Game-based Learning

Birgit Mayer
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SE Technology Enhanced Learning:
Psychological Foundations and Current Trends
Overview

- Motivation and background for game-based learning
- Game-based learning
  - Impact of computer/video games on young people
  - Reasons for using computer games for learning
  - How computer games have been used for learning
    - Example studies
  - Benefits of using computer-games for learning
  - Educational Game Design
- Discussion & demonstration of educational online games, screenshots, game trailers
Motivation for Game-based Learning

One of the biggest problems in *all* formal learning is *keeping students motivated* enough to stick with the learning process to the end of e.g. a lesson, course, semester,…
Motivation for Game-based Learning

- Learning requires efforts, and students rarely do it without motives
  - Intrinsic goals, extrinsic rewards, psychological factors like fear, need to please
- How effective will these motives be in the future?
  - Long range goals, promised rewards are much less certain and thus, less motivating
Motivation for Game-based Learning

Computer games

- Motivation is high
- Can be played for hours
- People enjoy playing games because:
  - Long-term goals (beating the game, fellow players,..)
  - Offer rewards such as scores, price, prestige
  - The process of playing games is **engaging**
    - Gameplay (doing, thinking, decision-making) is challenging (physically, intelectually, and/or emotionally) at every moment
Motivation for Game-based Learning

Computer games

- Play and learning are related
  - When playing games, students actively see and do, rather than read and listen, as they complete increasingly difficult levels of learning
  - They are personally involved in what they are doing, and therefore, more motivated to retain what they have learned
Motivation for Game-based Learning

- The process of learning is often experienced as painful 😞
- The process of game-playing is generally engaging 😊

- If school activity would be treated in terms of learning, playing, and helping, then children could be more thoroughly engaged in the learning process
Background

Playing

- Is an important part of children’s cognitive and social development
- A child learns through playing with others, creating, and improving his or her stage of development
- Offers cognitive support needed to develop higher order mental processes
- Initiates the symbolic use of objects, first form of symbolisation (first step towards abstract thinking)
Background

Playing games

- Games are a common form of playing
- Consist of rules and procedures, that have to be mastered
- The understanding of the underlying concepts plays an important organising role in cognition
  - Requires mental framework (goals, conditions, players, resolutions,..)
- Example of situated learning
- Changes as children grow up, following the course of cognitive devel.
- Using educational content in game formats has the advantage of following the natural course of children’s learning
- Games are used in school, but the incorporation of computer games creates resistance
Background

Today's children grow up with computer technology ("Game Generation")

- Able of processing large amounts of visual, textual, auditory data
- Demand to be taught in ways that they are comfortable with
- Not satisfied with traditional learning methods
Background

Cognitive style changes (Prensky, 2001)
- Twitch speed vs. conventional speed
- Parallel processing vs. linear processing
- Graphics first vs. text first
- Random access vs. step-by-step
- Connected vs. standalone
- Active vs. passive
- Play vs. work
- Payoff vs. patience
- Fantasy vs. reality
- Technology-as-friend vs. technology-as-foe
What can be learned from the motivation of games for the motivation in education?

How can gameplay be brought into the process of education?

What can be learned from the cognitive styles changes in young people for designing educational games?

GAME-BASED LEARNING
Game-based Learning

- It’s about making learning engaging
  - Instructional content is blurred with game characteristics
  - Computer games offer a programmed environment by which the student can play, experiment, and learn from mistakes and feedback...
    - Active learning, learning by experience, discovery learning...
Game-based Learning

Objectives

- To make learning meaningful to students
- To create a learning culture that is more in correspondence to student’s interests and learning styles
- To create learning environments that actively involve students in the problem and enable them to understand the complex situation
  - From “learning by listening” to more active “learning by doing”
- To provide a rewarding experience to many people with the application of computer games
Game-based Learning

Computer games

- Characteristics:
  - Rules
  - Goals and objectives
  - Outcomes and feedback
  - Conflict/competition/challenge/opposition
  - Interaction
  - Representation, story
Game-based Learning

Categories of computer games

- Action games
  - Platform-jumping games, falling things that must be shot
- Adventure games
  - Find the way around the unknown world, solve puzzles
- Simulation games
  - Building worlds or companies, flying, driving,
- Fighting games
  - Two characters battle each other
- Puzzler games
  - Problem solving, presented graphically
- Role-playing games
  - To rescue someone, -thing, character can be selected, equipment, action
- Sport games
- Strategic games
  - Management of something big (entire civilisation), making it evolve
Game-based Learning

Hardware systems

- Game consoles (Nintendo, Playstation,...)
- PC’s
- Handheld devices (Nintendo Gameboy,..)
- Mobile phones
Game-based Learning

