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Game-Based Learning: An Instructional Tool

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Abstract

Game-based learning is increasingly becoming popular in classrooms as an instructional tool. Considering the popularity of game-based learning, a large number of studies have been conducted explaining the positive effects that games have on learning. This paper examines literature related to the use of game-based learning as an instructional tool, the effectiveness compared to direct instruction, its usefulness in today’s society, and the applications associated with assessment. This review seeks to examine literature that supports game-based learning and aims to find how applicable it is in the classroom for teaching both content and skills. This paper also provides insight into the expanded role of computer games in the classroom and possibly assist in further studies.
Game-Based Learning: An Instructional Tool

Typically, video games are most often thought of as entertainment but games are increasingly entering the classroom for use in instruction. As games-based learning becomes increasingly popular, it is important to understand the influence that these games have on student learning and outcomes, they can be powerful learning tools. More specifically, it is important to understand how computer games can assist in teaching specific content and applicable skills. Trends in educational research suggest that there is an increase in game-based learning compared to more conventional classroom lectures due to student motivation and effort. Teaching specific content as well as applicable skills is a common goal of educators; however, it can be challenging to find the right format for teaching both content and skills. According to most research, game-based learning has a great potential to provide this type of instruction, which is why it is beneficial to research and understand the effectiveness of classrooms that use game-based learning. Computer games can be used as a teaching tool because they can positively benefit the learner through repetition, exploration, and practice. They connect technology with education and produce substantial learning outcomes. Computer games reach learners on their level, benefiting non-traditional learners as well as empowering learners to take responsibility for their own educational growth. Games provide a platform for students to take chances and be adventurous by allowing students to fail and try again without negative consequences. Games for instruction motivate, engage, and support learning where outcomes are relevant to real world contexts of practice (de Freitas, 2006).
Literature Review

Definition of game-based learning

Game-based learning is an environment where specific learning objectives are achieved through game play. As described by Qian and Clark (2016), “game-based learning describes an environment where game content and game play enhance knowledge and skills acquisition, and where game activities involve problem solving spaces and challenges that provide player/learners with a sense of achievement” (p. 51). Tang, Hanneghan, and El Rhalibi (2009), define game-based learning as “the innovative learning approach derived from the use of computer games that possess educational value or different kinds of software applications that use games for learning and education purposes such as learning support, teaching enhancement, assessment and evaluation of learners” (p.205). Ebner and Holzinger (2007), state that “game-based learning is similar to problem-based learning, wherein specific problem scenarios are placed within a play framework”. Additionally, Kim, Park and Baek (2009), define game-based learning as “achieving the particular objectives of given educational content through game play” (p. 801). Bellotti, Kapralo, Lee, Moreno-Ger and Berta (2013), define a type of game that is designed to be entertaining and educational a “Serious game, these games are attractive and appealing to a broad target audience similar to commercial games but they meet educational goals as well” (p.1). Playing educational video games does not always involve sitting in front of a desktop computer screen, currently new games include mobile games and augmented reality games that
offer an outdoor component (de Freitas, 2006). The multiple definitions listed above make it clear that game-based learning is not something finite but it is developing, changing, and emerging as more research is being conducted.

