The Use of Serious Games as Successful Educational Tool

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Summary

1. Introduction
2. Serious games as Educational Tools
3. The Design of the Serious Game
4. Final Remarks
1. Introduction

Serious games ⇒ main objective other than mere entertainment
Includes knowledge transmission to the player

Motivation: challenges; reward systems
1. Introduction (cont.)

Serious Games Idea: Not New

1789 ⇒ first reference to simulation games: game similar to modern war games (Helwing)
Later ⇒ improved by a military strategy scholar
Only for fun ⇒ cannot be considered a serious game

First serious game in the military context: Kriegsspiel ⇒ official training of the Prussian army (strategic and military capabilities)

Twentieth century ⇒ improvement and gain of new characteristics ⇒ war games reproduce actual conditions of great historical battles
1. Introduction (cont.)

IntelliGym (hockey or basketball players) ⇒ to improve core competencies until recently could not be trained:

- Decision-making under pressure
- Running
- Peripheral vision
- Concentration
- Anticipation
1. Introduction (cont.)

Rehabilitation and Physical Therapy

Neurogame therapy ⇒ patients with movements seriously compromised due to a stroke

Handcopter ⇒ Helicopter control to finger flexion and relaxation

Rehabtimals Pro ⇒ physiotherapist analyzes the rotation angles captured, notes reconstructions of movements, watches video sessions (treatment control and management)
1. Introduction (cont.)

Students accustomed to use:
- Social networks
- Collaborative online tools
- File shared storage tools

Traditional classes unattractive and not very motivating

Teacher: take advantage of digital literacy of students ⇒ introduction of technological innovations (serious games)
2. Serious games as educational tools

Certain situations in the real world ⇒ problems of safety, cost, time...
Eg: Real weapons to train militar strategies ⇒ high probability of an accident
Solution: serious games (realistic and immersive) ⇒ as productive as reality

Games in learning contexts:
The Oregon Trail ⇒ realities of life of the pioneers of the nineteenth century settlers, in the Oregon Trail
2. Serious games as educational tools (cont.)

Math Blaster! (learn mathematical skills) ⇒ story of a rescue in a futuristic universe, which takes the player to

Number Munchers (learn mathematical skills) ⇒ grid square with a numerical expression or word; player controls a green character (Muncher), avoiding deadly monsters

Supercharged! ⇒ use the electromagnetism physics to load spaceship (a charged particle) and navigate through the three-dimensional space

MyQuímica ⇒ drag chemical compounds of the periodic table to a test tube
2. Serious games as educational tools (cont.)

ActivChemistry ⇒ chemistry lab: allows performing experiences avoiding dangerous situations

Where in the world is Carmen Sandiego? ⇒ world geography, flags, coins ...

Castle of Puzzles (learn to program) ⇒ several challenges corresponding to studied subjects
3. The Design of the Serious Game

**Total Challenge** ⇒ dynamic work environment ⇒ students become more involved in various activities and understand and consolidate knowledge

**Target group** ⇒ children attending the first four years of school

**General Outline of the Game**
Most complex technical procedures difficult to execute by children ⇒ supported by tutors

Goal: track and improve several cognitive abilities ⇒ necessary a system to monitor the developments and send the data for further analysis.

Historical record ⇒ user/tutor must ensure the system is connected to a central database via Internet
3. The Design of the Serious Game (cont.)

Online mode:
- Required connection to Internet
- Required register the user in the official game website
- Help of a tutor may be necessary
- To play ⇒ after registration, user must enter the identification
  - and the password

New level of competitiveness ⇒ greater motivation

Offline Mode:
Most suitable:
- Training
- Device without Internet access
- Possibility to set all parameters of the game
- Player does not compete with others for rankings
All data of each player sent to a central server

Centralization ⇒ two functions:
- Access to all data for research purposes
- Access the results to analyze the evolution over time

Difficulty level related to:
- Response time
- Complexity of the contents
- Number of rounds for each game level

These parameters can be changed by the researchers to optimize them
3. The Design of the Serious Game (cont.)

