓ Breadth vs. depth; sub-set of topics to focus on
✓ What is NOT covered?
  ✓ Missing topics (breadth); missing content within topic (depth);
    Pre-requisite knowledge required
✓ What is wrong? (teachable moments)
  ✓ Inaccurate information (poetic license)
  ✓ Misleading information (fosters inaccurate/incomplete
    information)
  ✓ Alternate viewpoints/interpretations (one of many views or
    theories)
  ✓ Inappropriate/incorrect strategies (method of deriving
    information/conclusions inaccurate/incomplete)
Design & Evaluation

✓ Missing & inaccurate content
  ✓ Which content will you have to add?
  ✓ Who will provide this? (you, students, both)
  ✓ Maximize learner responsibility

✓ What activities can be created to address weaknesses?
  ✓ Learning is integral to story in commercial games
  ✓ Cycles of cognitive disequilibrium & resolution
  ✓ Leads to flow (Csikszentmihalyi, 1990; The psychology of optimum experience)
    ✓ Optimal learning state
  ✓ Intrinsic motivation (Malone & Lepper, 1987)
    ✓ Endogenous vs. exogenous fantasy (in relation to content)
    ✓ Endogenous fantasy will promote flow
    ✓ When not IN game, keep activities & roles endogenous TO game
Designing Instructional Activities

✓ Examples of activities
  ✓ Math & numbers: Budgets, spreadsheets, reports/charts, databases
  ✓ Writing: Diary, scientific report, letters, legal briefs, dictionary, faxes; multiple viewpoints
  ✓ Science: Design, duplicate, conduct experiments (endogenously!); conduct/write up feasibility studies; hypothesis testing
  ✓ Research: Assess veracity of game information, provide missing data (Internet, library, encyclopedia, etc.)

✓ Making the call: Is it worth the time?
  ✓ Is the amount of potential learning justified by the amount of work and time to implement the game?
  ✓ Must be willing to admit it is not!
An Example of DGBL

✓ *Physicus*

✓ Assessment/application, or new learning
✓ Inaccurate elements, combined with accurate
✓ Mixture of content blended with game & separate
Support

✓ Documentation & training support
  ✓ Established model of what games in classroom looks like
  ✓ Heuristics and job aids for planning and analysis
    ✓ See Game Analysis Packet at idt.und.edu; follow the “News” link
  ✓ Training for faculty & support staff
  ✓ Examples of best practices
Support

✓ Pedagogical support
  ✓ Hire instructional designers
  ✓ Support one-on-one development akin to online learning
  ✓ Find technology integration specialists in college of education

✓ Technical support
  ✓ Faculty during development and implementation
  ✓ Students during implementation
  ✓ Means training help desk and providing documentation to them
Support

✓ Financial support
  ✓ Assistance with licensing
    ✓ Set up volume licenses and limited use with companies
    ✓ Negotiate better pricing and pass on to students
  ✓ Development time
    ✓ Provide incentives to faculty to do it right way
    ✓ Similar model to much online course development
Infrastructure

✓ Appropriately configured labs
  ✓ Not locked down*
    ✓ Video resolutions
    ✓ Installation of proprietary drivers & game patches
    ✓ Ability to save and retrieve games

✓ Equipment
  ✓ Headphones/speakers; sound cards
  ✓ Video cards

✓ Access for out of class play (homework)

* Or dedicated technician support
Research & Development

✓ Find those doing research in games and learning
  ✓ Instructional design, education, cognitive psychology

✓ Collect and disseminate research and examples
  ✓ Database of examples, guidance for application to additional domains

✓ Encourage rigorous studies and game design
  ✓ Artificial intelligence, intelligent tutoring systems, pedagogical agents