**Evidence supporting computer games as instructional tools**

The influence of digital games and the idea that students might actually be developing useful skills impacted the way that teachers and researchers view games, allowing them to consider that they might provide useful and attractive new methods of teaching (Connolly, Boyle MacArthur, Hainey & Boyle, 2012 p. 661). Computer games have potential as a learning environment because they are a form of play that motivates students through entertainment and competition which also include rules, goals, feedback, interaction, and outcomes. Current research states that there is a beneficial purpose to using computer games as instructional tools. In fact, Plass, Homer and Kinzer (2015), claim that digital games are able to engage learners on an affective, behavioral, cognitive, and sociocultural level in ways few other learning environments are able to (p. 262). Educational computer games could become a major part of the instructional learning experience. Computer games provide a format that allows the learner to explore, inhabit, and master new concepts while creating new ideas, skills, and experiences (Squire, 2008, p.17). Games are able to link meaning to content within controlled environments where exploration and thinking are paramount. These games motivate students to succeed and reduce the negative connotation of failure because starting again is always an option and in some cases expected (Kapp, 2012). With
advances in technology and computer graphics, games are becoming an alternative to the traditional teacher lecture. Research over many years indicates that the use of games for learning leads to improved general learning, increased motivation, and improved performance (Wilson, Bedwell, Lazzara, Salas, Burke, Estock, & Conkey, 2009, p. 219). Game-based learning can offer opportunities for learning to be situational, according to Plass, Homer, and Kinser (2015), by providing the right information at the right time, this allows learners to benefit from the specific meaningfulness and relevance. Games present information and problems in ways that resemble real life, allowing important information to be transferred into learning (Plass, Homer, & Kinser, 2015). Transfer of knowledge is also explained by Salomon & Perkins (1989), through two main ways: a low road, which is based on repetition of a skill and a high road, which depends on conscious abstraction and application of knowledge (Plass, Homer & Kinser, 2015). Game-based learning is a prime example of how both forms of transferability can be present. Games transfer knowledge through repetition, practice, and application, which then can be transferred to a context and possibly skills. The way games can mirror real life extends their transferability of the skills learned beyond the game.

A case can be made for game-based learning that uses simulations and serious games. According to Bellotti et al., (2013), game-based learning is a safe, long lasting, and cost-effective means for learning skills and attitudes; it was observed that students preferred games and simulation over other classroom activities and participation in game-based learning can lead to changes in their attitudes toward education, career,
marriage, and children although these effects could be short lived (p. 2). Similarly, Connolly, Boyle, MacArthur, Hainey & Boyle (2012), found that playing computer games is linked to a range of perceptual, cognitive, behavioral, affective, and motivational impacts and outcomes. The most frequently occurring outcomes and impact were content understanding and affective and motivational outcomes; however, the literature reviewed provides limited evidence for this (p. 2). Games that encompass educational objectives and subject matter are believed to hold the potential to render learning of academic subjects more learner-centered, easier, more enjoyable, more interesting, and, thus, more effective (Kafai, 2001). Game-based learning is extremely versatile, it can be designed to fit any subject, provide specific information, build skills that are applicable to life, and assess knowledge comprehension and when applied effectively, it can be extremely entertaining and fun.

**Bridging the gap between today’s generation and instruction**

Connecting today’s generation with today’s instruction is a challenging goal for educators. However, as more research is being conducted on game-based learning, the more frequently games are entering the classroom. Today’s generation of students has been surrounded and influenced by technology their whole lives and as a result researchers are discovering that they have become more and more disengaged from traditional instruction. Accordingly, Van Eck (2006), urges teachers to become more aware of the potential effects computer games can have on student outcomes. Computer games are not only more relevant to the way students process information
but they provide a steady transfer of information from computer to performance. This generation has grown up with games and it is important for educators and researchers to seek value in the relationship that technology has with today’s youth. Van Eck (2006), states that an important factor regarding game-based learning is understanding how today’s “net-generation” requires multiple streams of information, prefer inductive reasoning, want frequent and quick interactions with content, and have exceptional visual literacy skills (p.1). The rapidly changing format of games is bringing new potential for learning in immersive worlds using multiple media (de Freitas, 2006). Today’s students also need to develop 21st century skills and be able to implement them in multiple areas of learning and life which is why Qian and Clark (2016) advocate using game-based learning because games provide a means of assessing these hard to evaluate skills that are valued in the new digital economy (p. 51). Game-based learning changes the approach of how students learn, allowing students to take control of their own learning.