User Interface

- Simple
- Designed especially for children

Game control: three buttons (blue, yellow and red)

- Attached to keys or specific command
- Carry out actions identified on the screen (fast forward, rewind and select)
3. The Design of the Serious Game (cont.)

Voice aids (also written in text form) ⇒ facilitate understanding of all areas of the game

- Friendly and fun shades
- Motivational messages

Idea and Design

Four main sections:

- Instructions ⇒ help for the correct use of the game
- Ranking ⇒ results of the top 10 played, by difficulty level
- Settings ⇒ to do login for the online mode; parameterize the offline mode; voice support
- Play ⇒ the game itself, three challenges.
All challenges:

• Based on interactions with images of different categories (transport, animals, and clothing)

• Test cognitive disorders: memory, decision-making time, ability of observation, association, perception player...
3. The Design of the Serious Game (cont.)

First challenge:

- Presented randomly three images
- Two images belong to the same category; the other belong to a different category
- Goal: find the image outside the context of the others

This challenge test: ability of perception, decision-making, association and categorization
Second challenge:

- Generated randomly three images of different categories
- Period of observation ⇒ images shuffled ⇒ limited time to reorganize them (initial order)

This challenge tests: ability of observation and memorization
Third challenge:

- Generated randomly three images of different categories
- Presented one of these categories by means of sound and text
- Goal: select the image that corresponds to this category

This challenge tests categorization capacity and knowledge application
3. The Design of the Serious Game (cont.)

Greater degree of difficulty \(\Rightarrow\) greater categories complexity (range from the general to the specific knowledge)

Example:

- Easy level \(\Rightarrow\) general categories (transports, clothing, animals...)
- Difficult level \(\Rightarrow\) specific categories (as air, land, sea transports...)

Different degrees of difficulty \(\Rightarrow\) different response times

Level of education required \(\Rightarrow\) Difficulty level:

- 1st grade \(\Rightarrow\) easy level
- 2nd or 3rd grade \(\Rightarrow\) medium level
- 4th grade \(\Rightarrow\) difficult level

Each correct answer has a fixed score of five points that is multiplied by the remaining time by the timer, which means that the quicker is the answer, the higher is the score.
3. The Design of the Serious Game (cont.)

Each correct answer ⇒ fixed score of five points multiplied by the remaining time by the timer
(quicker the answer ⇒ higher the score)

Advance to the next challenge ⇒ minimum score (2/3 of the challenge total score in the worst conditions)

Game ends ⇒ displayed one congratulatory message

Player cannot complete the game ⇒ encouraged to play again (try to get a better score)

Online mode ⇒ all the results obtained by level and by round sent to the remote server (response times, numbers of correct or incorrect responses and final result)
3. The Design of the Serious Game (cont.)
4. Final Remarks

• Notable efforts to make learning more enjoyable and more motivating
• Serious games ⇒ educational content and fun activities
• Formal education ⇒ rules imposed by adults, children obliged to give up what they want

Paradox of the serious game:
  • Set of rules

But activity that:
  • Stimulates competition
  • Gives the feel of a space detached of norms and impositions
  • Makes children to be in tune with the adults

Conditions for a more effective learning ⇒ maximize the construction of knowledge
4. Final Remarks (cont.)

- Serious game origin ⇒ not digital
- Currently ⇒ use of the potential of the new technologies Learning tool
- Competition, goals, rules, challenges, choices, and fantasy ⇒ motivation to facilitate learning
- All games discussed ⇒ high degrees of success

We expect:
- More and more sophisticated serious games ⇒ More satisfactory results

- Efficiency of education is a reality competitiveness patterns lead to excellence
- Total Challenge to be a successful tool in relation to the proposed objective

No statistical results ⇒ future work
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Thank You!

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