CJLT RCAT
Canadian Journal of Learning and Technology
La Revue canadienne de l'apprentissage et de la technologie

Volume 46 (3) Fall/Automne 2020

Serious Games in Higher Distance Education

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Abstract

Games have been socially entrenched throughout history as a form of entertainment. Current rapidly changing technological advances have permitted an increasingly prominent means of utilizing these entertainment sources in an instructional capacity for educational purposes. As a result, serious games focus on engaging learners in activities which are not developed solely for enjoyment purposes. Goal oriented pursuits based in either an authentic or fictitious scenario can be designed to improve motor and cognitive abilities or learner knowledge (de Freitas & Jarvis, 2006; Lamb et al., 2018; Protopsaltis et al., 2011). Serious games promote intentional, active, and mobile learning that can be successfully used as a supplemental educational tool to facilitate a situated understanding of specific content (Admiral et al., 2011; Gee, 2005). This paper is a brief overview of game-based learning, or serious games, as an innovative instructional strategy in higher distance education.

Keywords: Serious games; Post-secondary; Distance education; Instructional strategy; Educator practice

Serious Games Basics of Play

A variety of definitions of gaming exist, and therefore, each needs to be described based on differences in their purpose, approach, and impact on learning. Game-based learning refers to "the pedagogical approach of utilizing games in education" (Anastasiadis et al., 2018, p. 141). Coined by Nick Pelling in 2002, gamification is considered an overarching term which includes game-based elements, aesthetics, and reasoning to involve learners in various action and problem-solving activities in a non-game context (Deterding et al., 2011; Kapp, 2017; Seaborn & Fel, 2015). Serious gaming is considered a subset of the meta-concept of gamification. These game types are not purely rooted in entertainment but rather focus on the use of games, mostly digital, in an instructional capacity within other industries such as higher education and health care (Verkuyl et al., 2019). However, serious games are not always digital, and regardless of format, games are governed by similar design principles. Digital games specifically use a form of video or computer-based learning to create an engaging experience which targets specific practices, goals, and outcomes (de Freitas & Jarvis, 2006; Li & Tsai, 2013;

Whitton, 2010). Gamification and serious games share similar traits and goals. What sets them apart are the game elements in context.

Game Elements

The diversity of definitions means that classification of game elements becomes extremely difficult to develop. To best understand common game components, Kapp (2017) identified three groupings of these game aspects as engagement, autonomy, and a sense of progression based on feedback. Within these broad groupings, rules, goals, quantifiable outcomes, challenges or problems to solve, and a sense of control are among the most frequently cited elements. Not every game exhibits the same elements.

Characteristics

One key characteristic of serious games is the incorporation of traditional instructional content with interesting, enjoyable, and engaging game elements for non-entertainment purposes (Kapp, 2017). The integration of auditory, visual, and textual displays can be utilized to motivate learners (Woo, 2014), while providing an opportunity to become more personally, emotionally, and cognitively involved in the learning experience (Protopsaltis et al., 2011).

Motivational levers such as competition, cooperation, curiosity, and challenge are among some of the methods used to immerse individual or collaborative players in the game. Learners can be captured through video representations as three dimensional characters or avatars to further engage players into a meaningful role, identity, or situation. These processes enrich a learner's experience and cognitive success (Lamb et al., 2018; Woo, 2014). Serious games are widely accepted as having a beneficial impact on many of the learner's higher order thinking skills including conceptual understanding, critical thinking, problem solving, collaboration, spatial ability, automaticity, and creativity (Dondlinger, 2015; Gee, 2005). Serious games offer an effective and efficient means of providing a safe learning environment for the learner to explore content that is situated in the realities of practice (Admiral et al., 2011; Gee, 2005).

Additional features that influence learner engagement and satisfaction with this instructional approach include curiosity, role-playing of skills or tasks, specific rules, personal goals, individual challenges, flexibility and control over learning, and interaction with the system feedback (Anastasiadis et al., 2018; de Freitas & Routledge, 2013). A sense of accomplishment is established once the learner successfully completes the game requirements. Feedback is key to supporting the identification of areas for improvement which enables the learner to enhance skills or knowledge by viewing the situation from an alternate perspective. Augmented immersion, engagement, and success in completing serious games improves the self-esteem and autonomy of the learner (Anastasiadis et al., 2018; de Freitas & Jarvis, 2006).