Impact of computer games

Positive effects 😊
- Balancing aggression
- Gaming skills as precursor for computer skills
- Serve educational functions
  - Tutoring, exploring/practising skills, entertainment, attitude change
  - Increase motivation, attention, concentration

Negative effects 😞
- Negative psycho-social effects
  - Low self-esteem
  - Asocial, aggressive attitudes
  - Isolation
  - Gambling, stealing,…
- Negative impact on schoolwork
- Health issues
  - Headaches, eyestrain,…
### Excerpt of Types of Learning and Possible Game Styles (Prensky, 2001)

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<td>Strategic and tactical thinking</td>
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Reasons for Using Computer Games for Learning

Games engage and motivate

- **Seductive**
  - Rich visual and spatial aesthetics draw players into fantasy worlds (pleasure)

- **Motivate via**
  - Fun
  - Challenge, mastery
  - Instant (visual) feedback

- Immersive, active experience sustains interest in the game

- Encourage to try different ways of learning and thinking
Reasons for Using Computer Games for Learning

Elements that make Computer games engaging
(Prensky 2001)

- Representation, story ⇒ Emotion
- Rules ⇒ Structure
- Goals ⇒ Motivation
- Conflict/competition /challenge/opposition ⇒ Adrenaline
- Interactive, Interaction ⇒ Doing (i.e. the activity), social group
- Outcomes & feedback ⇒ Learning
Reasons for Using Computer Games for Learning

Elements that make computer games engaging (Prensky, 2001)

- Fun ⇒ Enjoyment and pleasure
- Play ⇒ Intense and passionate involvement
- Adaptive ⇒ Flow
- Winning ⇒ Ego gratification
- Problem solving ⇒ Sparks creativity
How Have Computer Games Been Used for Learning?

- Tutoring, amusing, helping
- Exploring new skills, practicing, raising skills
  - Reading, maths,..
- Supporting participative, active learning
- Promoting self-esteem, attention, concentration
- Simple games (addressing specific learning outcomes)
  - Recall of factual content
  - Basis for discussion
- Complex games
  - Support cognitive processing, strategic skills, critical thinking
  - Increasing learning and memory capabilities
  - Promoting computer literacy skills
Example I

Teaching basic skills: Training of reading skills

- *Teacher-based tuition vs. educational computer game* (Schwartz, 1988)

- 24 Primary school children
  - Reading comprehension deficit

- 2 Groups
  - Traditional: Teacher-directed programme: DISTAR training
  - Computer games training

- Skills to be trained
  - Word decoding and phonics
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<th>DISTAR Training</th>
<th>Computer games training</th>
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<tr>
<td><strong>A</strong> Letters and combinations of letters taught as sounds</td>
<td><strong>A</strong> Letter Match: using a response button, students decide as quickly and accurately as possible whether letters are the same or different</td>
</tr>
<tr>
<td><strong>B</strong> Reading aloud vocabulary, presented by teacher, including sounds practised in <strong>A</strong> as well as some new one</td>
<td><strong>B</strong> Word Match: like <strong>A</strong>, but with real words or pronounceable pseudo words</td>
</tr>
<tr>
<td><strong>C</strong> Story reading: short passages Follow-up: answering questions posed by teacher and also in their workbooks</td>
<td><strong>C</strong> Speed reading: reading a series of words and pseudo words aloud Accuracy monitored by the teacher, who also corrects pronunciation</td>
</tr>
<tr>
<td><strong>D</strong> General reading: time-set aside at end of session to read a continuing story self selected</td>
<td><strong>D</strong> Last word: reading a short sentence and deciding whether its last word is appropriate given the preceding context</td>
</tr>
</tbody>
</table>
Example I

Results

- Positive results for both approaches
- Poorest readers made significantly greater gains in the computer games training condition
- Computer games training provide a practical adjunct to traditional teacher programmes
Example II

Supporting multidisciplinary and vocational learning via computer simulations (Betz, 1995)

- Can computer simulations increase learning in an interactive multidisciplinary environment?

2 Forms of independent study

- Simulator (Simulation game Sim City 2000)
  - City systems simulator
  - 3D graphics
  - The game includes elements of architecture, urban planning, sociology, economics, political science, environmental science, mathematics, demographics, history, management, computers, etc.

