

Chapter 71

Evaluating Games in Classrooms: A Case Study with DOGeometry

Günter Wallner

University of Applied Arts Vienna, Institute of Art & Technology, Austria

Simone Kriglstein

University of Vienna, Faculty of Computer Science, Austria

Johannes Biba

University College of Teacher Education Vienna/Krems, Austria

ABSTRACT

Educational games have gained wide acceptance over the years and have found their way into many classrooms. Numerous evaluations of such games have been published, but mostly evaluations were carried out in controlled environments, with a small sample size or over a short period of time. However, the particular context where playing takes place has been established as a critical factor for game-based learning. Moreover, educational games are often considered as black box, measuring only input and output variables but neglecting the intermediate process. Many researchers have therefore argued that evaluations of educational games have to go beyond testing the learning outcomes only and should also show how and why it works. In this chapter the authors describe the evaluation of the game DOGeometry, which was carried out in a classroom environment over a four month period. They report the development process, the design of the evaluation, results, challenges, and problems faced.

OVERALL DESCRIPTION

The motivation to find alternative teaching methods to break through the traditional lecture format, where students are passively sitting in classrooms, has increased in recent years. Digital technologies

enable interactive learning environments with a high pedagogical potential (Foreman, 2003). Today's children grow up with digital technologies and digital games are one of the top activities in their life (Annetta et al., 2006; The Henry J. Kaiser Family Foundation, 2002). Several studies, such as (Kumar & Lightner, 2007; Tan, Ling & Ting

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2007; Greenblat & Duke, 1981), found that the usage of games, animations and other multimedia elements are valuable methods to motivate student positively and to open new ways of offering learning support. For example, Mayo (2009) shows that digital games can help to increase the learning outcome positively in comparison with a lecture on the same material in a classroom. Although educational games cannot solve all problems with education, it opens new opportunities to engage students with their learning and to motivate them to devote more, than is prescribed in a course.

A successful acceptance of a game depends strongly on if it meets learners' needs to deal with the learning content in such a way that the game can support them to learn the subject matter without being discouraged. Therefore, it is not only necessary to evaluate learning outcomes of educational games but also to make sure that the game provides a satisfactory experience for the learner and to identify problems regarding gameplay or design. However, the testing sessions of such games are primarily conducted in controlled environments, with small sample sizes or over short time periods. Controlled studies are often preferred over field studies because they are easier to control and to reproduce. Although controlled studies usually use a test environment with a realistic setting (e.g., in a usability lab), the classroom environment plays an essential role, because challenges and interesting insights (e.g., about social interactions between children) can occur which cannot be tested in an isolated controlled environment within a short time frame. For example, it is interesting to observe how children accept and use a game over a longer period of time.

In this chapter we present a case study that illustrates the evaluation of the educational game *DOGeometry*. The evaluation was carried out in nine classes divided into control and experimental group over a four month period. The game should help elementary school children to learn and understand the basic concepts of geometric

transformations (e.g., rotations, translation, and reflection) by solving different tasks (puzzles and creation of objects). We will describe the development and evaluation process as well as the design of the pre- and post-test, address practical challenges we encountered and report on the feedback received from pupils and teacher surveys. Furthermore, the value of visualizations in analyzing gameplay data in addition to statistical analysis is highlighted.

LITERATURE REVIEW

Game-based learning gained more and more acceptance over the years and games made their way into contemporary classrooms. Many educational games have been developed and their evaluations have been published in various conference proceedings, journals, and books. Sometimes the evaluations were carried out with small sample sizes or over a short period of time neglecting long-term benefits that may result from playing a game. Other cases studies were conducted in a controlled environment, neglecting the particular context for which the game is intended. However, as Defreitas and Oliver (2006) emphasize, context (e.g., classroom based, access to equipment, etc.) has been established as a critical factor for effective use of e-learning tools. Yet, to our best knowledge, there exist only few case studies on evaluating games in a school environment and all of them have been published in the last few years.

For example, Malliet, Quinten, and Van der Sluys (2010) used collaborative design methods and qualitative user experience tests to evaluate small educational games in a classroom context. The games were tested in three classrooms with a total of 57 pupils. They report on practical challenges encountered due to the testing in a school environment and formulated practical guidelines for using such qualitative evaluation methods. Vankúš (2008) conducted a control

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