Serious games support cognitive development and digital literacy (Anastasiadis et al., 2018; Lamb et al., 2018) by capitalising on the relationship between action and cognition in a digital game environment (Kapp, 2017). Enhanced learner decision-making and critical thinking skills are supported through authentic practices which require problem solving to formulate strategies to overcome obstacles,

reflecting on failures and successes, while continuing to work towards a goal (Dondlinger, 2015; Kapp, 2017). Customization offers variable levels of authenticity and difficulty (Anastasiadis et al., 2018). Opportunities for progressive learning through experience can be adjusted according to learner feedback to reduce cognitive load, so novice learners can focus on critical aspects of the skill or task being learned (Gee, 2005; Kapp, 2017; Whitton, 2010). To serve as a formative assessment of a learner's progress, tasks or skills must be related to the learning objectives.

Applicability in Education

Serious games are applied in various professional settings such as corporate, research, health care, industrial, military, government, and education sectors (Dichev & Dicheva, 2017; Whitton, 2010). Each game can be designed to serve one of many purposes including orientation, assessment, training, recruitment, knowledge management, scientific research, and education (Whitton, 2010). Within education, games are used as a complementary form of learning in elementary thru post-secondary settings.

Serious games are useful for teaching in areas where memorization of information is priority. The integration of repetition and recall processes can be used to support other learning processes such as development skills training within various disciplines (Verkuyl et al., 2019). In higher education, games have the greatest potential for developing and applying high-level transferable skills including critical thinking (Gee, 2003), problem solving, decision making, and communication (Bates, 2019; Dondlinger, 2015). They can also improve a student's motivation to learn and engage with the content more deeply to meet learning outcomes (Bates, 2019; de Freitas & Jarvis, 2006; de Freitas & Routledge, 2013). Motivation is key to instructional technique as it supports similar learning concepts such as engagement, determination, ambition, attention, self-efficacy, confidence, and achievement (Dichev & Dicheva, 2017).

Serious Games and Approaches to Learning Design

Literature pertaining to the use and design of serious games in higher distance education was reviewed for this study. Several learning theories support the application and use of serious games in higher distance education. Theoretical constructs from various behaviourist, cognitivist, constructivist, and connectivist learning theories provide pedagogic rationale for the use of serious games. These constructs establish clear pedagogical goals to support individual learning preferences and motivations (Protopsaltis et al., 2011).

Behaviourism

A behaviourist approach to learning identifies behavioural responses linked in a systematic and invariant way with stimuli. Like the basic tenets of Skinners (1968) operant conditioning theory, serious games can be designed to reinforce correct behaviour through rewards such as badges or points or discourage behaviour with a corrective approach (Bates, 2019; Whitton, 2010). Skinner's theory of learning provides a theoretical foundation for the development of measurable learning objectives, computer-assisted instruction, and multiple-choice tests (Bates, 2019), all which can be integrated into

serious game activities and online distance education practices. As part of a distance online course, the game objectives can be aligned with the overall course aims and used to establish the intended outcomes level achieved.

Behaviourist practices can also be valuable for the rote learning of facts or customary procedures within various disciplines. Games that focus on the rehearsal of skills have been successfully incorporated into higher education within disciplines like nursing (dos Santos et al., 2017; Verkuyl et al., 2019), to allow learners an opportunity to apply knowledge and test ideas in a risk-free environment.

Cognitivism

Cognitivism focuses on the identification of mental processes, or internal and conscious representations of the world, which are essential for human learning (Bates, 2019). These genetically wired processes are considered programmable and modifiable by external factors, especially new experiences. Overall, cognitivist learning theories appear better suited for use in higher education because of their influence in developing higher order thinking skills such as abstraction, analysis, synthesis, evaluation, problem-solving, and creative thinking (Bates, 2019).