**Game-based learning compared to direct instruction**

Consider the role of computer games as they relate to direct instruction, are they comparable? While there is considerable information promoting the use of games in aiding education, there is little empirical information proving how it holds up compared to teacher lead direct instruction as well as the effectiveness of games for concrete educational purposes. Prior studies have focused more on motivational aspects than on curricular content aspects and core academic benefits (Papastergiou, 2009). There is a
need to prove that not only are computer games beneficial and an appropriate format for the "net-generation" but that they are strong enough to stand on their own as instructional tools. Studies have been conducted on the use of games as pre-instructional strategy, co-instructional, or post-instructional but little is known about the use in place of direct instruction. Fletcher and Tobias (2006), review multiple sources that prove a positive transfer between playing a simulator type video game and actual improvements in real world task performance (p.1). Similarly, Qian and Clark (2016), reported that “some studies found that game-based learning might be superior to traditional classroom instruction as it could increase students’ motivation for learning and provide them with opportunities to explore and acquire new knowledge and skills; however, others did not find strong evidence to support the association between game-based learning and high academic achievement” (p.50). This invokes considerable assumptions about the transferability of information and the role computer games can play in the classroom which is why continued research should be conducted. Game-based learning has been associated with improvements in the development and reinforcement of sensory, motor, and cognitive skills. Games allow for experimentation and manipulation in a safe environment. It has been proposed that realistic and immersive virtual environments allow individuals the opportunity to interact with objects and events in novel and meaningful ways, acquire relevant contextual information, and integrate knowledge by doing (Shaffer et al., 2005). Furthermore, the open structure and self-directed discovery of information inherent in these virtual settings improves contextual learning and the transfer of situational knowledge (Shaffer
et al., 2005). Thus, successfully leveraging these advantages in the education and rehabilitation arenas could have immense appeal by facilitating the learning of demanding tasks and the transfer of acquired skills (Connors, Chrastil, Sanchez & Merabet, 2014). According to de Freitas (2006), it is becoming increasingly clear that the traditional methods of instruction and assessment are not engaging or expanding student achievement. With a greater emphasis upon learning experiences, game-based learning may provide significant challenges to our institutions and teaching strategies; however, it may also provide new opportunities for reconsidering how we learn and for supporting the development of new immersive spaces where learners may produce their own materials, share learning experiences, and practice skills for the ‘real world’ (de Freitas, 2006).

**Assessment of game-based learning**

Using game-based learning as an instructional tool, like any other instructional tool, must be able to show that specific learning has taken place and students are meeting the educational goals of the course through assessment. Assessment can typically be conducted in one of two ways: summative (information collected at the end of learning that tests knowledge) or formative (information collected throughout the learning process continuously monitoring progress and failures). Bellotti et al., (2013), suggests the use of formative assessment for the evaluation of game-based learning because this type of assessment can be incorporated into the experience of the game. Bellotti et al., (2013), also points out that summative assessments can be used for
game-based learning through the use of pre- and posttest which is one of the most widely used experimental designs in educational studies (p. 3). With more advances in technology, it is important to consider audio and visual technologies that support assessment. Bellotti et al., (2013), additionally discusses how recent technology can automatically record players playing and speaking using a variety of available tools, which can benefit assessment as well as research (p. 4). According to Kim and Shute (2015), there is a continuous need for new kinds of assessments, and they state that “scholars and practitioners have been recognizing the potential of video games for assessment and learning” (p. 340). However, Kim and Shute (2015), also discuss the difficulty of creating a game that has an assessment component but is also enjoyable and educational. Therefore, Kim and Shute (2015), caution that a game with “heavier emphasis on either one might hinder the enjoyment of the game or the strength of the evidence collected for assessment” (p. 341).

Conclusion

To summarize, this literature review integrated viewpoints of how game-based learning can be a substantial part of the education of students. These perspectives enable educators to make informed decisions about the use of computer games as an instructional tool. Undoubtedly, this paper has considered only a small amount of research papers, but with continued interest and support for game-based learning, research will continue and develop. The continued study of the role games play on student outcomes is significantly important to the development and use of games in the
classroom as instructional tools. While the current research has expanded the common understanding of game-based learning and its impacts, it also highlighted some problems. There is a need for more thorough research studies that can determine the ways that games are currently being used most effectively to support learning in the classroom. De Freitas (2006), states that “one of the main obstructions to uptake of games in learning contexts is a lack of empirical data to support the fact that they work, as well as a lack of understanding about how these games might be used most effectively in practice” (p.5). It is important to consider the available research on the effectiveness of games for concrete educational purposes, because most studies have focused more on motivational aspects than on the curricular content and core academic benefits. Another problem facing game-based learning is the negative connotation that is associated with digital games, these misconceptions must be overcome before the education field can embrace game-based learning (Schaaf, 2012). Much needed continued research will not only guide the creation of educational and engaging games but provide more information on the credibility of games as instructional tools.
References


