Chapter 21
Study Design and Data Gathering Guide for Serious Games' Evaluation

Jannicke Baalsrud Hauge
Bremer Institut für Produktion und Logistik (BIBA), Germany

Elizabeth Boyle
University of the West of Scotland, UK

Igor Mayer
Delft University of Technology, The Netherlands

Rob Nadolski
Open University of The Netherlands, The Netherlands

Johann C. K. H. Riedel
Nottingham University, UK

Pablo Moreno-Ger
Universidad Complutense de Madrid

Francesco Bellotti
Università degli Studi di Genova, Italy

Theodore Lim
Heriot-Watt University, UK

James Ritchie
Heriot-Watt University, UK

ABSTRACT

The objective of this chapter is to provide an overview of the different methods that can be used to evaluate the learning outcomes of serious games. These include Randomised Control Trials (RCT), quasi-experimental designs, and surveys. Case studies of a selection of serious games developed for use in higher education are then presented along with evaluations of these games. The evaluations illustrate the different evaluation methods, along with an assessment of how well the evaluation method performed. Finally, the chapter discusses the lessons learned and compares the experiences with the evaluation methods and their transferability to other games.

INTRODUCTION

In the last decade higher education has taken a digital turn in the use of games and simulations for learning and training. The long and well-established tradition of using teacher-led, no-technology or low-technology simulation games in higher education is 'under the spell' of online simulations, 3-D virtual worlds and digital Serious Games (SGs). So, what have we gained and/or possibly lost with this digital turn to Game-based Learning (GBL)? To answer this question we need to have ways of evaluating the learning impact of games. This chapter sets out to review and provide examples of the different evaluation methods that can be applied to serious games.

Considerable efforts and resources are now being put into the evaluation and assessment of game-based learning. As a result, both the number and the quality of evaluations of games for learning are increasing (see for a recent overview Connolly et al., 2012). However, there are still considerable weaknesses, for example, the absence of tools for unobtrusive, 'stealth' data gathering and assessment, and good research designs other than randomized controlled trials. Here, we wish to make a contribution by looking at how different evaluation methods have been applied to some serious games and to see what has been measured and how.

This chapter will present several case studies of serious games and their evaluation methodologies. It will identify the differences in the evaluation methods, and also discuss what this means for the transferability of the evaluation methods to other types of games.

EVALUATION METHODS FOR SG LEARNING OUTCOMES

The evaluation of games is complex and multidimensional since it involves evaluation not just of whether there is an improvement in performance on the targeted learning outcomes, but also evaluation of the user acceptance of, engagement with, and satisfaction with the game. The introduction of a serious game into the curriculum raises similar issues to any other educational intervention, since the aim of a game is to improve performance on a specific learning outcome. Woolfson (2011) proposes a hierarchy of evidence for evaluating educational interventions:

1. Meta-analyses
2. Randomised controlled trials (RCT)
3. Quasi-experimental designs
4. Single case experimental designs – pre & post test
5. Non experimental designs – surveys, correlational, qualitative

Meta-Analyses: At the top of the hierarchy of evidence for the effectiveness of interventions are meta-analyses. Meta-analysis combines the results from previous studies to identify patterns in research findings, especially with respect to whether games are effective methods in learning. Meta-analysis requires a reasonable number of empirical studies as input to compare – in serious games we still have a way to go to produce the needed studies, hence it has not been included in this chapter.

Randomised Control Trials (RCT): The Randomised Control Trial (RCT) is considered to be the gold standard for evaluating educational interventions. In a RCT participants are randomly allocated to an experimental (game) group or a control (non-game) group and their performance on the target skill/behaviour before and after the game intervention is tested. Ideally pre-testing should confirm no existing difference between the groups, while post-testing should show whether the experimental group performs better than the control group. Improvements in the target skill/behaviour for the experimental compared with the control group in a follow-up study would

Related Content

Identifying Stressors and Coping Strategies of Elite Esports Competitors

Matthew J. Smith, Phil D.J. Birchand Dave Bright (2019). *International Journal of Gaming and Computer-Mediated Simulations (pp. 22-39).*

www.irma-international.org/article/identifying-stressors-and-coping-strategies-of-elite-esports-competitors/238744

Simulation Framework for Substation Siting Integrating Load, Land Use, Neighborhood, and Cost Analysis

Jing Xiong, Jinming Yang, Yueling Deng, Zixuan Chen, Jihaoyu Yang, Chen Xuand Yong Qi (2024). *International Journal of Gaming and Computer-Mediated Simulations (pp. 1-24).*

www.irma-international.org/article/simulation-framework-for-substation-siting-integrating-load-land-use-neighborhood-and-cost-analysis/356272

The Dynamics of Video Gaming: Influences Affecting Game Play and Learning

Sandra Schamroth Abrams (2010). *Design and Implementation of Educational Games: Theoretical and Practical Perspectives (pp. 78-91).*

www.irma-international.org/chapter/dynamics-video-gaming/42447

The Effects of Using On-Screen and Paper Maps on Navigation Efficiency in 3D Multi-User Virtual Environments

Hakan Tüzünand Dilek Doan (2019). *International Journal of Gaming and Computer-Mediated Simulations (pp. 21-41).*

www.irma-international.org/article/the-effects-of-using-on-screen-and-paper-maps-on-navigation-efficiency-in-3d-multi-user-virtual-environments/252171

Ubiquitous Game-Based Learning in Higher Education: A Framework towards the Effective Integration of Game-Based Learning in Higher Education using Emerging Ubiquitous Technologies

Anna Kasimati, Sofia Mysirlaki, Hara Boutaand Fotini Paraskeva (2015). *Gamification: Concepts, Methodologies, Tools, and Applications (pp. 1015-1039).*

www.irma-international.org/chapter/ubiquitous-game-based-learning-in-higher-education/126102