Blooms (1956) taxonomy of learning objectives are commonly used as the basis for structuring program goals and course objectives to an appropriate level of learning (Whitton, 2010). Serious games offer an opportunity to integrate cognitive learning theories into online educational practices by aligning aims, objectives, and activities towards desired cognitive, affective, and psychomotor learning domains. Cognitive learning can be promoted through different cognitive activities such as problem solving and decision making (Lamb et al., 2018). Alternative realities and virtual worlds that are similarly integrated into the game design have the potential to impact learner emotions through immersion in character role play driven by game narrative (Bates, 2019). The impact on this affective domain within the learner has been described as one of the central benefits of serious game strategies (Zhonggen, 2019). Finally, technological gaming advancements are making the achievement of psychomotor learning objectives a reality in online settings through haptic applications (Whitton, 2010).

Constructivism

From a constructivist perspective, knowledge is subjectively created from a learner's perception and socially emerging principles. For the most part, behaviour is not considered predictable as each learner is unique in their interaction with different experiences (Bates, 2019). Knowledge is actively created (Ally, 2008) not simply acquired by learners through the memorization or transmission of information from a knowledge source such as an educator or facilitator. Meaning is ascribed to this information by cognitively managing and integrating it with current knowledge (Bates, 2019).

Within a higher education online setting, serious games can be designed to support personal and group reflection on individually or collectively taken actions. Different levels of challenge can be threaded into the game that require learners to seek new information and test ideas both separately and collaboratively within the social interactions of a group (Whitton, 2010; Zhonggen, 2019). Collaborative learning, an approach central to constructivist views, allows exploration of multiple angles by cooperatively sharing and explaining ideas while building communication skills and a community of

practice (Wenger, 1998; Whitton, 2010). Gaming communities formed through multi-user functions in an online environment provide a platform for developing team-based skills, which support the capacity to learn.

Based on constructivist tenets, the theory of zones of proximal development (Vygotsky,1978) can be used when creating a game activity to facilitate and focus on learner needs by altering the content or assistance complexity level and promoting learner independence. Adult learning theory principles (Knowles, 1998) such as learner autonomy, self-control, variety, and real-life applicability are key features of serious games which can motivate adults to learn within a distance educational environment through constructivist notions of learning (Whitton, 2010).

Connectivism

Connectivism asserts that knowledge is formed by the learner as a result of connections made between nodes of information within a network that is created in a constantly changing and chaotic manner, which extends beyond an individual or organizational level (Bates, 2019; Siemens, 2005). Within a group-based game environment, peer interactions further learner knowledge through connection. The concepts of transferring, producing, or building knowledge are not identified in connectivist learning approaches.

As a supplemental form of instruction, serious games offer the potential to incorporate these pedagogically based tenets into higher distance education to support online learner success. This contribution will depend on the required learning outcomes and the learning activities created by the educator designing the game.

Implications of Serious Games

Serious games offer potential advantages for higher distance education learners, however, the implications for educators are varied and need to be considered prior to incorporating this instructional strategy.

Implications for Educators

Essential skills and relevant knowledge such as awareness of appropriate pedagogical theories, game software applications, and game design information are required for integrating serious games as an instructional strategy. Since a serious game-based method of design can draw on several instructional design approaches, it is important, as an educator, to understand instructional techniques (Kapp, 2017).

Instructional strategies selected should motivate learners to facilitate meaningful learning in a contextual and authentic manner (Ally, 2008). Support and feedback are essential throughout the gaming experience to encourage continued learner engagement with the content when appropriate. Further to understanding these underlying instructional design-based principles, an educator requires the ability to navigate, create, and use game software appropriately (Bates, 2019).

Existing games can be used or modified to suit learning purpose. Prior to use, educators must assess the appropriateness of the game to meet the required objectives within an online course, as no

single game will be suitable for all circumstances (Becker, 2007). The time commitment required to design and develop serious games will ultimately depend on the game's complexity, purpose, and use (Becker, 2007). Further, the cost of quality video game development software may pose a challenge for educators with limited financial resources (Bates, 2019). Where educators lack the knowledge required to integrate technology effectively into course work (Bates, 2019; Becker, 2007; Sprague, 2004), even when successfully incorporated into their teaching practices, troubleshooting technological issues may pose additional barriers.

