Game-Based Learning: Benefits, Challenges, Solutions

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John Dewey (1938) believed that in order for education to have an impact on both the individual learner and society it must be based upon experience. He argues that education strives to prepare students for the future by helping them acquire certain skills and by learning certain subjects. However, these skills are often learned in specific conditions, disconnected from experience, and therefore inadequate in the context of the real world (Dewey, 1938). Research suggests that video games are beneficial to learning because they are action and goal oriented, provide distributed intelligence through digital tools, develop cross-curricular skills in meaningful situations, and are open ended (Gee, 2005). In other words, video games have the potential to provide experiences that help connect skills and content to cross-curricular meaningful situations, helping students develop skills that they can apply in real world contexts. This paper will examine the benefits and challenges of implementing Game-Based Learning (GBL) into the classroom as well as provide some possible suggestions for overcoming these barriers.

Benefits of Game-Based Learning

Game-Based Learning is becoming increasingly popular in educational research. According to Howard-Jones, Ott, van Leeuwen, and De Smedt (2014), studies shows that due to the ability of videogames to intensely engage a player, they stimulate an increase in midbrain dopamine which is associated with a higher ability to store and recall information. Additionally, a study found a positive impact on the numeracy skills of students with low socioeconomic status from playing a video game daily for 10 – 15 minutes over a period of three weeks. Additionally, another study compared the impact of a number line computer game on children diagnosed with dyscalculia to matched controls. The study found an improvement in spatial number representation and mathematical reasoning in both groups five weeks after training (Howard-Jones et. al, 2014).
Katmada, Mavridis, and Tsiatsos (2014) completed a study examining student’s and teacher’s opinion of the design and development of a game within the classroom. They found that both students and teachers had positive perspectives on the game and its use. Specifically, students reported that the game helped them develop a better understanding of the mathematical concepts, it was engaging, and could be useful when revising the lesson. Educators considered the game useful as an educational tool for the support and guidance of the students. Therefore, the study found that student’s and educator’s opinions were positive, considering GBL to be useful and engaging (Katmada et al., 2014).

Kliman (2006) and Ku, Chen, Wu, Lao, and Chan (2014) had similar results. Following studies on the impact of games to involve parents in student’s math learning, Kliman (2006) discovered that parents and students were more positive towards game play together than homework time, even though math learning was considered the most important value to playing. Ku et al. (2014) found that GBL increased confidence and mathematical proficiency of students, especially lower-ability students due to the constant feedback and its ability to build confidence. Additionally, GBL has been found to reduce test anxiety, enhance students’ motivation, increase self-esteem, and increase enjoyment (Chen et al., 2012; Tzuo, 2013).

According to Jabbar and Felicia (2015) when role-playing is part of the gameplay, students experience immersion which supports and improves engagement and learning and is positively linked with an increase in motivation. Plus, augmented-reality games have been shown to be effective in socially constructing knowledge in an active learning environment (Jabbar & Felicia, 2015). After completing a systematic meta-analysis of research pertaining to GBL, Jabbar and Felicia (2015) concluded that most research showed an opportunity for GBL to have an effect on the student learning. Research showed that GBL helped students to develop skills and knowledge and enhance their ability to apply these concepts to different
learning experiences. Furthermore, GBL increases enjoyment and motivation and increases cognitive and emotional involvement in learning (Jabbar & Felicia, 2015).

Therefore, research shows that GBL increases student’s ability to store and recall information, increases student motivation, engagement, confidence, and self-esteem as well as reduces academic related anxiety and helps students apply learning in different contexts (Chen et al., 2012; Howard-Jones et al., 2014; Jabbar & Felicia, 2015; Katmada et al., 2014; Kliman, 2006; Ku et al., 2014; Tzuo, 2013).

Student Engagement and Achievement

Student engagement can be described as “the interaction between the time, effort and other relevant resources invested by both students and their institutions intended to optimise the student experience and enhance the learning outcomes…” (Trowler, 2010, p. 3). Furthermore, student engagement can involve the positive, negative, or non-engagement factors within behavioral, emotional, and cognitive dimensions (Trowler, 2010). It is not surprising then that the effective use of GBL to redefine the student experience, immerse students within their learning, and improve learning outcomes has a positive effect on student engagement and motivation.

Carini, Kuh, and Klein (2006) report that student engagement is one of the best predictors of learning. In other words, the more a student studies, practices, or participates in activities about a subject, the more they will learn about it. Therefore, it is not a stretch to say that student engagement increases student achievement. Furthermore, since GBL has been shown to have a positive effect on student engagement, it is fair to assume that GBL will have a positive effect on student achievement. However, some studies examining the impact of using GBL in the classroom have found no effect or even a negative effect on some aspect of student achievement.
Carr (2012) completed a quantitative, quasi-experimental study examining the impact of using iPads as a 1:1 device on fifth grade students’ mathematics achievement. Teachers used the devices for at least one mathematics activity every day. This included using the iPads for GBL, presentations, online video tutorials, and interactive manipulatives. The control group did not use the devices, instead participating in non-iPad activities such as collaborative games, worksheets, and physical manipulatives. Carr (2012) found that there was no significant difference in achievement between the control group and the experimental group after one academic quarter. In other words, the study found that the use of iPads for activities such as GBL, did not have an effect on student achievement.

