



The Impact of Educational Games on Learning Outcomes: Evidence From a Meta-Analysis

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ABSTRACT

The objective of this study is to examine and compare the impact of serious games and gamification on learning achievement and motivation. The results of the meta-analysis indicate that gamification has a more positive influence on learning achievement and motivation compared to serious games. The analysis reveals that gamification demonstrates a stronger impact on extrinsic motivation than on intrinsic motivation. Serious games have a more positive effect on intrinsic motivation in comparison to extrinsic motivation. The overall outcome suggests that gamification has relatively stronger effects than serious games. While the impact on extrinsic motivation is more significant with both approaches, serious games excel in fostering intrinsic motivation. However, further research is recommended to investigate the specific mechanisms that drive these effects and to identify optimal strategies for implementing serious games and gamification in diverse educational settings.

KEYWORDS

extrinsic motivation, gamification, intrinsic motivation, learning achievement, serious games

1. INTRODUCTION

Numerous studies have been committed to serious games and gamification (e.g. Raju et al., 2021; Krath & von Korflesch (2021); Tan et al., 2021; Högberg et al., 2019). According to Katrin Becker's study (2015), a serious game can be defined as a digital game that is designed for a purpose beyond entertainment. It is intended to educate or train individuals while also providing an engaging and interactive gaming experience. Serious games are often used as a tool for learning, communication, or decision-making in various fields such as education, healthcare, business, and defense. On the other hand, gamification refers to the use of game design elements and principles in non-game contexts, with the aim of increasing engagement, motivation, and participation. It involves incorporating game-like

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features such as rewards, challenges, levels, and leaderboards into activities that are not inherently game-like. Gamification can be seen as a means to enhance user experience and drive behavioral change by applying game mechanics and psychology to real-world situations. To sum up, while serious games are designed as digital games with a specific educational or training purpose, gamification involves applying game elements to non-game contexts to enhance user engagement and motivation.

According to Kim and Lee (2015), a game is characterized by an engaging series of choices that allow players to achieve specific and compelling goals. As technological advancements have facilitated the integration of games or game elements in educational settings, educators have embraced various game-related approaches to enhance student interest, enjoyment, and instructional effectiveness (Kim, Song, Lockee, & Burton, 2018). The growing popularity of game-related approaches has prompted researchers to investigate their hypothesized motivational impact in instructional contexts (Kim et al., 2018; Sailer & Homner, 2020). Games could be considered a beneficial tool to enhance learning experiences and teaching strategies (Gee, 2013).

Different approaches to game implementation result in distinct game-related practices. Two common approaches include serious games and gamification (Loh, Sheng, Ifenthaler, 2015; Becker, 2015). Serious games are digital games designed not solely for entertainment purposes, but to be used for educational, training, or healthcare purposes (Loh et al., 2015). On the other hand, gamification refers to the use of game mechanics in non-gaming contexts to engage learners, enhance learning, and solve problems (Kapp, 2012; Kim et al., 2018; Yu, 2015).

Gamification activities and processes can be employed by educators to create game-related learning environments and address learning challenges (Kim et al., 2018; van Grove, 2011; Werbach & Hunter, 2012). However, unlike serious games, the primary emphasis of gamification is on incorporating game elements into pedagogical practices (Kim et al., 2018). It is important to note that gamification is not a distinct form of digital game in itself (Loh et al., 2015). Therefore, educators should consider utilizing gamification alongside digital games (Domínguez et al., 2013).

Hence, it is essential to differentiate between the serious game and gamification approaches, as they have distinct definitions and potential impacts on pedagogical practices. By recognizing their unique characteristics, we can effectively evaluate and compare the efficiency of these game-related approaches.

To measure the efficiency of game implementation, various dimensions can be considered. A commonly used criterion is learning achievement, which evaluates the extent to which learners have progressed in their academic performance (Kim et al., 2018). Additionally, the motivational power of games plays a significant role in assessing the efficacy of game-related approaches (Sailer & Homner, 2020). Motivation can be further classified into intrinsic and extrinsic motivations (Ryan & Deci, 2000a; 2000b). Therefore, we can adopt learning achievement and motivation as criteria for evaluating and comparing the efficiency of these game-related approaches in pedagogical practices.

Given the significance of this study, its primary objective is to validate the effectiveness of game implementation in pedagogical practices through meta-analyses. By utilizing statistical findings, we can provide compelling evidence to support game implementation as an innovative approach, rather than a trivial one, in pedagogical practices (Kim et al., 2018; Sailer & Homner, 2020).

Moreover, this study aims to differentiate between serious games and gamification, both theoretically and in terms of their practical effects on learning achievement and motivation. It is essential to avoid confusion between these game-related concepts. By comparing the effects of these approaches, we can investigate the specific contexts in which each approach is most effective. Consequently, educators can maximize the efficiency of game-related approaches in pedagogical practices.

Given the significance of this study, our primary objective is to validate the effectiveness of game implementation in pedagogical practices through meta-analyses. By analyzing statistical findings, we can provide persuasive evidence to support the use of games as an innovative approach in pedagogical practices (Kim et al., 2018; Sailer & Homner, 2020), demonstrating that it is not a trivial approach.

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