- Reading material
  (selected extracts from Sim City’s manual)
Example II

- **Engineer students**
  - Experimental group (EG)
    - Simulator and readings; independent reading task (+exam)
  - Control group (CG)
    - Only readings; independent reading task (+exam)
The game starts by providing you with a plot of land. Based on the contours and water sources, you can begin to design your city.
This is a closer look at a section of the city.
Example II

Results

- Tendency for the EG to learn more
- Students of the EG preferred using the simulator to reading
- Combination of simulator and reading facilitated understanding
  - Reading provided concepts and theory that gave them strategies when using the simulator
  - Simulator provided visual and casual images to allow students to see what happens when they applied the reading
Example II

Conclusions

- Increased learning occurs by problem solving in a complex interactive environment by seeing causal relationships between individual actions and whole systems.
- By using such computer games students become more effective learners and thinkers, allowing them to make connections across the curriculum.
More Results Found in Studies Investigating the Use of Computer Games for Learning

- Positive effects on learning, motivation, classroom dynamics
- Instant feedback motivates and encourage learning
- Complex games
  - Support critical thinking, problem solving, discovery learning, decision-making
  - Means to foster theoretical models and interaction effects
  - Support development of team, social, communication, and resource sharing skills
Young People’s Preferences in Using Computer Games for Learning and Leisure

- Enjoy computer games with fun, challenge, struggle
  - The process of game play is motivating itself
- Like goals, scoring, audio effects, unpredictability
- Educational software is often disliked (missing fun factor)
  - But preferred to standard classroom instructions

**Girls**
- Play to complete
- Enjoy fun characteristics (puzzles, quiz games)
- Story-line, realistic-familiar characters
- To resolve emotional issues

**Boys**
- Play to win
- Simulation, adventure, violent games
- To resolve conflicts
  - Head-to-head conflicts
Benefits of Using Computer Games in Educational Settings

General aspects

- Enhance motivation, which contributes to effective learning
- Encourage learners lacking interest or confidence and enhance their self-esteem
- Particularly effective when addressing a specific problem or skill (e.g. maths, physics,…)
- Support cognitive processing and development of strategic skills
- Support collaboration
Benefits of Using Computer Games in Educational Settings

Simulation Games

- Encourage visualisation, creativity, experimentation
- Accommodate different learning styles (audio, video, text)
  - Promote confidence and multi-modal literacy
- Enable engagement in activities otherwise to costly, difficult, dangerous,… to be implemented in the classroom
- Encourage construction of meaning and exploration of relationships
- Encouraging cooperative, competitive behavior within strategic context
- Gaming expertise is linked to
  - self-monitoring, pattern recognition, problem solving, decision making, qualitative thinking, superior short-term and long term memory
Benefits of Using Computer Games in Educational Settings

Collaboration, cooperation, communication

- Game community
  - Get information from other sources, explore, communicate, share information …

- Multiplayer-games
  - Foster competition and cooperation
  - Teams: self-formed to accomplish tasks
    - Mix of skills (theoreticians, experimenters, other skills)
  - Handing off and reinforcing each other’s learning (not often in classrooms)
Benefits of Using Computer Games in Educational Settings

Educational considerations

- For skills to be enhanced by game playing, these skills have to be already possessed.
- Teacher preferences towards a particular learning method can affect the effectiveness of games.
- Learning objectives may not be congruent with game objectives.
- What seems like a game to someone may feel like work to another.
Educational Game Design

- Design for blended learning solutions
  - Role of teacher (knows students, curricula,..)
- Focus on structure
  - Dynamic graphics, sound, interaction
  - Presence of goals and rules
  - Story line, complexity, fantasy,..
  - Challenge, problem solving, memory, logic,..
Educational Game Design

- Encourage active participation
  - Mirror real life (content, context, process)
  - Statement of goals and objectives
  - Clear instructions and supporting tools
  - Collaboration: Ask „how do groups of people learn with this?“

- Cater for diversity
  - Wide range of aptitudes and abilities, support

- Cater for management, networking, and wireless issues
  - Security, Technical boundaries, anytime-anywhere
Conclusions

Computer games

- Useful in addition to traditional teaching, learning methods
- Especially for students, who lack motivation
  - To adopt new attitudes towards learning
Thank You for Your Attention!!!
References

Review article

Valuable resource

Example studies
Online Games

Simple Games

- [http://www.earobics.com/gamegoo/gooey.html](http://www.earobics.com/gamegoo/gooey.html)
  - Alphabetic ordering (know and use alphabetical order of initial letters in words)
  - Identification of letters that compose words
  - Demonstrate knowledge of antonyms
Online Games

- Chemistry action games
  - http://webhome.crk.umn.edu/%7Edlim/itc/interactives.asp

- Number ordering
Screenshots, Game Trailers

- SimCity- Screenshots
  - [http://www.simszone.de/simcity/screenshots/](http://www.simszone.de/simcity/screenshots/)

- Sims (2) -Screenshots
  - [http://www.simszone.de/diesims/screenshots/](http://www.simszone.de/diesims/screenshots/)

- Game trailers
  - Empire Earth (Real-time strategy game)
THE END