Similarly, Cicchino (2015) examined the effects of a non-digital GBL environment on students’ ability to critically think and understand social studies concepts. Grade 8 students from multiple social studies classes were divided into small groups and assigned to a territory. The goal was to finish the game with a specific number of spaces determined by their territory. Each territory was given different advantages or disadvantages to simulate historical concepts. Control groups used lectures, textbooks, worksheets, and small-group work to understand the same concepts. After four days of video collection as well as pre and post-tests, there was no significant difference between the control groups and the experimental groups (Cicchino, 2015). Therefore, this study found that the use of a non-digital GBL activity did not have an effect on student achievement.

Therefore, student engagement is considered to be a strong predictor of student achievement (Carini et al., 2006). Additionally, GBL has been shown to have a positive impact on student engagement (Chen et al., 2012; Jabbar & Felicia, 2015; Tzuo, 2013). It seems logical then that GBL should have a positive impact on student achievement. However, studies have found that in some circumstances GBL has no effect on student achievement (Carr, 2012; Cicchino, 2015).
Challenges of Game-Based Learning

Demirbilek and Tamer (2010) recognized this disconnect as well. They argued that GBL has a huge potential to positively impact student learning but it is difficult to effectively integrate games into the curriculum of formal education, weakening the potential impact that GBL can have. To attempt to overcome this barrier, Demirbilek and Tamer (2010) completed a qualitative study examining the perspectives of teachers on the use of educational games in mathematics. Through semi-structured interviews with thirteen teachers in Turkey, data was gathered on the use of computer games by math teachers, problems associated with using computer games in math class, and requirements for using computer games. During the interviews, teachers mentioned problems associated with behavior management, adequacy of hardware for running the games, and lack of professional development on using technology in the classroom. In addition, some perspectives included negative feelings towards using games in the classroom instead of traditional methods and a perceived lack of benefit.

Additionally, Denham, Mayben, and Boman (2016) reported that teachers need assistance in developing their technological, pedagogical, and content knowledge (TPACK) to effectively use educational games within the classroom. Without this knowledge, educators may not feel confident enough to implement digital learning into their classroom.

Possible Solutions

Evans, Nino, Deater-Deckard, and Chang (2015) examined how the TPACK framework could change teachers’ strategies for integrating a mathematical learning game within the classroom as well as the professional development required to prepare teachers for the pedagogical and content changes that occur with this implementation. Nine educators participated in professional development focused on mathematics education and implementing educational tools. The educators then integrated a mathematics learning game into their classroom over the course of 20 weeks. After the study, the educators participated
in focus groups. Evans et al. (2015) found significant changes in the instructional practices of teachers. Overall, educators were able to change their pedagogy from traditional lectures and assessment to collaborative workshops and digital-based learning environments that contributed to students’ conceptual knowledge about fractions and pre-algebra concepts (Evans et al., 2015). Therefore, through professional development, educators developed effective strategies for integrating GBL into the classroom.

Garet, Porter, Desimone, Birman, and Yoon (2001) collected data from the Eisenhower Professional Development Program dedicated to supporting professional development for teachers in mathematics and science. Using this data, the relationship between features of professional development and teacher’s knowledge and skills of classroom teaching practices was compared and contrasted to examine the effects of different characteristics of professional development on teachers' learning. They found that effective professional development is continuous and extended, focuses on academic subject content, provides hands-on opportunities, and is integrated into the daily routines of the school (Garet et al., 2001).

Denham et al. (2016) used these principles to create an on-going professional learning group (PLG) called Integrating Game-Based Learning Initiative. It includes 15 in-service teachers participating in activities to develop the knowledge and skills to not only use commercially available games, but to design their own games and teach students how to design games. The professional development consisted of four sessions that examined repurposing commercially available games, the teacher as a game designer, and the learner as a game designer. The next phase of the PLG will be to contribute to a database of GBL activities and conduct case-study research to further examine the impact of GBL on student achievement, motivation, teaching practice, and 21st century skills (Denham et al., 2016). Therefore, through the use of effective professional development, educators can create PLG
to improve the proper implementation of GBL. This will help educators overcome barriers effecting the positive impact of GBL on student engagement, motivation, and achievement.

All in all, GBL increases student motivation, engagement, confidence, and self-esteem as well as reduces academic related anxiety and helps students apply learning in different contexts (Chen et al., 2012; Howard-Jones et. al, 2014; Jabbar & Felicia, 2015; Katmada et al., 2014; Kliman, 2006; Ku et al., 2014; Tzuo, 2013). Additionally, since student engagement is a good predictor of student achievement, GBL has the potential to have a positive impact on student achievement (Carini et al., 2006). Through effective professional development, educators can improve the technological, pedagogical, and content knowledge required to effectively implement GBL into the classroom thereby increasing the chance of GBL positively impacting student achievement (Denham et al., 2016; Evans et al., 2015).
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