Videogames as a Learning Tool: Measuring the efficacy of Game-Based Learning Interventions

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Pedagogical Value of Videogames

The potential of video games in learning has been increasingly studied and supported.  
(Ashinoff, 2014)

- Its complexity requires the coordination of a number of variables, such as understanding complex processes, managing diverse social networks (such as teams or clans), and creative expression with digital tools.  
(Squire, 2008)
Pedagogical Value of Videogames

Long-lasting positive effects of videogames on basic cognitive elements involved in the learning process.

(Eichenbaum, Bavelier, & Green, 2014)
Systematic Review with Metanalysis

• Aims to bridge the gap between scientific research and policy through systematic synthesis of research findings (Sánchez-Meca and Marín-Martínez, 2010).

Relevant Points
• Provides knowledge base for policy-makers and practitioners;
• Helps to identify knowledge gaps and prevailing degrees of uncertainty;
• Promotes the cumulative development of science.  
  (Sutton, 2000)
Metanalysis has been increasingly used as a research design in the field of education;

Between 1976 and 2011, a review of databases found a total of 5206 publications in this field.

(Ahn, Ames and Myers, 2012)
Objective

Summarize the learning improvements obtained with GBL approaches with RCT, materializing a meta-analysis procedure.

- To provide data on the efficacy of Game-based Learning interventions;
- To legitimate the role videogames can assume in the learning process, and their pedagogical value.
Method

Systematic search of existing databases

Scientific Databases
- B-ON;
- EBSCO;
- PUBMED;
- ACM;
- IEEE.

Researchers Social Networks
- Researchgate;
- Academia.edu

Trying to access grey literature “produced on all levels of government, academics, business and industry in print and electronic formats, but which is not controlled by commercial publishers”

(game-based learning AND (randomized control trial OR rct) AND (videogames OR digital games))
Method

Sample Inclusion Criteria

- Experimental research design, using Randomized Control Trials;
- Use digital GBL strategies (videogames) with clear learning objectives;
- Outcome measures to evaluate concrete learning gains;
- Compare learning gains with gains obtained using a traditional approach (without videogames).

- Analogical GBL approaches weren’t considered (e.g. Board Games, Card Games, etc...) -
Method

Identification

Ebsco (N = 27) → Selected papers (N = 68)

PubMed (N = 29)

ACM (N = 7)

ResearchGate (N = 5)

Screening

Screened (N = 68) → Excluded studies (N = 48)

Eligibility

Studies analyzed for eligibility (N = 20)

2 excluded: analogical games;
2 excluded: outcome measures don’t assess learning gains;
2 excluded: non-randomized trials.

Included

Studies considered in the meta-analysis (N = 14)
Data Analysis

1st
• Categorization of each study main characteristics
  • Year of publication;
  • Sample size (N);
  • Context of the study;
  • Population;
  • Learning goals;
  • Outcome measures;
  • Type of videogame (depending on author’s definition);
  • Platform.

2nd
• Studies were analyzed considering the reported results

*Comprehensive Meta-Analysis Software (CMA), version 2*

Statistical Package for the Social Sciences (IBM SPSS), version 22
Results

- Total sample of *1685 subjects*, with an average of 120.35 individuals per included study;

- Studies are from the last 10 years (*most recent scientific evidence in the field of learning through videogames*);

<table>
<thead>
<tr>
<th>Year of Publication</th>
<th>Count</th>
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<td>2008</td>
<td>1 (7.1%)</td>
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<tr>
<td>2007</td>
<td>1 (7.1%)</td>
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</tbody>
</table>
Results

Studied Populations

- Medical Students: 35.7%
- Teenagers: 21.4%
- Children: 21.4%
- Clinical Populations: 7.1%
- Tweens: 7.1%
- Engineering Students: 7.1%
Results

Videogames are used to improve learning in several areas/subjects

- Medical Practices;
- Health Literacy;
- Physics;
- Computer science;
- Mathematics;
- Science;
- History;
- Pedestrian safety;
- Engineering principles.

Context of the Studies
- Higher Education (42.9%);
- Basic Education (28.6%);
- Secondary Education (21.4%);
- Clinical Rehabilitation (7.1%).
## Results

### Types of Videogames
- Educational games (28.6%)
- Serious games (28.6%)
- Computer-based board games (14.3%)
- Role-playing games (7.1%)
- Simulation games (7.1%)
- Quizzes (7.1%)
- Virtual reality games (7.1%)
- GPS/location based games (7.1%)

### Platform
- PC (57.1%)
- Web-based games (28.6%)
- Games for smartphone (7.1%)
- Nintendo Wii® (7.1%)

Web-based games were considered separately, since they can assume a multi-platform use (PC, smartphone, tablet, etc.).
Results

(Using a fixed-effect analysis)

• The effect ratio for the 14 studies is 0.387;
• Confidence interval of 0.291 - 0.484;
• Game-Based Learning approaches can increase the learning process outcomes by 28% - 47% in comparison with traditional approaches (expository or self-study).
• $Z = 7.870$, $SE = 0.049$, $p < .001$
Discussion
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