Design Implications

One of the most significant problems with serious games is the inadequate integration of appropriate design principles. Further consideration of the best blend of game activity with other learning activities is also required by the educator. From a design perspective, consideration of three main categories of universal design principles of game vision, game space, and instructional space are key (Myers & Reigeluth, 2017). Creating the serious game vision consists of six key design elements: developing learning goals, designing an authentic learning experience, integrating increasing levels of content complexity, scaffolding learner support, providing appropriate timely feedback, and stimulating intrinsic and extrinsic motivation that supports learner success (Hess & Gunter, 2013; Myers & Reigeluth, 2017).

Game space focuses on the context and game rules (Meyers & Reigeluth, 2017). When designing game space, these 10 elements are necessary: goals, game mechanics or procedures for action, rules to govern action, interaction of player or players, environment including degree of fidelity, objects that enable game mechanics, information to support player decisions, technology required for input, a narrative for frame of reference, and aesthetics or felt experiences that arise among learners (Meyers & Reigeluth, 2017).

Finally, the instructional space design consists of three major types of scaffolding: adjusting the level of difficulty to support a learner's zone of proximal development, coaching with tips or short demonstration to support learners, and instructing when a significant amount of learning is required (Myers & Reigeluth, 2017). Appropriate use of scaffolding within the game should be established by the educator prior to utilizing any of them within the instructional space.

Practice Implications

A presentation formatted into a serious game entitled Game of Games was developed for a scheduled 15-minute synchronous discussion forum in Adobe Connect. A colleague offered use of gaming software through the Canadian Alliance of Nurse Educators Using Simulation (CAN-Sim) and the time to assist in developing this game. Thus, two potential barriers associated with the costs of serious game, software and lack of applicable knowledge, were overcome.

Prior to developing the game, five objectives regarding content coverage and game outcomes were identified. A PowerPoint background was used as a tool to format the key points related to each outcome. Learner cognitive load management meant that content presented on slides was kept to a minimum (Nelson & Erlandson, 2008). Content included the definition of main terms, key

characteristics, and primary purposes of serious games. The appropriateness and applicability of serious games in higher distance education was specifically discussed, identifying significant implications for educators.

Once the content was finalized, two questions were developed, each with three possible responses, one of which was correct. Three potential response options minimized cognitive load. Rationale for both correct and incorrect answers had to be determined for inclusion within the gaming software. These were included to engage the learner and support their understanding of key presentation content while providing an opportunity for embedded debriefing. Due to the limited presentation time, only a few questions were included.

After preparation was complete, a telephone support meeting guided software use and graphic design. At the bottom of each slide, advance and return buttons moved the game forward or back depending on each learner need. A reference list was embedded into a button located on the upper right corner of each slide. Buttons can be used to embed relevant information such as goals, indicators, or just-in-time information, to provide learner assistance (Gee, 2005; Kapp, 2017). Personalized certificates of completion further contributed to the feeling of a game. Set-up for certificates required direction and took three hours to complete. Prior to recording the voice and content for each slide, a script with key points was developed and presented. Extra time was required to record the audio portion of the content which was embedded into each slide of the game.

The game was designed to play on an individual basis, however, for the purposes of the presentation and size of audience, it was to be delivered through the screen share feature of Adobe Connect. Despite the success in sharing the game at a distance, the sound could not be heard by audience members and the presentation was rescheduled. It was later discovered that the feature within Adobe Connect that supports the use of Articulate software was not available through the host subscription. This provided opportunity to use the game as a preparatory activity for audience members prior to the postponed presentation and discussion in the following weeks.

Creating the serious games presentation was fun but highlighted some items for consideration prior to choosing this instructional strategy. Sharing resources supported learning and evidence of the ease in which a simple serious game can be learned and developed. Collaboration further lowered the costs to create the game. Problems using web conferencing media and arranging remedies, is possible, however, understanding the web conferencing system is critical to application and practice sessions are required to ensure familiarity with the software.

Conclusion

Many potential and practical functions for serious games in higher distance education exist. Despite the outlined benefits of serious games to learners and the suitability of this innovative instructional strategy for higher distance education, there are potential barriers to implementing this technique. The development of a serious game-based presentation provided an opportunity to utilize this instructional strategy in an online distance education setting, while learning some valuable lessons about

this instructional approach in the process. Although familiarity with the basic principles of this instructional strategy is essential, educators may not use them in practice. Collaboration and technical knowledge must be combined with pedagogically based learning approaches to effectively support the creation of successful serious game design.

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